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BASIC ASSUMPTIONS FOR THE PREPARATION OF FINANCIAL ANALYSIS OF ALL PROJECTS.

The following basic assumptions have been considered valid for all the projects for the preparation of the financial analysis by means of the UNIDO COMFAR software.

a) Economic life

Fifteen years have been considered the operational life of the plants, even if for some of them a longer life can be easily anticipated; this life span is largely sufficient to appreciate the profitability of a project; the increase of IRR due to longer life is definitely very small (passing from 15 to 20 years, the IRR of the calcium carbide project, for instance, is shifted from 13.12 to 13.38% and from 10.38 to 11.1 the IRR of the biomass based chemicals project, without considering any replacement); moreover, especially for chemical projects it is usual to consider even shorter economic life for taking into consideration the possibility of a rapid obsolescence of the process due to the coming-up of new technologies.

b) Rate of discount: 10%

c) Depreciation: straightline type;

rates: 6.67% for machinery and equipment

5 % for civil works

20 % for site preparation and pre-production expenditures.

scrap: 10 % for machinery and equipment

50 % for civil works and site preparation

d) Foreign loan

amount: 85% of the value of the imported machinery and equipment (installation costs included) as per "consensus" terms;

repayment: within eight years, starting from the first year of production;

amortization: constant principal type; interest: 10%

e) Working capital

Minimum day of coverage of the costs considered by the COMFAR programme:

	FC	LC
. accounts receivable	30	30
. inventory raw materials	180	30
. inventory utilities	to be defined case by case	
. inventory energy	30	1
. inventory spare parts	360	360
. work in progress	to be defined case by case	
. cash in hand	15	15
. finished products	30	30
. accounts payable	1(*)	30

(\*) this figure has been selected in order to be conservative taking into consideration that irrevocable letter of credit is the usual payment term in these cases.

f) Taxes

The products are considered as sold ex-works; consequently the profit tax only (50%) has been included in the calculations.

Moreover tax holiday and other facilitations granted to joint venture investments have not been included.

g) Currency

All the costs are expressed in birr or US dollars; in the COMFAR in US dollars only; the exchange rate has been assumed as 2.07 birr per 1 US dollar.

h) Fuels

Fuel oil, gas oil, LPG have always been considered as imported items; the storage volume, where applicable, has been considered equivalent to 30 days.

i) Utilities

The following prices have been assumed for evaluating the annual expenditures:

electricity 0.2 birr/kwh = 0,0966 \$/kwh

cooling water (recycled) 0.029 birr/m<sup>3</sup> = 0.014 \$/m<sup>3</sup>

cooling water (make-up) 0.04 birr/m<sup>3</sup> = 0.02 \$/m<sup>3</sup>

fuel oil 0.466 birr/kg = 0,225 \$/kg

The financial evaluation for the processes which are high consumers of electricity has been done in two alternatives: one with the price of 0.2 birr/kwh and one with 0.05

birr/kwh. This last price has been reported to the Consultant as a tariff applied in a recent past by ELPA to some special users (in particular to operators of electric boilers).

1) BEP

The BEP evaluations have been developed according to the UNIDO Manual for evaluation of industrial projects, pag. 120.

m) Other assumptions, different for the various projects are specified in the parag. 9 of each study.

REMARK: some minor discrepancies between the figures shown in the reports and in the financial evaluation are due to the rounding off of the COMFAR elaboration.

INVESTMENT PROMOTION SUGGESTIONS

1. **METHODOLOGY FOR THE RANKING OF THE PROJECTS FOR WHICH OPPORTUNITY STUDIES HAVE BEEN CARRIED OUT.**

The following factors have been taken into consideration to rank the various opportunity studies:

- Internal Rate of Return
- Magnitude of the investment
- Foreign exchange effect
- Ratio between investment and number of employees
- Magnitude of inputs of local origin versus imported ones
- Capability of the project to generate new projects, its social importance and the synergism with existing/planned plants.

For each factor a score has been selected taking into account the following relative weight:

- I.R.R.	30%
- Foreign exchange effect	24%
- Occupation/investment	20%
- Magnitude of investment	15%
- Local/import inputs	11%

The following table A shows the selected criteria for project ranking while table B summarizes the various data for each project. It can be noted that in some cases various alternatives are presented (for instance separate Calcium Carbide and Calcium Cyanamide plants as well as integrated in one plant only and the Sulphonation chemicals unit integrated in an existing factory).

TABLE A  
SELECTED CRITERIA FOR RANKING THE PROJECTS

1) IRR %	not found	from 1 to 5	from 5 to 11	from 11 to 15	from 15 to 20	> 20
Score	0	2	3	5	8	10
2) Investment M \$	< 1	from 1 to 5	from 5 to 10	from 10 to 15	> 15	
Score	5	4	3	2	1	
3) Foreign Exch. Effect M \$	from 0 to 2	from 2 to 5	from 5 to 10	from 10 to 20	from 20 to 30	>30
Score	0	1	2	4	6	8
4) Investment/occupation, 1000 \$/worker	< 10	from 10 to 50	from 50 to 100	from 100 to 150	> 150	
Score	7	5	3	2	1	
5) Local inputs %	from 0 to 30	from 30 to 50	from 50 to 80	from 80 to 100		
Score	0	1	2	4		
6) Other advantages						
Social impact		: multiplying factor 1 to 1.5				
Generation of other projects						

TABLE 3  
SUMMARY OF FINANCIAL AND INVESTMENT DATA FOR EACH PROJECT

		IRR/SEP %	DISC. NET FOREIGN EFFECT M \$	INVESTMENT M \$	HANPOWER M'	INVESTMENT PER EMPLOYER 1000 \$/PERS.	PERCENTAGE OF LOCAL RAW MATERIAL (2)
1	Animal feed	9.44/59.5	n.a.	1.012	29	36.143	98.7
2	Industrial canvas	14.86/30	28.317	11.600	124	93.548	100
3	Hygienic products	31.51/24	2.796	0.756	29	118.286	75.3
4	Biomass based chemicals	10.56/57.5	0.866	2.700	62	43.548	94.2
5	Industrial explosives (Scen.B)	4.91/59	9.913	8.100	113	71.681	30.9
6	Calcium Carbide (Hypo. 2)	12.84/47.9	(4.374)	7.550	60	125.833	91.1
7	Calcium Cyanamide (Hypo. 2)	7.55/66.9	3.724	5.750	66	87.121	98.9
7 bis	Ca Carbide & Cyana (one factory)	13.51/44.8	1.115	12.500	116	107.759	95.4
8	Purfural	5.39/76.6	7.741	12.600	79	159.494	100
9	Bleach. earth from bentonite	NP/>100	-	7.400	57	129.825	66/78
10	Diatomite	3.32/98	4.406	3.540	44	30.454	48.2
11	Hydrogen peroxide	NP/>100	(5.053)	12.700	40	317.500	70.3
12	Bone based chemical industry	18.71/25.6	36.743	4.900	115	42.609	32.1
13	Leather and canvas shoes (Alt A.)	31.58/7.2	40.250	7.600	694	10.951	72.1
14	Bromine (High selling price)	NP/neg.	(1.693)	8.300	55	160.000	66
15	Essential oil	13.6/38.3	0.758	0.200	17	11.764	52.5
16	Sulfonation chemical	13.36/33	0.427	1.185	37	32.327	2.2
16bis	Sulf chem(in a detergent factory)	16.61/22	0.553	0.950	31	30.645	2.2
17	Industrial adhesives	10.69/27.6	1.997	3.040	22	138.181	20.4
18	Chlor-alkaly plant (Hypo.B)	9.07/62.6	13.394	17.850	124	143.952	94.5
19	Calcium hypochlorite	9.85/48.9	n.a.	7.700	62	124.193	95.1
19bis	Calcium hypo. + chlor-alkaly	9.16	6.147	25.110	187	134.000	95
20	Canned fish	33.33/16.9	18.848	2.700	49	55.102	39.3
21	Diversif. of cement uses	18.99/24.1	-	1.360	237	5.738	98.1

(1) Administrative personnel excluded

(2) packaging and utilities, included



The results of this analysis are proposed in table C.

The multiplying factor to take into account the social impact of the project as well as its capability to generate new products has been applied to the following ones:

- Hygienic product : 1.1 because of the social use of the end-products
- Chlor Alkali Plant: 1.5 because it makes available chlorine for water potabilization and for other industries processes as well as makes possible the production of Calcium Hypochlorite.
- Biomass based chemicals : 1.2 it makes available raw materials for subsequent processing as well as fuels.
- Calcium carbide : 1.5 because it makes available calcium carbide to be used as source of lighting in rural areas as well as suitable to be used as raw material on subsequent industrial operations.
- Calcium Carbide & Calcium Cyanamide : 1.5 for the above reason and also because Calcium Cyanamide is an input to agriculture and therefore its social impact (increase of agricultural output) is higher.
- Bone based chemical industry : 1.1 because one of its products can be used as input to agriculture.
- Leather & canvas shoes : 1.1 because of the importance of the end-product.
- Sulphonation chemicals : 1.2 because its end product can be used in a number of subsequent industrial operations as well as the plant itself is multipurpose and can be used for various applications.

TABLE C

		PROPIETA.	FOREIGN EXCH. EFFECT	INVEST.	OCCUPAT.	LEGAL INPUTS	TOTAL	OTHER ADVANT. MULTIPL.	TOTAL SCORE
1	Animal feed	3	n.a.	4	5	4	16		16
2	Industrial canvas	8	6	2	3	4	23		23
3	Hygienic products	10	1	5	2	2	20	x1.1	22
4	Chlor-alkaly plant (Hypo. B)	3	4	1	2	4	14	x1.5	21
5	Biomass based chemicals	?	0	4	5	4	16	x1.2	19.2
6	Industrial explosives (Scen B)		2	3	3	1	11		11
7	Calcium Carbide (Hypo. 2)	5	0	3	2	4	14	x1.5	21
8	Calcium Cyanamide (Hypo. 2)	3	1	3	3	4	14	x1.1	15.4
8 bis	Ca Carbide & Cyana (one factory)	5	0	2	2	4	13	x1.5	19.5
9	Parfural	3	2	2	1	4	12		12
10	Bleach. earth from bentonite	0	0	3	2	2	7		7
11	Diatomite	2	1	4	3	1	11		11
12	Hydrogen peroxide	0	0	2	1	2	5		5
13	Bone based chemical industry	8	8	4	5	4	29	x1.1	31.9
14	Leather and canvas shoes	10	8	3	5	2	28	x1.1	30.8
15	Bromine	0	0	3	1	2	6		6
16	Essential oil	5	0	5	5	2	17		17
17	Sulfonation chemical	5	0	4	5	0	14	x1.2	16.8
17bis	Sulf chem(in a detergent factory)	8	0	5	5	0	18	x1.2	21.6
18	Industrial adhesives	3	0	4	2	0	9		9
19	Calcium hypochlorite	3	n.a.	3	2	4	12	x1.4	16.8
19bis	Chlore Alkali+calcium Hyp.	3	2	1	2	4	12	x1.5	18
20	Canned fish	10	6	4	3	4	27	x1.2	32.4
21	Diversif. of cement uses	10	0	4	7	4	25		25

- Calcium hypochlorite : 1.4 because of the extremely high importance of the product used for water potabilization.

- Canned fish : 1.2 because of exploitation of locally available resources to produce low cost, easy to transport and to store food.

- Calcium Cyanamide . 1.1 because of the importance the end product as input to agriculture (fertilizer).

Main criteria to assign the multiplying factor to the various projects have been as follows:

1.1 = moderate social impact of the final product or moderate synergism with existing/planned projects or capability to generate new projects.

1.2 = medium characteristics as above or combination of two or more effects (moderate).

1.3 = high characteristics as above or combination of two or more effects (at least two rated medium).

1.4 = very high characteristics as above or combination of two or more effects (at least two rated high)

1.5 = combination of two or more effects (at least one rated very high).

The final ranking of the projects is therefore the following one:

1 Canned Fish	32.4
2 Bone based chem. ind.	31.9
3 Leather & canvas shoes	30.8
4 Diversification of Cement uses	23
5 Industrial canvas	23
6 Hygienic products	22
7 Sulphonation chemicals	21.6

8 Chlor Alkali plant (alone)	21
9 Calcium Carbide (alone)	21
10 Biomass based chemicals	19.2
11 Chlor alkali plant + calcium hypo.	18
12 Essential oil	17
13 Calcium Hypochlorite (alone)	16.8
14 Animal feed	16
15 Calcium Carbide/Cyanamide	15.4
16 Furfural	12
17 Ind. explosives	11
18 Diatomite	11
19 Ind. adhesives	12
20 Bleach. earth from bentonite	7
21 Bromine	6
22 Hydrogen Peroxide	5

Recommendations on further actions to be taken for each project are provided in each opportunity study; a short summary is presented here below:

- The carrying out of a Feasibility study is suggested for:

Canned fish  
Bone Based chemicals  
Leather and canvas shoes  
Diversification of cement use  
Industrial canvas  
Hygienic products  
Sulphonation chemicals  
Chlor Alkali and Calcium Hypochlorite plant  
Essential oil  
Animal feed  
Calcium Carbide/Cyanamide  
Furfural  
Industrial Adhesives

- The carrying out of a detailed regional and international market survey is suggested for:

Industrial explosives  
Diatomite  
Bleaching earth/bentonite  
Hydrogen peroxide

## 2. IDENTIFICATION OF PROJECTS POTENTIALLY ATTRACTIVE FOR JOINT VENTURES.

The following projects are deemed interesting for joint ventures with foreign partners:

### 2.1 Leather and Canvas Shoes

Due to the fact that part of the output is for export, this is a typical case in which a joint venture is advisable and the foreign partner could take care of the international distribution.

Ethiopia, in the field, can provide a number of advantages because:

- good quality raw material (already widely exported to Europe and also used for shoes manufacturing. The export of shoes instead of hides would mean a greater added value)
- existing expertise and tradition in shoes manufacturing
- low cost of manpower (one of the main factor of shoe production cost)

The ideal partner for this potential joint venture is a company involved in shoes production/distribution that can provide:

- technology
- imported components
- product design
- marketing

## 2.2 Chlor Alkali and Calcium Hypochlorite

The proposed project is a very important one, because its products are import substitutions for a number of existing industrial and infrastructural projects and, at the same time, can allow the formulation of new products having very high social impact (water potabilization chemicals).

The availability of a chlor-alkali plant can also be considered, in conjunction with the Sulphuric Acid plant which implementation has been already decided, as the basis of the development of the Chemical industry in the Country. For this reason too a joint venture is advisable for this project.

Advantages that can attract foreign partners are:

- excellent geographical location (Assab) as far as export potential is concerned within PTA member countries that are presently importing Caustic Soda and Chlorine;
- the origin of electric energy, that accounts for a very important share of the finished products production cost, is hydroelectric and, therefore, completely independent from fluctuations of the oil generated electricity price (Assab will be connected to the grid within few years);

- the possibility of a fast development of the chemical industry in Ethiopia as well as of the industry consuming the final products of the plant (soap industry, food industry, pulp and paper industry etc.)

The advisable foreign partner is a chemical industry, already active in chlor-alkali production and, if possible, in the distribution in PTA Countries.

The foreign partner could provide:

- plant design and technology
- technical assistance
- personnel training
- marketing of the products for export

### 2.3 Essential oils

These products are mainly for export and is therefore a typical case in which joint ventures are advisable, mainly to assure the buy back of the product.

The advantages of a joint venture, in this specific case, would be very important because:

- Ethiopia have very little experience in essential oils bearing plants cultivation and processing: the foreign partner could provide the necessary know-how and technical assistance;



- Essential oils bearing plants that can be commercially exploited have not been completely identified (but few ones) nor the ideal pedological conditions are perfectly know (the same plant under different climatic and pedological conditions can produce essential oils having very different characteristics). Again the foreign partner could be of great assistance.

Due to the above described constraints a Joint Venture is possible but at terms and conditions a little more favourable to the foreign partner than in other circumstances.

On the other hand a number of advantages can be highlighted:

- plants can be grown in areas not very much exploitable for other crops;
- cooperatives movements could be interested in plants growing with consequent rationalization of the production and the required efficiency in the various phases of the production and extraction;
- low cost manpower

The advisable foreign partner should be an organization that knows very well the market of essential oils as well as is connected from the operational point of views with organizations active in essential oils bearing plants cultivation and processing techniques.

Foreign partner should provide the expertise for:

- selection of areas suitable for plant cultivation;
- identification of plants eligible for cultivation with respect to market requirements;
- buy-back and marketing

### 2.3 Furfural

The output of this plant will be exported overseas and, again, is a typical case in which a joint venture is advisable.

Advantages that can be offered by Ethiopia could be

- the availability of corn cobs, considered one of the best raw materials for furfural production;
- low cost of manpower for the picking-up of the cobs.

The ideal partner is a producer of furfural that wants to increase its share in a competitive market by importing it.

The partner would therefore provide:

- technology and operational experience
- training of personnel
- technical assistance
- buy-back and marketing

## 2.5 Industrial explosives

The opportunity study has shown that the implementation of the project is interesting only if plant is oversized for the domestic demand. There is therefore the need of exporting a large portion of the output and, for this reason, a comprehensive regional market survey is recommended.

If this scenario is accepted, the possibility of a joint venture could be taken into consideration. The ideal joint partner would be a company already involved in the production of industrial explosives and their international marketing.

In this case Ethiopia would become one of the few producers in Africa and the PTA countries could become a very interesting market.

The foreign partner could provide:

- technology
- technical assistance
- imported raw materials
- training
- international marketing

## 2.6 Diatomite

Diatomite is a natural resource that can be processed and packed for export.

A very large portion of the output will be marketed abroad and therefore a joint venture with foreign partners is highly advisable.

Ethiopia can provide advantages

- good quality product
- low cost manpower
- a good geographical location if the sale to PTA countries is shown convenient by the market survey.

In addition the consumption of diatomite in both industrialized countries and developing ones is increasing (food industry development etc) and therefore new sources of product (if quality and price are competitive) are very interesting.

The possible foreign partner is a company that is already involved in diatomite processing and/or marketing and should provide:

- processing technology
- technical assistance
- buy-back and international marketing

## **2.7 Industrial adhesives**

Even if the ranking of this project is quite low the potential for a joint venture with a foreign partner could be explored.

In fact the plant is based on the formulation of imported raw materials and companies producing

industrial adhesives could be interested in participating in an investment in Ethiopia that could become the basis for an export activity to other African countries in the region. On the other hand the advantages for the Ethiopian side in having a foreign partner are obvious:

- rationalization in the supply of raw materials
- increased potential for export with consequent optimization of the production capacity of the unit and lower production costs;
- continuous technical assistance

### 3. SYSTEMS AND PROCEDURE FOR COMMUNICATION AND FOLLOW-UP OF FOREIGN INVESTORS

The suggested system for the identification of potential foreign partners is the organization of an investment forum in Addis Ababa.

It could be organized with the assistance of UNIDO and should include the following main steps/activities:

- preparation of suitable documentation to be distributed among potential partners.

This documentation has the goal to provide comprehensive information on the project itself and on the framework into which it can be implemented and operate.

This documentation will therefore include:

- . summary of the guidelines for the establishment of joint ventures;
- . project profile with all data needed for a correct identification (or, eventually, the opportunity study or its summary can be provided to the most interested parties);
- . basic data on Ethiopia with particular emphasis on infrastructures, manpower, raw materials etc. specific of each project.

- Dissemination of the preliminary information through the mailing list in use with the Industrial Investment Division of UNIDO.

- Receipt of the letter of interest consequent to the announcement and foreword of the specific documentations.
- Organization of the Investment Forum with the participation of all interest companies.

It will consist of:

- . presentation of the guidelines for the industrial development of the Country;
- . presentation of the projects
- . bi-lateral discussions

#### 4. CONSIDERATIONS ON THE GUIDELINES FOR INVESTMENT IN JOINT VENTURES IN ETHIOPIA.

Accelerated investment in industry is one of the primary goals of the economic policies in developing countries. In order to attain this goal attractive conditions for potential investors shall be created; in fact the availability of resources, the dimensions of the market, a good general economic situation etc. are not, often, enough to orient positively the investors.

Governments are therefore offering a wide variety of incentives to promote investments, in general or in selected sectors and/or in preferred locations.

These benefits and codes are usually collected in "investment codes" together with other information which can influence the investors decisions as wages and labor regulations, interest rates, etc.

Ethiopia has issued its code as "A proclamation to provide for the establishment of joint ventures" (1983) which has been diffused in a comprehensive manual titled "guideline for investment in joint ventures in Ethiopia". The following notes are a short comparison between this code and other ones presently used in other countries.

##### 4.1.0 Excursus on incentive systems adopted by Developing Countries (1).

- (1) SOURCES: 1) Investment incentives for industry, some guidelines for Developing Countries World Bank 1984.  
2) KENYA: guidellines to investors



#### 4.1.1 Type of incentives

Types of incentives are many and include mainly:

- Tariff concessions, that is exemption of duties for imported materials and equipment; the exemption may apply to the equipment required by a new plant or an expansion of an existing one or may be extended to raw materials and spare parts for a certain number of years (5 to 10 years).
- Export incentives in various forms as exemption from export taxes, tax credits on imported materials or supplies, preferential tax treatment of income from exports, export subsidies, concessions on domestic sales in return for export performance, foreign exchange credits from export earnings and export insurance.
- Tax concessions, especially as tax holiday; it consists in full or in partial exemption from income and other taxes for a length of time of 5 or 10 years, but sometimes even 15 or 25 years. In some cases to make the concession effective, the holiday period begins not in the first year of operation but in the first year of earnings; in others, losses incurred during the holiday period can be written off against profits earned later.
- Stabilized fiscal regime, granted for a long period, up to 25 years.
- Accelerated depreciation

- Reinvestment allowance, especially dedicated to promote expansion of existing firms since it exempts from taxes the reinvested income.
- Creation of industrial estates, in selected locations, where land already supplied with water, power and telecommunication facilities, sewerage system, easy access for transportation and, even, factory buildings, can be bought or leased by new entrepreneurs.
- ..- Supply of preinvestment studies providing information on market, raw materials and availability of infrastructure concerning selected projects.
- Low interest rate, especially to incentivate agricultural projects and small scale enterprises.

#### 4.1.2 Guarantees to investors

These guarantees are considered essential to create a favourable investment climate and regard mainly repatriation of profit, transfer of capital and equality of treatment to local and foreign investors.

#### 4.1.3 Import competition

A substantial protection from import competition, through tariff rates and quantitative restrictions

are often granted to investors in key/sectors.

#### 4.2 INCENTIVES OFFERED IN ETHIOPIA

The incentives offered in Ethiopia include many of those listed in 4.1.0, as exemptions from custom duties, governmental and municipal taxes for investment goods and production requirements; exemption from duties and transaction taxes on exported goods; exemption from income tax for up to 5 years, followed by a reduction from 50 to 40% of the tax; exemption from income tax of dividends reinvested in Ethiopia; low taxation (10%) of the dividends remitted abroad; exemption from income tax for the salaries and allowances of expatriate employees and possibility to expatriate 50% of it; right of transfer of capital and guarantee of fair and equitable compensation in case of governmental decision to buy all the foreign shares. These incentives are however limited to joint ventures formed by Ethiopian public capital and foreign private or public capital.

#### 4.3 ADDITIONAL INCENTIVES THAT COULD BE CONSIDERED FOR APPLICATION IN ETHIOPIA.

- Creation of industrial estates with all infrastructures needed for new industrial plants;
- low interest rate on local loans
- financing or co-financing pre-investment studies
- possibility of protecting the new industry by limiting imports.

U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF ANIMAL FEED FROM  
AGRICULTURAL WASTES  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

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ANNEXES

ANNEXE 1 - FINANCIAL EVALUATION

ANNEXE 2 - BEP EVALUATION

ANNEXE 3 - drw. b.162-11-1 STRAW PROCESSING PLANT

0. SUMMARY AND CONCLUSIONS

Cattle raising is a very important activity in Ethiopia but the country is facing acute shortage of ingredients for animal feed (50% only of the demand is presently satisfied), with the result that the animal feed mixing plants are not operating at full capacity.

Alternate raw materials must therefore be found and this opportunity study deals with the construction of a plant to process straw into a fine quality animal feed ingredient. Straw is processed with caustic soda and then enriched with molasses. Both are available (or will be) in the country.

The straw processed in this way, is then pelletized and is equivalent, as nutritional value, to a forage of middle to high quality. It can be included in the composition of the feed at up to 70%, depending on the productive level of the animals, permitting a considerable reduction in feeding costs.

The technology is relevant and does not require large infrastructures.

It should be located within a major grains production area and, if successful, would be the first of a number of small plants scattered around the country.

The estimated fixed investment is 1,012,000 US \$ (657,000 \$ foreign exchange portion) and the plant will have a staff of 28.

The internal rate of return is 9.44% and the BEP 59%. Even if the project cannot be justified by an import substitution, its implementation is very interesting for its beneficial effect on the cattle breeding, which is so important in the economy of the Country. Consequently the preparation of a feasibility study is recommended.



1. INTRODUCTION

Animal feeds can be classified into two main categories:

- a) forages: feeds high in volume, if compared with their content of digestible nutrients; listed as forages;
- b) concentrates: feeds low in volume but with a high content of digestible nutrients.

The forages include green forages, ensilaged forages, roots and tubers, hay, straw and chaffs.

The concentrates include seeds and dried fruits, bran, husks, oil exhausted cakes, molasses, dried beer threshings, starch extraction wastes, wastes from slaughterhouses and from meat and fish processing factories. The production of forages and concentrates is a key condition for the developing of livestock breeding with the selection of breeds of great productive capacity and for this reason it is very important for Ethiopia, since cattle and meat are among its main items of its export possibilities. The animal feed production industry should be supported by a high availability, both in quantity and quality, of agricultural products and by-products, supplied at reasonable costs, in order to avoid poor rations and production programmes that cannot be implemented. This is true, at present, of many developing and developed countries; Ethiopia is suffering this kind of problem. The only solution, valid to tackle it can be found at present in the possibilities offered by the new technologies of processing agricultural wastes: the present study will, therefore, deal with the processing of some of the poorest but most diffuse by-products such as straw or similar materials.

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The product obtained by processing straw is a good animal feed, supplied in pellets and equivalent, as nutritional value, to a forage of middle or high quality. In addition, after the pelleting, the desirability of the product is increased and, as a consequence, the ingestion capacity of the cattle is increased (25 to 30%).

Other advantages are offered by:

- a) the possibility given by the process of introducing additives, so obtaining a more balanced feed
- b) the greater facility in handling and dosing the product, so avoiding any wastage in terms of manpower or product itself.

Furthermore, as a consequence of the higher density of the product compared with other forages, the costs of its storing and transportation are drastically reduced. Preservation of the product does not present any problem, thus its usefulness can be fully appreciated during the rainy season and during or after drought periods.

In conclusion, the processed straw constitutes a very good feed for cattle; depending on the productive level of the animals, it can be included in the composition of the dry matter of the rations up to 70%, so allowing a noticeable reduction in the animal feeding costs.

2.2 Forecast demand and plant capacity

There is no doubt about the existence of an ever increasing demand for animal feeds of good nutritional value and at an acceptable price.

The production of all types of concentrate in recent years has more than doubled, from about 10,000t in the year 1979-80 to 22,000 in 1985-86.

According to the information received from the Head of the Feed Branch of the National Feed Processing Enterprise the present demand, from the public sector only, amounts to more than 10,000 t/m and cannot be satisfied, both because of the low capacity of the plants, and, more importantly, for the scarcity of raw materials.

This situation is confirmed by the Livestock and Meat Co., Animal Production Dept. which stated that the actual procurement of ingredients for animal feeds in the last years satisfied only 40% of the demand in 84-85 and 50% in 85-86.

One example: the Kality mixing plant, belonging to the same Corporation, has not been able to work on three shifts per day due to the shortage of ingredients.

Another indicator of a general scarcity of animal feed is the average live weight of cattle slaughtered in the country: 270 kg vs. 320 or more, as pointed out in various reports on the subject.

To overcome these problems, the installation of new plants is suggested. These plants should be based totally on raw materials available in large quantity within the country such as for instance straw or other similar biomasses.

As for the capacity of the plant, the following other

considerations have been borne in mind:

- a) straw is a very voluminous material
- b) straw is expensive when it has to be transported over a long distance
- c) in Ethiopia transport costs are, generally, higher than other countries
- d) yield should be at least one ton/ha straw
- e) to keep the transport costs acceptable, the source area should not exceed 8000 hectares.

The plant capacity should, therefore, be adequate to process at least 8000 tonnes/year of straws plus the quantity of caustic soda and molasses that are added to the straw: the annual output will consequently be 9300 tonnes of finished product. On the basis of 250 working days/y and two shifts per day, this annual production can be satisfied by a plant sized for an hourly capacity of 2 ton of processed straw per hour; but taking into account the possibility of a higher availability of straw and, to a certain extent, of the seasonal nature of the production, this capacity has been fixed at 3.5 t/h.

### 2.3 Sales prices and total revenues

The sale price can be the same as for a good forage, which, according to the information collected by the Consultants, is around 150-160 birr/t. Thus based on a sales price of 75\$/t (155 birr), the total annual revenues for the planned production are:

$$9300 \text{ t/y} \times 75 \text{ \$/t} = 697,500 \text{ \$/y.}$$

3. MATERIALS AND INPUTS

3.1 Technology

The basic treatment consists in impregnating the straw with a caustic solution and then enriching it with molasses.

Thus the required raw materials, besides the straw, are caustic soda (4% by weight of the straw) and molasses (10% by weight of the straw); caustic soda is added as 40% solution while molasses as received.

3.2 Materials and utilities: requirements and costs

The complete list of raw materials and utility consumptions at full capacity are as follows:

	LC	FC	TOTAL
<u>Raw materials</u>			
Straw 8000t/yx10\$/t	80,000	-	80,000
Caustic soda 320t/y x 451\$/t	144,320	-	144,320
Dilution water 480t/y x 0.014 \$/t	7	-	7
Molasses 800t/y x 80 \$/t	64,000	-	64,000
	-----		-----
1' Subtotal \$	288,327	-	288,327

	LC	FC	TOTAL
<u>Utilities</u>			
Electric power			
8000t/y x 116.5kWh/t x 0.0966\$/KWh	90,070		90,070
Fuel oil			
8000t/y x 2.8Kg/t x 0.225\$/Kg		5,040	5,040
Cooling water			
8000t/y x 4m <sup>3</sup> /t x 0.014\$/m <sup>3</sup>	448		448
	-----	-----	-----
2° Subtotal \$	90,518	5,040	95,553
TOTAL \$	378,845	5,040	383,885

3.3 Raw materials and fuel purchasing programme and storage quantities

Caustic soda, molasses and fuel oil are the main products not generally produced in the same area of the plant; thus, for each of them, a stock equivalent to 30 days of consumption is advisable. On this basis the following quantities are required:

fuel oil	2688 Kg	equivalent to	605 s
caustic soda 100%	38 t	equivalent to	17,313 s
molasses	96 t	equivalent to	7,680 s
			-----
		Total	25,603 s

4. LOCATION

The plant should be located in rural areas where both the availability of straw and the consumption of the product are certain.

Utilities, due to their moderate importance, are not conditional.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The process is based on the combined action of a chemical and physical treatment; the first effect is obtained through the use of caustic solution, the second by means of heat and pressure which are applied in the pellet process. This combined action causes the total rupture of the non-covalent bonds between lignin, cellulose and hemicellulose, making them ready to be utilized by the ruminal bacteria; in this way the TDN% (total digestible nutrients express as percentage of the dry matter) increases to over the 150% of the original value.

The process can be subdivided into four steps:

- straw milling
- caustic treatment
- additive mixing
- pelleting.

Straw milling

The straw, possibly baled, is transferred from the stocking area to the inlet opening of a mill, by means of a transpallet. The mill is of the hammer type and cuts down the straw to a size smaller than 3.5 cm.

From the mill the strow is transferred pneumatically to a blender through a cyclone where the dust is separated; the dust stream is then filtered through cloth filters and vented to the atmosphere, while the coarse particles are also brought to the blender.



Caustic treatment

In the blender the straw is mixed with a 40% caustic solution; the amount of solution to be added, is 10% by weight of the straw and controlled by a dosing unit; a small amount of molasses (2%) is also added at this stage of the treatment.

Additive mixing

From the blender the processed straw flows towards the pelleting press through a mixer where the remaining quantity of molasses (8%) is added.

Pelleting process

At this stage the compound is extruded through a pelleting press. The pellets with a 18mm diameter, are then transferred to a cooling column and from here to the depot; it is important that the product at the end of the process be well cooled in order to avoid agglomeration which will create difficulties in handling.

The physical characteristics of the product are as follows:

moisture	about 14%
specific gravity	0,55 t/cu.mt
pellet hardness	97-98%
pellet diameter	18mm

The chemical characteristics depend on the type of straw used. The process is equally suitable to treat any type of straw and, in addition, the molasses can be substituted by other available concentrate such as oil exhausted cakes, meat meals, blood meals, etc., even in proportion higher than 10%; in this case the following specifications should be noted:

- the straw content must be not less than 70%
- the molasses content must not exceed 10%
- the cotton oil exhausted cakes: must not exceed 20% (1)
- the rape oil exhausted cakes: must not exceed 20% (2)
- the neug oil exhausted cakes: must not exceed 18% (3)
- lin oil exhausted cakes: must not exceed 10% (4)

As shown in the scheme B 162 the plant includes the following main equipment:

- 1 hammer mill, 3.5 t/h capacity
- 1 vertical blender, 20cu.mt capacity, equipped with cyclone and cloth filter (150sq.mt filtering surface) for the caustic treatment of the straw
- 1 mixer for the molasses addition
- 1 pelleting press
- 1 cooling column, equipped with dust recovery
- 1 molasses dosing unit, starting from flakes, equipped with a service tank of 1500 litres capacity (4 hours operation).
- 1 series of mechanical transporters including 1 pneumatic conveyer and 5 screw feeders
- 3 storage bins
- ancillary equipment including:
  - . oil fired, hot-water heating boiler
  - . compressed air unit
  - . motor control center and instrument control board (total electric - installed power: 410 kW)
  - . transpallets and trailers for the internal material handling

- (1) due to gossypol content
- (2) due to glycosinolate content
- (3) high fiber content, low digestibility
- (4) due to the content of mucilages with a laxative action

## 5.2 Packaging

The product can be shipped in bulk, especially if the customers, are in the vicinity, as is probable. The product should be stocked by the users in one or more silos.

## 5.3 Lay out and civil works

The factory is installed on an area of about 1800 sq.mt, of which:

- 600 sq.mt for the raw straw stocking
- 400 sq.mt for the process plant and finished product storage
- 200 sq.mt for a single-storey building, to serve as administrative offices, workshop, laboratory, etc.

The raw straw storage is a compacted area (gravel is also used); its level is higher than that of the courtyard to favour the rain water flow. During the rainy season it is advisable to protect the heap with temporary coverings.

The process equipment is sheltered by a roof supported by steel structure laid on a floor of concrete with a hard aggregate as finishing surface.

The building has its frame in reinforced concrete, the external and internal walls are of brickwork; the roof is covered with corrugated asbestos sheets, and its insulate is provided by means of mineral wool panels; the floor of the offices is covered with tiles, while the other rooms have concrete floors.

A wire-net is used for fencing the entire area.

5.4 Investment costs; depreciation and maintenance

Investment costs for the whole factory, utility and general facility included, are as follows:

	FC	LC	TOTAL
	\$	\$	\$
Machinery and equipment, FOB			
European port	550,000		550,000
Transportation costs	55,000	55,000	110,000
Erection	30,000	80,000	110,000
Land and site development		20,000	20,000
Civil works		200,000	200,000
Spare parts	22,000		22,000
	-----	-----	-----
	657,000	355,000	1,012,000
Contingencies	63,000	35,000	98,000
	-----	-----	-----
Grand total	720,000	390,000	1,110,000

The industrial life of this plant is estimated at 15 years.

The annual expenditures for maintenance can be estimated as equivalent to the 4% of the cost of machinery, that is 22,000 dollars.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

Site preparation	LC	20,000 \$
Civil works \	LC	235,000 \$
Machinery	FC	720,000 \$
Machinery	LC	135,000 \$
		-----
TOTAL		1,110,000 \$
		=====

6. PLANT ORGANIZATION

The factory is considered as a unit operating under the direction and administration of a State Farm or a Peasant Association. The plant organization will be highlighted on this basis in the next paragraph.

7. MANPOWER

The plant is very simple in conception; in any case the production manager must be well trained in the animal feed theory.

For the other positions the requirements are the same as for other agro-chemical industries.

7.1 Production department

		birr/m	birr/y
Production manager	1	1000	
Foremen	2	800	
Operators	4	1400	
Senior clerks	1	400	
Clerks and secretaries	3	1050	
Unskilled workers	8	1600	
Guards	4	800	
	--	----	-----
	23	7,050	84,600
			(40870 \$/y)

7.2 Maintenance department

Engineer	1	800	
Mechanics	1	400	
Electricians	1	400	
Unskilled workers	2	400	
	--	----	-----
	5	2,000	240,000
			(11594 \$/y)

8. IMPLEMENTATION SCHEDULING

Eighteen months is the estimated time for the design, materials supply and erection of the plant.



9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. this evaluation has been based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
. Inventories utilities	1	1
. Work in progress	1	1

- the assistance of one foreign expert for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- the production programme has been assumed as follows:

1st year: 5580 t (60% capacity)

2nd year: 7440 t (80% capacity)

from 3rd to 15th year: 9300 t (100% capacity)

Selling price: 75 \$/t

As a result, the evaluation yields an IRR of 9.44% and a BEP equal to 59%.

10. FOREIGN EXCHANGE EFFECT

The animal feed production is recommended considering its beneficial effects on the cattle breeding and consequently on the export of meat and live animals, which is one of the more profitable activity of the Country.

In this sense the relevant investment will have a positive effect on the foreign exchange, but strictly speaking it cannot be justified as an import substitution, since the present import of forages in Ethiopia is insignificant compared to the capacity of the proposed plant.

**Animal feed**

**ANNEXE 1**

**FINANCIAL EVALUATION**



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**ANIMAL FEED**  
February 88  
BASIC PROJECT

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	1231.20	63.450 % foreign
current assets:	0.00	0.000 % foreign
total assets:	1231.20	63.450 % foreign

**Source of funds during construction phase**

equity & grants:	560.00	0.000 % foreign
foreign loans :	612.00	
local loans :	0.00	
total funds :	1172.00	52.218 % foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	325.79	377.67	458.35
depreciation :	84.78	84.78	82.78
interest :	61.20	53.55	45.90
production costs	471.77	516.00	587.03
thereof foreign	32.91 %	23.95 %	20.61 %
total sales :	418.50	558.00	697.50
gross income :	-53.27	42.00	110.47
net income :	-53.27	21.00	55.24
cash balance :	-108.55	17.84	45.06
net cashflow :	29.15	147.89	167.46

Net Present Value at: 10.00 % = -40.39  
Internal Rate of Return on total investment: 9.44 %  
Equity paid versus Net income flow (IRR): 6.03 %  
Net Worth versus Net Cash Return (IRR): 3.82 %

**Index of Schedules** produced by CONFAR

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US DOLLARS**

Year . . . . .	1987.1	1987.2	1988.1	1988.2
<b>Fixed investment costs</b>				
Land, site preparation, development	20.00	0.00	0.00	0.00
Buildings and civil works . . . . .	47.00	164.00	24.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00
Plant machinery and equipment . . . . .	36.00	148.00	671.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>103.00</b>	<b>312.00</b>	<b>695.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	70.60	30.60
Net working capital . . . . .	0.00	0.00	0.00	0.00
<b>Total initial investment costs . . . . .</b>	<b>108.00</b>	<b>327.00</b>	<b>765.60</b>	<b>30.60</b>
Of it foreign, in % . . . . .	33.33	33.03	79.23	100.00



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**Total Current Investment in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	63.56	11.44	16.45
<b>Total current investment costs . . .</b>	<b>63.56</b>	<b>11.44</b>	<b>16.45</b>
Of it foreign, Z . . . . .	35.74	0.39	30.92



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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	60.00	80.00	100.00	100.00	100.00	100.00
Raw material i . . . . .	173.00	230.76	288.33	288.33	288.33	288.33
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	0.27	0.36	0.45	0.45	0.45	0.45
Energy . . . . .	57.06	76.09	95.11	95.11	95.11	95.11
Labour, direct . . . . .	40.87	40.87	40.87	40.87	40.87	40.87
Repair, maintenance . . . . .	11.59	11.59	11.59	11.59	11.59	11.59
Spares . . . . .	13.00	18.00	22.00	22.00	22.00	22.00
Factory overheads . . . . .	30.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>325.79</b>	<b>377.67</b>	<b>458.35</b>	<b>458.35</b>	<b>458.35</b>	<b>458.35</b>
Administrative overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	84.78	84.78	82.78	80.78	80.78	68.78
Financial costs . . . . .	61.20	53.55	45.90	38.25	30.60	22.95
<b>Total production costs . . . . .</b>	<b>471.77</b>	<b>516.00</b>	<b>587.03</b>	<b>577.38</b>	<b>569.73</b>	<b>550.08</b>
<b>Costs per unit ( single product ) . . . . .</b>	<b>0.08</b>	<b>0.07</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>	<b>0.06</b>
Of it foreign, % . . . . .	32.91	23.95	20.61	19.63	18.55	17.82
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	40.87	40.87	40.67	40.87	40.67	40.67



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Total Production Costs in 1000 US DOLLARS

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	100.00	100.09	100.00	100.00	100.00	100.00
Raw material I . . . . .	288.33	288.33	288.33	288.33	288.33	288.33
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	0.45	0.45	0.45	0.45	0.45	0.45
Energy . . . . .	95.11	95.11	95.11	95.11	95.11	95.11
Labour, direct . . . . .	40.87	40.87	40.87	40.87	40.87	40.87
Repair, maintenance . . . . .	11.59	11.59	11.59	11.59	11.59	11.59
Spares . . . . .	22.00	22.00	22.00	22.00	22.00	22.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	458.35	458.35	458.35	458.35	458.35	458.35
Administrative overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	68.78	68.78	68.78	57.03	28.12	6.00
Financial costs . . . . .	15.30	7.65	0.00	0.00	0.00	0.00
Total production costs . . . . .	542.43	534.78	527.13	515.38	486.47	458.35
Costs per unit (single product) . . . . .	0.06	0.06	0.06	0.06	0.05	0.05
Of it foreign, % . . . . .	16.66	15.47	14.24	14.56	10.43	3.90
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	40.87	40.87	40.87	40.87	40.87	40.87





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Net Working Capital in 1000 US DOLLARS

Year	1989	1990	1991	1992-2003
Coverage . . . . . mdc coto				
Current assets &				
Accounts receivable . . . 30 12.0	27.15	31.47	36.20	38.20
Inventory and materials . 30 12.0	14.42	19.23	24.03	24.03
Energy . . . . . 3 141.9	6.40	0.54	0.67	0.67
Spares . . . . . 360 1.0	13.00	18.00	22.00	22.00
Work in progress . . . . 1 360.0	0.90	1.05	1.27	1.27
Finished products . . . 30 12.0	27.15	31.47	38.20	38.20
Cash in hand . . . . . 15 24.0	3.58	2.94	3.10	3.10
Total current assets . . . . .	87.00	104.70	127.47	127.47
Current liabilities and				
Accounts payable . . . . . 28 12.8	23.44	29.70	36.02	36.02
Net working capital . . . . .	63.56	75.00	91.45	91.45
Increase in working capital . . . . .	63.56	11.44	16.45	0.00
Net working capital, local . . . . .	40.84	52.24	63.61	63.61
Net working capital, foreign . . . . .	22.71	22.76	27.84	27.84

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1	1988.2
Equity, ordinary ..	560.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	612.00	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	612.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	28.60	30.60
Total funds .....	1172.00	0.00	28.60	30.60

ANIMAL FEED --- February 88



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993	1994-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-76.50	-76.50	-76.50	-76.50	-76.50	-76.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-76.50	-76.50	-76.50	-76.50	-76.50	-76.50
Current liabilities	23.44	6.26	6.32	0.00	0.00	0.00
Bank overdraft ....	108.55	-17.84	-45.06	-64.34	-40.51	0.00
Total funds .....	55.49	-88.08	-115.25	-140.84	-117.01	-76.50

ANIMAL FEED --- February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2
Total cash inflow . .	1172.00	0.00	0.00	0.00
Financial resources .	1172.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow . .	108.00	327.00	765.60	30.60
Total assets . . . .	108.00	327.00	735.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	30.60	30.60
Repayment . . . . .	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1064.00	-327.00	-765.60	-30.60
Cumulated cash balance	1064.00	737.00	-28.60	-59.20
Inflow, local . . . . .	560.00	0.00	0.00	0.00
Outflow, local . . . .	72.00	219.00	159.00	0.00
Surplus ( deficit ) .	488.00	-219.00	-159.00	0.00
Inflow, foreign . . . .	612.00	0.00	0.00	0.00
Outflow, foreign . . .	36.00	108.00	606.60	30.60
Surplus ( deficit ) .	576.00	-108.00	-606.60	-30.60
Net cashflow . . . . .	-108.00	-327.00	-735.00	0.00
Cumulated net cashflow	-108.00	-435.00	-1170.00	-1170.00



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	441.94	564.32	703.82	697.50	697.50	697.50
Financial resources .	23.44	6.32	6.32	0.00	0.00	0.00
Sales, net of tax . .	418.50	558.00	697.50	697.50	697.50	697.50
Total cash outflow . .	550.49	546.48	658.75	633.16	629.34	631.51
Total assets . . . .	87.00	17.70	22.77	0.00	0.00	0.00
Operating costs . . .	325.79	377.67	458.35	458.35	458.35	458.35
Cost of finance . . .	61.26	53.55	45.90	38.25	30.60	22.95
Repayment . . . . .	76.50	76.57	76.50	76.50	76.50	76.50
Corporate tax . . . .	0.00	21.90	55.24	60.06	63.89	73.71
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-108.55	17.84	45.06	64.34	68.16	65.99
Cumulated cash balance	-167.75	-149.91	-104.84	-40.51	27.66	93.65
Inflow, local . . . . .	441.81	564.32	703.81	697.50	697.50	697.50
Outflow, local . . . .	343.93	394.36	504.22	491.37	495.20	505.02
Surplus ( deficit ) .	97.89	169.96	199.59	206.13	202.30	192.48
Inflow, foreign . . . .	0.13	0.00	0.01	0.00	0.00	0.00
Outflow, foreign . . .	206.56	152.12	154.54	141.79	134.14	126.49
Surplus ( deficit ) .	-206.43	-152.12	-154.53	-141.79	-134.14	-126.49
Net cashflow . . . . .	29.15	147.89	167.46	179.09	175.26	165.44
Cumulated net cashflow	-1140.85	-992.96	-825.49	-646.41	-471.14	-305.70



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	697.50	697.50	697.50	697.50	697.50	697.50
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	697.50	697.50	697.50	697.50	697.50	697.50
Total cash outflow . .	627.69	623.86	543.54	543.54	549.41	549.41
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	458.35	458.35	458.35	458.35	458.35	458.35
Cost of finance . . .	15.30	7.65	0.00	0.00	0.00	0.00
Repayment . . . . .	76.50	76.50	0.00	0.00	0.00	0.00
Corporate tax . . . .	77.54	81.36	85.19	85.19	91.06	91.06
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	69.81	73.64	153.96	153.96	148.09	148.09
Cumulated cash balance	163.46	237.10	391.07	545.03	693.12	841.21
Inflow, local . . . . .	697.50	697.50	697.50	697.50	697.50	697.50
Outflow, local . . . . .	508.85	512.67	516.50	516.50	522.57	522.57
Surplus ( deficit ) . .	188.65	184.83	181.00	181.00	175.13	175.13
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	118.84	111.19	27.04	27.04	27.04	27.04
Surplus ( deficit ) . .	-118.84	-111.19	-27.04	-27.04	-27.04	-27.04
Net cashflow . . . . .	161.61	157.79	153.96	153.96	148.09	148.09
Cumulated net cashflow	-144.09	13.70	167.67	321.63	469.72	617.81



COMEFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	697.50	697.50	697.50
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	697.50	697.50	697.50
Total cash outflow . .	549.41	563.86	577.92
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	458.35	458.35	458.35
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	91.06	105.51	119.57
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	148.09	133.64	119.57
Cumulated cash balance	989.30	1122.94	1242.51
Inflow, local . . . . .	697.50	697.50	697.50
Outflow, local . . . .	522.37	536.82	550.88
Surplus ( deficit ) .	175.13	160.68	146.61
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	27.04	27.04	27.04
Surplus ( deficit ) .	-27.04	-27.04	-27.04
Net cashflow . . . . .	148.09	133.64	119.57
Cumulated net cashflow	765.90	899.54	1019.11



**Cashflow Discountings:**

a) Equity paid versus Net income flow:

Net present value ..... -175.31 at 10.00 %  
Internal Rate of Return (IRRE1) .. 6.03 %

b) Net Worth versus Net cash return:

Net present value ..... -68.79 at 10.00 %  
Internal Rate of Return (IRRE2) .. 8.82 %

c) Internal Rate of Return on total investment:

Net present value ..... -40.39 at 10.00 %  
Internal Rate of Return (IRR) .. 9.44 %

Net Worth = Equity paid plus reserves





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	418.50	558.00	697.50	697.50	697.50
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	418.50	558.00	697.50	697.50	697.50
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	410.57	462.45	541.13	539.13	539.13
Operational margin . . . . .	7.93	95.55	156.37	158.37	158.37
As % of total sales . . . . .	1.90	17.12	22.42	22.71	22.71
Cost of finance . . . . .	61.20	53.55	45.90	38.25	30.60
Gross profit . . . . .	-53.27	42.00	110.47	120.12	127.77
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-53.27	42.00	110.47	120.12	127.77
Tax . . . . .	0.00	21.00	55.24	60.06	63.89
Net profit . . . . .	-53.27	21.00	55.24	60.06	63.89
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-53.27	21.00	55.24	60.06	63.89
Accumulated undistributed profit . . .	-53.27	-32.27	22.97	83.03	146.91
Gross profit, % of total sales . . . . .	-12.73	7.53	15.84	17.22	18.32
Net profit, % of total sales . . . . .	-12.73	3.76	7.92	8.61	9.16
RDE, Net profit, % of equity . . . . .	-9.51	3.75	9.86	10.73	11.41
RDI, Net profit+interest, % of invest.	0.64	5.99	8.02	7.79	7.49

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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	697.50	697.50	697.50	697.50	697.50
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	697.50	697.50	697.50	697.50	697.50
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	527.13	527.13	527.13	527.13	527.13
Operational margin .....	170.37	170.37	170.37	170.37	170.37
As % of total sales .....	24.43	24.43	24.43	24.43	24.43
Cost of finance .....	22.95	15.30	7.65	0.00	0.00
Gross profit .....	147.42	155.07	162.72	170.37	170.37
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	147.42	155.07	162.72	170.37	170.37
Tax .....	73.71	77.54	81.36	85.19	85.19
Net profit .....	73.71	77.54	81.36	85.19	85.19
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	73.71	77.54	81.36	85.19	85.19
Accumulated undistributed profit .....	220.62	298.16	379.52	464.70	549.89
Gross profit, % of total sales .....	21.14	22.23	23.33	24.43	24.43
Net profit, % of total sales .....	10.57	11.12	11.66	12.21	12.21
ROE, Net profit, % of equity .....	13.16	13.85	14.53	15.21	15.21
ROI, Net profit+interest, % of invest. ....	7.66	7.36	7.06	6.75	6.75



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	697.50	697.50	697.50	697.50	697.50
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	697.50	697.50	697.50	697.50	697.50
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	515.38	515.38	515.38	486.47	458.35
Operational margin . . . . .	182.12	182.12	182.12	211.03	239.15
As % of total sales . . . . .	26.11	26.11	26.11	30.25	34.29
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	182.12	182.12	182.12	211.03	239.15
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	182.12	182.12	182.12	211.03	239.15
Tax . . . . .	91.06	91.06	91.06	105.51	119.57
Net profit . . . . .	91.06	91.06	91.06	105.51	119.57
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	91.06	91.06	91.06	105.51	119.57
Accumulated undistributed profit . . .	640.95	732.01	823.07	928.59	1048.16
Gross profit, % of total sales . . . . .	26.11	26.11	26.11	30.25	34.29
Net profit, % of total sales . . . . .	13.06	13.06	13.06	15.13	17.14
ROE, Net profit, % of equity . . . . .	16.26	16.26	16.26	18.84	21.35
ROI, Net profit+interest, % of invest.	7.22	7.22	7.22	8.36	9.48



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2
<b>Total assets .....</b>	<b>1172.00</b>	<b>1172.00</b>	<b>1200.60</b>	<b>1231.20</b>
Fixed assets, net of depreciation	0.00	108.00	435.00	1200.60
Construction in progress .....	108.00	327.00	765.60	30.60
Current assets .....	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00
Cash surplus, finance available .	1064.00	737.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>1172.00</b>	<b>1172.00</b>	<b>1200.60</b>	<b>1231.20</b>
Equity capital .....	560.00	560.00	560.00	560.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00
Long and medium term debt .....	612.00	612.00	612.00	612.00
Current liabilities .....	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	28.60	59.20
<b>Total debt .....</b>	<b>612.00</b>	<b>612.00</b>	<b>640.60</b>	<b>671.20</b>
<b>Equity, % of liabilities .....</b>	<b>47.78</b>	<b>47.78</b>	<b>46.64</b>	<b>45.48</b>



COMFAR 2.0 - BALDO & CG. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year	1989	1990	1991	1992	1993	1994
Total assets	1286.69	1219.61	1138.60	1025.55	972.43	969.64
Fixed assets net of depreciation	1146.42	1061.64	978.86	898.08	817.30	748.53
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	83.02	101.76	124.36	124.36	124.36	124.36
Cash, bank	3.98	2.94	3.10	3.10	3.10	3.10
Cash surplus, finance available	0.00	0.00	0.00	0.00	27.66	93.65
Loss carried forward	0.00	53.27	32.27	0.00	0.00	0.00
Loss	53.27	0.00	0.00	0.00	0.00	0.00
Total liabilities	1286.69	1219.61	1138.60	1025.55	972.43	969.64
Equity capital	560.00	560.00	560.00	560.00	560.00	560.00
Reserves, retained profit	0.00	0.00	0.00	22.97	83.03	146.91
Profit	0.00	21.00	55.24	60.06	63.89	73.71
Long and medium term debt	535.50	459.00	582.50	306.00	229.50	153.00
Current liabilities	23.44	29.70	-36.02	36.02	36.02	36.02
Bank overdraft, finance required	167.75	149.91	104.84	40.51	0.00	0.00
Total debt	726.69	638.61	523.36	382.52	265.52	189.02
Equity, % of liabilities	43.52	45.92	49.18	54.60	57.59	57.75



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>970.68</b>	<b>975.54</b>	<b>1060.72</b>	<b>1145.91</b>	<b>1236.97</b>	<b>1328.03</b>
Fixed assets, net of depreciation	679.75	610.97	542.19	473.41	416.38	359.35
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	124.36	124.36	124.36	124.36	124.36	124.36
Cash, bank .....	3.10	3.10	3.10	3.10	3.10	3.10
Cash surplus, finance available	163.46	237.10	391.07	545.03	693.12	841.21
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>970.68</b>	<b>975.54</b>	<b>1060.72</b>	<b>1145.91</b>	<b>1236.97</b>	<b>1328.03</b>
Equity capital .....	560.00	560.00	560.00	560.00	560.00	560.00
Reserves, retained profit .....	220.62	298.16	379.52	464.70	549.69	640.95
Profit .....	77.54	81.36	85.19	85.19	91.06	91.06
Long and medium term debt .....	76.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	36.02	36.02	36.02	36.02	36.02	36.02
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>112.52</b>	<b>36.02</b>	<b>36.02</b>	<b>36.02</b>	<b>36.02</b>	<b>36.02</b>
<b>Equity, % of liabilities .....</b>	<b>57.69</b>	<b>57.40</b>	<b>52.79</b>	<b>48.97</b>	<b>45.27</b>	<b>42.17</b>



COMFAR 2.0 - SALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year	2001	2002	2003
Total assets	1419.09	1524.60	1644.18
Fixed assets, net of depreciation	302.32	274.20	274.20
Construction in progress	0.00	0.00	0.00
Current assets	124.36	124.36	124.36
Cash, bank	3.10	3.10	3.10
Cash surplus, finance available	989.30	1122.94	1242.51
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	1419.09	1524.60	1644.18
Equity capital	560.00	560.00	560.00
Reserves, retained profit	732.01	823.07	928.59
Profit	91.06	105.51	119.57
Long and medium term debt	0.00	0.00	0.00
Current liabilities	36.02	36.02	36.02
Bank overdraft, finance required	0.00	0.00	0.00
Total debt	36.02	36.02	36.02
Equity, % of liabilities	39.46	36.73	34.06

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1 US \$:

1) TOTAL REVENUES (EX WORKS)	<u>697,500</u>
2) VARIABLE COSTS:	<u>424,760</u>
. RAW MATERIALS	288,330
. UTILITIES	450
. ENERGY	95,110
. LABOUR	40,870
3) FIXED COSTS	<u>162,270</u>
. REPAIR-MAINTENANCE	11,590
. SPARES	22,000
. DEPRECIATION	82,780
. FINANCIAL COSTS	45,900
4) TOTAL PRODUCTION COSTS	<u>587,030</u>

$$\text{BEP} \quad \frac{162,270}{697,500 - 424,760} \times 100 = 59.5\%$$

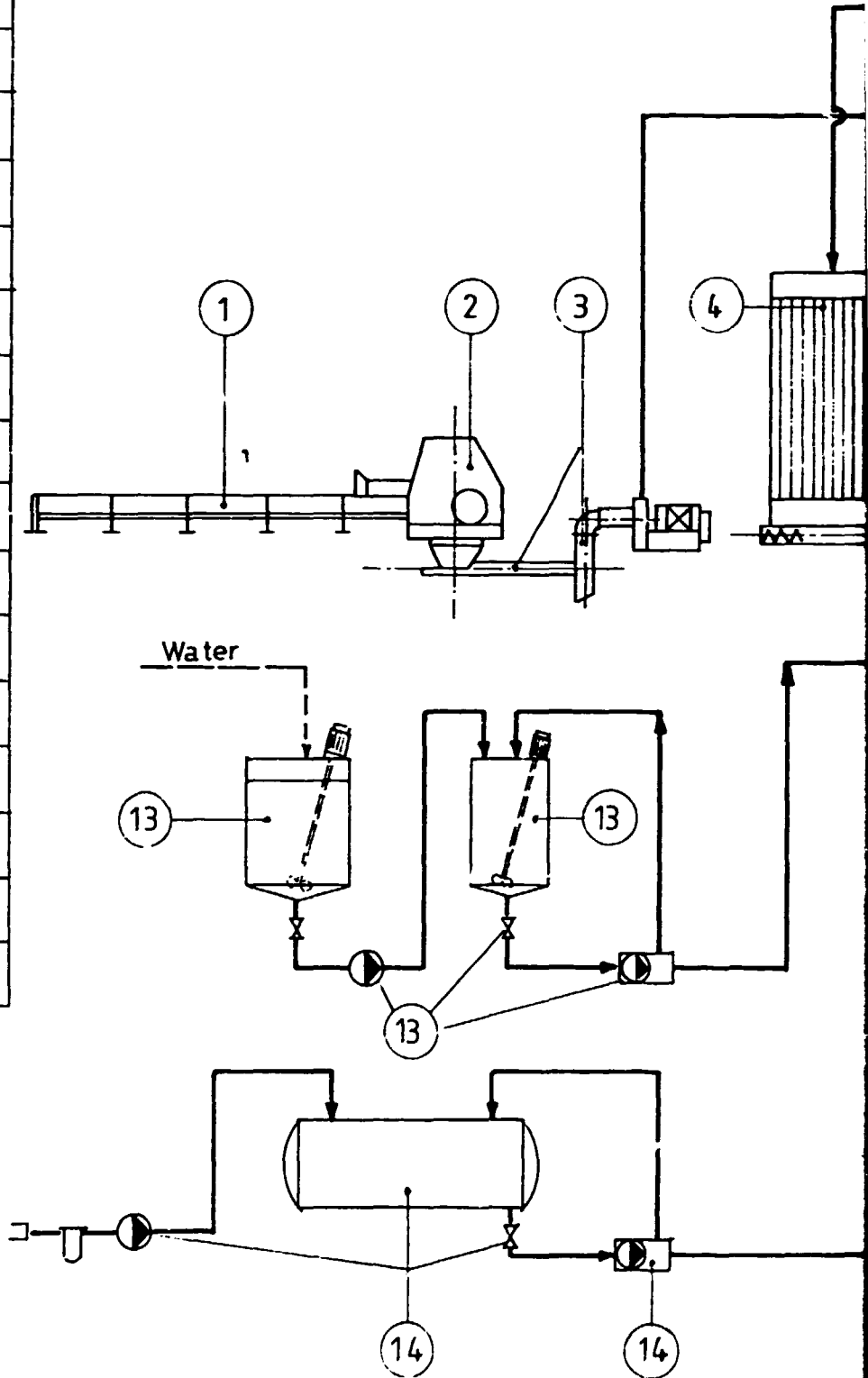
**Animal Feed**

**ANNEXE 3**

**DRW. B 162-11-1**  
**STRAW PROCESSING PLANT**

# LEGEND

1	FEEDING PLATFORM
2	CUTTING MACHINE TYPE F 32 / C
3	PNEUMATIC TRANSPORT SYSTEM
4	DECANTATION & FILTERING SYSTEM
5	VERTICAL MIXER TYPE F 100 / L
6	SLANT SCREW CONVEYOR
7	MOLASSES ADDING MACHINE
8	PELLETING PRESS TYPE M 1000
9	SCREW CONVEYOR
10	BELT CONVEYOR
11	VERTICAL COOLER TYPE RV23
12	DUST RECOVERY SYSTEM
13	SODA PREPARATION, MIXING AND DOSING SYSTEM
14	MOLASSES STORING AND DOSING EQUIPMENT
15	COMPRESSED AIR PRODUCTION & DISTRIBUTION SYSTEM
16	HOT WATER PRODUCTION & DISTRIBUTION STATION
17	ELECTRIC CONTROL AND POWER BOARD



## SECTION 1



U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF INDUSTRIAL CANVAS  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXE**

**ANNEXE 1 - FINANCIAL EVALUATION**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

0. SUMMARY AND CONCLUSIONS

This study analyzes the opportunity of producing industrial canvas in Ethiopia. The present consumption of industrial canvas, presently imported, is as follows:  
- 350,000 sq.mt for the manufacturing of tents and similar goods

It is assumed that this market will progressively increase and therefore a plant for the production of 2,250,000 sq.mt. canvas (both models) is proposed.

The fixed capital investment needed is in the range of 11.6 Mil. US \$. The plant will have a staff of 124 and can be integrated in any of the existing textile mills under the control of the National Textile Corporation. The internal rate of return on total investment is 14.86 and the foreign exchange effect is also positive.

The preparation of a detailed feasibility study is recommended.



1. INTRODUCTION

Industrial canvas is a coarse cloth made of cotton or other fibres. The most distinctive feature of this woven fabric is its weight and therefore its high resistance; the weight is 400 g/m<sup>2</sup> or above. Other features such as e.g. water resistance and rot resistance depend on the end use of the canvas.

The two samples given to the Consultants had a weight of about 480-500 g/m<sup>2</sup>. Fibre processing for manufacturing this type of cloth is much the same as for lighter textiles, but due to the yarn count the spinning and weaving machines are heavier and stronger and operate at a lower speed. The other operations (mercerizing, washing, bleaching, dyeing, drying, etc) can be performed in the same production line as other clothes.

For these reasons the industrial canvas production may be accomplished in a separate factory or, depending on the required capacity, may be integrated in an existing textile factory.

2. MARKET AND PLANT CAPACITY

2.1 Uses

The uses of heavy clothes may be various especially in the field of the protection of persons and goods against atmospheric conditions: solar radiation, rain, cold weather, wind, etc.; in this field the performance of clothes made of cotton or hemp are still the best, since these fibres are more durable and comfortable than synthetic products in these applications.

Their main uses, therefore, are for manufacturing tents, sacks, bags, rucksacks, awnings, tarpaulins, sails, temporary covering and other similar articles.

Another large field of application is the manufacture of shoes, especially of training shoes, which at present have a large market in all countries.

2.2 Forecast demand and plant capacity

At present heavy canvas for industrial use is not produced in the country, but has to be imported.

The forecast consumptions of this canvas, worked out by National Textiles Corp., are as follows:

- a) 350,000 m<sup>2</sup> for the manufacturing of tents and similar goods
- b) 1,400,000 m<sup>2</sup> for the manufacturing of heavy duty canvas shoes

The first figure according to the information received by the Consultants should correspond to the present value of imports. From the analysis of the import statistic a real trend is not identifiable, as the

quantities imported are rather irregular.

The second figure is in accordance with the forecasts of the N.L.S.C. relating to the developing of canvas shoe production.

Since the machinery for the production of both canvas is the same, and an increase in the use of these textiles is expected at short/medium term, the plant is proposed to have a production capacity of 2,250,000 sq.mt, that is, assuming a cloth width of 150 cm, around 1,500,000 linear metres of cloth per year, working on three shifts a day for 6700 h/y.

### 2.3 Sale prices and total revenues

No import prices are available at the time of the study and therefore the ex-works selling price has been assumed as similar to these in Europe, i.e. 4.6 \$/linear meter for the raw cloth and 6.9 \$/linear meter for finished cloth.

It has been stated that the proposed unit will produce only raw canvas while finishing will be carried out on existing lines.

At full production the total revenues will be as follows:

$$1,500,000 \text{ mts} \times 4.6 \text{ \$/m} = 6,900,000 \text{ \$}$$

3. MATERIAL AND INPUTS

3.1 Technology

The proposed cloth is made of woven cotton starting from bales of cotton, so that the cotton is the only required raw material. Since the proposed machinery is only relevant to the production of the woven raw fabric, no other reagent or additive is required.

3.2 Materials and utilities requirements and costs

The yield of cloth referred to the supply of cotton has been assumed as 90% by weight. Therefore for the production of 1,500,000 m or 2,250,000 m<sup>2</sup> of cloth of an average weight of 500 g/sq.mt, the annual consumption of cotton will be:

$$\frac{2,250,000 \text{ m}^2/\text{y} \times 0.5 \text{ kg/sq.mt}}{0.9} = 1,250,000 \text{ kg/y}$$

and at a price of 1.6 \$/Kg, the annual expenditure is:  
 $1,250,000 \times 1.6 = 2,000,000 \text{ \$/y}$

As for electricity, considering all the consumptions from the plucking to the woven fabric, the annual cost will be:

$$3.3 \text{ kWh/kg} \times 1,125,000 \text{ kg/y} \times 0.2 \text{ birr/kwh} = 742,500 \text{ birr/y} = 358,695 \text{ \$/y.}$$

3.3 Purchasing programme and storage volume

A stock of cotton equivalent to one month's full production is advisable; this means 100t of cotton equivalent to 120000 \$.

4. LOCATION

The proposed plant is conceived as a partial expansion of an existing textile factory; so it can be located adjacent to the Akaki factory, as originally foreseen, or, if the available area at the site is not large enough, near another factory.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The project takes into consideration all the process steps from cotton bale plucking to the woven fabric. Other operations such as mercerizing, bleaching, dyeing or impregnation are presumed as being carried out in the existing facility of the factory.

In connection with the high strength required by the end-use, the classic ring spinning in the carded system is suggested and no combing machine is included.

Consequently the considered process phases are:

a) Yarn spinning

- bale plucking
- fibres beating and cleaning
- carding
- multiple coupling and drawing
- roving frame
- ring spinning frame

b) threads preparation

- cone winding
- double winding
- double twist frames

c) cloth preparation

- weaving

Note: the warp preparation as well as the finishing or dyeing treatment are presumed as being accomplished in the existing departments of the factory, as the installation of new machinery for such a small capacity is not economically viable.

For the execution of the above mentioned sequence of operations relevant to the production of clothes having the following characteristics, the machinery listed below is required.

Characteristics of the clothes (corresponding to the samples handed over by NTC to the Consultants):

a) amount: 450,000 m<sup>2</sup>  
weight: about 500 g/m<sup>2</sup>  
warp: 22 ends/cm of Ne 14/3  
weft: 12 picks/cm of Ne 14/3

b) amount: 1,800,000 m<sup>2</sup>  
weight: about 500 g/m<sup>2</sup>  
warp: 22 ends/cm of Ne 12/4  
weft: 10 picks/cm of Ne 14/2

In a more general way the proposed machinery will be capable of producing canvas with characteristics ranging as follows:

- warp: from 15 to 22 ends/cm
- weft: from 8 to 15 "
- threads: from Ne 12 to Ne 16 twisted by 2,3 and 4 plys
- amount: 1125 t of cotton fabrics per year

The equipment list includes mainly:

- a) spinning room
- n.1 bale plucker
  - n.2 cleaning and beating units, working in sequence
  - n.6 cards (air feeders included) working in parallel
  - n.2 first-draw frames, working in parallel
  - n.2 second-draw frames, working in parallel, complete with autolevelers



- roving frames fitted with 100 spindles and complete with automatic doffing device
- spinning frames fitted with 6000 spindles and complete with automatic doffing device

b) threading room

- n.2 automatic cone winders, each fitted with 48 spindles sized for supplying 200 Kg/h of Ne13 thread (1000 m/min) complete with individual splicers and electronic yarn cleaners
- n.2 doubling winders each fitted with 24 spindles, sized for supplying 200 Kg/h of Nm 6.8 thread (650 m/min - 4200 gr/h/spindles)
- n.4 twisters, each fitted with 270 spindles sized for supplying 200 Kg/h of twisted threads (see above) complete with travelling suction units

c) loom room

- n.8 rapier weaving machine in 1900 mm width, cam motion type; suitable for producing cloth of 1500 width, waste selvages included. Each loom is complete with the following main standard accessories as:

cam system

automatic pick finder

central lube oil system

- . simple beam with 800 mm flanges, plus one spare
- . pick counter at 3 shifts
- . warp motion stop, electric type, 6 rows, 30 or 16 mm distance
- . weft control and automatic density adjustment from 3 to 80 pick/cm
- . light alloy cloth roller, plus one spare
- . weft selector up to 8 colours
- . anti-fold bar

- . 12 healds frames with quick hookup and separate guides
  - . 5000 healds 5.50x0.3, eyelet 6.5x1.8/330 mm
  - . 5000 drop-wires: 180 x 11 x 0.3
  - . reed
  - . weft pre-feeder with creel with separate coils at two plys
- n.4 looms, with the same characteristics as above, but fitted with a dobby system, Staubli type, for the moving of heddles.

Note: this solution, consisting of a mixed installation of cam and dobby looms, is a little more expensive than the solution with only cam looms, but offers the advantage of having a more flexible plant, not limited to the production of one type of cloth only, but with the possibility of producing, even if at a reduced capacity, any type of web, according to the request.

The total number of looms has been selected on the basis of the following calculation.

- amount of canvas to be produced annually:
  - 450,000 m<sup>2</sup>/y for the industrial utilizations
  - 1,800,000 m<sup>2</sup>/y for the heavy shoe manufacturing
  - or having assumed a width of 1.5 m for the web
  - 300,000 m/y for the industrial utilizations
  - 1,200,000 m/y for the heavy shoe manufacturing
  - 
  - 1,500,000 m/y total
  
- pick density: 10 picks/cm for the industrial canvas  
12 picks/cm for the shoe canvas

- total amount of picks:

10 x 100 x 300,000 = 300 millions per year for the industrial canvas

12 x 100 x 1,200,000 = 1,200 millions per year for the shoe canvas

As a total, 1,500 million picks per year

- quantity of looms:

assuming for the looms a rate of production of 400 picks per minute, and an annual working time (as for all the other machines) of 6,700 hours, the required loom quantity for producing 1,500,000 m/y of heavy canvas, is:

$$\frac{1,500 \text{ millions}}{400 \times 60 \times 6700} = 9.32$$

$$400 \times 60 \times 6700$$

and given an efficiency of 0.8 for taking into account the yarn ruptures and the time required for loading and unloading the looms:

$$\frac{9.3}{0.8} = 11.7, \text{ that is } 12 \text{ looms}$$

$$0.8$$

The process machinery installation should be completed by the following auxiliary plants:

- three air conditioning (dehumidifying) units for the three rooms, of the adiabatic (evaporative cooling) type, designed to keep the humidity levels in the following ranges:

45-50, in the winding room

55-60, in the threading room

55-65, in the loom room

- 1 compressed air unit including two air compressors (one stand-by) of 300 m<sup>3</sup>/h capacity and one 10 m<sup>3</sup> surge drum.
- anti-fire system of the sprinkler type.

## 5.2 Finishing treatment and packaging

The finishing treatments may include scorching, mercerizing, bleaching, drying, dyeing, water proofing and packaging. As stated above all these treatments, where applicable, may be carried out in the departments already existing in the factory for the same purpose. All these treatments are evaluated on the European market at a cost ranging from 2.4 to 2.8 \$/m.

## 5.3 Lay out and civil works

All the above mentioned machinery is installed inside a single-storey building (5,5m high) covering an area of about 4,000 - 5,000 sq.mt.

The construction is of reinforced concrete as supporting structures; the external and internal walls are of brickwork; the trusses are of standard steel members; the roof is of corrugated asbestos-cement insulated with mineral wool lagging.

All the floors are of reinforced concrete construction with a hard aggregate as finishing surface; in particular the design of the floor of the loom room must be carried out by an expert civil engineer due to the importance of the static and dynamic forces which are

developed by the loom during the operation.

**5.4 Investment cost, depreciation and maintenance**

The investment costs for the machinery and equipment for the process and utility plants according to the above mentioned description are as follows:

	FC	LC	Total
	M\$	M\$	M\$
Machinery and equipment for the spinning room, FOB European port	2.51	-	2.51
Machinery and equipment for the threading room/ FOB European port	1.27	-	1.27
Machinery and equipment for the loom room, FOB European port	0.59	-	0.59
	----	----	-----
	4.37	0.00	4.37
Machinery and equipment for the auxiliary plants FOB European port	1.6		1.6
	----	----	-----
	5.97	0.00	5.97
transportations	0.60	0.60	1.20

Erection	0.60	0.60	1.20
Land and site preparation	-	0.20	0.20
Civil works	-	1.85	1.85
Spare parts	0.15	-	0.15
	----	----	----
Total	7.32	3.25	10.57
Contingency	0.68	0.35	1.03
	----	----	----
Grand total	8.00	3.50	11.60

The life cycle of this plant can be estimated at 15 years.

The annual cost of maintenance is assumed to be 2% of the machinery value.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

Machinery	FC	8.000 million \$
Machinery	LC	1.200 " "
Civil Work	LC	2.200 " "
Site preparation	LC	0.200 " "
		-----
	TOTAL	11.600 million \$

6. PLANT ORGANIZATION

The plant has been conceived as an expansion of an existing factory of the NTC; the plant does not cause any modification in the plant organization, only requiring the increase of the operating manpower.

7. MANPOWER

The management and the administrative offices are the same as for the existing factory. The only new requirements regard the operating and maintenance personnel, mainly due to the increase of the work places more than to the necessity of new technical abilities. The required new personnel is estimated as follows:

		birr/m	birr/y
. Department prod.mng.	n. 1	1000	
. Shift foremen	n. 9	3600	
. Shift operators	n.54	18900	
. Shift helpers	n.32	9600	
. Shift mechanics	n. 15	6000	
. Clerk	n. 1	350	
	----	-----	-----
	n.112	39450	473400
			(228,696 \$/y)
Maintenance mechanics	n. 2	1200	
Electricians	n. 3	800	
Instrument specialists	n. 2	800	
Unskilled workers	n. 5	1000	
	----	----	-----
	n.12	3800	45600
			(22,029 \$/y)



8. IMPLEMENTATION SCHEDULING

From the awarding of the orders for the main items, a total construction time of 18 months is required.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. Such evaluation has been based on the data indicated in the study and on the followings:

- working capital input table: MDC

	FC	LC
Utilities	1	1
Work in hand	7	7

- the assistance of two foreign experts for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- the production programme has been assumed as follows:  
1st year : 30% capacity (450,000m)  
2nd year : 50% capacity (750,000m)  
3rd year : 75% capacity (1,125,000m)  
from the 4th to the 15th year: 100% capacity  
(1,500,000m)

Selling price 4.6 \$/m

As a result the evaluation gives an IRR of 14.86 and a BEP of 30%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 2.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import: 2.75 \$/linear meter CIF ASSAB

While the net foreign exchange flow results negative (no export is foreseen), the net foreign exchange effect is positive; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 28,317,800\$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, there would still be a surplus which in terms of present value would amount to 28,317,000 \$.

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Industrial Canvas

ANNEXE 1

**FINANCIAL EVALUATION**



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**INDUSTRIAL CANNS**  
February 88  
**BASIC PROJECT**

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	11710.00	68.318 % foreign
current assets:	0.00	0.000 % foreign
total assets:	11710.00	68.318 % foreign

**Source of funds during construction phase**

equity & grants:	4910.00	0.000 % foreign
foreign loans :	6800.00	
local loans :	0.00	
total funds :	11710.00	58.070 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1054.73	1489.73	2109.73
depreciation :	785.64	785.64	765.64
interest :	680.00	595.00	510.00
production costs	2520.37	2870.37	3385.37
thereof foreign	51.96 %	41.41 %	33.49 %
total sales :	2070.00	3450.00	5175.00
gross income :	-450.37	579.63	1789.63
net income :	-450.37	289.81	894.81
cash balance :	-731.61	127.62	671.15
net cashflow :	798.39	1572.62	2031.15

Net Present Value at: 10.00 % = 4146.94  
Internal Rate of Return: 14.86 %  
Return on equity1: 16.53 %  
Return on equity2: 16.72 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



Total Initial Investment in 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1
Fixed investment costs			
Land, site preparation, development	200.00	0.00	0.00
Buildings and civil works .....	330.00	1540.00	330.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant machinery and equipment ...	1600.00	4600.00	3000.00
Total fixed investment costs .....	2130.00	6140.00	3330.00
Pre-production capital expenditures.	0.00	10.00	100.00
Net working capital .....	0.00	0.00	0.00
Total initial investment costs ...	2130.00	6150.00	3430.00
Of it foreign, in % .....	75.12	65.04	69.97



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Total Current Investment in 1000 US DOLLARS

Year .....	1989	1990	1991	1992
Fixed investment costs				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00	0.00
Total fixed investment costs .....	0.00	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00
Working capital .....	216.88	97.84	139.31	137.98
Total current investment costs ...	216.88	97.84	139.31	137.98
Of it foreign, % .....	26.56	16.25	26.38	25.75

INDUSTRIAL CANONS — February 88



**COMFAR**  
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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	30.00	50.00	75.00	100.00	100.00	100.00
Raw material 1 . . . . .	600.00	1000.00	1500.00	2000.00	2000.00	2000.00
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	108.00	179.00	269.00	358.00	358.00	358.00
Labour, direct . . . . .	228.70	228.70	228.70	228.70	228.70	228.70
Repair, maintenance . . . . .	22.03	22.03	22.03	22.03	22.03	22.03
Spares . . . . .	36.00	60.00	90.00	119.00	119.00	119.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1054.73</b>	<b>1469.73</b>	<b>2109.73</b>	<b>2727.73</b>	<b>2727.73</b>	<b>2727.73</b>
Administrative overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	785.64	785.64	785.64	785.64	785.64	723.64
Financial costs . . . . .	680.00	595.00	510.00	425.00	340.00	255.00
<b>Total production costs . . . . .</b>	<b>2520.37</b>	<b>2870.37</b>	<b>3385.37</b>	<b>3898.37</b>	<b>3813.37</b>	<b>3706.37</b>
<b>Costs per unit ( single product ) .</b>	<b>5.60</b>	<b>3.83</b>	<b>3.01</b>	<b>2.60</b>	<b>2.54</b>	<b>2.47</b>
Of it foreign, % . . . . .	51.96	41.41	33.49	27.64	26.03	24.49
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	228.70	228.70	228.70	228.70	228.70	228.70





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Total Production Costs in 1000 US DOLLARS

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of max. capacity (single product)	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Energy .....	358.00	358.00	358.00	358.00	358.00	358.00
Labour, direct .....	228.70	228.70	228.70	228.70	228.70	228.70
Repair, maintenance .....	22.03	22.03	22.03	22.03	22.03	22.03
Spares .....	119.00	119.00	119.00	119.00	119.00	119.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2727.73</b>	<b>2727.73</b>	<b>2727.73</b>	<b>2727.73</b>	<b>2727.73</b>	<b>2727.73</b>
Administrative overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	723.64	723.64	723.64	613.64	302.68	0.00
Financial costs .....	170.00	85.00	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>3621.37</b>	<b>3536.37</b>	<b>3451.37</b>	<b>3341.37</b>	<b>3030.41</b>	<b>2727.73</b>
<b>Costs per unit ( single product ) .</b>	<b>2.41</b>	<b>2.36</b>	<b>2.30</b>	<b>2.23</b>	<b>2.02</b>	<b>1.82</b>
Of it foreign, % .....	22.72	20.86	18.91	19.53	12.61	4.36
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	228.70	228.70	228.70	228.70	228.70	228.70



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year .....		1989	1990	1991	1992	1993-2003
Coverage .....	ndc coto					
Current assets &						
Accounts receivable . . . . .	30 12.0	87.89	124.14	175.81	227.31	227.31
Inventory and materials . . . . .	30 12.0	50.00	83.33	125.00	166.67	166.67
Energy .....	1 360.0	0.30	0.50	0.75	0.99	0.99
Spares .....	360 1.0	36.00	60.00	90.00	119.00	119.00
Work in progress .....	7 51.4	20.51	28.97	41.02	53.04	53.04
Finished products . . . . .	30 12.0	87.89	124.14	175.81	227.31	227.31
Cash in hand .....	15 24.0	14.45	12.95	14.20	15.41	15.41
Total current assets .....		297.04	434.03	622.59	809.73	809.73
Current liabilities and						
Accounts payable .....	29 12.5	80.16	119.31	168.56	217.72	217.72
Net working capital .....		216.88	314.72	454.03	592.00	592.00
Increase in working capital .....		216.88	97.84	139.31	137.97	0.00
Net working capital, local .....		159.28	241.22	343.78	446.23	446.23
Net working capital, foreign .....		57.60	73.50	110.25	145.78	145.78

Notes: ndc = minimum days of coverage ; coto = coefficient of turnover .



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1
Equity, ordinary ..	4910.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	6800.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	6800.00
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	11710.00

INDUSTRIAL CANONS — February 88



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-850.00	-850.00	-850.00	-850.00	-850.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-850.00	-850.00	-850.00	-850.00	-850.00
Current liabilities	80.16	39.15	49.25	49.16	0.00
Bank overdraft ....	731.61	-127.62	-604.00	0.00	0.00
Total funds .....	-38.23	-938.47	-1404.75	-800.84	-850.00

INDUSTRIAL CAMPS — February 88



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in: 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1	1988.2
Total cash inflow ..	11710.00	0.00	0.00	0.00
Financial resources .	11710.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow . .	2130.00	6150.00	3430.00	0.00
Total assets .....	2130.00	6150.00	3430.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	9580.00	-6150.00	-3430.00	0.00
Cumulated cash balance	9580.00	3430.00	0.00	0.00
Inflow, local . . . .	4710.00	0.00	0.00	0.00
Outflow, local . . . .	530.00	2150.00	1030.00	0.00
Surplus ( deficit ) .	4380.00	-2150.00	-1030.00	0.00
Inflow, foreign . . .	6800.00	0.00	0.00	0.00
Outflow, foreign . . .	1600.00	4000.00	2400.00	0.00
Surplus ( deficit ) .	5200.00	-4000.00	-2400.00	0.00
Net cashflow . . . . .	-2130.00	-6150.00	-3430.00	0.00
Cumulated net cashflow	-2130.00	-8280.00	-11710.00	-11710.00



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21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993	1994
Total cash inflow ..	2150.16	3489.25	5224.25	6949.16	6900.00	6900.00
Financial resources .	80.16	39.25	49.25	49.16	0.00	0.00
Sales, net of tax ..	2070.00	3450.00	5175.00	6900.00	6900.00	6900.00
Total cash outflow ..	2881.77	3361.63	4553.10	5690.68	5461.05	5429.55
Total assets .....	297.04	136.99	188.56	187.14	0.00	0.00
Operating costs ...	1054.73	1489.73	2109.73	2727.73	2727.73	2727.73
Cost of finance ...	680.00	595.00	510.00	425.00	340.00	255.00
Repayment .....	850.00	850.10	850.00	850.00	850.00	850.00
Corporate tax ...	0.00	289.81	894.81	1500.81	1543.31	1594.81
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-731.61	127.62	671.15	1258.48	1438.95	1471.45
Cumulated cash balance	-731.61	-604.00	67.15	1325.63	2764.59	4235.04
Inflow, local .....	2149.89	3489.25	5224.17	6949.08	6900.00	6900.00
Outflow, local .....	1197.91	1840.73	3066.27	4261.08	4152.05	4205.55
Surplus ( deficit ) ..	951.99	1648.52	2157.90	2688.00	2747.95	2694.45
Inflow, foreign ...	0.27	0.00	0.08	0.08	0.00	0.00
Outflow, foreign ...	1683.87	1520.90	1486.83	1429.61	1309.00	1224.00
Surplus ( deficit ) .	-1683.60	-1520.90	-1486.75	-1429.52	-1309.00	-1224.00
Net cashflow .....	798.39	1572.62	2031.15	2533.48	2628.95	2575.45
Cumulated net cashflow	-10911.61	-9339.00	-7307.85	-4774.37	-2145.41	430.04



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALLO & CO. S.R.L., MILANO ---

Cashflow tables, production in 1000 US DOLLARS

Year .....	1995	1996	1997	1998	1999	2000
Total cash inflow ..	6900.00	6900.00	6900.00	6900.00	6900.00	6900.00
Financial resources ..	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	6900.00	6900.00	6900.00	6900.00	6900.00	6900.00
Total cash outflow ..	5387.05	5344.55	4452.05	4452.05	4507.05	4507.05
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs .....	2727.73	2727.73	2727.73	2727.73	2727.73	2727.73
Cost of finance .....	170.00	85.00	0.00	0.00	0.00	0.00
Repayment .....	850.00	850.00	0.00	0.00	0.00	0.00
Corporate tax .....	1639.31	1681.81	1724.31	1724.31	1779.31	1779.31
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) ..	1512.95	1555.45	2447.95	2447.95	2392.95	2392.95
Cumulated cash balance	5748.00	7303.45	9751.41	12199.36	14592.32	16985.27
Inflow, local .....	6900.00	6900.00	6900.00	6900.00	6900.00	6900.00
Outflow, local .....	4248.05	4290.55	4333.05	4333.05	4388.05	4388.05
Surplus ( deficit ) ..	2651.95	2609.45	2566.95	2566.95	2511.95	2511.95
Inflow, foreign .....	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign .....	1139.00	1054.00	119.00	119.00	119.00	119.00
Surplus ( deficit ) ..	-1139.00	-1054.00	-119.00	-119.00	-119.00	-119.00
Net cashflow .....	2532.95	2490.45	2447.95	2447.95	2392.95	2392.95
Cumulated net cashflow	2963.00	5452.45	7901.40	10349.36	12742.31	15135.27



**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	2001	2002	2003
Total cash inflow ..	6900.00	6900.00	6900.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax ..	6900.00	6900.00	6900.00
Total cash outflow ..	4507.05	4662.53	4613.87
Total assets .....	0.00	0.00	0.00
Operating costs .....	2727.73	2727.73	2727.73
Cost of finance .....	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00
Corporate tax .....	1779.31	1934.80	2086.14
Dividends paid .....	0.00	0.00	0.00
Surplus ( deficit ) .	2392.95	2237.47	2086.13
Cumulated cash balance	19378.23	21615.70	23701.84
Inflow, local .....	6900.00	6900.00	6900.00
Outflow, local .....	4388.05	4543.53	4694.87
Surplus ( deficit ) .	2511.95	2356.47	2205.13
Inflow, foreign .....	0.00	0.00	0.00
Outflow, foreign .....	119.00	119.00	119.00
Surplus ( deficit ) .	-119.00	-119.00	-119.00
Net cashflow .....	2392.95	2237.47	2086.13
Cumulated net cashflow	17528.22	19765.70	21851.83





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

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**Cashflow Discounting:**

c) Equity paid versus Net income flow			
Net present value .....	3384.42	at	10.00 %
Internal Rate of Return (IRR1) ..	16.53	%	
d) Net Worth versus Net cash return:			
Net present value .....	4167.10	at	10.00 %
Internal Rate of Return (IRR2) ..	16.72	%	
e) Internal Rate of Return on total investment:			
Net present value .....	4146.94	at	10.00 %
Internal Rate of Return ( IRR ) ..	14.86	%	
Net Worth = Equity paid plus reserves			

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INDUSTRIAL CANARS — February 88



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993
Total sales, incl. sales tax .....	2070.00	3450.00	5175.00	6900.00	6900.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	3.00	0.00
Variable margin .....	2070.00	3450.00	5175.00	6900.00	6900.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	1840.37	2275.37	2875.37	3473.37	3473.37
Operational margin .....	229.63	1174.63	2299.63	3426.63	3426.63
As % of total sales .....	11.09	34.05	44.44	49.66	49.66
Cost of finance .....	680.00	595.00	510.00	425.00	340.00
Gross profit .....	-450.37	579.63	1789.63	3001.63	3086.63
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	-450.37	579.63	1789.63	3001.63	3086.63
Tax .....	0.00	289.81	894.81	1500.81	1943.31
Net profit .....	-450.37	289.81	894.81	1500.81	1943.31
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	-450.37	289.81	894.81	1500.81	1943.31
Accumulated undistributed profit .....	-450.37	-160.56	734.26	2235.07	3778.39
Gross profit, % of total sales .....	-21.76	16.80	34.58	43.50	44.73
Net profit, % of total sales .....	-21.76	8.40	17.29	21.75	22.37
ROE, Net profit, % of equity .....	-9.17	5.90	18.22	30.57	31.43
ROI, Net profit+interest, % of invest. ....	1.93	7.36	11.55	15.65	15.31



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	6900.00	6900.00	6900.00	6900.00	6900.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	6900.00	6900.00	6900.00	6900.00	6900.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	3451.37	3451.37	3451.37	3451.37	3451.37
Operational margin .....	3448.63	3448.63	3448.63	3448.63	3448.63
As % of total sales .....	49.98	49.98	49.98	49.98	49.98
Cost of finance .....	25.00	170.00	85.00	0.00	0.00
Gross profit .....	3193.63	3278.63	3363.63	3448.63	3448.63
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	3193.63	3278.63	3363.63	3448.63	3448.63
Tax .....	1596.81	1639.31	1681.81	1724.31	1724.31
Net profit .....	1596.81	1639.31	1681.81	1724.31	1724.31
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	1596.81	1639.31	1681.81	1724.31	1724.31
Accumulated undistributed profit .....	5375.20	7014.52	8696.33	10420.65	12144.96
Gross profit, % of total sales .....	46.28	47.52	48.75	49.98	49.98
Net profit, % of total sales .....	23.14	23.76	24.37	24.99	24.99
RCE, Net profit, % of equity .....	32.52	33.39	34.25	35.12	35.12
ROI, Net profit+interest, % of invest.	15.05	14.71	14.36	14.02	14.02



**COMFAR**  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	6900.00	6900.00	6900.00	6900.00	6900.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	6900.00	6900.00	6900.00	6900.00	6900.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	3341.37	3341.37	3341.37	3030.41	2727.73
Operational margin . . . . .	3558.63	3558.63	3558.63	3869.59	4172.27
As % of total sales . . . . .	51.57	51.57	51.57	56.08	60.47
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	3558.63	3558.63	3558.63	3869.59	4172.27
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	3558.63	3558.63	3558.63	3869.59	4172.27
Tax . . . . .	1779.31	1779.31	1779.31	1934.80	2086.14
Net profit . . . . .	1779.31	1779.31	1779.31	1934.80	2086.14
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1779.31	1779.31	1779.31	1934.80	2086.14
Accumulated undistributed profit . . . . .	13924.28	15703.59	17482.91	19417.70	21503.84
Gross profit, % of total sales . . . . .	51.57	51.57	51.57	56.08	60.47
Net profit, % of total sales . . . . .	25.79	25.79	25.79	28.04	30.23
ROE, Net profit, % of equity . . . . .	36.24	36.24	36.24	39.41	42.49
ROI, Net profit+interest, % of invest. . . . .	14.46	14.46	14.46	15.73	16.96



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1	1988.2
Total assets .....	11710.00	11710.00	11710.00	11710.00
Fixed assets, net of depreciation	0.00	2130.00	8280.00	11710.00
Construction in progress .....	2130.00	6150.00	3430.00	0.00
Current assets .....	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00
Cash surplus, finance available .	9580.00	3430.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00
Total liabilities .....	11710.00	11710.00	11710.00	11710.00
Equity capital .....	4910.00	4910.00	4910.00	4910.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00
Long and medium term debt .....	6800.00	6800.00	6800.00	6800.00
Current liabilities .....	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00
Total debt .....	6800.00	6800.00	6800.00	6800.00
Equity, % of liabilities .....	41.93	41.93	41.93	41.93



**COMFAR**  
2.1 UNIDOC

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year	1989	1990	1991	1992	1993	1994
<b>Total assets</b>	<b>11671.77</b>	<b>11023.12</b>	<b>10223.38</b>	<b>10762.80</b>	<b>11456.11</b>	<b>12202.93</b>
Fixed assets, net of depreciation	10924.36	10138.72	9373.08	8627.44	7881.80	7158.16
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	282.60	421.07	608.39	794.32	794.32	794.32
Cash, bank	14.45	12.95	14.20	15.41	15.41	15.41
Cash surplus, finance available	0.00	0.00	67.15	1325.63	2764.59	4235.04
Loss carried forward	0.00	450.37	160.56	0.00	0.00	0.00
Loss	450.37	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities</b>	<b>11671.77</b>	<b>11023.12</b>	<b>10223.38</b>	<b>10762.80</b>	<b>11456.11</b>	<b>12202.93</b>
Equity capital	4910.00	4910.00	4910.00	4910.00	4910.00	4910.00
Reserves, retained profit	0.00	0.00	0.00	734.26	2235.07	3778.39
Profit	0.00	289.81	894.81	1500.81	1543.31	1596.81
Long and medium term debt	5950.00	5100.00	4250.00	3400.00	2550.00	1700.00
Current liabilities	80.16	119.31	168.56	217.72	217.72	217.72
Bank overdraft, finance required	731.61	604.00	0.00	0.00	0.00	0.00
<b>Total debt</b>	<b>6761.77</b>	<b>5823.31</b>	<b>4418.56</b>	<b>3617.72</b>	<b>2767.72</b>	<b>1917.72</b>
Equity, % of liabilities	42.07	44.54	48.03	45.62	42.86	40.24

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year	1995	1996	1997	1998	1999	2000
<b>Total assets</b>	<b>12992.24</b>	<b>13824.06</b>	<b>15548.37</b>	<b>17272.69</b>	<b>19052.00</b>	<b>20831.32</b>
Fixed assets, net of depreciation	6434.52	5710.88	4987.24	4263.60	3649.96	3036.32
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	794.32	794.32	794.32	794.32	794.32	794.32
Cash, bank	15.41	15.41	15.41	15.41	15.41	15.41
Cash surplus, finance available	5748.00	7303.45	9751.41	12199.36	14592.31	16985.27
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities</b>	<b>12992.24</b>	<b>13824.06</b>	<b>15548.37</b>	<b>17272.69</b>	<b>19052.00</b>	<b>20831.32</b>
Equity capital	4910.00	4910.00	4910.00	4910.00	4910.00	4910.00
Reserves, retained profit	5375.20	7014.52	8696.33	10420.65	12144.96	13924.28
Profit	1639.31	1681.81	1724.31	1724.31	1779.31	1779.31
Long and medium term debt	850.00	0.00	0.00	0.00	0.00	0.00
Current liabilities	217.72	217.72	217.72	217.72	217.72	217.72
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt</b>	<b>1067.72</b>	<b>217.72</b>	<b>217.72</b>	<b>217.72</b>	<b>217.72</b>	<b>217.72</b>

Equity, % of liabilities . . . .	37.79	35.52	31.58	28.43	25.77	23.57
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INDUSTRIAL CANVAS — February 88



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2.1 UNIOO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>22610.63</b>	<b>24946.43</b>	<b>26631.56</b>
Fixed assets, net of depreciation	2422.68	2120.00	2120.00
Construction in progress .....	- 0.00	0.00	0.00
Current assets .....	794.32	794.32	794.32
Cash, bank .....	15.41	15.41	15.41
Cash surplus, finance available	19378.22	21615.70	23701.83
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>22610.63</b>	<b>24946.43</b>	<b>26631.56</b>
Equity capital .....	4910.00	4910.00	4910.00
Reserves, retained profit .....	15703.59	17482.91	19417.70
Profit .....	1779.31	1934.80	2086.14
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	217.72	217.72	217.72
Bank overdraft, finance required	0.00	0.00	0.00
<b>Total debt .....</b>	<b>217.72</b>	<b>217.72</b>	<b>217.72</b>
<b>Equity, % of liabilities .....</b>	<b>21.72</b>	<b>20.00</b>	<b>18.44</b>



**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (4TH YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

A) BEP

1) TOTAL REVENUES	<u>6900</u>
2) VARIABLE COSTS:	<u>2586.7</u>
. RAW MATERIALS	2000
. UTILITIES	-
. ENERGY	358
. LABOUR (direct)	228.7
3) FIXED COSTS	<u>1311.67</u>
. REPAIR MAINTENANCE	22.03
. SPARES	119
. ADMINISTRATION	-
. DEPRECIATION	745.64
. FINANCIAL COSTS	425
4) TOTAL PRODUCTION COSTS	<u>3898.37</u>
BEP	1311.67
----- =	
6900 - 2586.7	0.30%

Industrial Canvas

ANNEXE 3

FOREIGN EXCHANGE EFFECT EVALUATION



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	6800.43	6800.00	0.43	6800.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	6800.43	6800.00	0.43	6800.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	18734.43	8000.00	10734.43	1600.00	4000.00	2400.00	0.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	7200.00	8000.00	-800.00	1600.00	4000.00	2400.00	0.00
imported materials . . .	1674.00	0.00	1674.00	0.00	0.00	0.00	0.00
repayment loans & overd.	6800.43	0.00	6800.43	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	3060.00	0.00	3060.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-11934.00	-1200.00	-10734.00	5200.00	-4000.00	-2400.00	0.00
import substit'n effect	84145.50	0.00	84145.50	0.00	0.00	0.00	0.00
net foreign exchange effect	72211.50	-1200.00	73411.50	5200.00	-4000.00	-2400.00	0.00
present values at 10.00 %							
foreign exchange flow .	-7636.77						
net foreign exchange effect	28317.22						



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 1.00 units local CU

	1990	1991	1992	production 1993	1994	1995	1996
total foreign inflow . .	0.27	0.00	0.08	0.08	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.27	0.00	0.08	0.08	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1683.87	1520.90	1486.83	1429.61	1309.00	1224.00	1139.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	57.87	15.80	36.83	35.61	0.00	0.00	0.00
imported materials . . .	96.00	60.00	90.00	119.00	119.00	119.00	119.00
repayment loans & overd.	850.00	850.10	850.00	850.00	850.00	850.00	850.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	680.00	595.00	510.00	425.00	340.00	255.00	170.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1683.60	-1520.90	-1486.75	-1429.53	-1309.00	-1224.00	-1139.00
import substit'n effect	1863.00	3105.00	4657.50	6210.00	6210.00	6210.00	6210.00
net foreign exchange effect	179.40	1584.10	3170.75	4780.48	4901.00	4986.00	5071.00
present values at 10.00 %							
foreign exchange flow .	-7636.77						
net foreign exchange effect	28317.22						



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1054.00	119.00	119.00	119.00	119.00	119.00	119.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	119.00	119.00	119.00	119.00	119.00	119.00	119.00
repayment loans & overd.	850.00	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	85.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-1054.00	-119.00	-119.00	-119.00	-119.00	-119.00	-119.00
import substit'n effect	6210.00	6210.00	6210.00	6210.00	6210.00	6210.00	6210.00
net foreign exchge effect	5156.00	6091.00	6091.00	6091.00	6091.00	6091.00	6091.00
present values at 10.00 %							
foreign exchange flow .	-7636.77						
net foreign exchge effect	28317.22						



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### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	production 2004	2005
total foreign inflow ..	0.00	0.00
equity capital . . . . .	0.00	0.00
subsidies, grants . . .	0.00	0.00
loans & overdraft . . .	0.00	0.00
exports . . . . .	0.00	0.00
indirect effects . . . . .	.....	.....
total foreign outflow .	119.00	-945.78
royalties . . . . .	0.00	0.00
equipment . . . . .	0.00	-946.11
imported materials . . .	119.00	0.00
repayment loans & overd.	0.00	0.33
other repayments . . . .	0.00	0.00
repatriated wages . . .	0.00	0.00
dividends paid . . . . .	0.00	0.00
interests . . . . .	0.00	0.00
indirect costs . . . . .	.....	.....
net foreign exchge flow	-119.00	945.78
import substit'n effect	6210.00	0.00
net foreign exchge effect	6091.00	945.78
present values at 10.00 %		
foreign exchange flow .	-7636.77	
net foreign exchge effect	28317.22	

**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF HYGIENIC PRODUCTS**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS



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**ANNEXES**

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- ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**
- ANNEXE 4 - DRW. B162 - 20-1 - PLANT LAY-OUT**

0. SUMMARY AND CONCLUSIONS

The products taken into consideration for the present study are the following:

- toothpaste
- shampoo
- cream for face and hand care
- hydrating cream
- baby oil

This group includes cosmetics which can be defined as hygienic products and which are potentially of the widest use.

The majority of these items are presently imported (CIF value of average inputs in 1982-1985 is in the range of 500,000 US \$/year) and consumption is hampered by high prices.

A single batch type production plant is proposed. It is very flexible so that production may change according to future market requirements.

Most of the raw materials have to be imported but several (Glycerine, Calcium carbonate, Maize starch, Salt, etc) are of local origin.

The proposed plant will employ 50 persons and will need an initial investment of 765,000 US\$.

The internal rate of return of the project is also quite interesting (IRR = 31.51%) and a selling price reduction could even be taken into consideration to make the products price more attractive and more accessible to a large share of population.

The net foreign effect, also, is positive; so the preparation of a feasibility study is recommended.

1. INTRODUCTION

Until the second half of the present century, cosmetics were considered as products for both the hygiene and aesthetic of the body: the number of the available products was already very large including articles for personal care; for softening, preserving or colouring the skin; for washing, dyeing or curling the hair or beard and for many other similar uses. But with the progress in biological knowledge, compensative effects (eutrophic activity) were also assigned to them: the preservation and completion of the healthy conditions of the human body constitute today the main object to be reached with these products. And the efforts of these industries to conform to this objective is clearly visible in the adaptation of formulations, in quality control, in the procedures for the preparation and packaging of the products, in order to reach the required efficacy and minimize the toxic actions which, however, are today minimal.

2. MARKET AND PLANT CAPACITY

2.1 Market

The latest official import statistics give an idea of the present market for personal hygiene products and cosmetics. The idea is most probably a partial one, because for some items there is also a small local production and because imports are regulated by licence and presumably only limited amounts of foreign exchange are allocated to the purchase abroad of "luxury" items. This latter point is confirmed by the opinion expressed by the existing (private) producer that, were he allowed to import the necessary inputs, he could easily work on three shifts instead of one.

The table below shows the available information on personal hygiene and cosmetics imports. No clear trends can be detected, which seems to confirm the idea that purchases abroad are permitted rather irregularly. Taking as a preliminary guide the averages for the last four years, hypothetical consumption would be, in round figures:

Imports of cosmetics, 1982-1985 (G.C.) averages, CIF

Assab

- alcoholic perfumery	8,500 kg/year	29,3 birr/kg	
- non alcoholic perfumery	400 "	38,9 "	
- toothpaste	9,000 "	17,1 "	
- face cream, powder, rouge, nail vernish	10,800 "	11,8 "	
- hair oil, cream, shampoo and tonic	7,800 "	8,4 "	
- shaving cream	30 "	17,2 "	

- other perfumery	25,000	"	4,6	"
- hairdyes	500	"	25,3	"
- perfumed wood	44,500	"	3,7	"

For several items a more detailed breakdown would be needed to describe the present (constricted) market. Even so, total imports have reached a CIF value of over one million birr in the last two years. Assuming, for the sake of argument, that import restrictions cut the potential demand only to half and that transport to and distribution in Addis Ababa can double the CIF price, the result is a global (retail) market worth some four million birr.

While large scale production is not envisageable for a number of obvious reasons, small scale production of selected items with an important impact on hygiene (toothpaste, baby oil, shampoo, etc) is recommended, also to be considered is the very low investment needed, the fact that some raw materials are locally available and in addition that the majority of the products are obtained diluting ingredients imported as concentrates

## 2.2 Product selection

The products taken into consideration for the present study are the following ones:

- tooth paste
- shampoo
- cream for hand and face care
- hydrating cream
- baby oil

This group of products include cosmetics which can be

certainly defined as hygienic products and which are potentially of the widest use. So this group can be considered a good base for the financial and economical evaluation of the project.

This group can by no means be intended as a limitation deriving from the design of the production plant, which on the contrary is very flexible and consequently allows for changes or expansion of the product mix in accordance with the evaluation of the demand (but in any case excluding the perfumery products). At present the consumption of such products does not seem very significant; but the impression received by the Consultants in the course of their task is that the demand is potentially high, especially in the towns, but the present retail prices are a very strong constraint to the expansion of consumption.

On the basis of this consideration the following consumptions have been estimated as a reasonable forecast:

- tooth paste: 1 million pieces, 45g each; total weight 45,000 Kg
- cream: 500,000 pieces, 45g each: total weight 22,500 kg
- shampoo: 300,000 pieces, 100 cm<sup>3</sup> each, total volume 30,000 l
- hydrating cream: 300,000 pieces, 45g each; total weight 13,500 kg
- baby oil: 100,000 pieces, 50 cm<sup>3</sup> each, total volume 5,000 l

Total weight (assuming 0.8 as specific gravity of liquid products): 109,000 kg

The capacity of the selected production equipment is 2t per batch being this the minimum economical size of the

major equipment. Working on one shift, one or two batches per day can be prepared.

### 2.3 Sales prices and total revenues

The three major products that will be produced by the unit are toothpaste, face cream and shampoos. The present import price for these items are (see paragraph 2.1)

- tooth paste :            8.55 \$/kg x 1.25 (20% custom duty  
                                 + 5% clearance and other  
                                 expenses) + inland transportation  
                                 0.8 \$/kg  
                                 = 11.48 \$/kg

- face cream :            5.9 \$/kg x 1.75 (65% custom duty  
                                 + 5% clearance fee and other  
                                 expenses) + inland transportation  
                                 0.8 \$/kg  
                                 = 11.12 \$/kg

- shampoos :            4.2 \$/kg x 1.70 + 0.8 \$/kg  
                                 = 7.94 \$/kg

Considering the average yearly consumption of the above three classes of products (see para 2.1) the average cost of the imported product is 10.33 US \$/kg. We can consider the ex-works price of some products produced in Ethiopia at 10 \$/kg.

The total revenues will therefore be:

$$10\$ \times 109,000 \text{ kg} = 1,090,000$$



3. MATERIALS AND INPUTS

3.1 Chemistry

The products are obtained through appropriate formulations, that is mixing, for a prefixed time and speed and at a prescribed temperature, a certain number of ingredients which must be added to the mixture according to a precise sequence in order to allow or avoid certain reactions among the components.

The following table shows the chemical ingredients needed for the formulation of the above stated products; the average price and the origin (domestic or import) are also indicated.

INGREDIENTS OF THE SELECTED PRODUCTS

<u>Ingredients</u>	<u>Price \$/kg (Addis Ababa)</u>	
	<u>FC</u>	<u>LC</u>
1. Texapon (1)	1.077	
2. Sanamid (2)	2.576	
3. Emulgin (4)	5.154	
4. Sodium lauryl sulphate (powder)	4.962	
5. Paracombin (3)	1.807	
6. Calcium carbonate light precipitate		1.558
7. Isopropyle myristate	4.423	
8. Glycerine 30 Bé, bidistilled		1.654
9. Formaldehyde 36%	0.461	
10. Petrolatum	1.354	
11. Stearin		0.653
12. Ammonia 28% v/v	0.419	
13. Triethanolamine	1.5	
14. Gum Tragacanth	54.11	
15. Cetyl alcohol	3.5	
16. Stearilic alcohol	3.815	
17. Myristic alcohol	4.038	
18. Perfumery essence	15.5	
19. Lanette Wax	4.308	
20. Salt		0.031
21. Maize starch		4.615

- 1) commercial name of a compound based on ammonium lauryl sulfate
- 2) " " " " " " " " cocodiethanolamide
- 3) " " " a mixture of ethyl, methyl, propyl and butyl paraoxibenzoate.
- 4) " " " an emulsifying agent

As can be seen from the table the majority of ingredients will be imported; but since these ingredients are concentrated components that will be diluted in the final product, local manufacture is equally profitable. In addition the establishment of a local manufacture allows the preparation of formulations with characteristics more suitable to local needs.

**3.2 Materials and utilities: requirements and costs**

On the basis of the prices indicated for the various ingredients in the table above, and assuming 0.415 \$/t the cost of the demineralized water, the cost of each of the five selected products, according to the possible formulae detailed below, are as follows:

	Content	Unit Price	FC	LC	Total
	kg	\$/kg	\$	\$	\$
<u>Shampoo</u>					
Texapon	31.24 x	1.077 =	33.645	-	33.645
Sanamid	4.69 x	2.576 =	12.081		12.081
Formaldehyde	0.47 x	0.461 =	0.217		0.217
Perfuming essence	1.13 x	15.5 =	17.515		17.515
Salt	0.09 x	0.031 =		0.000	0.000
Deminer water	62.47 x	0.0004 =		0.025	0.025
	-----		-----	-----	-----
	100.00		63.458	0.025	63.483
Unit cost		\$/Kg	0.635	0.000	0.635

	Content	Unit Price	FC	LC	Total
	kg	\$/kg	\$	\$	\$
<b><u>Toothpaste</u></b>					
Glycerine 30 Bé	20.97 x	1.654 =		34.68	34.68
Sodium laurilsulfate	2.86 x	4.962 =	14.19	-	14.19
Gun Tragacanth	1.43 x	54.11 =	77.38	-	77.38
Calciumcarbonate	44.81 x	1.538 =		68.92	68.92
Formaldehyde	0.19 x	0.461 =	0.09	-	0.09
Perfuming essence	1.14 x	15.5 =	17.67	-	17.67
Deminer.water	28.60 x	0.004 =	-	0.01	0.01
	-----		-----	-----	-----
	100.00		109.33	103.61	212.94
Unit cost		\$/Kg	1.09	1.04	2.13

**Cream**

Maize starch	1.71 x	4.615 =	-	7.89	7.89
Glycerine 30 Bé	51.15 x	1.654 =	-	84.60	84.60
Stearine	11.93 x	0.653 =	-	7.79	7.79
Lanette Wax	0.21 x	4.308 =	0.90	-	0.90
Paracombin	0.03 x	1.807 =	0.05	-	0.05
Demineral.water	32.82 x	0.0004 =	0.01	-	0.01
Ammonia 11,3% v/v					
2.261 l	2.15 x	0.419 =	2.57	-	2.57
	-----		-----	-----	-----
	100.00		3.53	100.28	103.81
Unit cost		\$/Kg	0.04	1.00	1.04

**Baby oil**

Cetyl alcohol	0.98 x	3.5 =	3.43	-	3.43
Stearilic "	0.85 x	3.815 =	3.24	-	3.24
Mirystic "	0.1 x	4.038 =	0.40	-	0.4

Emulgin	1.18 x 5.154 =	6.08	-	6.08
Isopropyle myristate	1.77 x 4.423 =	7.83	-	7.83
Glycerine 30 Bé	3.93 x 1.654 =	-	6.50	6.50
Petrolatum	7.47 x 1.354 =	10.11	-	10.11
Perfuming essence	1.18 x 15.5 =	18.29	-	18.29
Demin. water	82.54 x 0.0004 =		0.03	0.03
	-----	-----	-----	-----
	100.00	49.38	6.53	55.91
Unit cost		\$/kg 0.49	0.47	0.56

Hydrating cream

Texapon	0.95 x 1.077 =	1.02	-	1.02
Glycerine 30 Bé	6.67 x 1.654 =	-	11,03	11.03
Stearin	14.29 x 0.653 =	-	9.33	9.33
Lanette wax	4.76 x 4.308 =	20.51	-	20.51
Triethanolamine	0.95 x 1.5 =	1.43	-	1.43
Petrolatum	0.95 x 1.354 =	1.29	-	1.29
Demin. water	71.43 x 0.0004 =		0.03	0.03
	-----	-----	-----	-----
	100.00	24.25	20.39	44.64
Unit cost		\$/kg 0.24	0.20	0.44

The annual cost considering the above mentioned productions consequently is:

	Unit cost	Production	FC	LC	Total
	\$/kg	kg/y	\$/y	\$/y	\$/y
Shampoo	FC 0.635 x 24,000		15,240		15,240
	LC 0.000 x 24,000			0,000	0,000
	-----				-----
	T 0.635 x 24,000				15,240

Tooth-paste	FC	1.09 x	45,000	49,050	49,050
	LC	1.04 x	45,000	46,800	46,800
	----				-----
	T	2.13 x	45,000		95,850
Cream	FC	0.04 x	22,500	900	900
	LC	1.00 x	22,500	22,500	22,500
	----				-----
	T	1.04 x	22,500		23,400
Baby oil	FC	0.49 x	4,000	1,960	1,960
	LC	0.07 x	4,000	280	280
	----				-----
	T	0.56 x	4,000		2,240
Hydrating cream	FC	0.24 x	13,500	3,240	3,240
	LC	0,20 x	13,500	2,700	2,700
	----				-----
	T	0,44 x	13,500		5,940
				-----	-----
Total annual costs			109,000	70,390	72,280
					142,670

Thus the total amount of the annual costs for the raw materials for the whole quantity of 109,000 kg/y is 142,670 \$/y, which must be increased of the packaging cost (see para 5.2).

The utilities required for the proposed production are electricity and hot water, but the value of their annual consumption is equivalent to less than 10% of the other inputs, that is 14000 \$/y.

3.3 Raw material purchasing programme and storage value

For the imported ingredients, a stock equivalent to six months' consumption at full capacity is advisable; for the other ingredients one month equivalent consumption will be sufficient.

On this basis and taking into account that the 109,000 kg of raw materials include 13,642 kg of imported items, 47,165 kg of items to be found locally and 48,192 kg of demineralized water, the minimum stocks are as follows:

- from import  
6,821 Kg equivalent to 35,200 \$
- from domestic source  
24,100 Kg equivalent to 36,150 \$

4. LOCATION

Any location is suitable, provided that it is next to some main roads or railway.



5. PROJECT ENGINEERING

5.1 Process and equipment description

The ingredients considered in the following descriptions are those listed in the para 3.2

a) Shampoo

the four main ingredients are poured into a mixer in this order: Texapon, Sanamid, formaldehyde and perfume; then after having determined, by means of tests, the quantity of salt necessary to reach the request viscosity, the mixture is diluted, under agitation, to about 30% with demineralized water in which the prefixed amount of salt has been dissolved. At this point, if required, the product can be coloured with rodhamine (pink), for example, or fluorescein (yellow) or other dyestuffs.

b) "Nivea type" cream

First of all the starch glicerolate is prepared dissolving the maize starch in the glycerine (accurately avoiding the formation of clots) and heating the solution up to boiling point; now water and ammonia are added and then little by little the stearin (previously melted at 75°C) is added to the mixture continuing the mixing until a homogeneous glutinous mass is obtained. At this point mass is transferred into a turbomixer where it is beaten until its volume increases to one and a half times the initial one; now under a slow agitation the mass is cooled down and afterwards the perfume is added.

As a final step the mass is refined in a roller press-mill.

c) Tooth-paste

The first step consists in the separate heating of the water and glycerine; then the gum tragacanth is dispersed into the glycerine also adding water, little by little. When cooled down, the calcium carbonate is added little by little, under continuous agitation, until the powder is completely digested; finally the perfume is added.

d) Baby oil

The water and the fatty ingredients are heated separately at 75°C, then the latter ingredients are poured into the water kept at high agitation.

e) Hydrating cream

The fatty ingredients are heated and melted at 75°C, then the triethanolamine is added, under continuous agitation; now the water is heated at 75°C and poured into the fatty mixture; the agitation is kept steady until the mass is cooled down; then the perfume is added.

The formulation processes described above require the installation of the following main equipment:

- one turbo emulsifier coupled with a melter, having a capacity of two thousands kilograms of products per batch; stainless steel construction;
- one mixer with hot water jacket of 200 l capacity; stainless steel construction
- one roller press-mill with three grinding cylinders,

- each 400 mm long
- one hot-water boiler, burning fuel oil and with a capacity of 150,000 kcal/h
- one water demineralizing unit including a cation and an anion exchanger, regenerated with hydrochloric acid and caustic soda, stored in transportable plastic containers; demineralized water production: 1,500 l per day;
- five plastic tank, 2,000 l each, for the storage of the products
- electropumps for the loading, unloading and transfer of raw materials and products.

## 5.2 Packaging

Two types of packaging have been selected: plastic bottles for the liquid product (shampoo and baby oil) and aluminium tubes for the paste products (creams and toothpaste). For the bottles two sizes have been considered, 100 and 50 c.c., while the tubes are of one size, 45 g.

To fill them with the products already stored in the tanks, two packaging machines have to be installed, one for the tubes and the other one for the bottles.

From the product side, the machines are fed through a pump with the fluid to be packaged; from the packaging side, the machine is fed manually with the empty containers which are then manually drawn from the machine and put in suitable shipping cardboard boxes.

The cost of the container can be estimated as equivalent to the 100% of the raw materials costs (due to the small size of the pieces the incidence of packaging is very

high, even taking into consideration the local production of plastic bottles).

**5.3 Lay-out and civil works**

The lay-out of the factory is shown in the attached drawing. The total enclosed area amount to about 900 sq.mt.

Two buildings are foreseen:

- one for all the production equipment and the warehouse for the raw materials and the packaged final products.
- one for the workshops, the laboratory and the administrative offices.

Both the buildings have a reinforced concrete structure, with brick partition and external walls.

The roof is covered with asbestos-cement sheets, insulated with mineral wool lagging.

The floor inside the production building and between the two buildings is of reinforced concrete, with a hard aggregate as finishing surface.

The floor of the laboratory and offices are covered with cement tiles.

All the area outside the building is simply rolled and covered with gravel.

**5.4 Investment costs: depreciation and maintenance**

	FC	LC	Total
	\$	\$	\$
Machinery and equipment F.O.B.			
European port	300,000		300,000

Transportation	24,000	24,000	48,000
Erection and start-up assistance	24,000	24,000	48,000
Site preparation		20,000	20,000
Civil works		200,000	200,000
Spare parts	10,000		10,000
Licence	60,000		60,000
	-----	-----	-----
	418,000	268,000	686,000
Contingencies	42,000	27,000	69,000
	-----	-----	-----
Grand Total	460,000	295,000	755,000

The life cycle of the plant can be estimated in the range of 15 years.

An annual cost for maintenance has been assumed equivalent to 3% of the machinery and equipment cost, that is 9000 \$.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

Machinery	FC	460	million	\$
Machinery	LC	48	"	"
Civil works	LC	227	"	"
site preparation	LC	20	"	"
		----		
	TOTAL	775		

6. PLANT ORGANIZATION

The plant is considered as an autonomous unit operating within the organizational set up of the National Chemical Corp.

7. MANPOWER

The skills required in the various positions is no more than that requested of the employees of the same level of a chemical factory; thus no particular training has to be planned except for the chemist (specific controls of the raw materials and final products, from the chemical and bacteriological point of view) the production manager, the maintenance engineer (maintenance schedule for the packaging machine in particular), the purchasing personnel (classification of the suppliers and information about problems connected with foreign trade).

7.1	<u>Management</u>		birr/m	birr/y
	General manager	n.1	1,500	
	Technical manager	n.1	1,200	
		---	-----	-----
		n.2	2,700	32,400
				(15,652 \$/y)

7.2 Administrative department

Senior account.	n.1	800
Accountant	n.1	400
Clericals		
Purchasing dep.	n.2	750
Sale dep.	n.1	400
Storehouse	n.2	750
Clerks and secretary	n.4	1,400

		birr/m	birr/y
Drivers	n.3	1,050	
Guards	n.6	900	
	----	-----	-----
	n.20	6,450	74,400
			(35942 \$/y)
Total management and administrative dep.			106,800 b/y
			(51594 \$/y)

**7.3 Production and maintenance department**

**Production Departement**

Production manager	n.1	1,000	
Production foremen	n.2	800	
Operators	n.8	2,800	
Chemist	n.1	800	
Analyst	n.1	400	
Unskilled workers	n.4	800	
	---	-----	-----
	n.17	6,550	78,600
			(37971 \$/y)

**Maintenance Department**

Engineer	n.1	800	
Mechanics	n.2	800	
Electricians	n.1	400	
Tool machines operator	n.3	1,050	
Unskilled workers	n.4	800	
	---	-----	-----
	n.11	3,850	46,200
			(22318 \$/y)



8. IMPLEMENTATION SCHEDULING

18 months are needed for the design, construction and commissioning of the plant.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. Such evaluation has been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
Inventory utilities	1	1
Work in progress	1	1

- the assistance of one foreign expert for the first operation period (1 year) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "other raw materials"

- the production programme has been assumed as follows:  
1st year: 50% capacity (54,5 t/y as a whole)  
from the 2nd to the 15th year: 100% capacity (109 t/y)

Selling price (average weighted price): 10000 \$/t

As a result the evaluation yields an IRR of 31.51 and a BEP equal to 24%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import equal to the weighted average CIF price (parag. 2.1) for the similar groups of products, that is 6.07 \$/kg;

While the net foreign exchange flow results negative (no export is foreseen), the net foreign exchange effect is positive; by discounting the annual net foreign exchange effect at the rate of 10% a present value of the net foreign exchange effect amounting to 2,796,000\$ can be reckoned.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 2,796,000 \$

**Hygienic products**

**ANNEXE 1**

**FINANCIAL EVALUATION**



**COMFAR**<sup>2.0</sup>  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**HYGIENIC PRODUCTS**  
**FEBRUARY 1988**  
**BASIC PROJECT**

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	849.10	58.780 I foreign
current assets:	0.00	0.000 I foreign
total assets:	849.10	58.780 I foreign

**Source of funds during construction phase**

equity & grants:	419.00	0.000 I foreign
foreign loans :	391.00	
local loans :	0.00	
total funds :	810.00	48.272 I foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	326.05	420.23	420.23
depreciation :	60.23	60.23	58.23
interest :	39.10	34.21	29.33
production costs	425.38	514.68	507.79
thereof foreign	48.23 I	41.90 I	41.50 I
total sales :	545.00	1090.00	1090.00
gross income :	119.62	575.32	582.21
net income :	59.81	287.66	291.11
cash balance :	-25.26	246.05	300.46
net cashflow :	62.71	329.14	378.66

Net Present Value at: 10.00 I = 1536.26  
Internal Rate of Return on total investment: 31.51 I  
Equity paid versus Net income flow (IRR): 39.07 I  
Net Worth versus Net Cash Return (IRR): 36.13 I

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Total Initial Investment in 1000 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2
Fixed investment costs				
Land, site preparation, development	20.00	0.00	0.00	0.00
Buildings and civil works . . . . .	45.40	113.50	68.10	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	92.00	112.00	304.00	0.00
Total fixed investment costs . . . .	157.40	225.50	372.10	0.00
Pre-production capital expenditures.	15.00	15.00	44.55	19.55
Net working capital . . . . .	0.00	0.00	0.00	0.00
Total initial investment costs . . .	172.40	240.50	416.65	19.55
Of it foreign, in % . . . . .	53.36	38.25	70.93	100.00

HYGENIC PRODUCTS --- FEBRUARY 1988



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Total Current Investment in 1000 US DOLLARS

Year .....	1989	1990
Fixed investment costs		
Land, site preparation, development	0.00	0.00
Buildings and civil works .....	0.00	0.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00
Total fixed investment costs .....	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00
Working capital .....	96.43	52.97
Total current investment costs ...	96.43	52.97
Of it foreign, Z .....	67.60	75.85

HYGENIC PRODUCTS --- FEBRUARY 1988



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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	50.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	71.34	142.67	142.67	142.67	142.67	142.67
Other raw materials . . . . .	71.35	142.70	142.70	142.70	142.70	142.70
Utilities . . . . .	7.00	14.00	14.00	14.00	14.00	14.00
Energy . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Labour, direct . . . . .	37.97	37.97	37.97	37.97	37.97	37.97
Repair, maintenance . . . . .	22.30	22.30	22.30	22.30	22.30	22.30
Spare parts . . . . .	4.50	9.00	9.00	9.00	9.00	9.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>274.46</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>
Administrative overheads . . . . .	51.59	51.59	51.59	51.59	51.59	51.59
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	60.23	60.23	58.23	56.23	56.23	45.23
Financial costs . . . . .	39.10	34.21	29.33	24.44	19.55	14.66
<b>Total production costs . . . . .</b>	<b>425.38</b>	<b>514.68</b>	<b>507.79</b>	<b>500.90</b>	<b>496.01</b>	<b>480.13</b>
<b>Costs per unit (single product) .</b>	<b>7.81</b>	<b>4.72</b>	<b>4.66</b>	<b>4.60</b>	<b>4.55</b>	<b>4.40</b>
Of it foreign, % . . . . .	48.23	41.90	41.50	41.10	40.52	40.84
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	89.56	89.56	89.56	89.56	89.56	89.56





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**Total Production Costs in 1000 US DOLLARS**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
I of max. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I .....	142.67	142.67	142.67	142.67	142.67	142.67
Other raw materials .....	142.70	142.70	142.70	142.70	142.70	142.70
Utilities .....	14.00	14.00	14.00	14.00	14.00	14.00
Energy .....	0.00	0.00	0.00	0.00	0.00	0.00
Labour, direct .....	37.97	37.97	37.97	37.97	37.97	37.97
Repair, maintenance .....	22.30	22.30	22.30	22.30	22.30	22.30
Spares .....	9.00	9.00	9.00	9.00	9.00	9.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>	<b>368.64</b>
Administrative overheads .....	51.59	51.59	51.59	51.59	51.59	51.59
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	45.23	45.23	45.23	33.88	16.71	0.00
Financial costs .....	9.77	4.89	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>473.24</b>	<b>470.33</b>	<b>465.46</b>	<b>454.11</b>	<b>436.94</b>	<b>420.23</b>
<b>Costs per unit ( single product ) .</b>	<b>4.36</b>	<b>4.32</b>	<b>4.27</b>	<b>4.17</b>	<b>4.01</b>	<b>3.86</b>
Of it foreign, I .....	40.23	39.61	38.98	39.95	37.96	35.87
Of it variable, I .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	89.56	89.56	89.56	89.56	89.56	89.56

HYGENIC PRODUCTS --- FEBRUARY 1998



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year			1989	1990	1991-2003
Coverage	ndc	coto			
<b>Current assets &amp;</b>					
Accounts receivable	30	12.0	27.17	35.02	35.02
Inventory and materials	100	3.4	41.44	82.88	82.88
Energy	0	—	0.00	0.00	0.00
Spares	360	1.0	4.50	9.00	9.00
Work in progress	1	360.0	0.76	1.02	1.02
Finished products	30	12.0	27.17	35.02	35.02
Cash in hand	15	24.0	7.35	5.04	5.04
<b>Total current assets</b>			<b>108.40</b>	<b>167.98</b>	<b>167.98</b>
<b>Current liabilities and</b>					
Accounts payable	18	20.0	11.97	18.58	18.58
<b>Net working capital</b>			<b>96.43</b>	<b>149.40</b>	<b>149.40</b>
<b>Increase in working capital</b>			<b>96.43</b>	<b>52.97</b>	<b>0.00</b>
<b>Net working capital, local</b>			<b>31.24</b>	<b>44.03</b>	<b>44.03</b>
<b>Net working capital, foreign</b>			<b>65.19</b>	<b>105.37</b>	<b>105.37</b>

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1-88.2
Equity, ordinary ..	419.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsides, grants .	0.00	0.00	0.00
Loan A, foreign .	391.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	391.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	19.55
Total funds .....	810.00	0.00	19.55

HYGENIC PRODUCTS --- FEBRUARY 1988



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Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991-96
Equity, ordinary ..	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	-48.88	-48.88	-48.88
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	-48.88	-48.88	-48.88
Current liabilities	11.97	6.61	0.00
Bank overdraft ....	25.26	-64.36	0.00
Total funds .....	-11.65	-106.63	-48.88

HYGENIC PRODUCTS — FEBRUARY 1988



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Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2
Total cash inflow . .	810.00	0.00	0.00	0.00
Financial resources .	810.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow . .	172.40	240.50	416.65	19.55
Total assets . . . . .	172.40	240.50	397.10	0.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	19.55	19.55
Repayment . . . . .	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	637.60	-240.50	-416.65	-19.55
Cumulated cash balance	637.60	397.10	-19.55	-39.10
Inflow, local . . . . .	419.00	0.00	0.00	0.00
Outflow, local . . . .	80.40	148.50	121.10	0.00
Surplus ( deficit ) .	338.60	-148.50	-121.10	0.00
Inflow, foreign . . .	391.00	0.00	0.00	0.00
Outflow, foreign . . .	92.00	92.00	295.55	19.55
Surplus ( deficit ) .	299.00	-92.00	-295.55	-19.55
Net cashflow . . . . .	-172.40	-240.50	-397.10	0.00
Cumulated net cashflow	-172.40	-412.90	-810.00	-810.00



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	556.97	1096.61	1090.00	1090.00	1090.00	1090.00
Financial resources .	11.97	6.61	0.00	0.00	0.00	0.00
Sales, net of tax . .	545.00	1090.00	1090.00	1090.00	1090.00	1090.00
Total cash outflow . .	582.23	850.56	789.54	789.09	785.65	788.70
Total assets . . . .	108.48	59.58	0.00	0.00	0.00	0.00
Operating costs . . .	326.05	420.23	420.23	420.23	420.23	420.23
Cost of finance . . .	39.10	34.21	29.33	24.44	19.55	14.66
Repayment . . . . .	48.88	48.88	48.88	48.88	48.88	48.88
Corporate tax . . . .	59.81	287.66	291.11	294.55	296.99	304.94
Dividends paid . . . .	0.06	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-25.26	246.05	300.46	301.91	304.35	301.30
Cumulated cash balance	-64.36	181.69	482.15	784.06	1088.41	1389.71
Inflow, local . . . .	556.59	1096.57	1090.00	1090.00	1090.00	1090.00
Outflow, local . . . .	293.31	576.51	560.60	564.04	566.48	574.43
Surplus ( deficit ) .	263.28	520.06	529.40	525.96	523.52	515.57
Inflow, foreign . . .	0.38	0.04	0.00	0.00	0.00	0.00
Outflow, foreign . . .	288.92	274.05	228.94	224.05	219.16	214.28
Surplus ( deficit ) .	-288.55	-274.00	-228.94	-224.05	-219.16	-214.28
Net cashflow . . . . .	62.71	329.14	378.66	375.22	372.78	367.83
Cumulated net cashflow	-747.29	-418.15	-39.48	335.74	708.51	1073.35

HYGENIC PRODUCTS — FEBRUARY 1988



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	1090.00	1090.00	1090.00	1090.00	1090.00	1090.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	1090.00	1090.00	1090.00	1090.00	1090.00	1090.00
Total cash outflow . .	786.26	783.82	752.50	752.50	738.17	738.17
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	420.23	420.23	420.23	420.23	420.23	420.23
Cost of finance . . .	9.77	4.89	0.00	0.00	0.00	0.00
Repayment . . . . .	48.88	48.88	0.00	0.00	0.00	0.00
Corporate tax . . . .	307.38	309.82	312.27	312.27	317.94	317.94
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	303.74	306.18	337.50	337.50	351.83	351.83
Accumulated cash balance	1693.45	1999.63	2337.13	2714.64	3066.46	3418.29
Inflow, local . . . . .	1090.00	1090.00	1090.00	1090.00	1090.00	1090.00
Outflow, local . . . . .	576.87	579.31	581.76	581.76	587.43	587.43
Surplus ( deficit ) .	513.13	510.69	508.24	508.24	502.57	502.57
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	209.39	204.50	150.74	150.74	150.74	150.74
Surplus ( deficit ) .	-209.39	-204.50	-150.74	-150.74	-150.74	-150.74
Net cashflow . . . . .	362.39	359.95	337.50	337.50	351.83	351.83
Accumulated net cashflow	1433.74	1795.68	2153.18	2510.69	2862.51	3214.34



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	1090.00	1090.00	1090.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1090.00	1090.00	1090.00
Total cash outflow . .	738.17	746.76	735.11
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	420.23	420.23	420.23
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	317.94	326.53	334.89
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	351.83	343.24	334.89
Accumulated cash balance	3770.12	4113.36	4448.24
Inflow, local . . . .	1090.00	1090.00	1090.00
Outflow, local . . . .	587.43	596.02	604.38
Surplus ( deficit ) .	502.57	493.98	485.63
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	150.74	150.74	150.74
Surplus ( deficit ) .	-150.74	-150.74	-150.74
Net cashflow . . . . .	351.83	343.24	334.89
Accumulated net cashflow	3566.17	3909.41	4244.29





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**Cashflow Discounting:**

a) Equity paid versus Net income flow:			
Net present value .....	1485.21	at	10.00 %
Internal Rate of Return (IRRE1) ..	39.07	%	
b) Net Worth versus Net cash returns:			
Net present value .....	1524.51	at	10.00 %
Internal Rate of Return (IRRE2) ..	36.13	%	
c) Internal Rate of Return on total investment:			
Net present value .....	1536.26	at	10.00 %
Internal Rate of Return (IRR) ..	31.51	%	
Net Worth = Equity paid plus reserves			

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HYGIENIC PRODUCTS --- FEBRUARY 1988



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	545.00	1090.00	1090.00	1090.00	1090.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	545.00	1090.00	1090.00	1090.00	1090.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	386.28	480.46	478.46	476.46	476.46
Operational margin . . . . .	158.72	609.54	611.54	613.54	613.54
As % of total sales . . . . .	29.12	55.92	56.10	56.29	56.29
Cost of finance . . . . .	39.10	34.21	29.33	24.44	19.55
Gross profit . . . . .	119.62	575.32	582.21	589.10	593.99
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	119.62	575.32	582.21	589.10	593.99
Tax . . . . .	59.81	287.66	291.11	294.55	296.99
Net profit . . . . .	59.81	287.66	291.11	294.55	296.99
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	59.81	287.66	291.11	294.55	296.99
Accumulated undistributed profit . . .	59.81	347.47	638.58	933.12	1230.12
Gross profit, % of total sales . . . . .	21.95	52.78	53.41	54.05	54.49
Net profit, % of total sales . . . . .	10.97	26.39	26.71	27.02	27.25
RDE, Net profit, % of equity . . . . .	14.27	68.65	69.48	70.30	70.88
ROI, Net profit+interest, % of invest.	10.91	33.55	33.40	33.25	32.99



CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	1090.00	1090.00	1090.00	1090.00	1090.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1090.00	1090.00	1090.00	1090.00	1090.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	465.46	465.46	465.46	465.46	465.46
Operational margin . . . . .	624.54	624.54	624.54	624.54	624.54
As % of total sales . . . . .	57.30	57.30	57.30	57.30	57.30
Cost of finance . . . . .	14.66	9.77	4.89	0.00	0.00
Gross profit . . . . .	609.87	614.76	619.65	624.54	624.54
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	609.87	614.76	619.65	624.54	624.54
Tax . . . . .	304.94	307.38	309.82	312.27	312.27
Net profit . . . . .	304.94	307.38	309.82	312.27	312.27
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	304.94	307.38	309.82	312.27	312.27
Accumulated undistributed profit . . .	1533.05	1842.43	2152.26	2464.53	2776.80
Gross profit, % of total sales . . . .	55.95	56.40	56.85	57.30	57.30
Net profit, % of total sales . . . .	27.90	28.20	28.42	28.65	28.65
ROE, Net profit, % of equity . . . .	72.78	73.36	73.94	74.53	74.53
ROI, Net profit+interest, % of invest.	33.31	33.06	32.80	32.55	32.55



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	1090.00	1090.00	1090.00	1090.00	1090.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1090.00	1090.00	1090.00	1090.00	1090.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	454.11	454.11	454.11	436.94	420.23
Operational margin . . . . .	635.89	635.89	635.89	653.06	669.77
As % of total sales . . . . .	58.34	58.34	58.34	59.91	61.45
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	635.89	635.89	635.89	653.06	669.77
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	635.89	635.89	635.89	653.06	669.77
Tax . . . . .	317.94	317.94	317.94	326.53	334.89
Net profit . . . . .	317.94	317.94	317.94	326.53	334.89
Dividend paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	317.94	317.94	317.94	326.53	334.89
Accumulated undistributed profit . . . .	3094.74	3412.68	3730.62	4057.16	4392.04
Gross profit, % of total sales . . . . .	58.34	58.34	58.34	59.91	61.45
Net profit, % of total sales . . . . .	29.17	29.17	29.17	29.96	30.72
ROE, Net profit, % of equity . . . . .	75.88	75.88	75.88	77.93	79.92
ROI, Net profit+interest, % of invest.	33.14	33.14	33.14	34.03	34.91



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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2
Total assets .....	810.00	810.00	829.55	849.10
Fixed assets, net of depreciation	0.00	172.40	412.90	829.55
Construction in progress .....	172.40	240.50	416.65	19.55
Current assets .....	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00
Cash surplus, finance available .	637.60	397.10	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00
Total liabilities .....	810.00	810.00	829.55	849.10
Equity capital .....	419.00	419.00	419.00	419.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00
Long and medium term debt .....	391.00	391.00	391.00	391.00
Current liabilities .....	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	19.55	39.10
Total debt .....	391.00	391.00	410.55	430.10
Equity, I of liabilities .....	51.73	51.73	50.51	49.35

HYGENIC PRODUCTS — FEBRUARY 1988



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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>897.26</b>	<b>1078.30</b>	<b>1320.53</b>	<b>1566.20</b>	<b>1814.32</b>	<b>2070.38</b>
Fixed assets, net of depreciation	788.67	728.63	670.40	614.16	557.93	512.70
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	101.05	162.94	162.94	162.94	162.94	162.94
Cash, bank .....	7.35	5.04	5.04	5.04	5.04	5.04
Cash surplus, finance available ..	0.00	18.69	482.15	784.06	1088.41	1389.71
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>897.26</b>	<b>1078.30</b>	<b>1320.53</b>	<b>1566.20</b>	<b>1814.32</b>	<b>2070.38</b>
Equity capital .....	419.00	419.00	419.00	419.00	419.00	419.00
Reserves, retained profit .....	0.00	59.81	347.47	638.58	933.12	1230.12
Profit .....	59.81	287.66	291.11	294.55	296.99	304.94
Long and medium term debt .....	342.13	293.25	244.38	195.50	146.63	97.75
Current liabilities .....	11.97	18.58	18.58	18.58	18.58	18.58
Bank overdraft, finance required.	64.36	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>418.45</b>	<b>311.83</b>	<b>262.95</b>	<b>214.08</b>	<b>165.20</b>	<b>116.33</b>
<b>Equity, % of liabilities .....</b>	<b>46.70</b>	<b>38.86</b>	<b>31.73</b>	<b>26.75</b>	<b>23.09</b>	<b>20.24</b>

HYGENIC PRODUCTS --- FEBRUARY 1988



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**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>2328.89</b>	<b>2589.84</b>	<b>2902.10</b>	<b>3214.37</b>	<b>3532.32</b>	<b>3850.26</b>
Fixed assets, net of depreciation	467.46	422.23	376.99	331.76	297.88	263.99
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	162.94	162.94	162.94	162.94	162.94	162.94
Cash, bank .....	5.04	5.04	5.04	5.04	5.04	5.04
Cash surplus, finance available .	1693.45	1999.63	2357.13	2714.64	3066.46	3418.29
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Less .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2328.89</b>	<b>2589.84</b>	<b>2902.10</b>	<b>3214.37</b>	<b>3532.32</b>	<b>3850.26</b>
Equity capital .....	419.00	419.00	419.00	419.00	419.00	419.00
Reserves, retained profit .....	1535.05	1842.43	2152.26	2464.53	2776.80	3094.74
Profit .....	307.38	309.82	312.27	312.27	317.94	317.94
Long and medium term debt .....	48.88	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	18.58	18.58	18.58	18.58	18.58	18.58
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>67.45</b>	<b>18.58</b>	<b>18.58</b>	<b>18.58</b>	<b>18.58</b>	<b>18.58</b>
<b>Equity, % of liabilities .....</b>	<b>17.99</b>	<b>16.18</b>	<b>14.44</b>	<b>13.04</b>	<b>11.86</b>	<b>10.88</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year	2001	2002	2003
Total assets	4168.20	4494.73	4829.62
Fixed assets, net of depreciation	230.11	213.40	213.40
Construction in progress	0.00	0.00	0.00
Current assets	162.94	162.94	162.94
Cash, bank	5.04	5.04	5.04
Cash surplus, finance available	3770.12	4113.36	4448.24
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	4168.20	4494.73	4829.62
Equity capital	419.00	419.00	419.00
Reserves, retained profit	3412.68	3730.62	4057.16
Profit	317.94	326.53	334.89
Long and medium term debt	0.00	0.00	0.00
Current liabilities	18.58	18.58	18.58
Bank overdraft, finance required	0.00	0.00	0.00
Total debt	18.58	18.58	18.58
Equity, % of liabilities	10.05	9.32	8.68

HYGENIC PRODUCTS --- FEBRUARY 1988



**Hygienic products**

**ANNEXE 2**

**BEP EVALUATION**

**BEP EVALUATION**

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (2ND YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>1090</u>
2) VARIABLE COSTS:	<u>337.34</u>
. RAW MATERIALS	285.37
. UTILITIES	14
. ENERGY	-
. LABOUR (DIRECT)	37.97
3) FIXED COSTS	<u>177.33</u>
. REPAIR-MAINTENANCE	22.30
. SPARES	9.00
. ADMINISTRATION	51.59
. DEPRECIATION	60.23
. FINANCIAL COSTS	34.21
4) TOTAL PRODUCTION COSTS	<u>514.67</u>

$$\text{BEP} = \frac{177.33}{1090 - 337.34} \times 100 = 24 \%$$

**Hygienic products**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	391.42	391.00	0.42	391.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	391.42	391.00	0.42	391.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	3227.11	499.10	2728.01	92.00	92.00	295.55	19.55
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	374.90	460.00	-85.10	92.00	92.00	276.00	0.00
imported materials . . .	2245.74	0.00	2245.74	0.00	0.00	0.00	0.00
repayment loans & overd.	391.42	0.00	391.42	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	215.05	39.10	175.95	0.00	0.00	19.55	19.55
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-2835.69	-108.10	-2727.59	299.00	-92.00	-295.55	-19.55
import substit'n effect	9594.65	0.00	9594.65	0.00	0.00	0.00	0.00
net forgn exchge effect	6758.96	-108.10	6667.06	299.00	-92.00	-295.55	-19.55
present values at 10.00 %							
foreign exchange flow .	-1505.80						
net forgn exchge effect	2796.18						



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1990	1991	1992	production 1993	1994	1995	1996
total foreign inflow . . .	0.38	0.04	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.38	0.04	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	288.92	274.05	228.94	224.05	219.16	214.28	209.39
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	65.57	40.22	0.00	0.00	0.00	0.00	0.00
imported materials . . .	135.38	150.74	150.74	150.74	150.74	150.74	150.74
repayment loans & overd.	48.88	48.88	48.88	48.88	48.88	48.88	48.88
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	37.10	34.21	29.33	24.44	19.55	14.66	9.77
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-288.55	-274.01	-228.94	-224.05	-219.16	-214.28	-209.39
import substit'n effect	330.85	661.70	661.70	661.70	661.70	661.70	661.70
net foreign exchge effect	42.30	387.70	432.76	437.65	442.54	447.42	452.31
present values at 10.00 %							
foreign exchange flow . .	-1505.80						
net foreign exchge effect	2796.18						



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### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CU = 10.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	204.50	150.74	150.74	150.74	150.74	150.74	150.74
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	150.74	150.74	150.74	150.74	150.74	150.74	150.74
repayment loans & overd.	48.88	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	4.89	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-204.50	-150.74	-150.74	-150.74	-150.74	-150.74	-150.74
import substit'n effect	661.70	661.70	661.70	661.70	661.70	661.70	661.70
net foreign exchange effect	457.20	510.96	510.96	510.96	510.96	510.96	510.96
present values at	10.00 %						
foreign exchange flow .	-1505.80						
net foreign exchange effect	2796.18						



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	production	
	2004	2005
total foreign inflow . .	0.00	0.00
equity capital . . . . .	0.00	0.00
subsidies, grants . . .	0.00	0.00
loans & overdraft . . .	0.00	0.00
exports . . . . .	0.00	0.00
indirect effects . . . . .	.....	.....
total foreign outflow .	150.74	-190.47
royalties . . . . .	0.00	0.00
equipment . . . . .	0.00	-190.89
imported materials . . .	150.74	0.00
repayment loans & overd.	0.00	0.42
other repayments . . . .	0.00	0.00
repatriated wages . . .	0.00	0.00
dividends paid . . . . .	0.00	0.00
interests . . . . .	0.00	0.00
indirect costs . . . . .	.....	.....
net foreign exchange flow	-150.74	190.47
import substit'n effect	661.70	0.00
net foreign exchange effect	510.96	190.47
present values at	10.00 %	
foreign exchange flow .	-1505.80	
net foreign exchange effect	2796.18	

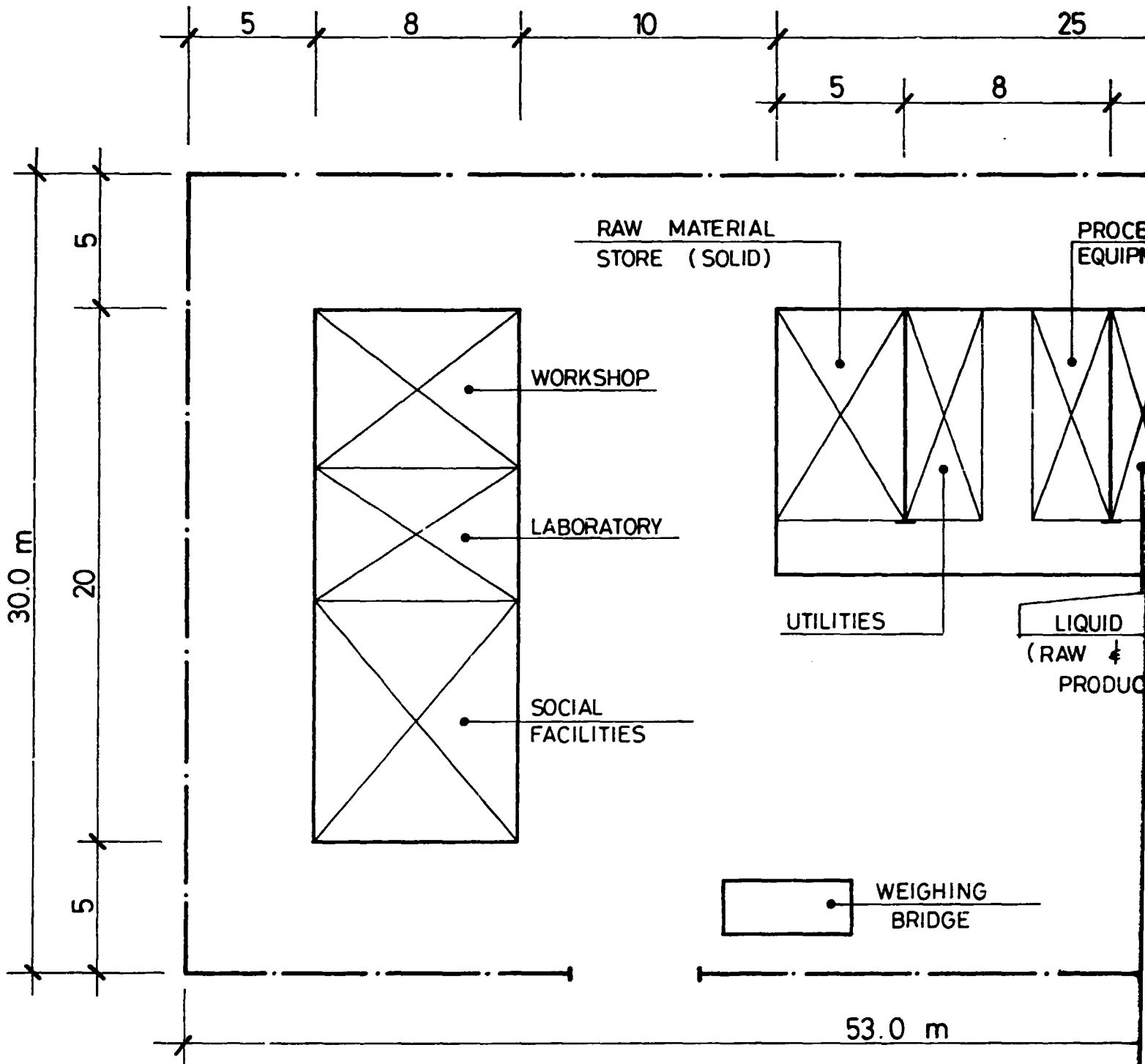
**Hygienic products**

**ANNEXE 4**

DRW. B162 - 20 - 1

PLANT LAY-OUT





**SECTION 1**

CLIENT  
CUSTOMER  
b  
CON



**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF CHLOR ALKALI**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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FACTORY

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0. SUMMARY AND CONCLUSIONS

The present study analyzes the opportunity of constructing a chlor-alkali plant to be located at Assab. The plant would use salt from the local solar salt works as main raw material and would produce the following outputs:

- chlorine: 3,550 tons/year
- sodium hypochlorite: 200 tons/year
- hydrochloric acid: 250 tons/year
- caustic soda: 4,340 tons/year

Chlorine is presently imported and is mainly used for water potabilization. The market survey has shown that in 1993/94 the consumption of chlorine will be in the range of 3200 tons and over 3,500 tons/year by the end of the century. It will be used for water potabilization, either as chlorine and calcium hypochlorite, to produce Sodium hypochlorite and Hydrogen chloride.

Sodium hypochlorite can be used as bleaching or sterilizing agent in a number of applications (bleaching of cotton yarn, disinfection of the facilities of food processing plants, disinfection and deodorizing of public facilities, hospitals, schools, etc.) Its consumption in Ethiopia is increasing and the small existing production facilities are obsolete.

Hydrogen chloride (Hydrochloric acid) is used in quantity (150-260 tons in 1985 and there is a forecast for 390-990 tons by 2004 depending on the implementation of a number of projects now under consideration) mainly by the Food Corporation and by the Textile Corporation.

Caustic soda is a basic chemical needed in a variety of

applications (soap, textiles) and its importance is so great that its consumption is taken as an index of the industrial activity of a country (the National Chemicals Corporation now has in the pipeline a project for the production of Caustic Soda using as raw material the brines of Lake Abjata). In the present project Caustic Soda would be a by-product of the chlorine production and due to the favourable location of the plant at Assab, could be easily exported to other African Countries (no plant is presently in operation in the region, the nearest one being in Egypt).

Total investment needed would be 17.84 Million US \$ and the number of persons employed would be 160.

The financial analysis has shown an internal rate of return of 5.96%. It must be considered, however, that the plant in question is high electric energy consumer and energy cost accounts for 50% of the total production cost (depreciation and financial costs excluded).

A second financial analysis has therefore been proposed by considering a reduction of energy cost from the present 0.2 birr/kWh to 0.05 birr/kWh. The internal rate of return improves to 9.07%.

In case the Electric Authority can favourably consider this special energy price it is recommended that a feasibility study for the chlor-alkali plant be carried out for the following main reasons:

- the plant permits the substitution of imports (chlorine, hydrochloric acid); in fact the net foreign exchange effect is positive and its present value amounts to 13,393,000 \$;
- the availability of chlorine makes possible the production of very interesting products such as Calcium hypochlorite, useful for water potabilization

in rural areas and whose social impact can be very high

- chlorine availability can improve the existing and planned water potabilization programmes
- Ethiopia would become an exporter of a basic chemical such as Caustic Soda, getting into new markets with consequent positive effects on the whole foreign trade.

The possibility of integrating this plant with an unit for the production of calcium hypochlorite, a bleaching and sterilizing agent, which uses chlorine as one of the most important inputs has been also considered as an alternative (I.R.R. 9.16%).



1. INTRODUCTION

Sodium Chloride is the main raw material for the production of some basic derivatives for the chemical industry. The products that will be considered in this opportunity study are: chlorine, sodium hydroxide, hydrogen, hydrochloric acid and, as a by-product, sodium hypochlorite.

The main characteristics of the products are:

- Chlorine (Cl<sub>2</sub>)

Atomic weight = 35.453

Physical state = greenish yellow gas

Boiling point = - 34.05°C

Melting point = - 101°C

Critical temperature = 144°C at 76.1 atm

Density of the gas = 3.214 g/l at 0°C and 1 atm

- Sodium hydroxide (Na OH)

Molecular weight = 40.01

Physical state = white deliquescent solid

Melting point = 318.4°C

Density at 20°C = 2.130 g/ml

- Hydrochloric acid (HCl)

Molecular weight = 36.5

Physical state = colourless gas

- Sodium hypochlorite (NaClO)

Molecular weight = 91.5

Physical state = liquid

Specific gravity = 1.200 kg/l (at available chlorine content of 12-13% by volume)

2. MARKET AND PLANT CAPACITY

2.1 Uses

2.1.1 Chlorine

Chlorine, which was originally used almost entirely for bleaching, is no longer of great importance in this field because it is too destructive for bleaching wool, silk and other products of animal origin while in recent years hydrogen peroxide has become economically available for this and other purposes.

Now chlorine is used mainly in the synthesis of chemicals mostly in the organic chemical field.

In many countries a notable use of chlorine is in the field of water sanitation.

Chlorine is also used in metallurgy, which includes several important methods not only for beneficiating ores and fluxings, but also for the actual extraction of copper, lead, zinc, nickel, gold, platinum, metallic elements of the rare earth group, titanium, tungsten, vanadium and others.

One other important field of utilization is the extraction of bromine.

2.1.2 Caustic soda

The utilization of sodium hydroxide has become increasingly diversified, especially in the field of chemical production. The traditional uses in the field of soap, textiles and petroleum refining, although still substantial, show percentage decreases. Effectively in

the highly industrialized countries, the mid-century decades have witnessed aggressive activity in finding new uses of caustic soda, in order to minimize the chlorine-caustic soda demand imbalance. Caustic soda is so important that its consumption is taken as an index of the industrial activity of a country.

In the industrializing countries, on the contrary, the same incentive has required even more intensive activity for finding new uses of chlorine.

### 2.1.3 Sodium hypochlorite

The main use of sodium hypochlorite is as a bleaching or sterilizing agent.

These possible applications are:

- water treatment: disinfection of city water, well water, water tanks; prevention of algae growth in water systems for both potable and industrial uses
- bleaching of cotton yarn and cotton cloth; disinfection and bleaching of children's clothing and linen for hospitals.
- disinfection of the facilities of food processing plants: meat and fish canning, dairies, sugar refineries, soft drink factories, vegetables and fruit cannings
- disinfection and deodorizing of public facilities, that is floors, walls, drains and toilets in hospitals, schools, railway stations and other public buildings.
- domestic disinfection and bleaching

2.1.4 Hydrogen gas

Hydrogen gas is used mainly in the manufacture of ammonia, which however is not yet produced in the country. At present the only possible use is the production of hydrochloric acid; the balance must be used as a fuel.

2.2 Forecast demand and plant capacity

The production to be considered is based on the possible chlorine consumption only. The sodium hydroxide that will be jointly produced must be considered mainly for export since the country has already set up a project for producing caustic soda starting from soda ash extracted from Lake Abjata. Consequently, in the financial and economical evaluations caustic soda will be quoted at the average price valid on the international market; as a matter of fact there are real possibilities of export of all the soda produced, as this plant is the only one in East Africa.

It has been mentioned that one of the most common use of chlorine is water purification. The largest consumer in this field is Addis Ababa Municipality with a consumption of 250 tonnes/year, up from 150 tonnes thanks to the increased availability of water stemming from the completed enlargement of the Legadadi reservoir. As a result, water supply has been raised from 70,000 cu.mt/day in 1985 up to 110,000 cu.mt/day in 1986. With the population of Addis projected to grow from 1.4 million in 1983/4 to 2.1 million by 1993/4 and

consumption per capita to increase by some 30%, total chlorine requirements for the capital can be expected to approach 490 tonnes by 1993/4. An analogous projection for Asmara adds another 100 tonnes to the forecast 1993/4 requirements.

The Water Supply and Sewerage Authority (WSSA) looks after water supply in towns other than Addis and Asmara. It has a current consumption of chlorine of some 25 tonnes per year. Its activity is expected to extend according to the provisions of the Ten Year Perspective Plan. By 1993 the number of towns and people to benefit from its activity will certainly grow: feasibility studies will consider the supply of piped water to another 12 towns. No estimate of population possibly benefited was provided but a projection of 100 towns by the end of the plan period (1993/94) can be regarded as conservative.

The Assab refinery has a current consumption of some 100 tonnes of chlorine per year; with the production expansion under way it will probably soon need 150 tonnes/year. With the starting of production of the cans factory, (by the Meat Corporation) meat and fruit/vegetables canning can be expected to pick up again. Expert opinion puts the yearly requirements of chlorine for disinfection at about 70 tonnes.

In addition chlorine can be used to produce Hydrochloric Acid (presently imported) which consumption is summarized by the following table:

Ethiopian Hydrochloric Acid Consumption - summary  
(tonnes 100% HCl)

	1985	1990	1997	2004
Food	70-130	90-180	140-250	197-443
Textiles	50-100	60-160	90-210	127-372
Pharmaceuticals	10	15-20	20-40	28-71
General Chemicals	10	10-15	15-30	21-53
Beverages	10	10-15	15-30	21-52
<b>TOTAL</b>	<b>150-260</b>	<b>185-390</b>	<b>280-560</b>	<b>394-991</b>

Source: Feasible study by the British Sulphur Corporation, 1986.

A big consumer is foreseen in the medium term as well: the paper pulp factory of the Paper and Printing Corp. that could be operational towards the end of the decade. Its consumption of chlorine is estimated by the recent feasibility study at a little over a thousand tonnes per year (1032).

If the Bromine project is implemented, approximately 1,000 tons of chlorine would be needed.

Furthermore the above estimate of chlorine requirements by the WSSA was based on projection of piped water supply. If calcium hypochlorite is made available to smaller towns and rural centres, water purification practices could spread faster. So would chlorine demand (the TYPP states that as of 1983 only 6.5% of the rural population had access to clean water and that only 14 towns out of 318 had adequate and dependable water supplies. Even if the 12 towns mentioned above are added, it will be obvious that much scope will be left for expanding clean water availability).

Further it is assumed that once chlorine is available in

reasonable quantity and price a number of additional uses will expand.

Chlorine is presently imported. Prices vary, however, according to the packaging. The WSSA imports 65kg cylinders: the Addis Ababa Water Supply Authority buys 100 kg cylinders. The respective prices F.O.B. Hamburg are 5880 and 2958 DM/tonnes. Put in Addis, the former has a cost of 7 birr/kg; the latter of 4.34 birr/kg (the fact that the price differential appears reduced, when calculated in Addis, is basically due to different lengths of stay at Assab warehouses).

From the above considerations it appears that the demand for chlorine will be over 3200 t/y by 1993/94 and over 3500 t/y by the end of the century.

The break down of this demand is as follow:

- water and sewage treatment	1000 t/y
- paper pulp mill	1000 t/y
- bromine	1000 t/y
- hydrochloric acid	200 t/y
	-----
	3200 t/y

On this basis the nominal capacity of the plant has been taken as 4000 t/y of Chlorine. Based on this capacity, the following mix of outputs will be taken into consideration for financial and economical evaluations:

2875 t/y chlorine gas, to be sold piped as gas to nextdoor plant to produce calcium hypochlorite as solid and liquid solutions.

250 t/y chlorine gas used for the production of about 250 t/y hydrochloric acid (but the relevant installation has been dimensioned to produce as much as 500 t/y)

200 t/y chlorine produced as sodium hypochlorite solution with 15% "available chlorine" (1); but the relevant installation has been sized for producing as much as 500 t/y (2)

675 t/y chlorine gas that can be liquified and used for other applications (e.g. initial production of approx. 1,200 t/y Bromine) or available for export.

-----

4000 t/y total produced chlorine

4340 t/y caustic soda (produced as solid flakes)

1,300,000 Nm<sup>3</sup> /y hydrogen gas of which approximately 10% will be used for the synthesis of hydrochloric acid and the balance as fuel for caustic soda dehydration.

- (1) The strength (or the oxidising power) of hypochlorite solution is usually measured in terms of "available chlorine", expressed as percentage or grams of available chlorine per 100 ml solution.
- (2) Sodium hypochlorite solution is one of the most widely used disinfectant for a variety of public and household uses. It is presently produced at SEDE, Addis Ababa and Asmara Soap but quantity (500 tons/year) is assumed to be significantly lower than potential demand.



2.3 Sales prices and total revenues

On the assumption of selling all the caustic soda (flakes) on the foreign market, East Africa especially, the price of this product has been assumed as equal to the present prevailing price fob European port (286 \$/t) plus the freight from Europe to Assab estimated as 110 \$/t; having supposed to locate the factory in Assab, a total price of 396 \$/t can be assumed as ex-works price (1)

As far as chlorine is concerned, the selling price has been fixed on the basis of the present cost of the imported Chlorine, that is 818 \$/t cif Assab (1) (excluding the cost of cylinders or tanks) plus the charges for clearing, unloading and loading, bank commissions and others (12% of cif price); as a total: 916 \$/t ex-works.

By the same procedure the hydrochloric acid price has been fixed as 325 \$/t.

As for the sodium hypochlorite, no import cost being available, the selling price has been fixed on the "available chlorine" content (15%), that is  $916 \times 0,15 = 137.5$  \$/t.

Based on these selling prices the total annual revenues, ex-works, can be evaluated as follows:

- chlorine		
2875 t/y x 916 \$/t	=	2,633,500 (Domestic market)
675 t/y x 816 \$/t	=	550,800 (Export market)
- sodium hypochlorite		
200 t/y x 137.5 \$/t	=	27,500 (Domestic market)
- hydrochloric acid		
250 t/y x 325 \$/t	=	81,250 (Domestic market)

(1) see foot note at next page

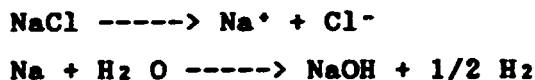
- caustic soda  
4340 t/y x 396 \$/t(1) = 1,718,640 (Export Market)  
-----  
Total revenues = 5,011,690

- (1) These prices should be competitive for the export market. In fact the most part of the African Countries (especially on the east coast) are currently importing these products from Europe.

3. MATERIAL AND INPUTS

3.1 Chemistry

Chlorine is produced almost entirely by electrolytic methods from electrolysis of brines: chlorine is produced at the anode and hydrogen, together with sodium hydroxide, at the cathode.



It follows that as main inputs only salt and electricity are required; both are available in the country. As will be pointed out in the financial and economical evaluation, in this case as in all other electrochemical productions (as hydrogen peroxide or calcium carbide) the price of electricity must be an object of special consideration, not being used, as in other productions, as a utility, but rather as an unreplaceable raw material.

The quality of salt will correspond to the following specification:

NaCl	97.2% w/w
Ca	0.04% w/w
Mg	0.02% w/w
Fe	0.5 ppm
SO <sub>4</sub>	0.2% w/w
Al	0.5 ppm
Sr	5 "
SiO <sub>2</sub>	3 "

Mn	0.01	"
I	0.2	"
Humidity	2.5%	w/w
Suspended solids	0.04%	"
Heavy metals (Cr-V-Mo)	0.01	ppm

3.2 Materials and utilities requirements and costs.

The complete list of raw materials and utilities to be supplied annually to the plant at full capacity (4000 t/y of chlorine) is:

Raw materials

	M birr/y
- Salt (NaCl, washed) 7,029tx61.9 birr/t	= 0.435
- Electricity for the process 11,246x10 <sup>3</sup> kWhx0.2 birr/kWh=	2.249
- Chemicals	= 0.043
- Demineralized water 23,500 t x 0.86 birr/t	= 0.020
	-----
	2.247

Utilities

- electricity 2,530x10 <sup>3</sup> kWh x 0.2 birr/kWh=	0.506
- fuel (in addition to hydrogen) 359.3 t x 351.9 birr/t	= 0.126
- cooling water 2.6x10 <sup>6</sup> m <sup>3</sup> x 0.029birr/m <sup>3</sup> =	0.075
(7°C temperature range)	-----
	0.707

For the financial evaluation the costs are grouped as follows:

- raw material (salt)=	435,000 birr/y =	210,145 \$/y as LC
- raw material(others)=	63,000 birr/y =	30,434 \$/y as FC
- energy (electricity)=	2,755,000 birr/y =	1,330,918 \$/y as LC
- energy (fuel)	= 126,000 birr/y =	60,870 \$/y as FC
- utilities	= 75,000 birr/y =	36,232 \$/y as LC
	-----	-----
TOTAL	3,454,000 birr/y	1,668,599 \$/y

**Remarks:**

- the salt price is based on 52.62 birr/t for raw salt, plus approximately 15% (washing losses ) that is 61.9 birr/ton.
- chemicals (technical grade) are generally utilized for brine treatment. The main of them are: caustic soda solution, HCl solution, sodium sulfate, sodium carbonate, barium chloride, precoating material for filtration, make-up resins for ion exchanging columns, sugar. Besides H<sub>2</sub>SO<sub>4</sub> is used for chlorine drying. (see process flow sheet B 162-12-3).
- on the assumption of locating the plant in Assab, the fuel oil price is estimated as equal to the price ex-works at the refinery

**3.3 Raw material purchasing programme and storage volumes**

On the assumption (parag.4) that the factory will be located next to the saline works, a salt stock equivalent to one month's consumption at full production is estimated as sufficient. A similar stock is sufficient for the fuel oil (due to the vicinity of the refinery) and for the other inputs.

As a result, the following amounts of salt and other chemicals must be considered as a minimum storage:

- raw salt	689 t	equivalent to	17,512 \$
- sulfuric acid	11 t	)	
- soda ash	8.3 t	(	
- barium chloride	8.3 t	)	" 3,500 \$
- sodium sulfite	0.8 t	(	
- fuel	30 t	)	" to 5,100 \$
			-----
		<b>Total</b>	<b>26,112 \$</b>

4. LOCATION

Due to the high consumption of salt, the ideal place would be in the neighbourhood of a salt works, provided that the required electric power is available. This is the case of Assab that within three year would be connected to the national electric grid.

5. PROJECT ENGINEERING

5.1 Process description

Up-to-date chlorine-caustic soda processes are based on membrane electrolyzers (diaphragm process), while in the past mercury cathode cells were used.

In the diaphragm process brine is fed continuously into all the cells and flows from the anode compartment through a diaphragm to the cathode.

The main steps of the process, including the production of hydrochloric acid, can be summarized as follows:

- Brine preparation and its electrolysis
- Chlorine cooling and drying
- Chlorine compression and liquefaction
- Caustic soda
- Caustic soda - evaporation unit
- Neutralization of wasted gases with production of sodium hypochlorite.
- Hydrochloric acid synthesis unit

The design allows the plant to be operated within a production range from 40% to 100% of the rated capacity.

5.1.1 Brine preparation and its electrolysis (see attached process flow sheet)

Raw salt is collected in an open storage area from which, through a feed mill and a belt conveyor is fed to the brine preparation tank with process water. The brine is collected in a water purifier with flocculants; then



is sent to a settler where it is separated from impurities.

The NaCl solution prepared in this way (that is with a concentration of approximately 300 gpl) is fed to the electrolyzers.

The brine feed rate is held at a value proportional to the rated capacity of the electrolyser so as to ensure that the brine leaving the electrolyser will contain approx. 200 g/l NaCl.

The depleted brine leaving the electrolyzers, saturated with chlorine, is first sent to the chlorate decomposer where concentrated hydrochloric acid is added to the brine for decomposing the excess gas of chlorates in order to maintain them at an acceptable value for the membranes of the cell, then it is dechlorinated by vacuum dechlorination.

The chlorine gas is recovered in the main chlorine header.

The dechlorinated brine is then passed through a column packed with activated carbon for neutralization of the last traces of dissolved chlorine which may adversely affect the subsequent purification process.

After neutralizing the excess acidity, the dechlorinated brine is submitted to the re-saturation step.

The saturated brine, at approx. 300 g/l NaCl, flows to the reactor, mechanically agitated, where it is mixed with chemicals to precipitate the impurities.

The impurities which are usually present in a raw brine are mainly magnesium, calcium, sulphate and, though in a small quantities, iron.

Caustic soda is used for precipitating magnesium as magnesium hydroxide, barium chloride lets sulphites precipitate as barium sulphites and sodium carbonate for

the calcium precipitation as calcium carbonate.

The brine from the reactor flows by gravity to a settler and is then pumped through a filter precoat type and sent to a receiver.

After controlling the brine temperature, the filtered brine undergoes the purification process suitable to reduce the Ca and Mg hardness to a few tenths of ppm, as required by the membrane cells process.

High purification levels are reached by ion exchange treatment in columns packed with chelating resins having high selectivity towards the metal ion impurities of the brine.

Three columns are installed, two in operation and one in regeneration.

The operating sequence at the three columns is automatically controlled by a programme/controller.

Following this step of purification, the brine flows to the cells.

#### 5.1.2 Chlorine cooling and drying

Chlorine leaving the electrolyzers saturated with water vapour flows to a titanium shell and tubes cooler, where the gas is cooled so that most of its water vapour is condensed.

Afterwards the chlorine flows to a second shell and tube titanium cooler with chilled water as cooling medium. The chlorine is sub-cooled so that most of its water vapour is condensed in order to minimize sulphuric acid consumption for chlorine drying.

Chlorine saturated condensed water is sent to brine before dechlorination. Sub-cooled chlorine is passed

through a special mist eliminator, which removes salt mist and entrained particles, and then flows to the first drying tower where it is dried by direct washing with sulphuric acid.

A centrifugal pump re-circulates the acid through the tower while a fraction of acid overflows continuously to the dilute acid pump tank. Dilute acid is stripped with air to remove dissolved chlorine and is then pumped to a storage tank and then to the plant battery limits.

The concentration of overflowing diluted sulphuric acid is kept at approximately 80% which is a tolerable limit for the piping material and the cooler provided for the system.

A similar acid circulation takes place in the second and third drying tower: from this tower acid overflows to the first drying tower at a concentration of about 93%, while fresh acid, at 96-98% concentration, is fed continuously into the system from the concentrated acid head tank.

Coolers are provided to remove the absorption and dilution heat from the sulphuric acid solution. The cooling medium for these sulphuric acid coolers is chilled water.

### 5.1.3 Chlorine compression

Dry chlorine gas is compressed by a sulphuric acid liquid ring-compressor at approx. 3.5 ATA and delivered to chlorine liquefaction, or if needed, to the HCl synthesis unit and chlorine neutralization (sodium hypochlorite, see para 5.1.7).

#### 5.1.4 Chlorine liquefaction

The compressed chlorine gas is condensed by a freon system.

Condensed chlorine flows by gravity to liquid chlorine storage tanks.

The composition of non-condensed gases (known as sniff gas) is controlled in order to keep the hydrogen content within safe limits. This sniff gas will be delivered to the chlorine neutralization unit/gas.

#### 5.1.5 Caustic soda

The caustic soda from the electrolyzers (a 33% NaOH water solution) is collected in a stainless steel receiver located at the end of the electrolysis room and is delivered to utilisations or to the evaporation unit.

#### 5.1.6 Caustic soda evaporation unit

This unit has been foreseen for the production of caustic soda flakes to be filled into bags; furthermore the unit has the flexibility of producing the whole quantity of solid caustic soda packaged into drums.

The 33% caustic solution is evaporated under vacuum in a falling film evaporator up to approx. 50%.

The generated vapours are condensed in a mixing condenser. Inert gases are sucked off by a steam ejector vacuum pump. The pre-concentrate is heated by the vapours generated in the final concentrator.

By means of a pump, the pre-concentrated caustic is fed

to a 50% caustic soda storage tank and then to the utilization and to the final concentrator, where it is dehydrated during one pass up to 99%. The final concentrator, which operates by the product side under atmospheric pressure, is heated by molten salt.

In order to protect the concentrator (made of nickel) from corrosion, a small quantity of sugar in an aqueous solution is added to the caustic. The sugar solution is prepared in a dissolving tank, from where it is fed into the NaOH feed line by a dosing pump.

By gravity the caustic melt flows to the flaking system where it is filled by hand into bags. The flaking system is cooled by water. The bags (25kg each) can be carried to the storage area on hand trailers.

The heat required for this second effect is fed in by molten salt. The heat carrying salt is circulated by a submerged pump through the heater, where it is warmed to an operating temperature of approx. 430°C by the combustion of fuel oil and gas. The flue gases are passed through a combustion air preheater and are vented through the stack into the atmosphere.

The salt tank is located at the lowest point of the plant, therefore the heat transfer salt will drain by gravity into the tank if the plant is stopped. The salt tank is equipped with an efficient steam tracing system by which the crystalline salt mixture may be molten before the first start-up, or be kept in liquid form during shut-down periods of the plant.

All the interlocked connections are centralized in a control and regulation panel.

5.1.7 Neutralization of wasted gases: hypochlorite production

The absorption system consists essentially of one reaction tower, two circulation tanks and of a set of centrifugal pumps for recirculating the absorption solution through the reaction tower. Vent and sniff chlorine gases from the various plant sections are fed to the bottom of the reaction tower, while diluted caustic enters at the top of the tower and is recirculated through it until the limit strength has been obtained.

This sector of the plant gives rise to a production of sodium hypochlorite solution.

The normal quantity of chlorine to be neutralized is about the 4% of the total chlorine production.

The capacity of the absorption system is calculated to neutralize up to about the 10% of the total chlorine production. Unabsorbed gases such as nitrogen, oxygen and hydrogen are vented by an exhaust fan from the reaction tower to the atmosphere.

5.1.8 Hydrochloric acid synthesis unit

The hydrochloric acid synthesis unit consists of 3 principal parts: the burner, the synthesis chamber-heat exchanger assembly, the receptor.

- a) The burner consists of two silica tubes mounted inside a graphilor housing. These tubes are fixed in the housing, in order to assure their easy replacement. The burner has two inlets, one for chlorine, and the other for hydrogen.

b) The synthesis chamber-heat exchanger assembly consists of a combustion chamber provided with two sight tubes which permit the automatic control of the flame and the lighting of the furnace.

The unit synthesis-absorption type includes also a distribution element with an inlet for the absorber. The heat exchanger (at the lower part) consists of a column of absorbing blocks. The heat exchanger includes a column of cooler blocks.

c) The receptor is a graphilor element for the separation of the acid product from the vent gases. At the bottom of this element there is a graphilor safety disk and below this an explosion guard.

The hydrogen coming from electrolysis room, after cooling is delivered to the furnace burner by blowers.

The chlorine is directly fed to the furnace burner by the chlorine blowing system. The chlorine pressure is automatically controlled by a pressure control valve.

In both the hydrogen and chlorine lines automatic block valves interlocked with the furnace photoelectric cell are installed. In case of flame failure, the two valves are automatically closed, while a third automatic block valve will allow an inert gas to enter the furnace to purge the system.

The hydrochloric acid gas is absorbed by water and the obtained hydrochloric acid solution flows down into an intermediate tank from where is pumped to the storage tank.

5.1.9 Expected quality of the obtained products

Chlorine

As dry compressed gas from the electrolysis cells:

Cl<sub>2</sub> : 97-98% V/V  
H<sub>2</sub> : max 0.1 % V/V  
O<sub>2</sub> : max 2% V/V  
Air : balance  
Temperature : 40° - 50° C

As liquid, after the liquefaction of the compressed gas:

Cl<sub>2</sub> 99.5-99.9% W/W  
Moisture 10-20 ppm

Caustic soda

Solution at electrolyzers outlet:

NaOH 33% W/W  
NaCl 30 ppm  
NaClO<sub>3</sub> 30 ppm

Solid:

NaOH 99% W/W

Hydrogen

H<sub>2</sub> 99.9% V/V

Hydrochloric acid

Liquid at the plant outlet

Hcl 30% W/W  
Fe max 0.05% W/W



Sodium hypochlorite

Title: 15% "available chlorine"

Density 1.2 Kg/l

5.2 Packaging

The caustic soda, for export only, will be packaged in 25 kg bags.

As far as chlorine is concerned, the plant is provided with a tank for storing ten days' production of liquid chlorine (about 100t). The liquid chlorine will be supplied to the customers in one ton container: their managing and costs will be taken into consideration when defining the selling costs.

Sodium hypochlorite will be stored and shipped in plastic drums.

5.3 Lay-out and civil works

The general lay-out of the plant is shown in drawing B162-12-1. The whole complex including the production plants, the utility and the general facility plant and the offices covers an area of about 14,000 sq.m

The administrative offices, laboratories, the workshops, the storehouse, the electrical substation, the emergency diesel power station, the electrolysis plant and its auxiliaries are all inside buildings; storage areas for liquid chlorine cylinders, hypochlorite drums and caustic soda bags are protected by a light shelter; all the remaining sections of the plant are installed outdoors.

The administrative building is of two-storeys, covering an area of 200 sq.m; its structure is of reinforced concrete while the walls, internal and external, are of brickwork; the roof is insulated with mineral wool lagging covered with corrugated asbestos-cement sheets. The other buildings covering a total area of 1330 sq.m, are of the same construction design, but single-storey. The shelters, covering an area of 150 sq.m have steel columns, steel trusses and a roof insulated with mineral wool lagging covered with corrugated asbestos-cement sheets. The roads and all the open spaces among the various plant sections are asphalted. The routings of pipes and cables are completely above-ground on steel racks. The sewerage consists of two sewer systems: one for rain water collection and one for the waste water to be treated.

5.4 Investment cost: depreciation and maintenance cost.

The investment costs for the plant, utilities included, but caustic soda concentrating equipment excluded, are:

	LC	FC	Total
	M\$	M\$	M\$
Machinery and equipment			
FOB European port	-	8.665	8.665
Transportation	0.865	0.865	1.730
Insulation & paintings	0.150	0.115	0.265

Erection	0.865	0.865	1.730
Site preparation	0.150	-	0.150
Civil works	1.476	-	1.476
Spare parts	-	0.433	0.433
	-----	-----	-----
	3.506	10.943	14.449
Contingencies	0.354	1.067	1.421
	-----	-----	-----
Grand total	3.860	12.010	15.870

The investment cost of the equipment for the caustic soda concentration (from NaOH 33% to NaOH flakes) is:

	LC	FE	Total
	M\$	M\$	M\$
Machinery & Equipment FOB European port	-	1.091	1.091
Transportation	0.109	0.109	0.218
Erection	0.118	0.100	0.218
Civil work	0.185		0.185

Insulation & painting	0.021	0.012	0.033
Spare part		0.055	0.055
	-----	-----	-----
<b>TOTAL</b>	<b>0.433</b>	<b>1.367</b>	<b>1.800</b>
Contingencies	0.047	0.133	0.180
	-----	-----	-----
<b>GRAND TOTAL</b>	<b>0.480</b>	<b>1.500</b>	<b>1.980</b>

Total investment cost  $15.87 + 1.98 = 17.85$  M\$

The life cycle of the plant can be considered fifteen years.

The annual maintenance cost, has been assumed equivalent to 4% of the machinery and equipment costs, that is 390,000 \$.

In the financial evaluation the above mentioned total investment cost (contingencies included) has been subdivided as follows:

Machinery	FC	$12.010 + 1.500 = 13.510$	million \$
Machinery	LC	$1.880 + 0.248 = 2.128$	million \$
Civil works	LC	$1.830 + 0.232 = 2.062$	million \$
Site preparation	LC	$0.150 = 0.150$	million \$
		-----	
		<b>17.050</b>	<b>million \$</b>

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit, complete with utilities and facilities operating under the direction of the National Chemical Corp.

7. MANPOWER

7.1 Management

		birr/m	birr/y
General Manager	n° 1	1500	
Technical Manager	n° 1	1200	
	-----	-----	-----
	n° 2	2700	32,400
			(15652 \$/y)

7.2 Administrative Dep.

Finance Manager	n° 1	800	
Senior accountant	n° 1	400	
Accountant	n° 1	350	
Accountant clerks	n° 2	700	
Purchasing Dep.head	n° 1	400	
Purchasing " Ass.	n° 2	700	
Store Head	n° 1	400	
Store clerks	n° 2	700	
Sales Dep. Head	n° 1	400	
Sales Dep. Ass.	n° 2	700	
Transport officer	n° 1	400	
Drivers	n° 5	1750	
Security officer	n° 1	400	
Guards	n° 9	1350	
Secretaries	n° 4	1400	
	-----	-----	-----
	n° 34	10850	130,200
			(62899 \$/y)
Total Management and Administrative dep.			162,600 b/y
			(78551 \$/y)

7.3 Production and Maintenance Departments

		birr/m	birr/y
<u>Production Department</u>			
Production Manager	n° 1	1000	
Dep. Production Mng	n° 1	800	
Shift Foremen	n° 8	3200	
Shift operators	n° 28	9800	
Semiskilled workers	n° 28	8400	
Chief chemist	n° 1	800	
Chemist	n° 1	700	
Analyst	n° 4	1400	
Clerks	n° 2	700	
Unskilled workers	n° 8	1600	
Steam prod. Head	n° 1	400	
" " operators	n° 8	2800	
	-----	-----	-----
	n° 91	31600	379,200 (183,188 \$/y)
 <u>Engineering Dep.</u>			
Chief engineer	n° 1	1000	
Engineers	n° 4	3200	
Workshop head	n° 1	700	
Mech. Store head	n° 1	400	
Foremen	n° 3	1200	
Welders	n° 2	800	
Electricians	n° 4	1600	
Mechanics	n° 6	2400	
Semiskilled worker	n° 3	900	
Clerks	n° 2	700	
Labourers	n° 6	1200	
	-----	-----	-----
	n° 33	14100	169,200 (81,739 \$/y)

8. IMPLEMENTATION SCHEDULE

Approximately 30 months are needed for the design, construction and commissioning of the plant from the moment the project is approved.



9. FINANCIAL EVALUATION

The Comfar financial evaluations are attached as Annexe 1 and 2.

Such evaluations have been based on the data indicated in the foreward and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the price of electricity has been taken as 0.2 birr/kWh (Hypothesis A) or as 0.05 birr/kWh (Hypothesis 2)

- the assistance of one foreign expert for the first operation period (2 years) has been taken into account and indicated as "foreign factory overheads"

- the production programme has been assumed as follows:

1st year: 50% capacity (2170 t C.Soda + 1437.5t Chlorine (domestic) + 337.5 Chlorine (export) + 100 t S. Hypo + 125 t HCl)

2nd year: 75% capacity (3255 t C.Soda + 2156.25t Chlorine (domestic) + 506.25g Chlorine (export)+ 150 t S. Hypo + 187.5 HCl)

From the 3rd to the 15th: 100% capacity (4340 t C.Soda + 2875 Chlorine (domestic) + 675 Chlorine (expport) + 200 t S.Hypo +250 t HCl)

The selling prices are:

Caustic soda:	396	\$/t
Chlorine :	916	\$/t (Domestic market)
Chlorine :	818	\$/t (Export market)
Sodium hypo.:	137.5	\$/t
Hydrochloric acid:	325	\$/t

As a result the evaluation yields an IRR of 5.96 (Hyp. A) and 9.07 (Hyp. B); furthermore the BEP, computed on the basis of Hyp. B, is equal to 75%.

Prolonging the estimated production life of the plant from 15 to 20 years the IRR of the Hyp. B increases to 9.99%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 4.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions (1):

- yearly imported quantities equal to the production programme for Chlorine, Sodium Hypo. and Hydrochloric acid;
- cost of import equal to the CIF prices estimated at parag. 2.3

The net foreign exchange effect is positive while the net foreign exchange flow is negative; by discounting the annual values of both these items at the rate of 10% the calculation arrives at a present value of (- 3,825,000 \$) for the net foreign exchange flow and to 13,394,000 for the net foreign exchange effect.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 13,394,000 \$

- (1) To be on the conservative side the export of Chlorine has not been considered.

11. INTEGRATED CHLOR-ALKALI AND CALCIUM HYPOCHLORITE FACTORY

The financial advantage deriving from the production in a same factory of chlore and calcium hypochlorite (HSH), has also been analyzed.

The main advantages are:

- a) The utilities plants (in particular the electrical substations) can be unified and the relevant reduction in investment costs has been evaluated 300,000 \$.
- b) Some buildings (administrative offices and social services) can be shared in common and this gives another reduction of 140,000 \$.
- c) Administrative and maintenance personnel quantity can be reduced and this leads to a reduction of 57,681 \$/y for the administrative department and 9,276 \$/y for the maintenance.
- d) Chlore and caustic soda will be supplied to the calcium hypochlorite production at the production cost.

The sale programme at 100% capacity and the annual revenues result modified as follows:

- chlore		
675 t/y x 816 \$/t	=	550,800 \$/y (export market)
- calcium hypochlorite		
2500 t/y x 2000 \$/t	=	5,000,000 \$/y
- Calcium hypochlorite solut.		
11,000 t/y x 101 \$/t	=	1,111,000 \$/y
- Sodium hypochlorite		
200 t/y x 135 \$/t	=	27,500 \$/y
- Hydrochloric acid		
250 t/y x 325 \$/t	=	81,250 \$/y
- Caustic soda		
2715 t/y x 396 \$/t	=	1,075,140 \$/y
		-----
		7,845,690 \$/y

On these basis and assuming 0.05 birr/kwh as electricity cost financial and foreign exchange effect evaluations (Annexe 5) have been prepared; the IRR is equal to 9.16% and the discounted net foreign exchange effect (1) equal to 6,147.

- (1) The import substitution effect has been estimated on the basis of the production of Chlore, HCl and sodium hypochlorite as per the Chlore Alkali plant.

FINANCIAL EVALUATION

HYPOTHESIS A

Cost of electric energy: 0.2 birr/kWh



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CHLOR-ALKALI PLANT  
 february 88  
 HYPOTHESIS A - Power at 0.2birr/kWh

3 year(s) of construction, 15 years of production  
 currency conversion rates:  
 foreign currency 1 unit = 1.0000 units accounting currency  
 local currency 1 unit = 1.0000 units accounting currency  
 accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	19153.40	76.479 % foreign
current assets:	0.00	0.000 % foreign
total assets:	19153.40	76.479 % foreign

**Source of funds during construction phase**

equity & grants:	6531.00	0.000 % foreign
foreign loans :	11484.00	
local loans :	0.00	
total funds :	18015.00	63.747 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1432.79	1944.93	2402.08
depreciation :	1208.49	1208.49	1193.49
interest :	1148.40	1004.85	861.30
production costs	3789.68	4158.27	4456.87
thereof foreign	62.00 %	55.88 %	50.33 %
total sales :	2505.84	3758.77	5011.69
gross income :	-1283.83	-399.50	554.82
net income :	-1283.83	-399.50	277.41
cash balance :	-1905.51	-789.46	-121.09
net cashflow :	678.39	1650.89	2175.71

Net Present Value at: 10.00 % = -4254.27  
 Internal Rate of Return on total investments: 5.96 %  
 Equity paid versus Net income flow (IRR): 0.78 %  
 Net Worth versus Net Cash Return (IRR): 4.49 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement



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Total Initial Investment is 1050 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	50.00	610.00	610.00	560.00	232.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	675.00	2225.00	4900.00	6250.00	1578.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>875.00</b>	<b>2835.00</b>	<b>5510.00</b>	<b>6810.00</b>	<b>1810.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	50.00	654.20	574.20
Net working capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>880.00</b>	<b>2850.00</b>	<b>5525.00</b>	<b>6860.00</b>	<b>2464.20</b>	<b>574.20</b>
Of it-foreign, in Z . . . . .	76.70	71.05	73.30	78.72	78.09	100.00

CHLOR-ALKALI PLANT --- february 88





**COMFAR**  
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**Total Current Investment in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	394.66	162.95	156.49
<b>Total current investment costs . . .</b>	<b>394.66</b>	<b>162.95</b>	<b>156.49</b>
<b>Of it foreign, I . . . . .</b>	<b>67.37</b>	<b>75.89</b>	<b>74.90</b>

CHLOR-ALKALI PLANT — february 88

## Total Production Costs in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995
% of max. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I .....	120.29	100.44	240.50	240.50	240.50	240.50
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	18.12	27.17	36.23	36.23	36.23	36.23
Energy .....	695.90	1043.04	1391.79	1391.79	1391.77	1391.79
Labour, direct .....	183.19	183.19	183.19	183.19	183.19	183.19
Repair, maintenance .....	81.74	81.74	81.74	81.74	81.74	81.74
Spares .....	195.00	290.00	390.00	390.00	390.00	390.00
Factory overheads .....	60.00	60.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1354.24</b>	<b>1866.38</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>
Administrative overheads .....	78.55	78.55	78.55	78.55	78.55	78.55
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	1208.49	1208.49	1193.49	1178.49	1178.49	1145.49
Financial costs .....	1148.40	1004.85	861.30	717.75	574.20	430.65
<b>Total production costs .....</b>	<b>3789.68</b>	<b>4158.27</b>	<b>4456.87</b>	<b>4298.32</b>	<b>4154.77</b>	<b>3978.22</b>
<b>Costs per unit (single product) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, I .....	62.00	55.00	50.33	48.84	47.00	45.56
Of it variable, I .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	261.74	261.74	261.74	261.74	261.74	261.74



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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	240.58	240.58	240.58	240.58	240.58	240.58
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	36.23	36.23	36.23	36.23	36.23	36.23
Energy . . . . .	1391.79	1391.79	1391.79	1391.79	1391.79	1391.79
Labour, direct . . . . .	183.19	183.19	183.19	183.19	183.19	183.19
Repair, maintenance . . . . .	81.74	81.74	81.74	81.74	81.74	81.74
Spares . . . . .	390.00	390.00	390.00	390.00	390.00	390.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>	<b>2323.53</b>
Administrative overheads . . . . .	78.55	78.55	78.55	78.55	78.55	78.55
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1145.49	1145.49	1145.49	1042.39	514.16	0.00
Financial costs . . . . .	287.10	143.55	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>3834.67</b>	<b>3691.12</b>	<b>3547.57</b>	<b>3444.47</b>	<b>2916.24</b>	<b>2402.08</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	43.52	41.32	38.95	40.12	31.73	20.04
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	261.74	261.74	261.74	261.74	261.74	261.74

CHLOR-ALKALI PLANT --- february 98



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US DOLLARS**

Year .....		1990	1991	1992	1993-2004
Coverage .....	ndc cots				
<b>Current assets &amp;</b>					
Accounts receivable . . .	30 12.0	119.40	162.08	200.17	200.17
Inventory and materials .	43 8.4	16.42	24.62	32.83	32.83
Energy .....	2 120.7	4.39	6.58	8.77	8.77
Spares .....	360 1.0	193.00	290.00	390.00	390.00
Work in progress .....	1 360.0	3.76	5.18	6.45	6.45
Finished products . . .	30 12.0	119.40	162.08	200.17	200.17
Cash in hand .....	15 24.0	24.94	28.89	30.56	30.56
Total current assets .....		483.30	679.44	868.96	868.96
<b>Current liabilities and</b>					
Accounts payable .....	24 15.0	88.63	121.82	154.86	154.86
Net working capital .....		394.66	557.62	714.10	714.10
Increase in working capital .....		394.66	162.95	156.49	0.00
Net working capital, local .....		128.78	168.07	207.35	207.35
Net working capital, foreign .....		265.88	389.55	506.75	506.75

Note: ndc = minimum days of coverage ; cots = coefficient of turnover .



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2-88.2	1989.1	1989.2
Equity, ordinary ..	6531.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	11484.00	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	11484.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	564.20	574.20
Total funds .....	18015.00	0.00	564.20	574.20

CHLOR-ALKALI PLANT — february 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50
Current liabilities	88.63	33.19	33.04	0.00	0.00	0.00	0.00
Bank overdraft ....	1905.51	789.46	121.69	-99.67	-171.45	-226.72	-298.50
Total funds .....	558.65	-612.85	-1281.37	-1535.17	-1606.95	-1662.22	-1734.00

CHLOR-ALKALI PLANT -- february 88

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1997	1998	1999
Equity, ordinary ..	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	-1435.50	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	-1435.50	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	-370.27	-1877.55	-910.29
Total funds .....	-1805.77	-1877.55	-910.29

CHLOR-ALKALI PLANT -- february 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	18015.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	18015.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	880.00	2850.00	5525.00	6860.00	2464.20	574.20
Total assets . . . .	880.00	2850.00	5525.00	6860.00	1890.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	574.20	574.20
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) . .	17135.00	-2850.00	-5525.00	-6860.00	-2464.20	-574.20
Cumulated cash balance	17135.00	14285.00	8760.00	1900.00	-564.20	-1138.40
Inflow, local . . . .	6531.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	205.00	825.00	1475.00	1460.00	540.00	0.00
Surplus (deficit) . .	6326.00	-825.00	-1475.00	-1460.00	-540.00	0.00
Inflow, foreign . . .	11484.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	675.00	2025.00	4050.00	5400.00	1924.20	574.20
Surplus (deficit) . .	10809.00	-2025.00	-4050.00	-5400.00	-1924.20	-574.20
Net cashflow . . . . .	-880.00	-2850.00	-5525.00	-6860.00	-1890.00	0.00
Cumulated net cashflow	-880.00	-3730.00	-9255.00	-16115.00	-18005.00	-18005.00

CHLOR-ALKALI PLANT --- february 88

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2594.48	3791.95	5044.72	5011.69	5011.69	5011.69
Financial resources .	88.63	33.19	33.04	0.00	0.00	0.00
Sales, net of tax . .	2505.84	3758.77	5011.69	5011.69	5011.69	5011.69
Total cash outflow . .	4499.99	4581.42	5163.82	4912.02	4840.24	4784.97
Total assets . . . .	483.30	196.14	189.52	0.00	0.00	0.00
Operating costs . . .	1432.79	1944.93	2402.08	2402.08	2402.08	2402.08
Cost of finance . . .	1148.40	1004.85	861.30	717.75	574.20	430.65
Repayment . . . . .	1435.50	1435.50	1435.50	1435.50	1435.50	1435.50
Corporate tax . . . .	0.00	0.00	277.41	356.69	428.46	516.74
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1905.51	-789.46	-121.09	99.67	171.45	226.72
Cumulated cash balance	-3043.91	-3833.37	-3954.46	-3854.79	-3683.34	-3456.62
Inflow, local . . . .	1458.92	2089.55	2775.11	2742.25	2742.25	2742.25
Outflow, local . . . .	1348.71	1598.59	2270.34	2277.47	2349.24	2437.52
Surplus ( deficit ) .	110.21	490.95	504.77	464.78	393.01	304.73
Inflow, foreign . . . .	1135.56	1702.41	2269.61	2269.44	2269.44	2269.44
Outflow, foreign . . . .	3151.28	2982.82	2895.48	2634.55	2491.00	2347.45
Surplus ( deficit ) .	-2015.72	-1280.42	-625.86	-365.11	-221.56	-78.01
Net cashflow . . . . .	678.39	1650.89	2175.71	2252.92	2181.15	2092.87
Cumulated net cashflow	-17326.61	-15675.72	-13500.01	-11247.09	-9065.94	-6973.07





COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1996	1997	1978	1999	2000	2001
Total cash inflow . .	5011.69	5011.69	5011.69	5011.69	5011.69	5011.69
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	5011.69	5011.69	5011.69	5011.69	5011.69	5011.69
Total cash outflow . .	4713.19	4641.42	3134.14	3134.14	3185.69	3185.69
Total assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	2402.08	2402.08	2402.08	2402.08	2402.08	2402.08
Cost of finance . . .	287.10	143.55	0.00	0.00	0.00	0.00
Repayment . . . . .	1435.50	1435.50	0.00	0.00	0.00	0.00
Corporate tax . . .	588.51	660.29	732.06	732.06	783.61	783.61
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	298.50	370.27	1877.55	1877.55	1826.00	1826.00
Cumulated cash balance	-3158.12	-2787.85	-910.30	967.25	2793.75	4619.24
Inflow, local . . . . .	2742.25	2742.25	2742.25	2742.25	2742.25	2742.25
Outflow, local . . . .	2509.29	2581.07	2652.84	2652.84	2704.39	2704.39
Surplus ( deficit ) .	232.96	161.18	89.41	89.41	37.86	37.86
Inflow, foreign . . .	2269.44	2269.44	2269.44	2269.44	2269.44	2269.44
Outflow, foreign . . .	2203.90	2060.35	481.30	481.30	481.30	481.30
Surplus ( deficit ) .	65.54	209.09	1788.14	1788.14	1788.14	1788.14
Net cashflow . . . . .	2021.10	1949.32	1877.55	1877.55	1826.00	1826.00
Cumulated net cashflow	-4951.97	-3002.65	-1125.10	752.45	2578.45	4404.45

CHLOR-ALKALI PLANT — February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2002	2003	2004
Total cash inflow . .	5011.69	5011.69	5011.69
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	5011.69	5011.69	5011.69
Total cash outflow . .	3185.69	3449.81	3706.89
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2402.00	2402.00	2402.00
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	783.61	1047.73	1304.80
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	1826.00	1561.88	1304.80
Cumulated cash balance	6445.24	8007.12	9311.93
Inflow, local . . . .	2742.25	2742.25	2742.25
Outflow, local . . . .	2704.39	2968.51	3223.59
Surplus ( deficit ) .	37.86	-226.26	-483.34
Inflow, foreign . . .	2269.44	2269.44	2269.44
Outflow, foreign . . .	481.30	481.30	481.30
Surplus ( deficit ) .	1788.14	1788.14	1788.14
Net cashflow . . . . .	1826.00	1561.88	1304.80
Cumulated net cashflow	6230.44	7792.33	9097.13

CHLOR-ALKALI PLANT --- february 88



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### Cashflow Discountings:

a) Equity paid versus Net income flow:		
Net present value .....	-4832.83 at	10.00 %
Internal Rate of Return (IRRE1) ..	0.78 %	
b) Net Worth versus Net cash returns:		
Net present value .....	-4147.96 at	10.00 %
Internal Rate of Return (IRRE2) ..	4.49 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-4254.27 at	10.00 %
Internal Rate of Return ( IRR ) ..	5.96 %	

Net Worth = Equity paid plus reserves

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CHLOR-ALKALI PLANT --- february 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2505.84	3758.77	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2505.84	3758.77	5011.69	5011.69	5011.69
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2641.28	3153.42	3595.57	3580.57	3580.57
Operational margin . . . . .	-135.43	605.35	1416.12	1431.12	1431.12
As % of total sales . . . . .	-5.40	16.10	28.26	28.56	28.56
Cost of finance . . . . .	1148.40	1004.85	861.30	717.75	574.20
Gross profit . . . . .	-1283.83	-399.59	554.82	713.37	856.92
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1283.83	-399.59	554.82	713.37	856.92
Tax . . . . .	0.00	0.00	277.41	356.69	428.46
Net profit . . . . .	-1283.83	-399.59	277.41	356.69	428.46
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1283.83	-399.59	277.41	356.69	428.46
Accumulated undistributed profit . . .	-1283.83	-1683.33	-1405.92	-1049.24	-620.78
Gross profit, % of total sales . . . . .	-51.23	-10.63	11.07	14.23	17.10
Net profit, % of total sales . . . . .	-51.23	-10.63	5.54	7.12	8.55
RDE, Net profit, % of equity . . . . .	-19.66	-6.12	4.25	5.46	6.56
ROI, Net profit+interest, % of invest.	-0.74	3.26	6.08	5.74	5.36



CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	5011.69	5011.69	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5011.69	5011.69	5011.69	5011.69	5011.69
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3547.57	3547.57	3547.57	3547.57	3547.57
Operational margin . . . . .	1464.12	1464.12	1464.12	1464.12	1464.12
As % of total sales . . . . .	29.21	29.21	29.21	29.21	29.21
Cost of finance . . . . .	430.65	287.10	143.55	0.00	0.00
Gross profit . . . . .	1033.47	1177.02	1320.57	1464.12	1464.12
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1033.47	1177.02	1320.57	1464.12	1464.12
Tax . . . . .	-516.74	588.51	- 660.29	732.06	732.06
Net profit . . . . .	516.74	588.51	660.29	732.06	732.06
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	516.74	588.51	660.29	732.06	732.06
Accumulated undistributed profit . . .	-104.04	484.47	1144.75	1876.82	2608.88
Gross profit, % of total sales . . . .	20.62	23.49	26.35	29.21	29.21
Net profit, % of total sales . . . .	10.31	11.74	13.17	14.61	14.61
RGE, Net profit, % of equity . . . .	7.91	9.01	10.11	11.21	11.21
RDI, Net profit+interest, % of invest.	5.06	4.68	4.29	3.91	3.91

CHLOR-ALKALI PLANT -- february 88



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	2000	2001	2002	2003	2004
Total sales, incl. sales tax .....	5011.69	5011.69	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	5011.69	5011.69	5011.69	5011.69	5011.69
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	3444.47	3444.47	3444.47	2916.24	2402.06
Operational margin .....	1567.22	1567.22	1567.22	2095.45	2609.61
As % of total sales .....	31.27	31.27	31.27	41.81	52.07
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
Gross profit .....	1567.22	1567.22	1567.22	2095.45	2609.61
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	1567.22	1567.22	1567.22	2095.45	2609.61
Tax .....	783.61	783.61	783.61	1047.73	1304.00
Net profit .....	783.61	783.61	783.61	1047.73	1304.00
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	783.61	783.61	783.61	1047.73	1304.00
Accumulated undistributed profit .....	3392.49	4176.10	4959.71	6007.44	7312.24
Gross profit, % of total sales .....	31.27	31.27	31.27	41.81	52.07
Net profit, % of total sales .....	15.64	15.64	15.64	20.91	26.04
ROE, Net profit, % of equity .....	12.00	12.00	12.00	16.04	19.98
ROI, Net profit+interest, % of invest. ....	4.19	4.19	4.19	5.60	6.97

CHLOR-ALKALI PLANT — february 68



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CONFAR 2.0 - DALNO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Total assets .....</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18579.20</b>	<b>19153.40</b>
Fixed assets, net of depreciation	0.00	880.00	3730.00	9255.00	16155.00	18579.20
Construction in progress .....	880.00	2850.00	5525.00	6860.00	2464.20	574.20
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	17135.00	14285.00	8760.00	1900.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18579.20</b>	<b>19153.40</b>
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	11484.00	11484.00	11484.00	11484.00	11484.00	11484.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	564.20	1138.40
<b>Total debt .....</b>	<b>11484.00</b>	<b>11484.00</b>	<b>11484.00</b>	<b>11484.00</b>	<b>12048.20</b>	<b>12622.40</b>
<b>Equity, % of liabilities .....</b>	<b>36.25</b>	<b>36.25</b>	<b>36.25</b>	<b>36.25</b>	<b>35.15</b>	<b>34.10</b>

CHLOR-ALKALI PLANT --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>19712.04</b>	<b>19099.20</b>	<b>18095.23</b>	<b>16639.33</b>	<b>15104.16</b>	<b>13330.21</b>
Fixed assets, net of depreciation	17944.91	16736.42	15342.94	14364.45	13185.96	12040.47
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	438.36	650.54	838.40	838.40	838.40	838.40
Cash, bank .....	24.94	28.09	30.56	30.56	30.56	30.56
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	1283.83	1683.33	1405.92	1049.24	620.78
Loss .....	1283.83	399.50	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>19712.04</b>	<b>19099.20</b>	<b>18095.23</b>	<b>16639.33</b>	<b>15104.16</b>	<b>13330.21</b>
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	277.41	336.69	428.46	516.74
Long and medium term debt .....	10048.50	8613.00	7177.50	5742.00	4306.50	2871.00
Current liabilities .....	88.63	121.82	154.86	154.86	154.86	154.86
Bank overdraft, finance required.	3043.91	3833.38	3954.46	3854.79	3483.34	3456.62
<b>Total debt .....</b>	<b>13181.05</b>	<b>12568.20</b>	<b>11286.22</b>	<b>9751.64</b>	<b>8144.70</b>	<b>6482.47</b>
<b>Equity, % of liabilities .....</b>	<b>33.13</b>	<b>34.20</b>	<b>36.09</b>	<b>39.25</b>	<b>43.24</b>	<b>48.27</b>





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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	11867.98	10618.45	9472.97	9294.73	10078.34	10861.95
Fixed assets, net of depreciation	10894.98	9749.49	8604.01	7458.52	6416.13	5373.74
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	838.40	838.40	838.40	838.40	838.40	838.40
Cash, bank .....	30.56	30.56	30.56	30.56	30.56	30.56
Cash surplus, finance available .	0.00	0.00	0.00	967.25	2793.25	4619.25
Loss carried forward .....	104.04	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	11867.98	10618.45	9472.97	9294.73	10078.34	10861.95
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	0.00	484.47	1144.75	1876.82	2606.89	3392.49
Profit .....	588.51	660.29	732.06	732.06	783.61	783.61
Long and medium term debt .....	1435.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	154.86	154.86	154.86	154.86	154.86	154.86
Bank overdraft, finance required.	3158.12	2787.84	910.29	0.00	0.00	0.00
Total debt .....	4748.47	2942.70	1065.15	154.86	154.86	154.86
Equity, % of liabilities .....	55.03	61.51	68.94	70.27	64.80	60.13

CHLOR-ALKALI PLANT — february 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2002	2003	2004
Total assets .....	11645.56	12693.29	13998.10
Fixed assets, net of depreciation	4331.35	3817.20	3817.20
Construction in progress .....	0.00	0.00	0.00
Current assets .....	838.40	838.40	838.40
Cash, bank .....	30.56	30.56	30.56
Cash surplus, finance available .	6445.25	8007.13	9311.94
Less carried forward .....	0.00	0.00	0.00
Less .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>11645.56</b>	<b>12693.29</b>	<b>13998.10</b>
Equity capital .....	6531.00	6531.00	6531.00
Reserves, retained profit .....	4176.10	4959.71	6007.44
Profit .....	783.61	1047.73	1304.80
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	154.86	154.86	154.86
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>154.86</b>	<b>154.86</b>	<b>154.86</b>
<b>Equity, % of liabilities .....</b>	<b>56.08</b>	<b>51.45</b>	<b>46.66</b>

CHLOR-ALKALI PLANT --- february 89

**Chlor-Alkali production**

**ANNEXE 2**

**FINANCIAL EVALUATION**

**HYPOTHESIS B**

**Cost of electric energy: 0.05 birr/kWh**



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CHLOR-ALKALI PLANT  
February 88  
HYPOTHESIS B - Power at 0.05 birr/kWh

3 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	19153.40	76.479 % foreign
current assets:	0.00	0.000 % foreign
total assets:	19153.40	76.479 % foreign

**Source of funds during construction phase**

equity & grants:	6531.00	0.000 % foreign
foreign loans:	11484.00	
local loans:	0.00	
total funds:	18015.00	63.747 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	933.70	1196.27	1403.89
depreciation :	1208.49	1208.49	1193.49
interest :	1148.40	1004.85	861.30
production costs	3290.59	3409.63	3458.68
thereof foreign	71.40 %	68.15 %	64.83 %
total sales :	2505.84	3758.77	5011.65
gross income :	-784.74	349.14	1533.01
net income :	-784.74	174.57	776.51
cash balance :	-1362.06	-193.21	400.19
net cashflow :	1221.84	2247.14	2696.99

Net Present Value at: 10.00 % = -1019.43  
Internal Rate of Return on total investment: 9.07 %  
Equity paid versus Net income flow (IRR): 7.22 %  
Net Worth versus Net Cash Return (IRR): 8.83 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US DOLLARS**

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	50.00	610.00	610.00	560.00	232.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	675.00	2225.00	4900.00	6250.00	1578.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>875.00</b>	<b>2835.00</b>	<b>5510.00</b>	<b>6810.00</b>	<b>1810.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	50.00	654.20	574.20
Net working capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>880.00</b>	<b>2850.00</b>	<b>5525.00</b>	<b>6860.00</b>	<b>2464.20</b>	<b>574.20</b>
Of it foreign, in % . . . . .	76.70	71.05	73.30	78.72	78.09	100.00

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US DOLLARS**

Year .....	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	350.30	140.77	134.31
<b>Total current investment costs . . . . .</b>	<b>350.30</b>	<b>140.77</b>	<b>134.31</b>
Of it foreign, % . . . . .	75.90	87.85	87.27

CHLOR-ALKALI PLANT — february 88



COMFAR 2.0 - BALNO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year			1990	1991	1992	1993-2004
Coverage	ndc	coto				
<b>Current assets &amp;</b>						
Accounts receivable	30	12.0	77.81	99.69	116.99	116.99
Inventory and materials	43	8.4	16.42	24.62	32.83	32.83
Energy	5	65.6	3.00	4.50	6.00	6.00
Spares	360	1.0	193.00	290.00	390.00	390.00
Work in progress	1	360.0	2.30	3.10	3.68	3.68
Finished products	30	12.0	77.81	99.69	116.99	116.99
Cash in hand	15	24.0	24.94	28.90	30.56	30.56
Total current assets			397.34	530.50	697.65	697.65
<b>Current liabilities and</b>						
Accounts payable	19	18.5	47.04	59.43	71.67	71.67
Net working capital			350.30	491.07	625.38	625.38
Increase in working capital			350.30	140.77	134.31	0.00
Net working capital, local			84.42	101.52	118.62	118.62
Net working capital, foreign			265.88	389.55	506.75	506.75

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992	1993	1994	1995
I of non. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	120.29	100.44	240.50	240.50	240.50	240.50
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	10.12	27.17	36.23	36.23	36.23	36.23
Energy . . . . .	196.81	295.20	393.60	393.60	393.60	393.60
Labour, direct . . . . .	183.19	183.19	183.19	183.19	183.19	183.19
Repair, maintenance . . . . .	81.74	81.74	81.74	81.74	81.74	81.74
Spare . . . . .	195.00	290.00	390.00	390.00	390.00	390.00
Factory overheads . . . . .	60.00	60.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>855.15</b>	<b>1117.74</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>
Administrative overheads . . . . .	78.55	78.55	78.55	78.55	78.55	78.55
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1200.49	1200.49	1193.49	1170.49	1170.49	1145.49
Financial costs . . . . .	1140.40	1004.85	861.30	717.75	574.20	430.65
<b>Total production costs . . . . .</b>	<b>3290.59</b>	<b>3409.63</b>	<b>3450.68</b>	<b>3300.13</b>	<b>3156.50</b>	<b>2900.03</b>
<b>Costs per unit (single product) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, I . . . . .	71.40	68.15	64.85	63.62	61.96	60.82
Of it variable, I . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	261.74	261.74	261.74	261.74	261.74	261.74





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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I .....	240.58	240.58	240.58	240.58	240.58	240.58
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	36.23	36.23	36.23	36.23	36.23	36.23
Energy .....	393.60	393.60	393.60	393.60	393.60	393.60
Labour, direct .....	183.19	183.19	183.19	183.19	183.19	183.19
Repair, maintenance .....	81.74	81.74	81.74	81.74	81.74	81.74
Spares .....	390.00	390.00	390.00	390.00	390.00	390.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>	<b>1325.34</b>
Administrative overheads .....	78.55	78.55	78.55	78.55	78.55	78.55
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	1145.49	1145.49	1145.49	1042.39	514.16	0.00
Financial costs .....	287.10	143.55	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>2836.48</b>	<b>2692.93</b>	<b>2549.38</b>	<b>2446.28</b>	<b>1918.05</b>	<b>1400.89</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	58.84	56.27	54.20	56.48	48.25	34.28
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	261.74	261.74	261.74	261.74	261.74	261.74

CHLOR-ALKALI PLANT — february 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2-88.2	1989.1	1989.2
Equity, ordinary ..	4531.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	11484.00	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	11484.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	564.20	574.20
Total funds .....	18015.09	0.00	564.20	574.20

CHLOR-ALKALI PLANT — february 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50	-1435.50
Current liabilities	47.04	12.39	12.24	0.00	0.00	0.00	0.00
Bank overdraft ....	1362.06	193.21	-400.19	-598.77	-670.54	-725.82	-298.35
Total funds .....	-26.40	-1229.90	-1823.45	-2034.27	-2106.04	-2161.32	-1733.85

CHLOR-ALKALI PLANT — february 89

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1997
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-1435.50
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	-1435.50
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	-1435.50

CHLOR-ALKALI PLANT — february 90



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Cashflow Tables, construction in 1000 US DOLLARS**

Year . . . . .	1967.1	1967.2	1968.1	1968.2	1969.1	1969.2
Total cash inflow . .	18015.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	18015.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	800.00	2850.00	5325.00	6860.00	2464.20	574.20
Total assets . . . .	800.00	2850.00	5325.00	6860.00	1890.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	574.20	574.20
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	17135.00	-2850.00	-5325.00	-6860.00	-2464.20	-574.20
Cumulated cash balance	17135.00	14285.00	8760.00	1900.00	-564.20	-1138.40
Inflow, local . . . .	6531.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	205.00	825.00	1475.00	1460.00	540.00	0.00
Surplus ( deficit ) .	6326.00	-825.00	-1475.00	-1460.00	-540.00	0.00
Inflow, foreign . . .	11484.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	675.00	2825.00	4050.00	5400.00	1924.20	574.20
Surplus ( deficit ) .	10809.00	-2025.00	-4050.00	-5400.00	-1924.20	-574.20
Net cashflow . . . . .	-800.00	-2850.00	-5325.00	-6860.00	-1890.00	0.00
Cumulated net cashflow	-800.00	-3730.00	-9255.00	-16115.00	-18005.00	-18005.00

CHLOR-ALKALI PLANT — february 68



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2552.89	3771.16	5023.93	5011.69	5011.69	5011.69
Financial resources .	47.04	12.39	12.24	0.00	0.00	0.00
Sales, net of tax . .	2505.84	3758.77	5011.69	5011.69	5011.69	5011.69
Total cash outflow . .	3914.94	3964.37	4623.74	4412.92	4341.15	4285.87
Total assets . . . .	397.34	153.16	146.55	0.00	0.00	0.00
Operating costs . . .	933.70	1196.29	1403.89	1403.89	1403.89	1403.89
Cost of finance . . .	1148.40	1004.85	861.30	717.75	574.20	430.65
Repayment . . . . .	1435.50	1435.50	1435.50	1435.50	1435.50	1435.50
Corporate tax . . . .	0.00	174.57	776.51	855.78	927.56	1015.83
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1362.06	-193.21	400.19	598.77	670.54	725.82
Accumulated cash balance	-2500.46	-2693.67	-2293.48	-1694.71	-1024.17	-298.35
Inflow, local . . . .	1417.33	2068.75	2754.31	2742.25	2742.25	2742.25
Outflow, local . . . .	763.67	981.54	1728.26	1778.37	1850.15	1938.42
Surplus ( deficit ) .	653.67	1087.21	1026.05	963.88	892.10	803.83
Inflow, foreign . . .	1135.56	1702.41	2269.61	2269.44	2269.44	2269.44
Outflow, foreign . . .	3151.28	2982.82	2895.48	2634.55	2491.00	2347.45
Surplus ( deficit ) .	-2015.72	-1280.42	-625.86	-365.11	-221.56	-78.01
Net cashflow . . . . .	1221.84	2247.14	2696.99	2752.02	2660.24	2591.97
Accumulated net cashflow	-16783.16	-14536.02	-11839.03	-9087.01	-6406.77	-3814.80

ALUMINIUM-ALKALI PLANT — February 88



**COMFAR**<sup>2.0</sup>  
UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1996	1997	1998	1999	2000	2001
Total cash inflow ..	5011.69	5011.69	5011.69	5011.69	5011.69	5011.69
Financial resources ..	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	5011.69	5011.69	5011.69	5011.69	5011.69	5011.69
Total cash outflow ..	4214.10	4142.32	2635.05	2635.05	2686.60	2686.60
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs .....	1403.89	1403.89	1403.89	1403.89	1403.89	1403.89
Cost of finance .....	287.10	143.55	0.00	0.00	0.00	0.00
Repayment .....	1435.50	1435.50	0.00	0.00	0.00	0.00
Corporate tax .....	1087.61	1159.38	1231.16	1231.16	1282.71	1282.71
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) ..	797.59	869.37	2376.64	2376.64	2325.09	2325.09
Cumulated cash balance	499.25	1368.61	3745.26	6121.90	8447.00	10772.09
Inflow, local .....	2742.25	2742.25	2742.25	2742.25	2742.25	2742.25
Outflow, local .....	2010.20	2081.97	2153.75	2153.75	2205.30	2205.30
Surplus ( deficit ) ..	732.05	660.28	588.50	588.50	536.95	536.95
Inflow, foreign .....	2269.44	2269.44	2269.44	2269.44	2269.44	2269.44
Outflow, foreign .....	2203.90	2060.35	481.30	481.30	481.30	481.30
Surplus ( deficit ) ..	65.54	209.09	1788.14	1788.14	1788.14	1788.14
Net cashflow .....	2520.19	2448.42	2376.64	2376.64	2325.09	2325.09
Cumulated net cashflow	-1294.60	1153.81	3530.46	5907.10	8232.20	10557.29

GILDR-ALKALI PLANT — February 98



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1990 US DOLLARS

Year . . . . .	2002	2003	2004
Total cash inflow . .	5011.69	5011.69	5011.69
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	5011.69	5011.69	5011.69
Total cash outflow . .	2486.60	2950.71	3207.79
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1403.89	1403.89	1403.89
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	1282.71	1546.82	1803.90
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	2525.09	2060.98	1803.90
Accumulated cash balance	13097.18	15158.16	16962.06
Inflow, local . . . . .	2742.25	2742.25	2742.25
Outflow, local . . . .	2205.30	2469.41	2726.49
Surplus ( deficit ) .	536.95	272.84	15.76
Inflow, foreign . . . .	2269.44	2269.44	2269.44
Outflow, foreign . . . .	481.30	481.30	481.30
Surplus ( deficit ) .	1788.14	1788.14	1788.14
Net cashflow . . . . .	2525.09	2060.98	1803.90
Accumulated net cashflow	12882.38	14943.36	16747.26



**Cashflow Discountings**

a) Equity paid versus Net income flow		
Net present value .....	-1644.30 at	10.00 %
Internal Rate of Return (IRRE1) ..	7.22 %	
b) Net Worth versus Net cash returns:		
Net present value .....	-913.14 at	10.00 %
Internal Rate of Return (IRRE2) ..	8.83 %	
c) Internal Rate of Return on total investments:		
Net present value .....	-1019.45 at	10.00 %
Internal Rate of Return (IRR) ..	9.07 %	
Net Worth = Equity paid plus reserves		





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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2505.04	3758.77	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2505.04	3758.77	5011.69	5011.69	5011.69
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2142.19	2404.78	2597.38	2582.38	2582.38
Operational margin . . . . .	363.66	1353.99	2414.31	2429.31	2429.31
As % of total sales . . . . .	14.51	36.02	48.17	48.47	48.47
Cost of finance . . . . .	1148.40	1004.85	861.30	717.75	574.20
Gross profit . . . . .	-784.74	349.14	1553.01	1711.56	1855.11
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-784.74	349.14	1553.01	1711.56	1855.11
Tax . . . . .	0.00	174.57	776.51	855.78	927.56
Net profit . . . . .	-784.74	174.57	776.51	855.78	927.56
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-784.74	174.57	776.51	855.78	927.56
Accumulated undistributed profit . . .	-784.74	-610.17	166.33	1022.11	1949.67
Gross profit, % of total sales . . . . .	-31.32	9.29	30.99	34.15	37.02
Net profit, % of total sales . . . . .	-31.32	4.64	15.49	17.08	18.51
ROE, Net profit, % of equity . . . . .	-12.02	2.67	11.89	13.10	14.20
ROI, Net profit+interest, % of invest.	1.98	6.38	8.79	8.45	8.06

CHILD-ALKALI PLANT — february 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - DALIO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999
Total sales, incl. sales tax .....	5011.69	5011.69	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
<b>Variable margin .....</b>	<b>5011.69</b>	<b>5011.69</b>	<b>5011.69</b>	<b>5011.69</b>	<b>5011.69</b>
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2549.38	2549.38	2549.38	2549.38	2549.38
<b>Operational margin .....</b>	<b>2462.31</b>	<b>2462.31</b>	<b>2462.31</b>	<b>2462.31</b>	<b>2462.31</b>
As % of total sales .....	49.13	49.13	49.13	49.13	49.13
Cost of finance .....	430.65	287.10	143.55	0.00	0.00
<b>Gross profit .....</b>	<b>2031.66</b>	<b>2175.21</b>	<b>2318.76</b>	<b>2462.31</b>	<b>2462.31</b>
Allowances .....	0.00	0.00	0.00	0.00	0.00
<b>Taxable profit .....</b>	<b>2031.66</b>	<b>2175.21</b>	<b>2318.76</b>	<b>2462.31</b>	<b>2462.31</b>
Tax .....	1015.83	1007.61	1159.38	1231.16	1231.16
<b>Net profit .....</b>	<b>1015.83</b>	<b>1007.61</b>	<b>1159.38</b>	<b>1231.16</b>	<b>1231.16</b>
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	1015.83	1007.61	1159.38	1231.16	1231.16
Accumulated undistributed profit .....	2965.50	4053.11	5212.49	6443.64	7674.80
Gross profit, % of total sales .....	40.54	43.40	46.27	49.13	49.13
Net profit, % of total sales .....	20.27	21.70	23.13	24.57	24.57
ROE, Net profit, % of equity .....	15.55	16.65	17.75	18.85	18.85
ROI, Net profit+interest, % of invest.	7.76	7.30	6.99	6.61	6.61

CHLOR-ALKALI PLANT --- february 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	5011.69	5011.69	5011.69	5011.69	5011.69
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5011.69	5011.69	5011.69	5011.69	5011.69
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2446.28	2446.28	2446.28	1918.05	1463.89
Operational margin . . . . .	2565.41	2565.41	2565.41	3093.64	3607.80
As % of total sales . . . . .	51.19	51.19	51.19	61.73	71.99
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	2565.41	2565.41	2565.41	3093.64	3607.80
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2565.41	2565.41	2565.41	3093.64	3607.80
Tax . . . . .	1282.71	1282.71	1282.71	1546.82	1803.90
Net profit . . . . .	1282.71	1282.71	1282.71	1546.82	1803.90
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1282.71	1282.71	1282.71	1546.82	1803.90
Accumulated undistributed profit . . . .	8957.50	10240.21	11522.92	13069.74	14873.64
Gross profit, % of total sales . . . . .	51.19	51.19	51.19	61.73	71.99
Net profit, % of total sales . . . . .	25.59	25.59	25.59	30.86	35.99
RDE, Net profit, % of equity . . . . .	19.64	19.64	19.64	23.68	27.62
ROI, Net profit+interest, % of invest.	6.89	6.89	6.89	8.30	9.68

CHLOR-ALKALI PLANT -- february 88



**COMFAR**  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Total assets .....</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18579.20</b>	<b>19153.40</b>
Fixed assets, net of depreciation	0.00	800.00	3730.00	9255.00	16115.00	18579.20
Construction in progress .....	800.00	2850.00	5525.00	6860.00	2464.20	574.20
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	17135.00	14285.00	8760.00	1900.00	0.00	0.00
Less carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Less .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18015.00</b>	<b>18579.20</b>	<b>19153.40</b>
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	11484.00	11484.00	11484.00	11484.00	11484.00	11484.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	564.20	1138.40
<b>Total debt .....</b>	<b>11484.00</b>	<b>11484.00</b>	<b>11484.00</b>	<b>11484.00</b>	<b>12048.20</b>	<b>12622.40</b>
<b>Equity, % of liabilities .....</b>	<b>36.25</b>	<b>36.25</b>	<b>36.25</b>	<b>36.25</b>	<b>35.15</b>	<b>34.10</b>

CHLOR-ALKALI PLANT — february 85



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
Total assets .....	19127.00	18071.67	16850.16	15061.50	13883.01	12737.52
Fixed assets, net of depreciation	17944.91	16736.42	15542.94	14364.45	13185.96	12040.47
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	372.41	521.61	644.49	646.49	646.49	646.49
Cash, bank .....	24.94	28.90	30.56	30.56	30.56	30.56
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	784.74	610.17	0.00	0.00	0.00
Loss .....	784.74	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	19127.00	18071.67	16850.16	15061.50	13883.01	12737.52
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	0.00	0.00	0.00	166.33	1022.11	1949.67
Profit .....	0.00	174.57	776.51	855.78	927.56	1015.83
Long and medium term debt .....	10048.50	8613.00	7177.50	5742.00	4306.50	2871.00
Current liabilities .....	47.04	59.43	71.67	71.67	71.67	71.67
Bank overdraft, finance required.	2500.46	2693.67	2293.48	1694.71	1024.17	278.35
Total debt .....	12596.00	11366.10	9542.65	7508.38	5402.34	3241.02
Equity, % of liabilities .....	34.15	36.14	38.76	43.36	47.04	51.27

CILDR-ALKALI PLANT — february 88



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1996	1997	1998	1999	2000	2001
<b>Total assets .....</b>	<b>12091.28</b>	<b>11815.16</b>	<b>13046.32</b>	<b>14277.47</b>	<b>15560.18</b>	<b>16842.88</b>
Fixed assets, net of depreciation	10894.98	9749.49	8604.01	7458.52	6416.13	5373.74
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	666.49	666.49	666.49	666.49	666.49	666.49
Cash, bank .....	30.56	30.56	30.56	30.56	30.56	30.56
Cash surplus, finance available	499.25	1368.62	3745.26	6121.90	8447.00	10772.09
Less carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Less .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>12091.28</b>	<b>11815.16</b>	<b>13046.32</b>	<b>14277.47</b>	<b>15560.18</b>	<b>16842.88</b>
Equity capital .....	6531.00	6531.00	6531.00	6531.00	6531.00	6531.00
Reserves, retained profit .....	2965.50	4053.11	5212.49	6443.64	7674.80	8957.50
Profit .....	1087.61	1159.38	1251.16	1231.16	1282.71	1282.71
Long and medium term debt .....	1435.59	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	71.67	71.67	71.67	71.67	71.67	71.67
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1507.17</b>	<b>71.67</b>	<b>71.67</b>	<b>71.67</b>	<b>71.67</b>	<b>71.67</b>
<b>Equity, % of liabilities .....</b>	<b>54.01</b>	<b>55.28</b>	<b>50.06</b>	<b>45.74</b>	<b>41.97</b>	<b>38.78</b>

CHLOR-ALKALI PLANT — february 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2002	2003	2004
<b>Total assets</b> .....	<b>18125.59</b>	<b>19672.41</b>	<b>21476.31</b>
Fixed assets, net of depreciation	4331.35	3817.20	3817.50
Construction in progress .....	0.00	0.00	0.00
Current assets .....	666.49	666.49	666.49
Cash, bank .....	30.56	30.56	30.56
Cash surplus, finance available	13097.19	15158.16	16962.06
Loss carried forward .....	0.00	0.00	0.00
Less .....	0.00	0.00	0.00
<b>Total liabilities</b> .....	<b>18125.59</b>	<b>19672.41</b>	<b>21476.31</b>
Equity capital .....	6531.00	6531.00	6531.00
Reserves, retained profit .....	10240.21	1522.92	13069.74
Profit .....	1282.71	546.82	1803.90
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	71.67	71.67	71.67
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt</b> .....	<b>71.67</b>	<b>71.67</b>	<b>71.67</b>
<b>Equity, % of liabilities</b> .....	<b>36.03</b>	<b>33.20</b>	<b>30.41</b>

CHLOR-ALKALI PLANT --- february 88

**Chlor-Alkali production**

**ANNEXE 3**

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	HYP. B	HYP. A
1) TOTAL REVENUES	<u>5011.69</u>	<u>5011.69</u>
2) VARIABLE COSTS:	<u>853.60</u>	<u>1851.79</u>
. RAW MATERIALS	240.58	240.58
. UTILITIES	36.23	36.23
. ENERGY	393.60	1391.79
. LABOUR	183.19	183.19
3) FIXED CCSTS	<u>2605.08</u>	<u>2605.08</u>
. REPAIR-MAINTENANCE	81.74	81.74
. SPARES	390	390
. ADMINISTRATION	78.55	78.55
. DEPRECIATION	1193.49	1193.49
. FINANCIAL COSTS	861.30	861.30
4) TOTAL PRODUCTION COSTS	<u>3458.68</u>	<u>4456.87</u>

$$\text{BEP (HYP.B)} = \frac{2605.08}{5011.69 - 853.60} \times 100 = 62.6 \%$$

$$\text{BEP (HYP.A)} = \frac{2605.08}{5011.69 - 1851.79} \times 100 = 82.4 \%$$

Chlor-Alkali production

ANNEXE 4

FOREIGN EXCHANGE EFFECT EVALUATION



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	construction			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	35975.96	11484.00	24491.96	11484.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	11485.34	11484.00	1.34	11484.00	0.00	0.00	0.00
exports . . . . .	24490.62	0.00	24490.62	0.00	0.00	0.00	0.00
indirect effects . . . . .							
total foreign outflow .	35788.18	14652.40	21129.78	675.00	2025.00	4050.00	5400.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	11010.60	13510.00	-2499.40	675.00	2025.00	4050.00	5400.00
imported materials . . .	6976.04	0.00	6976.04	0.00	0.00	0.00	0.00
repayment loans & overd.	11485.34	0.00	11485.34	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	6316.20	1148.40	5167.80	0.00	0.00	0.00	0.00
indirect costs . . . . .							
net foreign exchge flow	187.78	-3174.40	3362.18	10809.00	-2025.00	-4050.00	-5400.00
import substit'n effect	42750.00	0.00	42750.00	0.00	0.00	0.00	0.00
net forgn exchge effect	42937.78	-3174.40	46112.18	10809.00	-2025.00	-4050.00	-5400.00
present values at 10.00 %							
foreign exchange flow .	-3824.94						
net forgn exchge effect	13393.88						



**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	.....construction.....		production				
	1988.1	1989.2	1992	1993	1994	1995	1996
total foreign inflow ..	0.00	0.00	860.16	1289.31	1718.81	1718.64	1718.64
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.84	0.33	0.17	0.00	0.00
exports . . . . .	0.00	0.00	859.32	1288.98	1718.64	1718.64	1718.64
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1934.20	574.20	3151.28	2982.82	2895.48	2634.55	2491.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1360.00	0.00	266.72	123.99	117.38	0.00	0.00
imported materials . . .	0.00	0.00	300.66	418.48	481.30	481.30	481.30
repayment loans & overd.	0.00	0.00	1435.50	1435.50	1435.50	1435.50	1435.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	574.20	574.20	1148.40	1004.85	861.30	717.75	574.20
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1934.20	-574.20	-2291.12	-1693.52	-1176.67	-915.91	-772.36
import substit'n effect	0.00	0.00	1500.00	2250.00	3000.00	3000.00	3000.00
net foreign exchange effect	-1934.20	-574.20	-791.12	-56.48	1823.33	2084.09	2227.64
present values at 10.00 %							
foreign exchange flow .	-3824.94						
net foreign exchange effect	13393.88						



**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	1718.64	1718.64	1718.64	1718.64	1718.64	1718.64	1718.64
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1718.64	1718.64	1718.64	1718.64	1718.64	1718.64	1718.64
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	257.45	2203.90	2060.35	481.30	481.30	481.30	481.30
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	481.30	481.30	481.30	481.30	481.30	481.30	481.30
repayment loans & overd.	1435.50	1435.50	1435.50	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	430.65	287.10	143.55	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-628.81	-485.26	-341.71	1237.34	1237.34	1237.34	1237.34
import substit'n effect	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
net foreign exchge effect	2371.19	2514.74	2658.29	4237.34	4237.34	4237.34	4237.34
present values at 10.00 %							
foreign exchange flow .	-3824.94						
net foreign exchge effect	13373.88						



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow . . .	1718.64	1718.64	1718.64	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00
exports . . . . .	1718.64	1718.64	1718.64	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow . .	481.30	481.30	481.30	-3006.15
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-3007.49
imported materials . . . .	481.30	481.30	481.30	0.00
repayment loans & overd.	0.00	0.00	0.00	1.34
other repayments . . . . .	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchge flow	1237.34	1237.34	1237.34	3006.15
import substit'n effect	3000.00	3000.00	3000.00	0.00
net forgn exchge effect	4237.34	4237.34	4237.34	3006.15
present values at 10.00 %				
foreign exchange flow . .	-3824.94			
net forgn exchge effect	1393.88			

Chlor-Alkali production

ANNEXE 5

FINANCIAL AND FOREIGN EXCHANGE EFFECT EVALUATIONS  
FOR THE CHLOR-ALKALI AND  
CALCIUM HYPOCHLORITE FACTORY



**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**CHLORAL ALKALI + CALCIUM HYPOCHLORITE**

February 88

Integr. factory - Power at 0.05 b/kWh

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 \$

**Total initial investment during construction phase**

fixed assets:	26928.80	75.788 % foreign
current assets:	0.00	0.000 % foreign
total assets:	26928.80	75.788 % foreign

**Source of funds during construction phase**

equity & grants:	9342.00	0.000 % foreign
foreign loans :	15988.00	
local loans :	0.00	
total funds :	25330.00	63.119 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1298.33	1645.40	1873.47
depreciation :	1701.14	1701.14	1679.04
interest :	1598.80	1398.95	1199.10
production costs	4598.27	4745.49	4751.61
thereof foreign	71.58 %	68.49 %	65.02 %
total sales :	3140.00	4710.00	6280.00
gross income :	-1458.27	-35.49	1528.39
net income :	-1458.27	-35.49	764.20
cash balance :	-2194.18	-504.46	296.98
net cashflow :	1403.12	2892.99	3494.50

Net Present Value at: 10.00 % = -1405.48  
Internal Rate of Return: 9.16 %  
Return on equity<sup>1</sup>: 7.83 %  
Return on equity<sup>2</sup>: 9.28 %

**Index of Schedules** produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance





Total Initial Investment in 1000 \$

Year .....	1987	1988	1989
Fixed investment costs			
Land, site preparation, development	221.00	0.00	0.00
Buildings and civil works .....	930.00	1526.00	368.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant machinery and equipment ...	4020.00	14070.00	3975.00
Total fixed investment costs .....	5171.00	15596.00	4343.00
Pre-production capital expenditures.	20.00	30.00	1768.80
Net working capital .....	0.00	0.00	0.00
Total initial investment costs ...	5191.00	15626.00	6111.80
Of it foreign, in % .....	73.59	76.48	75.90



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**Total Current Investment in 1000 \$**

Year .....	1990	1991	1992	1993
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00
Working capital .....	438.55	171.61	147.83	172.83
<b>Total current investment costs ...</b>	<b>438.55</b>	<b>171.61</b>	<b>147.83</b>	<b>172.83</b>
<b>Of it foreign, % .....</b>	<b>73.95</b>	<b>86.84</b>	<b>84.72</b>	<b>86.98</b>

CHLOR ALKALI + CALCIUM HYPOCHLORITE — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 \$**

Year . . . . .	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	131.11	196.66	262.22	327.78	327.78	327.78
Other raw materials . . . . .	28.00	42.00	56.00	70.00	70.00	70.00
Utilities . . . . .	16.45	24.67	32.90	41.13	41.13	41.13
Energy . . . . .	296.58	444.88	593.16	741.46	741.46	741.46
Labour, direct . . . . .	295.07	295.07	295.07	295.07	295.07	295.07
Repair, maintenance . . . . .	96.81	96.81	96.81	96.81	96.81	96.81
Spares . . . . .	223.00	334.00	446.00	558.00	558.00	558.00
Factory overheads . . . . .	120.00	120.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1207.02</b>	<b>1554.09</b>	<b>1782.16</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>
Administrative overheads . . . . .	91.31	91.31	91.31	91.31	91.31	91.31
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1701.14	1701.14	1679.04	1656.94	1656.94	1612.94
Financial costs . . . . .	1598.80	1398.95	1199.10	999.25	799.40	599.55
<b>Total production costs . . . . .</b>	<b>4598.27</b>	<b>4745.49</b>	<b>4751.61</b>	<b>4877.75</b>	<b>4677.90</b>	<b>4434.05</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	71.58	68.49	65.02	62.52	60.91	59.74
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	386.38	386.38	386.38	386.38	386.38	386.38



**Total Production Costs in 1000 \$**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	327.78	327.78	327.78	327.78	327.78	327.78
Other raw materials . . . . .	70.00	70.00	70.00	70.00	70.00	70.00
Utilities . . . . .	41.13	41.13	41.13	41.13	41.13	41.13
Energy . . . . .	741.46	741.46	741.46	741.46	741.46	741.46
Labour, direct . . . . .	295.07	295.07	295.07	295.07	295.07	295.07
Repair, maintenance . . . . .	96.81	96.81	96.81	96.81	96.81	96.81
Spares . . . . .	558.00	558.00	558.00	558.00	558.00	558.00
Factory overheads . . . . .	0.00	1.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>
Administrative overheads . . . . .	91.31	91.31	91.31	91.31	91.31	91.31
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1612.94	1612.94	1612.94	1471.74	725.93	0.00
Financial costs . . . . .	399.70	199.85	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>4234.20</b>	<b>4034.35</b>	<b>3834.50</b>	<b>3693.30</b>	<b>2947.49</b>	<b>2221.56</b>
<b>Costs per unit ( single product ) . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	57.86	55.77	53.46	55.51	47.98	35.81
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 \$

Year .....		1990	1991	1992	1993	1994-2004
Coverage .....	ndc coto					
Current assets &						
Accounts receivable . . . . .	30 12.0	108.19	137.12	156.12	185.13	185.13
Inventory and materials . . . . .	40 9..	19.36	29.07	38.76	48.46	48.46
Energy . . . . .	9 40.6	7.30	10.95	14.60	18.25	18.25
Spares . . . . .	360 1.0	223.00	334.00	446.00	558.00	558.00
Work in progress . . . . .	1 360.0	3.35	4.32	4.95	5.92	5.92
Finished products . . . . .	30 12.0	108.19	137.12	156.12	185.13	185.13
Cash in hand . . . . .	15 24.0	34.42	39.05	38.72	43.38	43.38
Total current assets . . . . .		503.85	691.62	855.28	1044.27	1044.27
Current liabilities and						
Accounts payable . . . . .	19 18.8	65.30	81.46	97.28	113.44	113.44
Net working capital . . . . .		438.55	610.16	757.99	930.83	930.83
Increase in working capital . . . . .		438.55	171.61	147.83	172.83	0.00
Net working capital, local . . . . .		114.26	136.85	159.43	182.02	182.02
Net working capital, foreign . . . . .		324.29	473.31	598.56	748.81	748.81

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



Source of Finance, construction in 1000 \$

Year .....	1987	1988	1989
Equity, ordinary ..	9342.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	15988.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	15988.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	3.00	0.00	1598.80
Total funds .....	25330.00	0.00	1598.80



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Source of Finance, production in 1000 \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50
Current liabilities	65.30	16.16	15.82	16.16	0.00	0.00	0.00
Bank overdraft ....	2194.18	504.46	-296.90	-971.73	-1244.49	-1322.41	-461.91
Total funds .....	260.98	-1477.88	-2279.57	-2754.07	-3242.49	-3320.91	-2460.41

CHLOR ALKALI + CALCIUM HYPOCHLORITE — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 \$

Year .....	1997
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-1998.50
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	-1998.50
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	-1998.50

CHLOR ALKALI + CALCIUM HYPOCHLORITE — February 88



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 \$

Year .....	1987	1988	1989
Total cash inflow ..	25330.00	0.00	0.00
Financial resources .	25330.00	0.00	0.00
Sales, net of tax ..	0.00	0.00	0.00
Total cash outflow ..	5191.00	15626.00	6111.80
Total assets .....	5191.00	15626.00	4513.00
Operating costs ...	0.00	0.00	0.00
Cost of finance ...	0.00	0.00	1598.80
Repayment .....	0.00	0.00	0.00
Corporate tax ...	0.00	0.00	0.00
Dividends paid ...	0.00	0.00	0.00
Surplus ( deficit ) .	20139.00	-15626.00	-6111.80
Cumulated cash balance	20139.00	4513.00	-1598.80
Inflow, local .....	9342.00	0.00	0.00
Outflow, local .....	1371.00	3676.00	1473.00
Surplus ( deficit ) .	7971.00	-3676.00	-1473.00
Inflow, foreign ...	15988.00	0.00	0.00
Outflow, foreign ...	3820.00	11950.00	4638.80
Surplus ( deficit ) .	12168.00	-11950.00	-4638.80
Net cashflow .....	-5191.00	-15626.00	-4513.00
Cumulated net cashflow	-5191.00	-20817.00	-25330.00

CHLOR ALKALI + CALCIUM HYPOCHLORITE — February





COMFAR<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	3205.30	4726.16	6295.82	7866.16	7850.00	7850.00
Financial resources .	65.30	16.16	15.82	16.16	0.00	0.00
Sales, net of tax . .	3140.00	4710.00	6280.00	7850.00	7850.00	7850.00
Total cash outflow . .	5399.48	5230.62	5998.92	6894.43	6605.51	6527.59
Total assets . . . .	503.85	187.77	163.66	188.99	0.00	0.00
Operating costs . . .	1298.33	1645.40	1873.47	2221.56	2221.56	2221.56
Cost of finance . . .	1598.80	1398.95	1199.10	999.25	799.40	599.55
Repayment . . . . .	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50
Corporate tax . . .	6.00	0.00	764.20	1486.13	1586.05	1707.98
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2194.18	-504.46	296.90	971.73	1244.49	1322.41
Cumulated cash balance	-3792.98	-4297.44	-4000.54	-3028.81	-1784.33	-461.91
Inflow, local . . . .	2948.29	3742.02	4984.11	6226.22	6210.50	6210.50
Outflow, local . . . .	1038.69	1087.23	2039.99	2950.52	3012.14	3134.07
Surplus ( deficit ) .	1509.60	2654.78	2944.12	3275.70	3198.36	3076.43
Inflow, foreign . . .	657.02	984.14	1311.71	1639.94	1639.50	1639.50
Outflow, foreign . . .	4360.79	4143.39	3958.93	3943.91	3593.37	3393.52
Surplus ( deficit ) .	-3703.78	-3159.25	-2647.22	-2303.97	-1953.87	-1754.02
Net cashflow . . . . .	1403.12	2892.99	3494.50	3969.48	4042.39	3920.46
Cumulated net cashflow	-23926.88	-21033.89	-17539.39	-13569.91	-9527.52	-5607.06



**COMFAR**  
2.1 UNICO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 \$

Year .....	1996	1997	1998	1999	2000	2001
Total cash inflow ..	7850.00	7850.00	7850.00	7850.00	7850.00	7850.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	7850.00	7850.00	7850.00	7850.00	7850.00	7850.00
Total cash outflow ..	4227.66	4327.74	4229.31	4229.31	4299.91	4299.91
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs ...	2221.56	2221.56	2221.56	2221.56	2221.56	2221.56
Cost of finance ...	399.70	199.85	0.00	0.00	0.00	0.00
Repayment .....	1998.50	1998.50	0.00	0.00	0.00	0.00
Corporate tax ...	1807.90	1907.83	2007.75	2007.75	2078.35	2078.35
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1422.34	1522.26	3620.69	3620.69	3550.09	3550.09
Cumulated cash balance	960.42	2482.68	6103.37	9724.06	13274.15	16824.23
Inflow, local .....	6210.50	6210.50	6210.50	6210.50	6210.50	6210.50
Outflow, local .....	3233.99	3333.92	3433.84	3433.84	3504.44	3504.44
Surplus ( deficit ) .	2976.51	2876.58	2776.66	2776.66	2706.06	2706.06
Inflow, foreign ...	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
Outflow, foreign ...	3193.67	2993.82	795.47	795.47	795.47	795.47
Surplus ( deficit ) .	-1554.17	-1354.32	844.03	844.03	844.03	844.03
Net cashflow .....	3820.54	3720.61	3620.69	3620.69	3550.09	3550.09
Cumulated net cashflow	-1786.52	1934.09	5554.78	9175.46	12725.55	16275.64



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	7850.00	7850.00	7850.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	7850.00	7850.00	7850.00
Total cash outflow . .	4299.91	4672.81	5035.78
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2221.56	2221.56	2221.56
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	2078.35	2451.25	2814.22
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	3550.09	3177.19	2814.22
Cumulated cash balance	20374.32	23551.51	26365.72
Inflow, local . . . . .	6210.50	6210.50	6210.50
Outflow, local . . . .	3504.44	3877.34	4240.31
Surplus ( deficit ) .	2706.06	2333.16	1970.19
Inflow, foreign . . . .	1639.50	1639.50	1639.50
Outflow, foreign . . .	795.47	795.47	795.47
Surplus ( deficit ) .	844.03	844.03	844.03
Net cashflow . . . . .	3550.09	3177.19	2814.22
Cumulated net cashflow	19825.73	23002.91	25817.13



**Cashflow Discounting:**

a) Equity paid versus Net income flow:			
Net present value .....	-1954.98	at	10.00 %
Internal Rate of Return (IRRE1) ..	7.83	%	
b) Net Worth versus Net cash return:			
Net present value .....	-834.49	at	10.00 %
Internal Rate of Return (IRRE2) ..	9.28	%	
c) Internal Rate of Return on total investment:			
Net present value .....	-1405.48	at	10.00 %
Internal Rate of Return ( IRR ) ..	9.16	%	
Net Worth = Equity paid plus reserves			



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 \$

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	3140.00	4710.00	6280.00	7850.00	7850.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3140.00	4710.00	6280.00	7850.00	7850.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	2999.47	3346.54	3552.51	3878.50	3878.50
Operational margin . . . . .	140.53	1363.46	2727.49	3971.50	3971.50
As % of total sales . . . . .	4.48	28.95	43.43	50.59	50.59
Cost of finance . . . . .	1598.80	1398.95	1199.10	999.25	799.40
Gross profit . . . . .	-1458.27	-35.49	1528.39	2972.25	3172.10
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1458.27	-35.49	1528.39	2972.25	3172.10
Tax . . . . .	0.00	0.00	764.20	1486.13	1586.05
Net profit . . . . .	-1458.27	-35.49	764.20	1486.13	1586.05
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1458.27	-35.49	764.20	1486.13	1586.05
Accumulated undistributed profit . . . . .	-1458.27	-1493.75	-729.56	756.57	2342.62
Gross profit, % of total sales . . . . .	-46.44	-0.75	24.34	37.86	40.41
Net profit, % of total sales . . . . .	-46.44	-0.75	12.17	18.93	20.20
ROE, Net profit, % of equity . . . . .	-15.61	-0.38	8.18	15.91	16.98
ROI, Net profit+interest, % of invest. . . . .	0.55	5.26	7.53	9.46	9.08



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 \$**

Year .....	1995	1996	1997	1998	1999
Total sales, incl. sales tax .....	7850.00	7850.00	7850.00	7850.00	7850.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	7850.00	7850.00	7850.00	7850.00	7850.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	3834.50	3834.50	3834.50	3834.50	3834.50
Operational margin .....	4015.50	4015.50	4015.50	4015.50	4015.50
As % of total sales .....	51.15	51.15	51.15	51.15	51.15
Cost of finance .....	599.55	399.70	199.85	0.00	0.00
Gross profit .....	3415.95	3615.80	3815.65	4015.50	4015.50
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	3415.95	3615.80	3815.65	4015.50	4015.50
Tax .....	1707.98	1807.90	1907.83	2007.75	2007.75
Net profit .....	1707.98	1807.90	1907.83	2007.75	2007.75
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	1707.98	1807.90	1907.83	2007.75	2007.75
Accumulated undistributed profit .....	4050.60	5858.50	7766.33	9774.08	11781.83
Gross profit, % of total sales .....	43.52	46.06	48.61	51.15	51.15
Net profit, % of total sales .....	21.76	23.03	24.30	25.58	25.58
ROE, Net profit, % of equity .....	18.28	19.35	20.42	21.49	21.49
ROI, Net profit+interest, % of invest. ....	8.79	8.41	8.03	7.65	7.65



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3693.30	3693.30	3697.50	2947.49	2221.56
Operational margin . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
As % of total sales . . . . .	52.95	52.95	52.95	62.45	71.70
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
Tax . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Net profit . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Accumulated undistributed profit . . . .	13860.19	15938.54	18016.89	20468.14	23282.36
Gross profit, % of total sales . . . .	52.95	52.95	52.95	62.45	71.70
Net profit, % of total sales . . . .	26.48	26.48	26.48	31.23	35.85
ROE, Net profit, % of equity . . . .	22.25	22.25	22.25	26.24	30.12
ROI, Net profit+interest, % of invest.	7.91	7.91	7.91	9.33	10.72



**COMFAR**<sup>C</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 \$**

Year .....	1987	1988	1989
<b>Total assets .....</b>	<b>25330.00</b>	<b>25330.00</b>	<b>26928.80</b>
Fixed assets, net of depreciation	0.00	5191.00	20817.00
Construction in progress .....	5191.00	15626.00	6111.80
Current assets .....	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00
Cash surplus, finance available .	20139.00	4513.00	0.00
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>25330.00</b>	<b>25330.00</b>	<b>26928.80</b>
Equity capital .....	9342.00	9342.00	9342.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	15988.00	15988.00	15988.00
Current liabilities .....	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	1598.80
<b>Total debt .....</b>	<b>15988.00</b>	<b>15988.00</b>	<b>17586.80</b>
<b>Equity, % of liabilities .....</b>	<b>36.88</b>	<b>36.88</b>	<b>- 34.69</b>

CHLORINE ALKALI + CALCIUM HYPOCHLORITE — February 88





**CONFAR**  
21 UNIDO

CONFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 \$**

Year	1990	1991	1992	1993	1994	1995
Total assets	27189.78	25711.90	24196.52	21964.38	19577.89	17964.96
Fixed assets, net of depreciation	25227.66	23526.53	21847.49	20190.56	18533.62	16920.69
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	469.43	652.57	816.56	1000.89	1000.89	1000.89
Cash, bank	34.42	39.05	38.72	43.38	43.38	43.38
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward	0.00	1458.27	1493.75	729.56	0.00	0.00
Loss	1458.27	35.49	0.00	0.00	0.00	0.00
Total liabilities	27189.78	25711.90	24196.52	21964.38	19577.89	17964.96
Equity capital	9342.00	9342.00	9342.00	9342.00	9342.00	9342.00
Reserves, retained profit	0.00	0.00	0.00	0.00	756.57	2342.62
Profit	0.00	0.00	764.20	1486.13	1586.05	1707.98
Long and medium term debt	13989.50	11991.00	9992.50	7994.00	5995.50	3997.00
Current liabilities	65.30	81.46	97.28	113.44	113.44	113.44
Bank overdraft, finance required	3792.98	4297.44	4000.54	3028.81	1784.32	461.91
Total debt	17847.78	16369.90	14090.32	11136.25	7873.27	4572.36
Equity, % of liabilities	34.36	36.33	38.61	42.53	47.72	52.00

CHLOR ALKALI + CALCIUM HYPOCHLORITE — February 88

CONFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 \$**

Year	1996	1997	1998	1999	2000	2001
Total assets	17312.44	17221.77	19229.52	21237.28	23315.63	25393.98
Fixed assets, net of depreciation	15307.75	13694.81	12081.88	10468.94	8997.21	7525.47
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	1000.89	1000.89	1000.89	1000.89	1000.89	1000.89
Cash, bank	43.38	43.38	43.38	43.38	43.38	43.38
Cash surplus, finance available	960.42	2482.69	6103.37	9724.06	13274.15	16824.24
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	17312.44	17221.77	19229.52	21237.28	23315.63	25393.98
Equity capital	9342.00	9342.00	9342.00	9342.00	9342.00	9342.00
Reserves, retained profit	4050.60	5858.50	7766.33	9774.08	11781.83	13860.19
Profit	1807.90	1907.83	2007.75	2007.75	2078.35	2078.35
Long and medium term debt	1998.50	0.00	0.00	0.00	0.00	0.00
Current liabilities	113.44	113.44	113.44	113.44	113.44	113.44
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	2111.94	113.44	113.44	113.44	113.44	113.44

Equity, % of liabilities . . . .	53.96	54.25	48.58	43.99	40.07	36.79
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CHLORINE ALKALI + CALCIUM HYPOCHLORITE — February 30



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2.1  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 \$

Year .....	2002	2003	2004
Total assets .....	27472.33	29923.58	32737.80
Fixed assets, net of depreciation	6053.74	5327.80	5327.80
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1000.89	1000.89	1000.89
Cash, bank .....	43.38	43.38	43.38
Cash surplus, finance available .	20374.32	2351.51	26365.73
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>27472.33</b>	<b>29923.58</b>	<b>32737.80</b>
Equity capital .....	9342.00	9342.00	9342.00
Reserves, retained profit .....	15938.54	18016.89	20468.14
Profit .....	2078.35	2451.25	2814.22
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	113.44	113.44	113.44
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>113.44</b>	<b>113.44</b>	<b>113.44</b>
Equity, % of liabilities .....	34.01	31.22	28.54

CHLORINE ALKALI + CALCIUM HYPOCHLORITE — February 88



**Foreign Exchange Effect in 1000 \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1/90
total foreign inflow ..	38615.31	15988.00	22627.31	15988.00	0.00	0.00	657.02
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	15990.21	15988.00	2.21	15988.00	0.00	0.00	1.22
exports . . . . .	22625.10	0.00	22625.10	0.00	0.00	0.00	655.80
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	51329.88	20408.80	30921.08	3820.00	11950.00	4638.80	4360.79
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	15330.20	18810.00	-3479.80	3820.00	11950.00	3040.00	325.50
imported materials . . . .	11216.07	0.00	11216.07	0.00	0.00	0.00	437.99
repayment loans & overd.	15990.21	0.00	15990.21	0.00	0.00	0.00	1998.50
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	8793.40	1598.80	7194.60	0.00	0.00	1598.80	1598.80
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-12714.57	-4420.80	-8293.77	12168.00	-11950.00	-4638.80	-3703.78
import substit'n effect	42750.00	0.00	42750.00	0.00	0.00	0.00	1500.00
net forgn exchange effect	30035.43	-4420.80	34456.23	12168.00	-11950.00	-4638.80	-2203.78
present values at 10.00 %							
foreign exchange flow .	-11071.50						
net forgn exchange effect	6147.31						



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - GALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	984.14	1311.71	1639.94	1639.50	1639.50	1639.50	1639.50
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.44	0.11	0.44	0.00	0.00	0.00	0.00
exports . . . . .	983.70	1311.60	1639.50	1639.50	1639.50	1639.50	1639.50
indirect effects . . . . .							
total foreign outflow .	4143.39	3958.93	3943.91	3593.37	3393.52	3193.67	2993.82
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	149.47	125.36	150.69	0.00	0.00	0.00	0.00
imported materials . . .	596.47	635.97	795.47	795.47	795.47	795.47	795.47
repayment loans & overd.	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	1398.95	1199.10	999.25	799.40	599.55	399.70	199.85
indirect costs . . . . .							
net foreign exchange flow	-3159.25	-2647.22	-2303.97	-1953.87	-1794.02	-1554.17	-1354.32
import substit'n effect	2250.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
net forgn. exchge effect	-909.25	352.78	696.03	1046.13	1245.98	1445.83	1645.68
present values at 10.00 %							
foreign exchange flow .	-11071.50						
net forgn exchge effect	6147.31						



**Foreign Exchange Effect in 1000 \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . . .	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidiaries, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . . .	795.47	795.47	795.47	795.47	795.47	795.47	795.47
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . . .	795.47	795.47	795.47	795.47	795.47	795.47	795.47
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	844.03	844.03	844.03	844.03	844.03	844.03	844.03
import substit'n effect	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
net foreign exchge effect	3844.03	3844.03	3844.03	3844.03	3844.03	3844.03	3844.03
present values at	10.00 %						
foreign exchge flow . . .	-11071.50						
net foreign exchge effect	6147.31						



Foreign Exchange Effect in 1000 \$  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	production 2005
total foreign inflow . .	0.00
equity capital . . . . .	0.00
subsidies, grants . . .	0.00
loans & overdraft . . .	0.00
exports . . . . .	0.00
indirect effects . . . . .	.....
total foreign outflow .	-428.61
royalties . . . . .	0.00
equipment . . . . .	-420.82
imported materials . . .	0.00
repayment loans & overd.	2.21
other repayments . . . .	0.00
repatriated wages . . .	0.00
dividends paid . . . . .	0.00
interests . . . . .	0.00
indirect costs . . . . .	.....
net foreign exchange flow	428.61
import substit'n effect	0.00
net foreign exchange effect	428.61
present values at 10.00 %	
foreign exchange flow .	-11071.50
net foreign exchange effect	6147.31

**Chlor-Alkali production**

**ANNEXE 6**

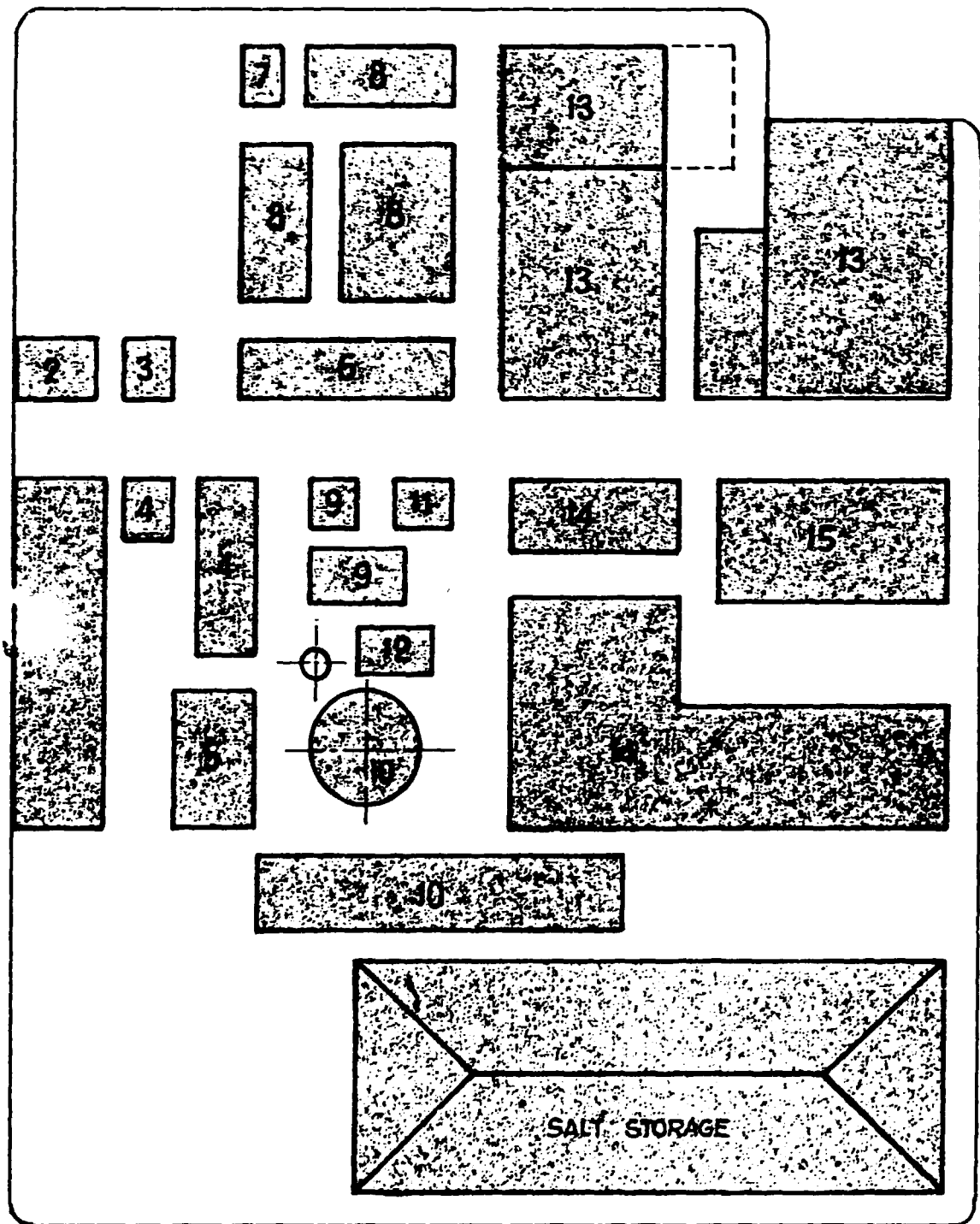
DWR. B. 162 - 12-1

SITE LAY OUT

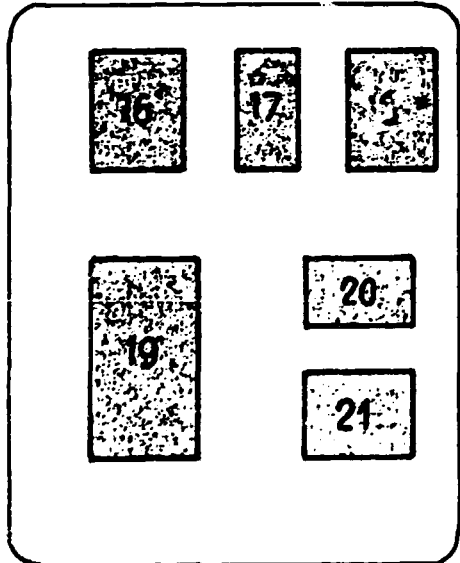
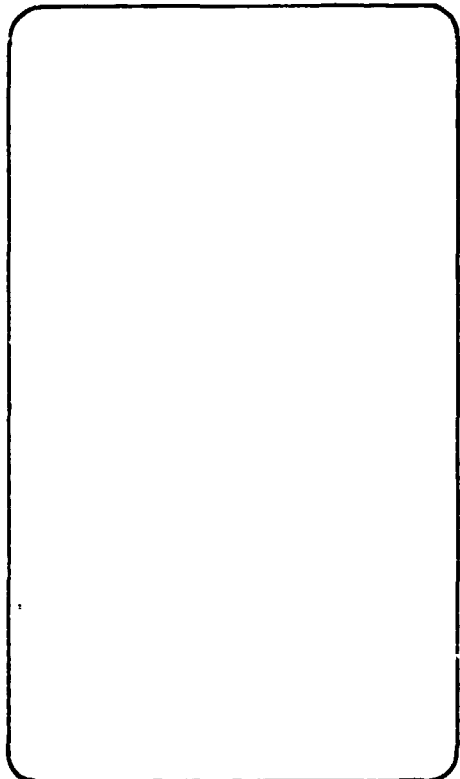
DWR. B.162 - 12 - 2

FLOW DIAGRAM





SECTION 1



m. 105

- 1 - BRINE DECHLORINAT.-BRINE FEEDING
- 2 - HYDROGEN HANDLING
- 3 - EFFLUENT FROM BRINE SECONDARY PURIFICAT.
- 4 - BRINE SECOND. PURIFICAT. STORAGE
- 5 - REAGENTS SYSTEM & FLOCCULAT. PRECIPITAT.
- 6 - CHLORINE DRYING & H<sub>2</sub>SO<sub>4</sub> STORAGE
- 7 - COOLING WATER RECEIVER & DEMI-WATER STOR.
- 8 - HCl SYNTHESIS-HCl RECEIVER & STORAGE
- 9 - BRINE FILTRATION & STORAGE
- 10 - BRINE SATURAT.-PURIFICATION SETTING
- 11 - FILTER AID AND PRECOAT
- 12 - SLUDGE DISPOSAL
- 13 - CHLORINE COMPRESSION-LIQUEFACT.-STORAGE
- 14 - CATHOLYTE STORAGE-CONCENTR.& DRUMS FILLING
- 15 - CHLORINE NEUTRALIZATION
- 16 - PROCESS WATER STORAGE
- 17 - DEMI-WATER PRODUCTION
- 18 - COOLING WATER TOWER
- 19 - STEAM PRODUCTION
- 20 - PADDING AIR SYSTEM
- 21 - FUEL OIL STORAGE

## SECTION 2

CHLOR-ALKALY PLANT  
SITE LAY-OUT

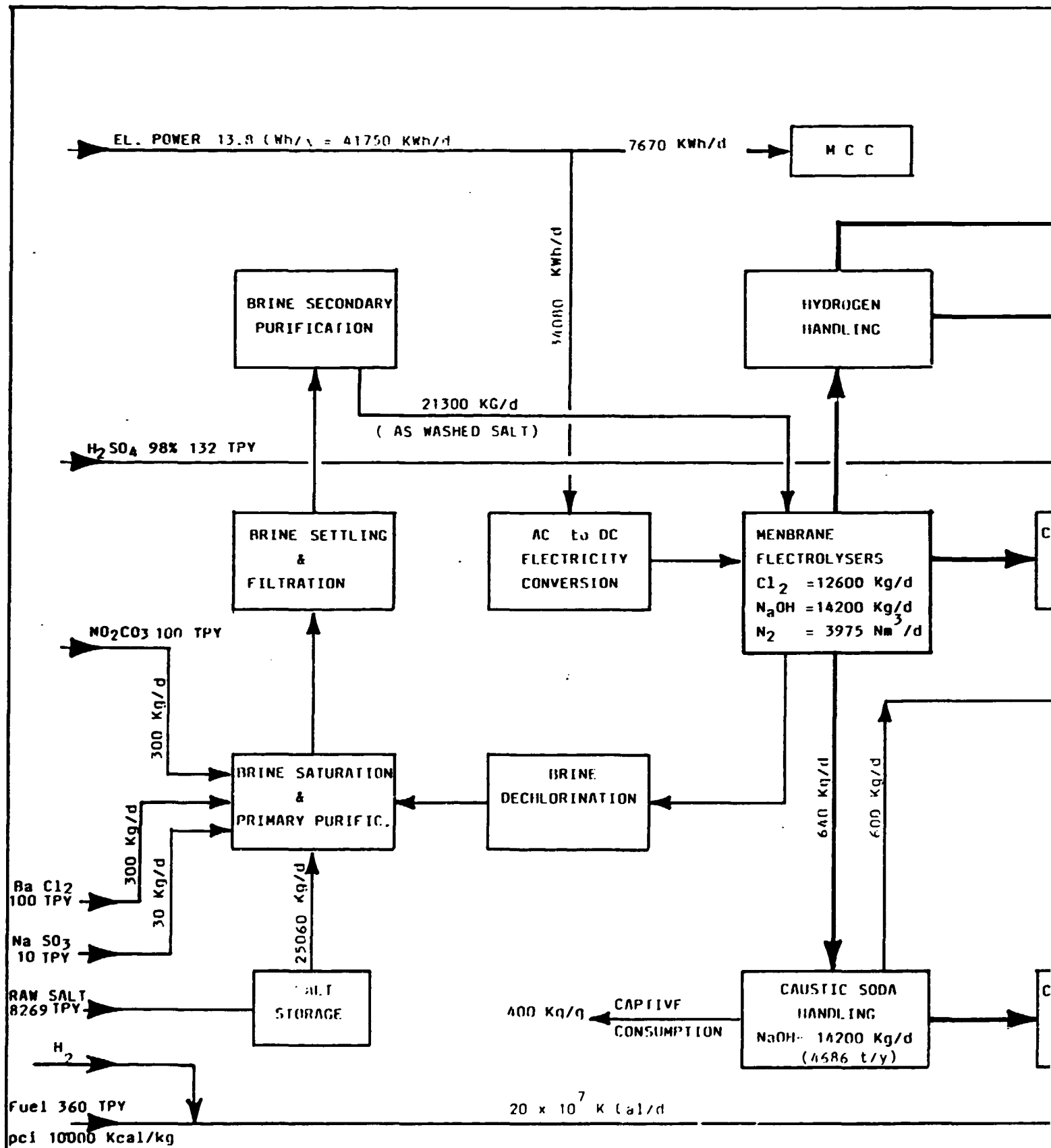
**Waldo & C.**  
CONSULTING ENGINEERS

Via Sillicone 39, 20154 MILANO  
Ph. N. 3102 Tlx N. 330229

DIS. N°  
DWG N°

B.162 -12 -1

REV





**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF BIOMASS BASED**  
**CHEMICALS IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 4 - DWR. B. 162 - 14 - 1  
PLANT LAY OUT**

**DWR. B. 162 - 14 - 2  
PROCESS FLOW SHEET**

0. SUMMARY AND CONCLUSIONS

This study analyses the possibility of processing locally available biomasses into chemicals, mainly:

- acetic acid
- creosote
- raw methanol
- charcoal

Acetic acid is presently imported in Ethiopia at a price of approximately 2.71 birr/kg and finds a ready market in the textile industry.

Creosote is a chemical that is used for the impregnation of wood to preserve it from moisture and parasites. It can be used by EELPA to substitute the expensive chemicals presently imported to impregnate wooden poles. Methanol produced by the plant is poor in quality, but it may have an excellent application as fuel.

Charcoal is a by-product of the process but very important due mainly to lack of suitable fuels for domestic consumption.

The technology that is proposed for the plant is an appropriate one and is essentially based on the dry distillation of wood.

The only required raw material, apart some reagents is wood (forest maintenance products, waste, chip wood, etc).

Ethiopia presently faces a serious lack of fuel wood but large reforestation programmes are due to be financed. One of these programmes foresees the rehabilitation and expansion of the forests around Addis Ababa (World Bank) and also the production of 15,000 tons/year of charcoal. The plant proposed in this study could be a part of this programme.



The plant will employ over 80 persons, will require a fixed initial investment of a 2,700,000 US \$ (59.2% foreign) and has interesting financial returns:

- internal rate of return on total investment 10.56%
- equity paid versus net income flow 8.68%
- net worth versus net cash return 10.46%

The plant has also a positive net foreign effect, whose present value amounts to 867,000 \$; moreover its production increases the input to the market of charcoal with consequent better use of the scarce fuel wood reserves.

The project seems interesting and the preparation of a detailed feasibility study is recommended. This study could also investigate in detail the suitability of raw materials other than wood (agro-wastes mainly) because of the above mentioned scarce wood resources.

1. INTRODUCTION

The term biomass implies all forms of vegetable and animal substance grown on land, in or on the water and substances from biological growth.

The conversion of biomasses to fuels or other products can be carried out in different ways, i.e. through processes of combustion, carbonization, pyrolysis and gasification.

In the present study wood pyrolysis will be taken into consideration.

Pyrolysis is the thermal decomposition of solid carbonaceous fuels in the absence of air.

This process produces combustible gases, chemicals and solid charcoal. Pyrolysis of wood is a well established technology, in use for a long time. Pyrolysis of wood was used in many industrialized countries before, during and after World War I to produce charcoal, tar, piroligneous acid and gases. Nowadays in the industrialized countries charcoal has become the primary product of pyrolysis, since with the development of synthetic chemicals, the use of pyrolysis gas as chemical feedstock has ceased, but it is still of relevant interest in developing countries. In several of these countries, wood pyrolysis is carried out by means of obsolete technologies (beehive type kilns) which does not allow the recovery and use of the gaseous and liquid product of the pyrolysis with consequent poor utilization of the energy resources of wood. On the contrary, available improved technologies offer, together with the full recovery of the liquid products, higher energetic yield.

Although a large variety of biomasses (urban solid waste,

wood chips and agricultural wastes like corn cobs, sugar cane tops, cotton stalks etc.) can be fed to a pyrolysis plant, the study is based on the utilization of wood (wood, tops, branches, stumps, butts, chipwoods and any residue of wood working) because for this material the yields are well known, while for other biomasses, the same technology can be used but the amount of chemicals that can be actually be produced depends on the characteristics of the raw materials.

Specific laboratory tests have to be carried out for each potential raw material to identify possible yields and, therefore, properly dimension the plant.

In this case too, important by-products are charcoal and energy (gas, methanol-and tar).

## 2. MARKET AND PLANT CAPACITY

### 2.1 Types of products and their use

The process described in the present study is suitable for the production of charcoal and pyrolytic oil.

Charcoal is a high-energy-density, low-sulfur-content solid fuel. It can be used as a fuel in both household and industry; it can be gasified especially for fuelling diesel generators, since with the proposed process the charcoal does not entrain any cinders so it produces a clean gas. Other important industrial applications can be found in the metallurgical industry (as metal reductant) and in the production of calcium carbide where it is considered as one of the best feedstock.

The pyrolysis oil is a highly oxygenated viscous liquid with slightly corrosive property; from this oil (not similar to any conventional petroleum-derived liquid fuels) three main components can be separated, namely:

- an aqueous solution of methanol, containing 40% of methanol ( $\text{CH}_3\text{OH}$ ), acetone and other organic products. From this solution pure methanol could be extracted, but, due to its cost, this operation is not recommended; however this solution can be used as a liquid fuel, alone or mixed with fuel oil;
- acetic acid, with purity of 95%. Acetic acid has many industrial applications: in the dying process of clothes, in the production of artificial dying agents as well as feedstock for the production of several other chemicals.

It is also used in laboratories as a reagent and in the cosmetics and pharmaceutical industry;

- creosote: this is a mixture of different water insoluble viscous phenolic derivatives; its main use is as disinfectant and as an impregnating agent for wooden structures, especially for electric or telephone poles.

## 2.2 Forecast demand and plant capacity

The following major products have been taken into consideration:

- acetic acid
- creosote
- methanol
- charcoal

Acetic acid, presently imported, would find a ready market in the textile industry. Presently the National Textiles Corporation (NTC) consumes about 86 tonnes per year, at a price in Addis Ababa of 2.71 birr/kg. If the requirements kept pace with the development of cotton fabrics production, they could double by 1994/95 G.C.

As for creosote is concerned its main use can be found in the impregnation of wood to preserve it from moisture and parasites.

EELPA has a requirement of 40-50,000 new wooden poles every year. A project is afoot for a factory to produce 24-25,000 cement poles per year, for which financing is expected from the Italian Government - alternatively, or hopefully concurrently, a similar project could be financed by the Japanese Government. But such projects would not reduce the demand for wooden poles - so much so that EELPA has its own forestation programme. Presently impregnation is carried out with imported chemicals (salt

K33), but creosote is considered a perfectly adequate alternative by the Technical Equipment and Supplies Department of EELPA. Current consumption of impregnating chemicals is around 200 tonnes per year (4-5 kg per pole) at a price (in Addis) of 2.5 - 3.0 birr per kg.

Methanol (Methyl Alcohol) produced in this way is poor in quality and it only can be used as fuel.

A very important by-product is charcoal. The lack of fuels, above all for domestic consumption, is a great problem facing the country and the TYPP contains a number of ideas on how to tackle it, from the planting of 3.55 million ha of trees over a ten-year period, to the installing of 1,500 charcoal kilns (expected to save 2.2 million m<sup>3</sup> of firewood) to distribution of 1.2 million improved stoves, to installing 13,000 solar panels for water heating, etc. Among others, the World Bank has a project to produce 15,000 tonnes/year of charcoal from forest wastes for domestic consumption in Addis Ababa. A portion of the raw material foreseen for this plant (mainly wastes from forest maintenance) could be used to feed the proposed chemicals/charcoal unit.

The plant capacity therefore has been selected to process 13500 t/y of wood (moisture 30%) and produce:

- 200 (max 400) t/y of acetic acid 95% purity
- 200 (max 300) t/y of creosote
- 280 (max 300) t/y of raw methanol to be eventually used as fuel
- 3000 (max 3500) t/y charcoal

This capacity is based on a continuous operation (three shifts) for 300 days a year.

2.3 Sales prices and annual revenues

The selling prices of the products can be estimated as follows:

- acetic acid: on the basis of the present price, paid by the NTC for the imported product free at their factories, that is 2710 birr/t (1309.18 \$/t)
- creosote: on the basis of the price paid by ELPA for an imported product that can be substituted by creosote, that is 2750 birr/t (1328.5 \$/t)
- methanol: on the basis of the ratio of its calorific value to the fuel oil calorific value; i.e. 226 birr/t (109.18 \$/t)
- charcoal: on the basis of the average wholesale price, that is 400 birr/t (193.24 \$/t)

On these basis the total revenues will be:

- acetic acid: 200 t/y x 1309.18 \$/t=	261,836 \$/y
- creosote: 200 t/y x 1328.5 \$/t =	265,700 \$/y
- raw methanol: 280 t/y x 109.18 \$/t =	30,570 \$/y
- charcoal: 3000 t/y x 193.24 \$/t =	579,720 \$/y
	-----
TOTAL	1,137,826 \$/y

### 3. MATERIALS AND INPUTS

#### 3.1 Technology

The process consists essentially in a dry distillation of wood. As a consequence the only required raw material apart from some reagents (butyl acetate) required for the separation of the liquid phases, is wood (wood, chip wood, or underwood products). Ethiopia is presently facing a serious lack of fuel wood but large reforestation programmes are due to be financed (1). One of these programmes foresees the rehabilitation and expansion of the forests around Addis Ababa; in this programme the production of 15000t of charcoal is also included (2); the plant proposed in this study could be a part of this programme.

Assuming a moisture content of 30% the required amount of wood at full capacity (3000 t/y of charcoal) is 13,500 t which is presumed as being available at the wholesale price of 40 birr/t (3).

#### 3.2 Materials and utilities: requirement and costs

The complete list of raw materials and utilities required annually by the plant running at full capacity, that is producing 3000 t/y of charcoal and 720 t/y of liquid products, is as follows:

- (1) Source: Department of forestry, Ministry of Agriculture
- (2) Source: World Bank study
- (3) Source: FAO 1985; SHELL 1986



	LC	FC
a) raw materials		
. wood (30% moisture)		
13,500 t x 40 birr/t =	540,000 b/y	
. butyl-acetate		
16t x 714 \$/t =	-	11,424 \$/t
	-----	
	540,000 b/y	11,424 \$/t
	(260,869.\$/y)	
b) utilities		
. electricity		
252,000 kWhx0,2 b/kWh	50,400 b/y	-
	(24,348 \$/y)	
. cooling water		
7,200 m3x0,029 b/m3	210 b/y	-
	(101 \$/y)	
. steam (produced by using distillations byproducts as fuel)	-	-
	-----	
	50,610 b/y	-
	-----	
Grand totals	590,610 birr/y	11,424 \$/ton
	(285,318 \$/y)	

Notes:

- 1) the price for the wood is valid on the assumption of an average transportation distance of 30-35 Km
- 2) the consumption of electric power can be attributed as 90% to the charcoal production and the balance for chemical production. The total installed power is about 100 KW
- 3) the cooling water represents the make-up only. The total ricirculating water is 30 m3/h
- 4) the capacity of the steam boiler is 1 t/h at 6 bar

3.3 Raw material purchasing programme and storage volumes

The plant will be located near the forest (see para 1.4) and a stock equivalent to 1 month full production should be envisaged (1)

As the auxiliary reagent (butyl-acetate) is imported, an amount equivalent to six months consumption is advisable.

On this basis the minimum required stocks are as follows:

- wood: 1,125 t equivalent to	21,740 \$
- butyl acetate: 8t equivalent to	5,712 \$
	-----
	27,452 \$

(1) Wood should be air dried for approximately 6 months before use.

4. LOCATION

Any location next to the forest area or wood working factories is suitable.

5. PROJECT ENGINEERING

5.1 Process and equipment description (Dwr. B162-14-2)

The plant for the production of charcoal and chemicals is divided in two sections:

- a) in the first section the raw material (wood or similar) is converted in charcoal, and non-condensable and condensable vapours are extracted.
- b) in the second section the condensed vapours, released during the carbonization process, are distilled and the various chemicals separated.

5.1.1 Carbonization process

The conversion process from wood to coal is accomplished in a tunnel type furnace; this furnace is divided in three reaction sections (chambers): in the first one the wood is preheated and dried; in the second one the conversion to coal takes place and in the third one the coal is cooled. The sections are isolated by means of mobile gates in order to avoid the mixing of different vapours and gases produced or circulated in the three chambers. The tunnel is completed by two other chambers, one for the introduction of the raw material and one for the extraction of the coal; the raw material (which must have a size larger than 2 cm) is loaded on trolleys which are then pushed in the first chamber; the transfer movement of the trolleys inside the furnace is intermittent and carried out by means of pushers whose

action is synchronized with the opening and closing of the gates. When the trolleys come out of the tunnel the coal is unloaded and replaced with new wood; the trolley is then pushed again into the furnace; so the process is practically continuous.

The heat required by the preheating and conversion process is supplied to the wood either indirectly (carbonization room) through a heat exchanger, either directly (drying room) by means of high temperature combustion products outcoming from a combustion chamber adjacent to the furnace.

These combustion products are obtained by burning the non-condensable gases released during the carbonization process: in this way the process, after the start up, becomes self sufficient in term of energy.

In fact, once the start-up is completed, the temperature regulation of the three reaction zones (drying, carbonization and cooling) is carried on as follows:

- drying zone: the wood is heated by direct contact of the flue-gases discharged by the heat exchanger of the carbonization zone; these flue-gases flow countercurrent through the drying zone and are then discharged at the end of it; part of them, cooled and dehumidified, is again recirculated in the same zone in order to facilitate the control of the drying temperature;
- carbonization process: the heat for the carbonization step is supplied through a heat exchanger by the combustion products of an adjacent combustion chamber. During the start up these combustion products are obtained by burning wood or another auxiliary fuel,

afterwards by burning the non-condensable vapours released during the carbonization process itself.

- cooling zone: the cooling is obtained by circulating in this zone the non-condensable gases (cooled and dehumidified) extracted from the carbonization room and from the cooling room itself.

The piroligneous liquid obtained by the condensation of the vapours released by the carbonization process are sent to a settling tank; the upper part of the settled liquid is practically water and is recycled to the vapour condenser (cyclone); the lower part rich of chemicals is transferred to the extraction unit.

The characteristics of the products depend on the temperature (450-700°C) of the process and on the heating speed; the higher the temperature, the higher the amount of piroligneous liquid product and the content of fixed carbon in the coal; the lower the speed, the higher the amount of coal produced.

Consequently it is possible to optimize the process according to the raw material available and the production needs.

The furnace is made-up of thermoinsulated steel plates, has a total length of about 60 m and a cross section of about 3 x 3 m (3.9 x 3.9 in the carbonization zone).

The tube bundle of the heat exchanger is of stainless steel. The gates separating the reaction zones are of the guillotine type with sliding guides hermetically sealed by means of ceramic fibres; their movement as well as the transfer of the trolleys is controlled by means of servomechanisms.

The loading and unloading of the trolleys is supposed manually done.

### 5.1.2 Separation process

This process is accomplished in a system composed of four distillation columns; the system is fed with the piroligneous liquid pumped from the settling tank, mentioned in parag. 5.1.1; the liquid is preheated by the flue gas of an auxiliary steam boiler.

In the first column the following products are separated:

- at the top (70°C), a mixture of liquid fuels, out of which 40% is methanol; this mixture is the product named "methanol" at the parag. 2.1;
- at the bottom, an aqueous solution of acetic acid, phenolic derivates and soluble tar.

The bottom solution of the first column, is fed, after the addition of butyl acetate to the second column, where the following streams are separated:

- at the top, an azeotropic mixture of water and water carrier (butyl acetate);
- at the bottom, acetic acid, phenols, tar and a small amount of water.

The top mixture is sent to the third column, while the bottom solution is supplied to the fourth one.

In the third column the streams separated are:

- at the top : the butyl acetate
- at the bottom: practically pure water

For the fourth column the products separated are:

- at the top, acetic acid, 95% purity
- at the bottom: a mixture of phenolic derivates and soluble tars; this mixture is called creosote (para 2.1).

The three products are sent to storage tanks (20 m<sup>3</sup>); a fourth tank (5 m<sup>3</sup>) is for the butyl acetate.

All the pumps, piping and storage tanks are of stainless steel.

The first, second and fourth column are of stainless steel, fitted with reboiler and condenser and have the following dimensions:

first column : diameter 400 mm; height 8000 mm  
second " : first section : ø 600 mm; height 7000 mm  
                  second section: ø 800 mm; height 3000 mm  
fourth column: diameter 400 mm; height 8000 mm

The third column is of the stripping type, is of carbon steel, filled with Rashing rings and has the following dimensions: diameter 400 mm; height 5000 mm.

## 5.2 Packaging

The charcoal is shipped in jute bags, manually filled, 20 kg each.

The chemical products are shipped in drums (about 150-200



kg): carbon steel drums for creosote and raw methanol; polyethylene drums for acetic acid.

The cost of drums can be estimated, as an average, at about 35 \$ per piece; this cost has been included in the investment costs, having assumed the drums will be returned to the factory by the customers.

### 5.3 Lay-out and civil works (Drw. B162-14-1)

The area required for the plant is about 4300 sq.mt, of which the 30% is needed by the process plant, 20% by the storage areas and the administrative buildings and the balance by roads and yards.

The process equipment is completely outdoors, except for the electrical equipment and the instrument panel which are located in a small building. The storage area for coal and chemicals is covered by a shelter, while the wood is stocked in the open air.

The administrative offices, laboratory, workshop and warehouse are located in a two-storey building of 200 sq.mt. The floor of the process plant area is made of reinforced concrete with hard aggregate as finishing surface; the same type of floor is used for the area covered by a shelter. Steel structure is used for the shelter and the roof is insulated with mineral wool lagging covered with corrugated asbestos-cement sheets. The floor of the wood storage area is simply rolled and covered with gravel.

Reinforced concrete is used for the building housing the electric equipment and instrumentation.

The administrative building has a reinforced concrete structure and external and partition walls in masonry.

All the roads are asphalted; an underground weighing bridge is installed near the entrance.

Cement poles and brick walls are used for fencing.

**5.4 Investment costs: depreciation and maintenance**

The investment costs for the machinery and equipment of the plant, utilities plant and civil works are as follows:

	FC	LC	Total
	M\$	M\$	M\$
. machinery and equipment			
FOB European port	1.310	-	1.310
. transportation	0.130	0.130	0.260
. erection	0.170	0.090	0.260
. Site preparation	-	0.040	0.040
. civil works	-	0.480	0.480
. spare parts	0.100	-	0.100
	-----	-----	-----
. Total	1.710	0.740	2.450
. Contingencies	0.170	0.080	0.250
	-----	-----	-----
GRAND TOTAL	1.880	0.820	2.700

The industrial life of the plant, since the corrosion problem is low, can be estimated at 15 years.

Annual maintenance cost has been evaluated in the range of 4% of the cost of machinery and equipment, i.e. approximately 50,000 \$/year.

In the financial evaluation, the investment costs (contingencies included) have been so subdivided:

machinery	FC	1.880	million \$
machinery	LC	0.220	million \$
site preparation	LC	0.040	million \$
civil work	LC	0.560	million \$
		-----	
	total	2.700	

6. PLANT ORGANIZATION

The plant organization is highlighted in the para 1.7 and has been drafted assuming that the plant will operate as an autonomous unit operating within the organizational framework of the National Chemical Corporation.

7. MANPOWER

No special skills are required for any of the positions listed below except for the technical manager, the production manager, the workshop engineer and the chemist, who must have through training in the technology involved in the process. The requirements for all the other positions are not different from those required in any other chemical factory.

7.1 Management

		birr/m	birr/y
General manager	1	1,500	
Technical manager	1	1,200	
		----	-----
		2,700	32,400
			(15652 \$/y)

7.2 Administrative department

Senior accountant	1	800	
Purchasing dep.	1	400	
Store dep.	2	400	
Sale dep.	2	400	
Clerks and secretaries	3	1,050	
Guards	6	900	
Drivers	3	1,050	
	--	-----	-----
	18	5,000	60,000
			(28985 \$/y)
Total Management and Administrative dept.			92,400 b/y
			(44637 \$/y)

7.3 Production and maintenance department

a) Production department		birr/m	birr/y
Production manager	1	1000	
Chemist	1	800	
- Charcoal production			
Shift foreman	4	1600	
Shift operators	20	7000	
Unskilled workers	10	2000	
- Charcoal packing			
Foreman	1	400	
Unskilled workers	10	2000	
- Steam production			
Foreman	1	400	
Shift operators	4	1400	
	--	-----	-----
	52	16600	199,200
			(96232 \$/y)
b) Maintenance department			
Engineer	1	800	
Electricians	2	800	
Mechanics	4	1600	
Semi-skilled workers	3	1050	
	--	-----	-----
	10	4,250	51,000
			(24,638 \$/y)

8. IMPLEMENTATION SCHEDULE

From the moment the investment is decided and relevant financing finalized, 24 months are needed to the moment the plant can start-up.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	3	3

- the assistance of two foreign experts for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- the production programme has been assumed as follows:  
1st year: 60% capacity (120t acetic acid + 120 t creosote + 168 t r.methanol + 1800 t charcoal)

2nd year: 80% capacity (160t acetic acid + 160 t creosote + 224 r.methanol + 2400 t charcoal)

from the 3rd to the 15th year: 100% capacity (200 t acetic acid + 200 t creosote + 280 t r.methanol + 3000 t charcoal)

Selling prices:

acetic acid	1309.18 \$/t
creosote	1328.5 \$/t
r.methanol	109.18 \$/t
charcoal	193.24 \$/t

As a result the evaluation yields an IRR of 10.56% and a BEP of 0.58.



10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 2.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import
  - . acetic acid: 1000 \$/t CIF Assab (presently quoted 1309.18 \$/t in Addis Ababa);
  - . chemicals for impregnation: 1195 \$/t CIF Assab (presently quoted 1328.5 \$/t in Addis Ababa);
  - . methanol to be used as fuel (price related to its calorific power compared with the one of fuel oil) 100 \$/t CIF Assab.

While the net foreign exchange flow results negative (no export is foreseen), the net foreign exchange effect is positive; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the net foreign exchange effect amounting to 867,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, there would still be a surplus which in terms of present value would amount to 867,000 \$

**Biomass based chemicals**

**ANNEXE 1**

**FINANCIAL EVALUATION**



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**BIO MASS BASED CHEMICALS**  
**February 88**  
**BASIC PROJECT**

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	2969.80	68.685 % foreign
current assets:	0.00	0.000 % foreign
total assets:	2969.80	68.685 % foreign

**Source of funds during construction phase**

equity & grants:	1212.00	0.000 % foreign
foreign loans :	1598.00	
local loans :	0.00	
total funds :	2810.00	56.868 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	433.55	442.91	512.25
depreciation :	198.07	198.07	194.07
interest :	154.81	134.83	114.86
production costs	786.42	775.81	821.18
thereof foreign	47.95 %	39.88 %	36.74 %
total sales :	682.29	909.76	1137.20
gross income :	-104.14	133.95	316.02
net income :	-104.14	66.98	158.01
cash balance :	-213.86	54.86	129.07
net cashflow :	140.69	389.44	443.67

Net Present Value at: 10.00 % = 99.04  
Internal Rate of Return on total investment: 10.56 %  
Equity paid versus Net income flow (IRR): 8.79 %  
Net Worth versus Net Cash Return (IRR): 10.70 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Total Initial Investment in 1000 US \$		
Year . . . . .	1987	1988
Fixed investment costs		
Land, site preparation, development	40.00	0.00
Buildings and civil works . . . . .	392.00	168.00
Auxiliary and service facilities . .	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00
Plant machinery and equipment . . .	420.00	1680.00
<b>Total fixed investment costs . . . .</b>	<b>852.00</b>	<b>1848.00</b>
Pre-production capital expenditures.	20.00	249.00
Net working capital . . . . .	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>872.00</b>	<b>2097.00</b>
Of it foreign, in Z . . . . .	43.12	79.31



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US \$**

Year . . . . .	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	100.05	10.44	23.27
<b>Total current investment costs . . .</b>	<b>100.05</b>	<b>10.44</b>	<b>23.27</b>
<b>Of it foreign, Z . . . . .</b>	<b>49.84</b>	<b>8.09</b>	<b>50.77</b>



COMFAR 2.0 - BALDI & CO. S.R.L., MILANO

Total Production Costs in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	6.85	9.14	11.42	11.42	11.42	11.42
Other raw materials . . . . .	156.52	208.70	260.87	260.87	260.87	260.87
Utilities . . . . .	0.06	0.08	0.10	0.10	0.10	0.10
Energy . . . . .	14.61	19.48	24.35	24.35	24.35	24.35
Labour, direct . . . . .	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance . . . . .	24.64	24.64	24.64	24.64	24.64	24.64
Spares . . . . .	30.00	40.00	50.00	50.00	50.00	50.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	388.91	398.27	467.62	467.62	467.62	467.62
Administrative overheads . . . . .	44.64	44.64	44.64	44.64	44.64	44.64
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	198.07	198.07	194.07	190.07	190.07	168.07
Financial costs . . . . .	154.81	134.83	114.86	94.88	74.91	54.93
Total production costs . . . . .	786.42	775.81	821.18	797.20	777.23	735.25
Costs per unit (single product) . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Of it foreign, % . . . . .	47.95	39.88	36.74	35.34	33.67	32.88
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	140.87	140.87	140.87	140.87	140.87	140.87



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
% of new capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	11.42	11.42	11.42	11.42	11.42	11.42
Other raw materials . . . . .	260.87	260.87	260.87	260.87	260.87	260.87
Utilities . . . . .	0.10	0.10	0.10	0.10	0.10	0.10
Energy . . . . .	24.35	24.35	24.35	24.35	24.35	24.35
Labour, direct . . . . .	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance . . . . .	24.64	24.64	24.64	24.64	24.64	24.64
Spares . . . . .	50.00	50.00	50.00	50.00	50.00	50.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>467.62</b>	<b>467.62</b>	<b>467.62</b>	<b>467.62</b>	<b>467.62</b>	<b>467.62</b>
Administrative overheads . . . . .	44.64	44.64	44.64	44.64	44.64	44.64
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	168.07	168.07	168.07	140.07	69.09	0.00
Financial costs . . . . .	34.96	14.98	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>715.28</b>	<b>695.30</b>	<b>680.32</b>	<b>652.32</b>	<b>581.34</b>	<b>512.25</b>
<b>Costs per unit (single product) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	31.01	29.02	27.46	28.64	21.21	11.99
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	140.87	140.87	140.87	140.87	140.87	140.87





COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year	1989	1990	1991	1992-2003
Coverage . . . . . ndc coto				
Current assets &				
Accounts receivable . . . 30 12.0	36.13	36.91	42.69	42.69
Inventory and materials . 36 9.9	16.47	21.96	27.45	27.45
Energy . . . . . 1 360.0	0.04	0.05	0.07	0.07
Spares . . . . . 360 1.0	30.00	40.00	50.00	50.00
Work in progress . . . . 3 120.0	3.24	3.32	3.90	3.90
Finished products . . . 30 12.0	36.13	36.91	42.69	42.69
Cash in hand . . . . . 15 24.0	10.65	8.56	8.98	8.98
Total current assets . . . . .	132.65	147.72	175.77	175.77
Current liabilities and				
Accounts payable . . . . . 26 13.8	24.61	25.23	34.02	34.02
Net working capital . . . . .	108.05	118.48	141.75	141.75
Increase in working capital . . . . .	108.05	10.44	23.27	0.00
Net working capital, local . . . . .	54.19	63.79	73.38	73.38
Net working capital, foreign . . . . .	53.85	54.76	68.37	68.37

Note: ndc = minus days of coverage ; coto = coefficient of turnover .



**COMFAR**  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	1212.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1598.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1598.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	159.00
Total funds .....	2810.00	159.00



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-199.75	-199.75	-199.75	-199.75	-199.75	-199.75
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-199.75	-199.75	-199.75	-199.75	-199.75	-199.75
Current liabilities	24.61	4.62	4.79	0.00	0.00	0.00
Bank overdraft ....	213.86	-54.86	-129.04	-160.32	-29.42	0.00
Total funds .....	38.72	-249.98	-324.03	-360.07	-229.17	-199.75

BIOMASS BASED CHEMICALS -- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	2810.00	0.00
Financial resources .	2810.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	872.00	2097.80
Total assets . . . .	872.00	1938.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	159.80
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	1938.00	-2097.80
Cumulated cash balance	1938.00	-159.80
Inflow, local . . . .	1212.00	0.00
Outflow, local . . . .	496.00	434.00
Surplus ( deficit ) .	716.00	-434.00
Inflow, foreign . . .	1598.00	0.00
Outflow, foreign . . .	376.00	1663.80
Surplus ( deficit ) .	1222.00	-1663.80
Net cashflow . . . . .	-872.00	-1938.00
Cumulated net cashflow	-872.00	-2810.00



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	706.89	914.52	1141.99	1137.20	1137.20	1137.20
Financial resources .	24.61	4.76	4.79	0.00	0.00	0.00
Sales, net of tax . .	682.29	909.76	1137.20	1137.20	1137.20	1137.20
Total cash outflow . .	920.76	859.66	1012.92	976.88	966.89	967.91
Total assets . . . .	132.65	15.06	28.05	0.00	0.00	0.00
Operating costs . . .	433.55	442.91	512.25	512.25	512.25	512.25
Cost of finance . . .	154.81	134.83	114.86	94.88	74.91	54.93
Repayment . . . . .	199.75	199.68	199.75	199.75	199.75	199.75
Corporate tax . . . .	0.00	66.98	158.01	170.00	179.99	200.97
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) . .	-213.86	54.86	129.07	166.32	170.31	169.29
Cumulated cash balance	-373.66	-318.81	-189.74	-29.42	140.88	310.18
Inflow, local . . . .	706.62	914.52	1141.95	1137.20	1137.20	1137.20
Outflow, local . . . .	415.23	475.09	623.19	620.83	630.61	651.80
Surplus (deficit) . .	291.40	439.42	518.77	516.37	506.59	485.40
Inflow, foreign . . .	0.27	0.00	0.03	0.00	0.00	0.00
Outflow, foreign . . .	505.53	384.57	389.74	356.06	336.08	316.11
Surplus (deficit) . .	-505.26	-384.57	-389.70	-356.06	-336.08	-316.11
Net cashflow . . . . .	140.69	389.44	443.67	454.95	444.96	423.97
Cumulated net cashflow	-2669.31	-2279.87	-1836.20	-1381.25	-936.29	-512.31



CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	1137.20	1137.20	1137.20	1137.20	1137.20	1137.20
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	1137.20	1137.20	1137.20	1137.20	1137.20	1137.20
Total cash outflow . .	957.92	947.93	740.69	740.69	754.69	754.69
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	512.25	512.25	512.25	512.25	512.25	512.25
Cost of finance . . .	34.96	14.98	0.00	0.00	0.00	0.00
Repayment . . . . .	199.75	199.75	0.00	0.00	0.00	0.00
Corporate tax . . . .	210.96	220.95	228.44	228.44	242.44	242.44
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	179.28	189.27	396.51	396.51	382.51	382.51
Cumulated cash balance	489.46	678.72	1075.23	1471.74	1854.25	2236.76
Inflow, local . . . .	1137.20	1137.20	1137.20	1137.20	1137.20	1137.20
Outflow, local . . . .	661.79	671.78	679.27	679.27	693.27	693.27
Surplus ( deficit ) .	475.41	465.42	457.93	457.93	443.93	443.93
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	296.13	276.16	61.42	61.42	61.42	61.42
Surplus ( deficit ) .	-296.13	-276.16	-61.42	-61.42	-61.42	-61.42
Net cashflow . . . . .	413.99	404.00	396.51	396.51	382.51	382.51
Cumulated net cashflow	-98.33	305.67	702.18	1098.69	1481.20	1963.71



CONFAR 2.0 - BALDG & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	1137.20	1137.20	1137.20
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1137.20	1137.20	1137.20
Total cash outflow . .	754.69	790.18	824.73
Total assets . . . . .	0.00	0.00	0.00
Operating costs . . .	512.25	512.25	512.25
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	242.44	277.93	312.47
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	382.51	347.02	312.47
Cumulated cash balance	2619.27	2966.29	3278.76
Inflow, local . . . . .	1137.20	1137.20	1137.20
Outflow, local . . . .	693.27	728.76	763.30
Surplus ( deficit ) .	443.93	408.44	373.90
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	61.42	61.42	61.42
Surplus ( deficit ) .	-61.42	-61.42	-61.42
Net cashflow . . . . .	382.51	347.02	312.47
Cumulated net cashflow	2246.22	2593.24	2905.71



**Cashflow: Discounting:**

a) Equity paid versus Net income flow:			
Net present value .....	-123.43	at	10.00 %
Internal Rate of Return (IRRE1) ..	8.79	%	
b) Net Worth versus Net cash return:			
Net present value .....	92.35	at	10.00 %
Internal Rate of Return (IRRE2) ..	10.70	%	
c) Internal Rate of Return on total investment:			
Net present value .....	99.04	at	10.00 %
Internal Rate of Return (IRR) ..	10.56	%	

Net Worth = Equity paid plus reserves





CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	682.29	909.76	1137.20	1137.20	1137.20
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	682.29	909.76	1137.20	1137.20	1137.20
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	631.62	640.98	706.32	702.32	702.32
Operational margin . . . . .	50.67	268.78	430.88	434.88	434.88
As % of total sales . . . . .	7.43	29.54	37.89	38.24	38.24
Cost of finance . . . . .	154.81	134.83	114.86	94.88	74.91
Gross profit . . . . .	-104.14	133.95	316.02	340.00	359.97
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-104.14	133.95	316.02	340.00	359.97
Tax . . . . .	0.00	66.98	158.01	170.00	179.99
Net profit . . . . .	-104.14	66.98	158.01	170.00	179.99
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-104.14	66.98	158.01	170.00	179.99
Accumulated undistributed profit . . .	-104.14	-37.16	120.85	290.85	470.83
Gross profit, % of total sales . . . .	-15.26	14.72	27.79	29.90	31.65
Net profit, % of total sales . . . .	-15.26	7.36	13.89	14.95	15.83
ROE, Net profit, % of equity . . . .	-8.59	5.53	13.04	14.03	14.85
ROI, Net profit+interest, % of invest.	1.74	6.89	9.24	8.97	8.64



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	1137.20	1137.20	1137.20	1137.20	1137.20
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1137.20	1137.20	1137.20	1137.20	1137.20
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	680.32	680.32	680.32	680.32	680.32
Operational margin . . . . .	456.88	456.88	456.88	456.88	456.88
As % of total sales . . . . .	40.18	40.18	40.18	40.18	40.18
Cost of finance . . . . .	54.93	34.96	14.98	0.00	0.00
Gross profit . . . . .	401.95	421.92	441.90	456.88	456.88
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	401.95	421.92	441.90	456.88	456.88
Tax . . . . .	200.97	210.96	220.95	228.44	228.44
Net profit . . . . .	200.97	210.96	220.95	228.44	228.44
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	200.97	210.96	220.95	228.44	228.44
Accumulated undistributed profit . . .	671.81	882.77	1103.72	1332.15	1560.59
Gross profit, % of total sales . . . . .	35.35	37.10	38.86	40.18	40.18
Net profit, % of total sales . . . . .	17.67	18.55	19.43	20.09	20.09
ROE, Net profit, % of equity . . . . .	16.58	17.41	18.23	18.85	18.85
RDI, Net profit+interest, % of invest.	8.67	8.33	7.99	7.74	7.74



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1999	2000	2001	2002	2003
Total sales, incl. sales tax	1137.20	1137.20	1137.20	1137.20	1137.20
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	1137.20	1137.20	1137.20	1137.20	1137.20
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	652.32	652.32	652.32	581.34	512.25
Operational margin	484.88	484.88	484.88	555.86	624.95
As % of total sales	42.64	42.64	42.64	48.88	54.95
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	484.88	484.88	484.88	555.86	624.95
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	484.88	484.88	484.88	555.86	624.95
Tax	242.44	242.44	242.44	277.93	312.47
Net profit	242.44	242.44	242.44	277.93	312.47
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	242.44	242.44	242.44	277.93	312.47
Accumulated undistributed profit	1803.03	2045.47	2287.91	2565.84	2878.31
Gross profit, % of total sales	42.64	42.64	42.64	48.88	54.95
Net profit, % of total sales	21.32	21.32	21.32	24.44	27.48
ROE, Net profit, % of equity	20.00	20.00	20.00	22.93	25.78
ROI, Net profit+interest, % of invest.	8.21	8.21	8.21	9.42	10.59



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
<b>Total assets .....</b>	<b>2810.00</b>	<b>2969.00</b>
Fixed assets, net of depreciation	0.00	872.00
Construction in progress .....	872.00	2097.00
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available	1938.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	6.00
<b>Total liabilities .....</b>	<b>2810.00</b>	<b>2969.00</b>
Equity capital .....	1212.00	1212.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1598.00	1598.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required	0.00	159.00
<b>Total debt .....</b>	<b>1598.00</b>	<b>1757.00</b>
<b>Equity, % of liabilities .....</b>	<b>43.13</b>	<b>40.81</b>

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1989	1990	1991	1992	1993	1994
Total assets	3008.52	2825.51	2592.52	2365.29	2316.10	2317.33
Fixed assets, net of depreciation	2771.73	2573.66	2379.59	2189.52	1999.45	1831.36
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	122.01	139.15	166.79	166.79	166.79	166.79
Cash, bank	10.65	8.56	8.98	8.98	8.98	8.98
Cash surplus, finance available	0.00	0.00	0.00	0.00	140.88	310.18
Less carried forward	0.00	104.14	37.16	0.00	0.00	0.00
Less	104.14	0.00	0.00	0.00	0.00	0.00
Total liabilities	3008.52	2825.51	2592.52	2365.29	2316.10	2317.33
Equity capital	1212.00	1212.00	1212.00	1212.00	1212.00	1212.00
Reserves, retained profit	0.00	0.00	0.00	120.85	290.85	470.83
Profit	0.00	66.98	158.01	170.00	179.99	200.97
Long and medium term debt	1398.25	1198.50	998.75	799.00	599.25	399.50
Current liabilities	24.61	29.23	34.02	34.02	34.02	34.02
Bank overdraft, finance required	373.66	318.81	189.74	29.42	0.00	0.00
Total debt	1796.52	1546.54	1222.51	862.44	633.27	433.52
Equity, % of liabilities	40.29	42.89	46.75	51.24	52.33	52.30



COMFAR 2.0 - BALBO & C. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1995	1996	1997	1998	1999	2000
Total assets	2328.54	2349.73	2578.17	2806.61	3049.05	3291.49
Fixed assets, net of depreciation	1663.31	1493.24	1327.17	1159.10	1019.03	879.96
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	166.79	166.79	166.79	166.79	166.79	166.79
Cash, bank	8.98	8.98	8.98	8.98	8.98	8.98
Cash surplus, finance available	489.44	678.72	1075.23	1471.74	1854.25	2236.76
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	2328.54	2349.73	2578.17	2806.61	3049.05	3291.49
Equity capital	1212.00	1212.00	1212.00	1212.00	1212.00	1212.00
Reserves, retained profit	671.81	802.77	1103.72	1332.15	1560.59	1803.03
Profit	210.96	220.95	228.44	228.44	242.44	242.44
Long and medium term debt	199.75	0.00	0.00	0.00	0.00	0.00
Current liabilities	34.02	34.02	34.02	34.02	34.02	34.02
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	233.77	.02	34.02	34.02	34.02	34.02
Equity, % of liabilities	52.05	51.58	47.01	43.18	39.75	36.82



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	2001	2002	2003
Total assets .....	3533.93	3811.86	4124.33
Fixed assets, net of depreciation	738.89	669.00	669.00
Construction in progress .....	0.00	0.00	0.00
Current assets .....	166.79	166.79	166.79
Cash, bank .....	8.98	8.98	8.98
Cash surplus, finance available	2619.27	2966.29	3278.76
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	3533.93	3811.86	4124.33
Equity capital .....	1212.00	1212.00	1212.00
Reserves, retained profit .....	2045.47	2287.91	2545.84
Profit .....	242.44	277.93	312.47
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	34.02	34.02	34.02
Bank overdraft, finance required	0.00	0.00	0.00
Total debt .....	34.02	34.02	34.02
Equity, % of liabilities .....	34.30	31.80	29.39

**Biomass based chemicals**

**ANNEXE 2**

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>1137.20</u>
2) VARIABLE COSTS:	<u>392.97</u>
. RAW MATERIALS	272.29
. UTILITIES	0.10
. ENERGY	24.35
. LABOUR	96.23
3) FIXED COSTS	<u>428.21</u>
. REPAIR-MAINTENANCE	24.64
. SPARES	50.00
. ADMINISTRATION	44.64
. DEPRECIATION	194.07
. FINANCIAL COSTS	114.86
4) TOTAL PRODUCTION COSTS	<u>821.18</u>

$$\text{BEP} \frac{428.21}{1137.20 - 392.97} \times 100 = 57.5\%$$

**FOREIGN EXCHANGE EFFECT EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1987	1990
total foreign inflow ..	1598.30	1598.00	0.30	1598.00	0.00	0.27	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	1598.30	1598.00	0.30	1598.00	0.00	0.27	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	4913.96	2039.80	2874.16	376.00	1663.80	505.53	384.57
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1532.20	1880.00	-347.80	376.00	1504.00	54.12	0.71
imported materials . . . .	944.50	0.00	944.50	0.00	0.00	96.85	49.14
repayment loans & overd.	1598.30	0.00	1598.30	0.00	0.00	199.75	199.88
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	838.95	159.80	679.15	0.00	159.80	154.81	134.83
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-3315.65	-441.80	-2873.85	1222.00	-1663.80	-505.26	-384.57
import substit'n effect	6722.97	0.00	6722.97	0.00	0.00	277.82	373.63
net foreign exchange effect	3407.32	-441.80	3849.12	1222.00	-1663.80	-227.44	-10.94
present values at 10.00 %							
foreign exchange flow .	-2135.97						
net foreign exchange effect	866.87						

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	0.03	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsides, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.03	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	389.74	356.06	336.08	316.11	296.13	276.16	61.42
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	13.71	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	61.42	61.42	61.42	61.42	61.42	61.42	61.42
repayment loans & overd.	199.75	199.75	199.75	199.75	199.75	199.75	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	114.86	94.88	74.91	54.93	34.96	14.98	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-389.70	-356.06	-336.08	-316.11	-296.13	-276.16	-61.42
import substit'n effect	467.04	467.04	467.04	467.04	467.04	467.04	467.04
net forgn exchge effect	77.34	110.98	130.96	150.93	170.91	190.88	405.62
present values at foreign exchange flow .	10.00 %	-2135.97					
net forgn exchge effect		866.87					



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	61.42	61.42	61.42	61.42	61.42	61.42	-416.17
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-416.34
imported materials . . .	61.42	61.42	61.42	61.42	61.42	61.42	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.17
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-61.42	-61.42	-61.42	-61.42	-61.42	-61.42	416.17
import substit'n effect	467.04	467.04	467.04	467.04	467.04	467.04	0.00
net forgn exchge effect	405.62	405.62	405.62	405.62	405.62	405.62	416.17
present values at foreign exchange flow .	10.00 %	-2135.97					
net forgn exchge effect		866.87					

**Biomass based chemicals**

**ANNEXE 4**

**DRW. B.162 - 14 -1 PLANT LAY OUT**

**DWR. B.162 - 14 - 2**  
**PROCESS FLOW SHEET**

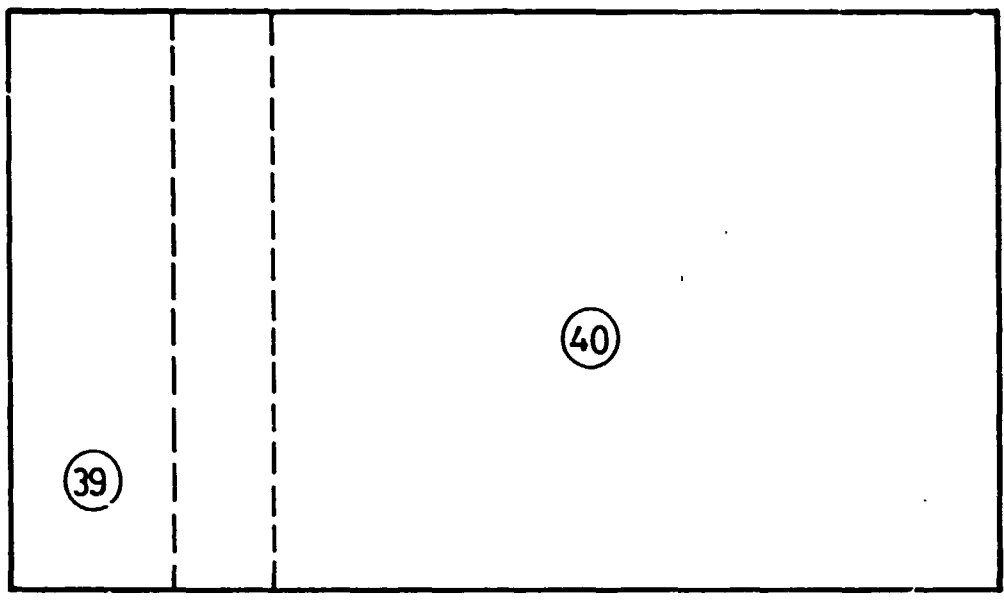
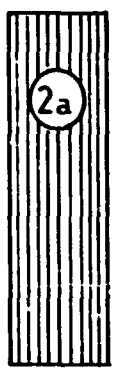
- |   |   |
|---|---|
| 1- FENCING                              | 19- TAR RECOVERING PUMP                     |
| 1a- ENTRY                               | 20- FAN                                     |
| 1b- EXIT                                | 21- AUXIL. COMBUST. CHAMBER FOR STEAM PROD. |
| 2- ROADS                                | 22- PRE-HEATER (COMBUSTION AIR)             |
| 2a- SCALE                               | 23- PRE-HEATER (LIQUID TO BE DISTILLED)     |
| 3- STORING AREA FOR WOOD                | 24- FAN                                     |
| 4- TROLLEY LOADED WITH WOOD             | 25- CHIMNEY                                 |
| 5- CARBONIZING TUNNEL INLET             | 26- DISTILLATION COLUMN                     |
| 6- WOOD DRYING AREA                     | 27- METHANOL TANK                           |
| 7- WOOD CARBONIZATION AREA              | 28- WATER SEPARATION TANK                   |
| 8- CHARCOAL COOLING AREA                | 29- BUTYL ACETATE TANK                      |
| 9- TUNNEL OUTLET                        | 30- WATER/BUTYL ACETATE SEPARATOR           |
| 10- TROLLEY LOADED WITH CHARCOAL        | 31- COLUMN                                  |
| 11- PARTITION DOORS                     | 32- DISTILLATION COLUMN                     |
| 11a- TUNNEL INLET                       | 33- TANK FOR TARS                           |
| 11b- PARTITION LOADING/DRYING AREA      | 34- ACETIC ACID TANK                        |
| 11c- PARTITION DRYING/CARBONIZAT. AREA  | 35- WATER DRAIN                             |
| 11d- PARTITION CARBONIZAT./COOLING AREA | 36- WATER TANK                              |
| 11e- PARTITION COOLING/OUTLET AREA      | 37- DRAIN PUMP                              |
| 11f- TUNNEL OUTLET                      | 38- CONTROL ROOM                            |
| 12- COMBUSTION CHAMBER                  | 39- AREA FOR OFFICES AND WORKSHOP           |
| 12a- HEAT EXCHANGER                     | 40- AREA FOR CHARCOAL STORING               |
| 12b- EXTRACTION HIGH TEMPERATURE GASES  |   |
| 13- FLUE GAS FAN                        |   |
| 14- FLUE GAS FAN (FOR WOOD DRYING)      |   |
| 15- TANK FOR CONDENSATE                 |   |
| 16- CONDENSER                           |   |
| 17- RECYCLE PUMPS                       |   |
| 18- RECYCLE LIQUID COOLER               |   |

SECTION 1

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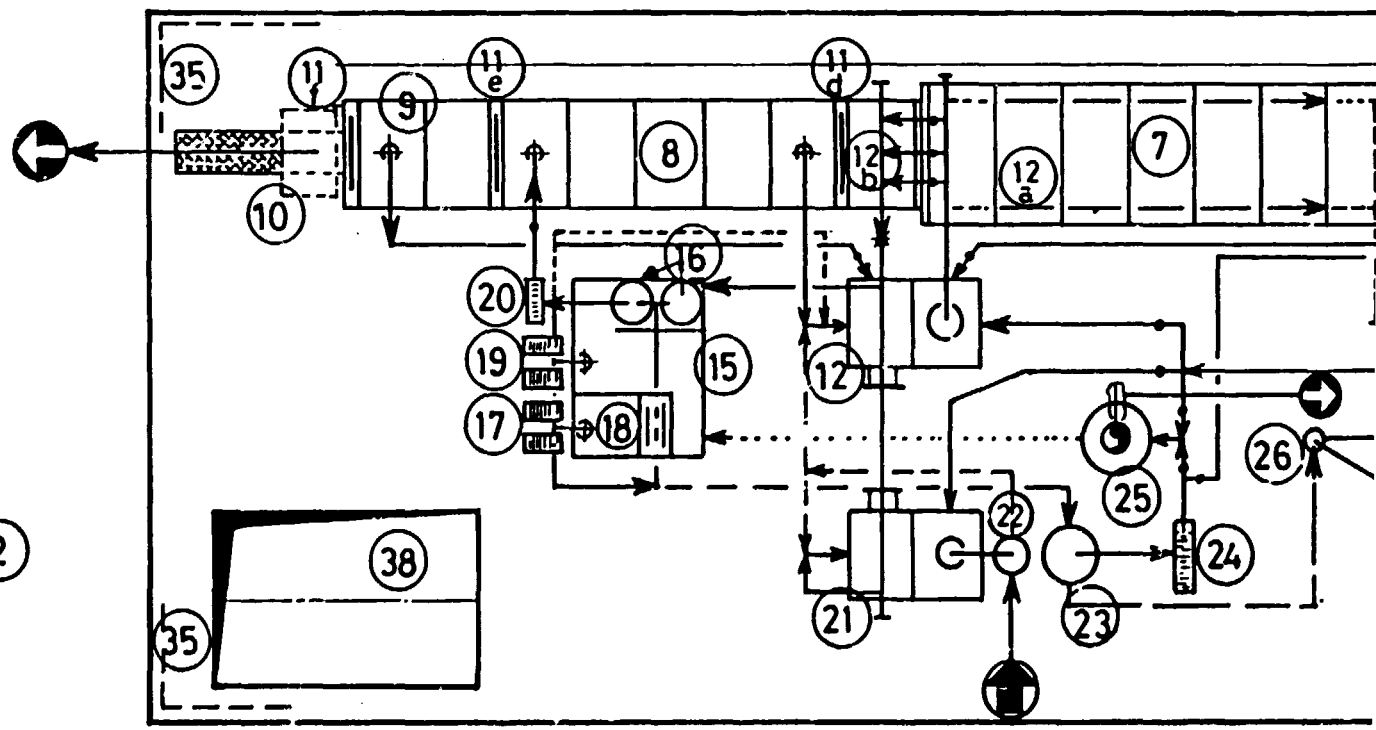
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SECTION 2

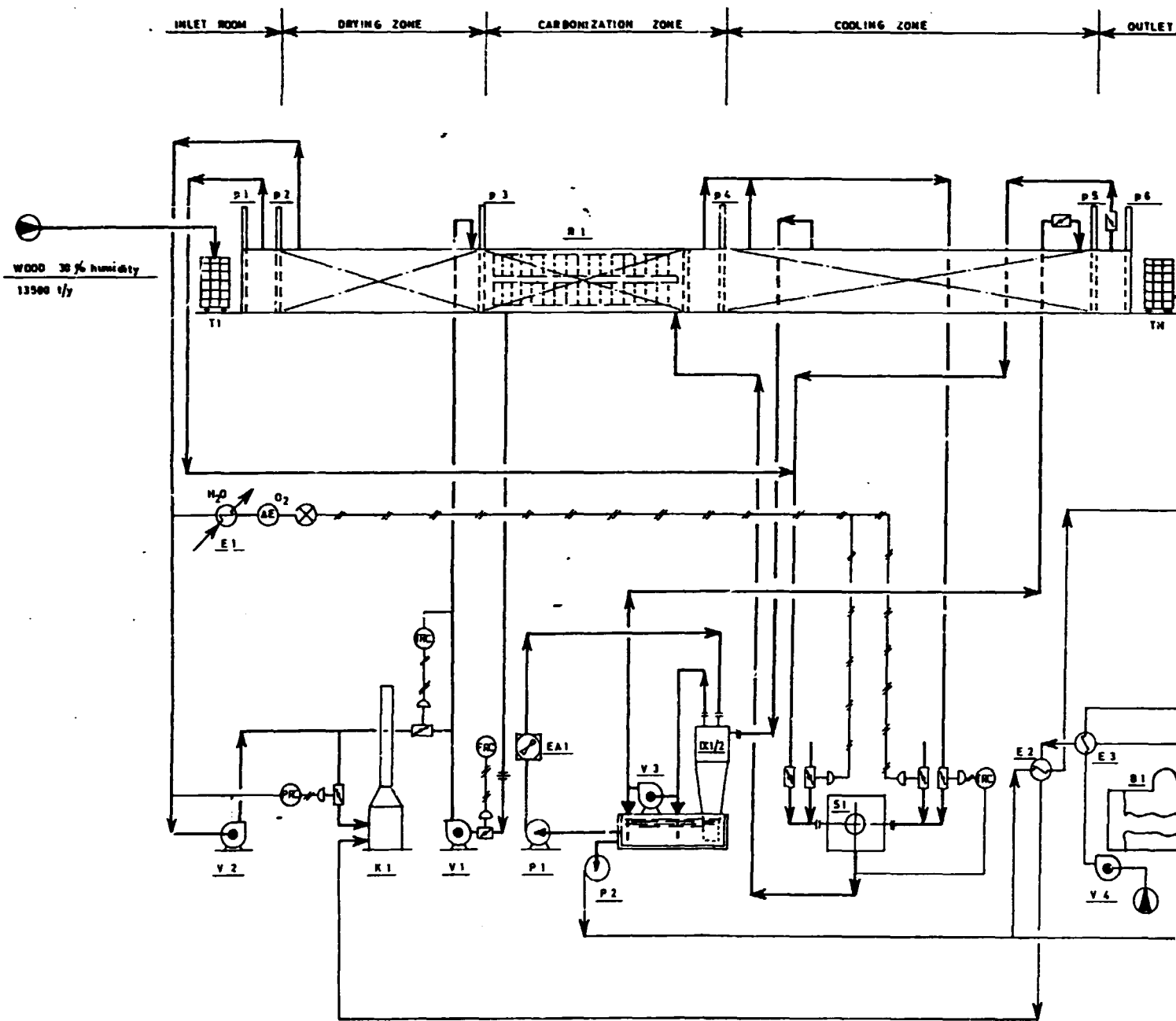
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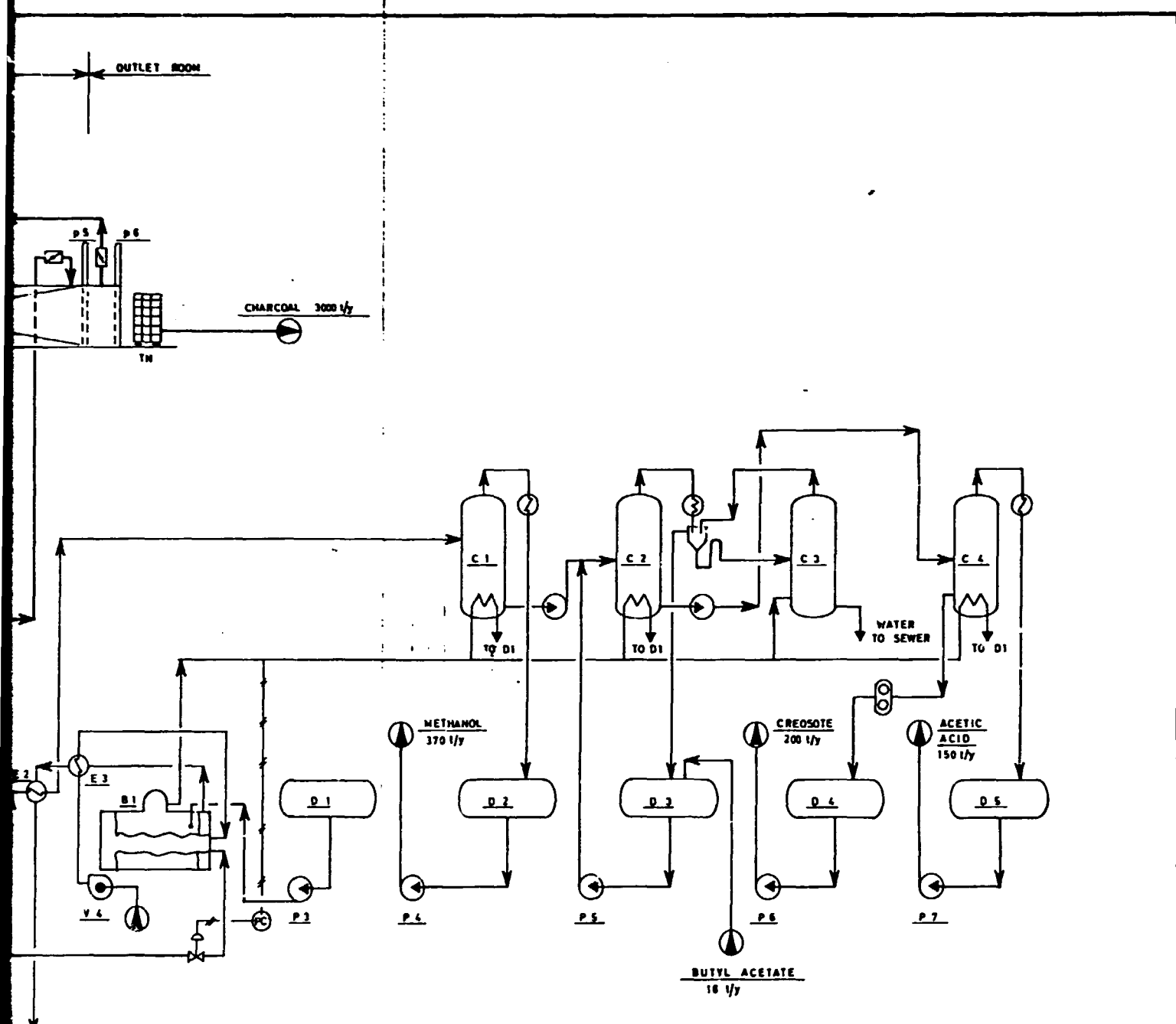




**LEGENDA**

- |  |   |
|--|---|
| <p>P5 - INJECTION OF BUTYL ACETATE</p> <p>R1 - CARBONIZATION FURNACE - TUNNEL TYPE</p> <p>T1...TN - TROLLEY</p> <p>P1...P6 - MOBILE GATLS</p> <p>K - STACK</p> <p>V1,V2,V3- GAS RECIRCULATING FAN</p> <p>S1 - COMBUSTION CHAMBER</p> <p>P1 - PUMP FOR RECIRCULATION OF LIGHT CONDENSATES TO THE CYCLONES DC1/2.</p> <p>P2 - PUMP FOR HEAVY CONDENSATES (PIROLIGNOUS ACID) DELIVERY TO THE DISTILLATING SECTION.</p> <p>DC1 - CYCLONE TYPE DAMPER</p> <p>EA1 - AIR COOLER OF LIGHT CONDENSATES</p> <p>E1 - GAS SAMPLE COOLER</p> <p>E2 - PREHEATER OF PIROLIGNOUS ACID</p> <p>E3 - COMBUSTION AIR PREHEATER</p> | <p>P4/6/7 - PUMP FOR SHIPPING OF PRODUCTS</p> <p>B1 - STEAM BOILER</p> <p>V4 - COMBUSTION AIR FAN</p> <p>P3 - B.F. WATER PUMP</p> <p>D1 - B.F. WATER TANK</p> <p>C1 - 1st DISTILLATION COLUMN FOR SEPARATION THANOL FROM AQUEOUS SOLUTIONS OF ACETIC ACID AND CREOSOTE.</p> <p>C2 - 2nd DISTILL. COLUMN FOR SEPARATION ( BUTYL ACETATE) FROM ACETIC ACID AND CREOSOTE.</p> <p>C3 - STRIPPING COLUMN FOR RECOVERY OF BUTYL ACETATE FROM WATER.</p> <p>C4 - 3rd DISTILL. COLUMN FOR SEPARATION ( ACETIC ACID) FROM CREOSOTE.</p> <p>D2 - STORAGE TANK OF METHANOL.</p> <p>D3 - STORAGE TANK OF BUTYL ACETATE.</p> <p>D4 - STORAGE TANK OF CREOSOTE.</p> <p>D5 - STORAGE TANK OF ACETIC ACID</p> |
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**SECTION 1**



COLUMN FOR SEPARATION OF M -  
 DUS SOLUTIONS OF ACETIC  
 T.  
 COLUMN FOR SEPARATION OF WATER  
 FROM ACETIC ACID AND CREOSOTE.  
 FOR RECOVERY OF BUTYL ACETATE  
 COLUMN FOR SEPARATION OF ACETIC  
 DTE.  
 METHANOL.  
 BUTYL ACETATE.  
 CREOSOTE.  
 ACETIC ACID

## SECTION 2

CLIENTE CUSTOMER	COMMESSA N° JOB N° B-162	
<b>PROCESS FLOW DIAGRAM</b>	CONTROLLATO APPROVED	DATA DATE
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<b>baldo &amp; c.</b> CONSULTING ENGINEERS	Via Sillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	
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**U.N.I.O.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF INDUSTRIAL EXPLOSIVES**  
**IN ETHIOPIA**

**PROJECT OP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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0. SUMMARY AND CONCLUSIONS

The present study analyses the opportunity of producing industrial explosives, mainly for use in mining, road construction, quarrying, etc.

Explosives are presently imported and the average consumption is in the range of 1000-1,100 tons per year at a cost of over 2 Million \$. Major users are the Ministry of Construction, the Mineral Resources Development Corporation and the Ethiopian Cement Corporation. The market survey has shown that the present consumption should increase to approximately 1500 tons by the end of the decade and 2,000 tons by 1994/5.

This amount is too small to justify the construction of an industrial plant. The key unit of the project in fact is the production department of Nitroglyceroglycol (NG) whose minimum economic size presently on the market is in the range of 600 kg/hour output, a quantity that is sufficient for the production of 8,000 tons per year of blasting gelatine.

This output is too large to be used entirely domestically and therefore an export potential should be found, considering also that no similar plants are presently in operation in the Region (Sudan, Kenya, Uganda, Tanzania, etc.) and that lower transportation costs could be an important factor for commercial penetration into these markets.

The financial analysis has been carried out twice, to take into consideration two scenarios

A : production of 2,000 tons per year to satisfy mainly  
Local market only

B : production gradually increasing from 2000 to 8,000 tons/year, out of which the export component is 6,000 tons.

The first scenario shows that the IRR is extremely low, 1.55% only, and that the plant is barely justifiable. In the latter the situation improves to an IRR of 4.91 and to a present value of the foreign exchange effect of 9,813,000 US \$. These results justify the preparation of a market study to ascertain actual export potential in the Region.

The plant needs an initial fixed investment of 8,100,000 US \$ and would employ nearly 150 persons.



1. INTRODUCTION

Explosives or exploding agents are those capable of being transformed into other materials by the action of an initiator, emitting a considerable quantity of gas in the course of this reaction, which can instantaneously carry out mechanical work in a length of time from a few centiseconds to several milliseconds.

Nearly all explosions are, in practice, the result of a combustion, i.e. a chemical reaction of oxidation taking place between two elements: the oxidizer and the fuel. When the fuel is slow-burning, the process is known as combustion, however, when it burns or oxidizes quickly or almost instantaneously, the correct terms used to describe these processes are deflagration or detonation. There does exist nevertheless a fundamental difference between an ordinary fuel and an explosive mixture. Ordinary fuel, such as wood or naphtha, burns through the oxygen in the air, but an explosive compound can also burn, deflagrate or detonate in a totally confined atmosphere without any need of air, since the oxygen required for combustion is one of the components of the compound itself.

The phenomenon of explosion involves both deflagration and detonation.

The former is a relatively slow explosion, taking place at a velocity, below 1000 m/sec, while the latter takes place in the form of a shock wave at much higher velocities up to 8-9000 m/sec.

The explosive materials may exist in a gaseous, liquid or solid state, or in a semi-solid state such as gelatines. One of most well known and widely used liquid explosives is nitroglycerine, an oleous liquid.

Another form of explosive is the gel formed by dissolving solid nitrocotton (nitrocellulose) in nitroglycerine. The resulting gel is a highly sticky substance generally known as dynamite or gelatine dynamite, commonly called gelatine or blasting gelatine. Nowadays "Gelatinized explosives" or "Dynamites" consist of a mixture of one or more explosives compound with non explosive materials.

The percentage of gelatinized nitroglycerine (for a more common blend of gelatinized nitroglycerine and nitroglycol called nitroglyceroglycole) varies from a minimum of 20% to a maximum of 93%

Explosives which undergo detonation at rates varying from 1000 to 8500 m/sec are known as "high explosives" and are divided into two categories based on their relative ease of detonation.

The so called primers, or initiating explosives, explode at the slightest stimulation, such as friction, impact or application of heat; in exploding they cause the detonation of secondary explosives, (or noninitiating high explosives) which are too insensitive to be detonated by means of impact, friction, or the brief application of heat. Dynamites are included in the latter types of explosives.

This study will deal with the manufacturing of a typical "Gelatinized explosive" or "Dynamite".

Obviously with changes in the composition it is possible to vary the characteristics of the final product but, as has already been said, this study will only deal with a typical "Dynamite" which will have the following properties:

Physical state : plastic  
Stability (Abel test) : more than 30 minutes at 80°C

Weight strength : 80%  
Trauzl test : 405 cm<sup>3</sup>  
Hess test : 24mm  
Velocity of detonation: 5900 m/sec  
Sensitivity : (with cartridges diam.30x120 -  
density 1,42): more than 10 cm  
Density : about 1,42 kg/cm<sup>2</sup> (this value  
can increase according to the  
quality of the used ammonium  
nitrate)  
Freezing resistance : better than -10°C  
Oxygen balance : + 4.233%  
Explosion heat : 4.200 kJ/kg  
Water resistance : good

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

Dynamites, like many other noninitiating high explosives, are used industrially to carry out mechanical jobs such as quarrying, or dislodging, ditching, excavation, seismic exploration; metal forming, bonding riveting, etc.

### 2.2 Forecast demand and plant capacity

#### 2.2.1 Forecast demand

Explosives are presently exclusively imported. The following table 1 shows data published by the Customs and Excise Tax Administration. Wide fluctuations can be seen in apparent consumption. For some years no imports are recorded. The explanation obtained from the Ethiopian Transport and Construction Authority (ETCA, by far the largest consumer) is that vast stocks of explosives had been brought in, and left behind, by the Chinese teams engaged in the construction of roads. Direct interviews with all the main consumers have yielded quantities for total consumption already higher than those seen in the table. They are shown in table 2 with projections to 1994/5.

**Table 1 - Imports of industrial explosives SITC 512.12, 1975-85**

YEAR (G.C.)	TONNES	THOUSAND	BIRR/KG
		BIRR (a)	(b)
1975	108.2	226	2.08
1976	2.6	28	10.56
1977	69.4	249	3.60
1978	2.2	272	125.53
1979	-	-	-
1980	36.2	131	3.62
1981	-	-	-
1982	89.6	475	5.30
1983	104.4	272	2.60
1984	422.6	1124	2.66
1985	751.8	1739	2.31

(a) CIF Ethiopian border or Djibouti - (b) calculated on unrounded figures.

Source: Ministry of Finance - Customs and Excise Administration

Annual External Trade Statistics.

**Table 2 - Industrial Explosives consumption (actual and forecast) in tonnes/y**

	Consumer	Years			
		1985/6 (b)	1986/7 (a)	1990/1	1994/5
Ministry of construction	( ETCA	805	925	1182	1438
	) BATU	15	(		
	( BLUE NILE	16	)		
	) EBCA	10	( 87	110	147
	( BERTA	1	)		
	( NATIONAL ENG.	40			
Mineral Res.Dev.Corp.		30	30	60	100
Eth. Cement Corp.		100	100	150	250
		----	----	-----	-----
	<b>TOTAL</b>	<b>1017</b>	<b>1142</b>	<b>1502</b>	<b>1935</b>

(a) + 15% in 1986/87 and 4% per year afterwards according to ETCA; for the other enterprises under the Ministry of Construction, a rate at least equal to that assumed for the growth of GDP (6 per cent) seems in order (the current three-year plan projects an increase of gross fixed investment of 27 per cent per year in real terms). For ETCA, projections by the Corporation.

Source: Authorities and Corporations listed.

(b) Nearly 100% of the above figures is related to blasting gelatine

### 2.2.2 Plant capacity

The plant should therefore be dimensioned for the production of 2,000 tons per year of dynamite (blasting gelatines) i.e., 8t/d when at full production.

The product will be supplied as follows:

- 50% of total output in cartridges, 200 mm long, 22 or 25 mm diameter
- 50% of total output in plastic tubes, 400mm long, 55mm diameter.

However the above mentioned capacity is far below the minimum economic size presently available on the market for the glycerin nitration plant in particular; consequently, the capacities of the three main sections of the factory (nitration, formulation, packaging) have been selected as specified here below:

a) Nitroglyceroglycol (NG) production department

600 kg/h (that is 2100 t/y), minimum available size.

Note: this production corresponds to 8000 t/y of final dynamite. Although if it is a continuous process it is possible to stop and re-start the production without problems, so the production itself will be regulated according to the need, which is about 528 t/y (of NG).

b) Formulation department

In accordance with NG production.

c) Packaging department

The production could be:

- Cartridges: diameter 22mm, length 200mm; 2 packaging machines (Rollex) each with a capacity of 400 Kg/h.

Total capacity: 2400 TPY

Note: one machine will be sufficient for the 4 t/d of needed production. The second machine will be considered as a spare as recommended.

- Plastic tubes: diameter 55mm, length 400mm; capacity 1000 Kg/h that is 3000 t/y

Total packaging capacity: 5400 t/y

2.3 Sale prices and total revenues

As the product should be sold domestically, the sale price should be not higher than 1330 US \$/ton, which is the estimated average price in A.A. of the imported product.

The total revenue for the envisaged production is:  
2.660.000 US \$/y

Due to the greater plant capacity in comparison with the forecast demand, the possibility of export to the surrounding countries may also be considered.

In this case we have worked out a second scenario with the hypothesis of exporting approximately 6,000 tons of explosive per year (plant therefore operating at full capacity). The export selling price FOB Assab has been



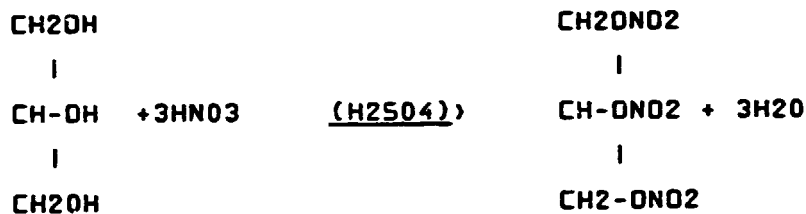
estimated in the range of 1,000 \$/ton that is equivalent to the one for the product exported from Europe plus freight. The total revenues for this scenario when the plant is in full production will be 8,660,000 \$/y.

3. MATERIAL AND INPUTS

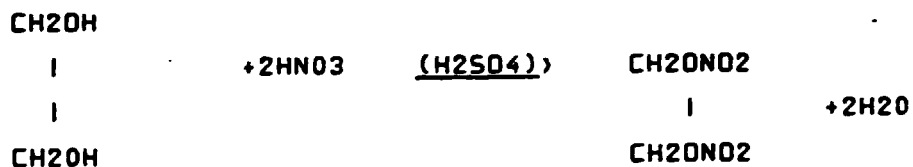
3.1 Chemistry

The initiation process is represented as follows:

3.1.1 Nitroglycerine



3.1.2 Nitroglycol



In practice the nitration of glycerine and glycol is carried out simultaneously in a blend of glycerine and glycol and the obtained product is called nitroglyceroglycol.

Of the raw material involved in these reactions, glycol and nitric acid must be imported, while the others are produced locally.

The following ingredients are required to neutralize the effluents and for the formulation of the explosive: soda carbonate, saw dust, calcium carbonate (all locally produced), nitrocellulose, dinitrotoluene and ammonium nitrate (imported).

3.2 Materials and utilities: requirements and costs

The materials and utilities required are shown in the following tables.

**RAW MATERIALS: REQUIREMENTS AND COSTS** referring to the production of 2000 t/y of dinamite

DESCRIPTION	QUANTITY		UNIT COSTS \$/t		ANNUAL COSTS \$/y		
	t/t final product	t/y	L.C.	F.C.	L.C.	F.C.	Tt
<b>a) NITROGLYCEROL (528 t/y)</b>							
GLYCERINE	0.213	112.464	1,665	-	187,253	-	187,253
GLYCOL	0.219	115.632	-	666	-	100,137	100,137
SULPHURIC ACID (1)	1.024	540.672	310	-	167,608	-	167,608
NITRIC ACID	1.060	559.680	-	455	-	254,654	254,654
SODIUM CARBONATE	0.070	36.960	248	-	9,166	-	9,166
<b>SUB TOTAL</b>	-	-	-	-	<b>364,027</b>	<b>354,791</b>	<b>718,818</b>
RECOVERED SPENT ACID	..586	837.408	38.2	-	-32,000	-	-32,000
<b>NET TOTAL</b>		<b>528.000</b>			<b>332,027</b>	<b>354,791</b>	<b>686,818</b>
<b>b) DYNAMITE (2000 t/y)</b>							
NITROGLYCEROL	0.264	528	628.839	671.952	332,027	354,791	686,818
NITROCELLULOSE	0.014	28	-	4,051	-	113,428	113,428
DINITROTOLUENE	0.050	100	-	973	-	97,300	97,300
AMMONIUM NITRATE	0.640	1,280	-	440	-	563,200	563,200
POWDERED WOOD	0.030	60	138	-	8,280	-	8,280
CALCIUM CARBONATE	0.002	4	46	-	184	-	184
<b>TOTAL</b>		<b>2,000</b>			<b>340,491</b>	<b>1,128,719</b>	<b>1,469,210</b>

(1) The estimated price has been assumed as 310 \$/t instead of 601 (see opportunity study on "furfural")

Packaging materials (on the assumption of the use of cardboard cases with a net weight of 25 Kg of final product), referring to the production of 2000 t/y of dinamite, 50% as cartridges and 50% as plastic tubes.

DESCRIPTION	UNIT OF MESURE	QUANTITY		UNIT COST \$/t		ANNUAL COSTS U.S.\$/y		
		t/t	t/y	LC	FC	LC	FC	Tt
PARAFFIN	ton	0.0043	8.75	-	929	-	8,128	8,128
PAPER	ton	0.017	35.25	1,481	-	52,205	-	52,205
POLYTHENE TUBES AND BAGS	ton	0.007	14.00	-	2,621	-	36,694	36,694
CARDBOARD CASES	n°	40	80,000	1.23	-	98,400	-	98,400
<b>TOTAL</b>	/	/	/	/	/	150,605	44,822	195,427

Total consumption of utilities (referring to the production of 2000 t/y of dynamite)

DESCRIPTION	UNIT OF MEASURE	QUANTITY		UNIT COSTS \$		ANNUAL COSTS \$/y		
		u/t	u/y	LC	FC	LC	FC	Tt
ELECTRIC POWER	kWh	162	324,000	0.09660	-	31,298	-	31,298
WATER (20°C-4 bar)	m <sup>3</sup>	100	200,000	0.01401	-	2,802	-	2,802
TOTAL						34,100	-	34,100

TOTAL COST OF RAW MATERIALS, PACKAGING AND UTILITIES  
FOR 1 TON OF EXPLOSIVE:

$$\frac{1,469,210 + 195,427 + 34,100}{2,000} = \frac{1,698,737}{2,000} = 849.4 \text{ \$/t}$$

3.2.1 Characteristics of main raw materials, intermediate and by-products (spent acid)

Raw materials

Glycerine

Purity: 99.5%

Density (20°C): 1.26

B.P. (760mm Hg): 290°C

Glycol

Purity: 99%

Density (20°C): 1.11

B.P. (760 mm Hg): 198°C

Sulphuric acid

Sulphuric acid is oleum with 8% or more of SO<sub>3</sub> content. Supplied in tank trucks of about 20-25 tons or in special drums of about 380 Kg gross weight (about 50 kg tare).

The material of the tanks and drums is carbon steel.

Nitric acid

Concentration: 98-99% (D 15°C = sp. 1.51)

Must be free of nitrous acid. Supplied in tank trucks of approx. 25 tons.

Material of the tank: stainless steel.

Sodium carbonate

Commercial grade. Generally supplied in paper bags of 20-25 Kg content.

**Nitroglycerine / Ethylen glycoldinitrate**

- Appearance : oily liquid
- Stability at 80°C (Abel Test) : 15 minutes

**Nitrocellulose**

- Appearance : mechanical impurities  
and foreign matter:  
absent
- Nitrogen content : 12.2 - 12.3%
- Solubility in ether-alcohol : more than 99%
- Ash content : not more than 0.4%
- Stability at 80°C  
(Abel heat test) : more than 18 minutes
- Water content : at least 30% to  
permit safe  
transport, less than  
15% as component of  
explosives

**Dinitrotoluene (DNT)**

- Appearance : semi-solid mass
- Colour : brown yellow
- Colour of the melt : brown yellow limpid
- Solidification point : 25 - 35°C
- Acidity : max. 0.005% (as  
Sulphuric acid)
- Alcohol or benzene insoluble : none
- Moisture : max 0.3%
- Stability at 80°C  
(Abel heat test) : more than 60 minutes



**Ammonium nitrate**

- Appearance : white crystals or prills
- Assay : min. 99,5%
- Nitrites : nil
- Moisture : max 0,2%
- Anti-caking agent : max 0,1%
- Bulk density : 0,70 - 0,80 kg/l

**Powdered wood**

Must be of small particle size and free of coarse material.

Supplied in paper bags of about 25 kg

**Calcium carbonate**

Commercial grade. Supplied in paper bags of 25 kg

**Packaging materials**

**Paraffin**

- Appearance : colourless, semi-transparent; no odour or taste
- Melting point : 50 - 55°C
- Reaction : neutral
- Sulphuric acid test : no alteration, no darkening of the acid

**Paper for cartridges**

- Single-side calendered paper
- Colour : red
- Weight : 80 - 100 g/sq m

- Coils dia. : 600 mm
- Coils hole dia. : 70 mm

**Polyethylene for tubes and bags**

- Width : 40 to 450 mm
- Lengths : various
- Colour : neutral - black  
colour admissible

The polyethylene can be supplied with "antistatic" treatment.

**Corrugated cardboard boxes**

Thickness of cardboard: 0.956 kg/m<sup>2</sup>. Box size: 250x400x215 mm. Content: 25 kg of explosive.

**By product**

The only by product that comes from the explosive manufacture is the so called "Spent acid". Its composition is about:

sulphuric acid	67%
nitric acid	8%
water	25%
density	1.55 about

One of the possible utilizations of this acid is the production of fertilizers, to which it could be devoted, practically free of charge (see table "Raw materials: requirements and costs").

**RAW MATERIALS PURCHASING PROGRAMME AND STORAGE VOLUMES**

PRODUCT	ORIGIN (1)	PURCHASING PROGRAMME t/month(2)	AVERAGE STOCK ton	N°	STORAGE TANKS CAPACITY (CU. MT)		MATERIAL (3)	WAREHOUSE SURFACE (SQ. MT)
					one unit	total		
GLYCERINE	L	10 / 1	5	2	10	20	C	
GLYCOL	I	60 / 6	30	3	30	90	C	
SULPHURIC ACID (5)	L	50 / 1	25	3	30	90	C	
NITRIC ACID (5)	I	75/1.5(6)	37.5	3	50	150	A	
SODIUM CARBONATE	L	3.5/1	1.7					/
NITROCELLULOSE (NC)	I	15/6	7					50
DINITROTOLUENE (DNT)	I	50/6	25					40
AMMONIUM NITRATE	I	650/6	325					1300
POWDERED WOOD	L	5/1	2.5					25
CALCIUM CARBONATE	L	0.3/1	2					1
PACKAGING MATERIAL (paraffine paper polythene tubes and bags-cardboard cases)	(L(75%) - )I (25%)	6/1	4					200
SPENT ACID (5)	L	74/1	37	1	50	50	SS	
<b>TOTALS</b>			/	12	/	400		1623

- (1) L = local      I = imported
- (2) The first figure points out the amount (tonnes) of each purchase; the second one the time (months) between two successive purchases
- (3) C = carbon steel    SS = stainless steel AISI 304    A = aluminium 99.5%
- (4) The storage volumes exceed the supply volumes, having taken into account the opportunity of an initial stock
- (5) The storage volume will be completed with 2x25 cu.m additional stainless steel tanks for the mixture of sulphuric and nitric acid needed for a week's production (one in the emptying phase, feeding the process, the other one in the filling phase or ready for quality check).
- (6) In the financial evaluation six months will be considered, as it is an import item; but from the technical point of view 1.5 would be better, since nitric acid suffers a decay after a long storing period.

4. LOCATION

The ideal location of the plant would be in the neighbourhood of an industrial area provided with transportation facilities. Due to the potential danger of the product it is advisable to built the plant not very close to urban or highly industrialized areas.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The process consists of 3 main steps.

**Nitroglyceroglycol (NG)**

The first process, or nitration step, consists of the reaction between a mixture of sulphuric and nitric acid and a mixture of glycerine and glycol.

Because of the characteristics of the final product the process is carried out continuously, since a small amount of explosive is involved in the system at a given time, according to the Biazzi Process.

The nitrator is designed to permit rapid reaction through rapid heat absorption. In a special separator the acid layer (spent-acid) is removed and the nitroglyceroglycol is washed and neutralized with a sodium carbonate solution.

The process is completely automated. Nitration, separation, spent-acid stabilization, washing, transfer, storage and weighing are carried out in accordance with a time programme without the direct intervention of personnel. The development of the entire programme can be followed from a control room, although the presence of an operator is strictly required only for a few minutes during the start up and shut down phases. This control room is located at a safe distance from the nitration house. The equipment is made of stainless steel and the process can easily be stopped and started. The NG, from the nitration plant, is transferred to a storage tank by water as emulsion. Then the

transportation water is separated and the emulsified NG is dried and weighed for the formulation.

### **Formulation**

The required quantity of nitrocellulose is introduced into a special stainless steel open vessel where, in the following order, the NG, the dinitrotoluene, the ammonium nitrate, the powdered wood and calcium carbonate are added. The loaded vessel is then manually transferred to the mixing room where the mixing operation will be carried out by means of a special planetary mixer.

This latter operation is carried out without the presence of personnel and it is started from a "Remote control" area.

The stirring stops automatically after a pre-fixed time.

### **Packaging**

The above mentioned stainless steel vessels are then manually transferred to the cartridge packaging room. The product is poured into hopper which feeds the packaging machine.

For the manufacturing of the smaller cartridges (diameter 25mm, length 200mm) the product is rolled with paraffined paper and the rolls collected in polythene bags of 2.5 kg each. Ten of these filled bags are then introduced into a corrugated card-board case for a total net weight of 25 kg.

For the manufacturing of the polythene tubes (diameter

55mm, length 400mm) the product is automatically introduced into polythene tubes whose endpoints are then closed.

The polythene tubes, prepared in this way, are then introduced into a corrugated cardboard case to give a total net weight of 25 kg.

All the abovementioned process steps are shown in the following schemes:

- B.162 - 2 - 3 FLOW DIAGRAM OF GLYCERINE-GLICOL NITRATION UNIT.
- B.162 - 2 - 2 PROCESS BLOCK DIAGRAM

## 5.2 Layout and civil works

The attached layout shows the battery limits of the various process plant sections.

The buildings inside and outside the process plant are listed in the table 5.2

Due to obvious safety reasons, the plant consists of very small units spread out over a very large area. The total surface enclosed within the fence amounts to 210,000 sq.mt, subdivided in three main zones: process plants (about 45,000 sq.mt), storage area (about 43,000 sq.mt) and free area between these two of 120,000 sq.mt. In addition another 400 m wide area will be freed of building all around the fence.

All the roads inside the factory should be protected by side embankments; in addition near some process units the paving (shaded on the drawing) must be particularly smooth to minimize the results of vibration.

All the buildings are single-storeyed and consist of brickwork walls and corrugated asbestos-cement roofs.

The fence is made of steel wire netting supported by poles of reinforced concrete.



Table 5.2

BUILDINGS

DESTINATION	No. of blgs	Surface of each sq.mt	Max explosive stock (Kg)
Nitration	1	41	300
Refrig+services+remote control	1	237	-
NG deposit	1	35	1200
NG weighing	1	15	450
NC weighing	1	72	200
JNT weighing	1	24	400
Loading of components + NA	1	120	750
Grinding NA	1	160	-
Mixing	2	44	250
Rollex cartridging	2	108	400
LD-EX-701 cartridging house	1	54	400
Packaging house	3	120	250
(a) SUB TOTAL m2		1030	1030
Laboratory	1	150	-
Workshop	1	200	-
Offices (administration, social facilities, gate house, etc)	2	400	-
Electric compartment	1	80	
Warehouse for raw materials in bags or drums	1	1662	
Warehouse for one month of finished product (1)	10	1280	
(b) SUB TOTAL m2		3772	3772
(a + b) TOTAL			4802

(1) see footnote in the next page

**5.3 Investment costs of machinery and equipment;  
depreciation; maintenance**

	L	F	TOT.
	M\$	M\$	M\$
Machinery and equipments			
FOB European port	0.286	3.692	3.978
Transportation	0.380	0.369	0.749
Erection	0.169	0.507	0.676
Site preparation	0.2	-	0.2
Civil works	1.6	-	1.6
Insulation and painting	0.04	0.04	0.08
Spare parts	-	0.198	0.198
	-----		
TOTAL	2.675	4.806	7.481
Contingencies	0.225	0.394	0.619
	-----		
GRAND TOTAL	2.900	5.200	8.100

(1) Note from the previous page.

Ten buildings measuring 8x12 m, spaced with an interval of 35m between each other and at a distance of 300-400m from the external wall of the factory buildings. Eight of these buildings; are for the storage of the finished product, one for the safety fuses and one for the detonators. The two latter products are not produced in the factory, but bought by specialized firms.

- The life cycle of the plant can be considered as 15 years
- Annual cost for maintenance has been assumed as equivalent to approximately 3% of the total investment cost required for machinery and other equipment.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

machinery	FC	5.200 million \$
machinery	LC	0.875 million \$
civil works	LC	1.825 million \$
site preparation	LC	0.200 million \$
		-----
Total		8.100 million \$

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit, complete with utilities and facilities operating under the direction of NCC.

7. MANPOWER

No particular skills are required of the personnel except for the safety officer, transportation officer, drivers, production manager, shift foremen chemist, storekeeper, chief engineer, who have through training in the technology involved in the process as well as in the safety rules to be observed in the working and handling of the explosives. For all the other positions the same skill as in every other chemical factory are required.

7.1 Management

		birr/m	birr/y
General manager	1	1500	
Technical manager	1	1200	
	--	-----	-----
	2	2700	32,400
			(15652 \$/y)

7.2 Administrative dept.

Finance manager	1	800
Senior accountant	1	400
Accountants	3	1050
Purchasing dept.head	1	400
Purchasing assistant	1	350
Store head	1	400
Store assist.	2	700
Transport officer	1	700
Drivers	4	1600

		birr/m	birr/y
Safety manager	1	700	
Guards	12	1800	
Secretaries	4	1400	
	--	-----	
	32	10300	123,600
			(59,710 \$/y)
Total management and administrative de...			156,000 b/y
			(75362 \$/y)

**7.3 Production and maintenance department**

Production dept

Production manager	1	1000	
Shift foremen	8	3200	
Shift operators	32	11200	
Semi-skilled operators	32	9600	
Chemist	1	800	
Analysts	4	1400	
Clerks	2	700	
Unskilled workers	4	800	
	--	-----	-----
	84	28700	344 400
			(166,376 \$/y)

Engineering dept.

Chief engineer	1	1000
Engineers	4	2800
Workshop head	1	700
Foremen	3	1200

Welders	2	800	
Electricians	4	1600	
Mechanics	6	2400	
Clerk	2	700	
Unskilled workers	6	1200	
	--	----	-----
	29	12400	148,800
			(71,884 \$/y)

8. IMPLEMENTATION SCHEDULING

From the moment the investment is decided and relevant financing finalized, 30 months are needed to the moment the plant can start up.



9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (two years) has been taken into account and indicated as "foreign factory overheads"
- packaging costs have been included in "other raw material"
- the production programme has been assumed in two alternatives, as follows:

Scenario A

From the 1st to the 15th year: 2000 t/y Dynamite (25% capacity)

Selling price 1330 \$/t

Scenario B

The 1st year: 2000 t/y Dynamite (25% capacity)

The 2nd year: 2400 t/y (30% capacity) out of which 400 t/y for export.

The 3rd year: 4000 t/y (50% capacity) out of which 2000 t/y for export.

The 4th year: 6400 t/y (80% capacity) out of which 4400 t/y for export.

From the 5th to the 15th year: 8000 t/y (100% capacity) out of which 6000 t/y for export.

Selling price: 1330 \$/t for domestic market  
1000 \$/t for export market

As a result the evaluation yields an IRR of 1.55% for the Scenario A and 4.91% for the Scenario B; for this last alternative the estimated BEP results 30%.

10. FOREIGN EXCHANGE EFFECT

The foreign exchange effect shown in Annexe 2 has been estimated for the Scenario B only (for the Scenario A, the foreign exchange effect is negligible being 393,000 \$).

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR, Scenario B, for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import equal to 1000 \$/t CIF Assab (the present price in Addis Abeba is 1330 \$/t)

By discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the net foreign exchange effect amounting to 9,813,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 9,813,000 \$

Industrial explosives

ANNEXE 1

FINANCIAL ANALYSIS  
FOR SCENARIO A

Production of 2,000 tons/year



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Scenario A - Max. Production: 2000 t/y

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	8703.00	64.828 % foreign
current assets:	0.00	0.000 % foreign
total assets:	8703.00	64.828 % foreign

**Source of funds during construction phase**

equity & grants:	3841.00	0.000 % foreign
foreign loans :	4420.00	
local loans :	0.00	
total funds :	8261.00	53.504 % foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	2100.36	2100.36	2040.36
depreciation :	568.65	568.65	548.65
interest :	442.00	386.75	331.50
production costs	3111.01	3055.76	2920.51
thereof foreign	65.91 %	65.29 %	64.37 %
total sales :	2660.00	2660.00	2660.00
gross income :	-451.01	-395.76	-260.51
net income :	-451.01	-395.76	-260.51
cash balance :	-1395.94	-379.61	-251.86
net cashflow :	-401.44	559.64	632.14

Net Present Value at: 10.00 % = -4112.39

Internal Rate of Return on total investments: 1.55 %

Equity paid versus Net income flow (IRR): -11.54 %

Net Worth versus Net Cash Return (IRR): -0.54 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US \$**

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	50.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	550.00	550.00	550.00	175.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . . . .	304.00	910.00	1822.00	2430.00	609.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>454.00</b>	<b>1510.00</b>	<b>2372.00</b>	<b>2980.00</b>	<b>784.00</b>	<b>0.00</b>
<b>Pre-production capital expenditures. Net working capital . . . . .</b>	<b>5.00</b> <b>0.00</b>	<b>15.00</b> <b>0.00</b>	<b>15.00</b> <b>0.00</b>	<b>50.00</b> <b>0.00</b>	<b>297.00</b> <b>0.00</b>	<b>221.00</b> <b>0.00</b>
<b>Total initial investment costs . . . . .</b>	<b>459.00</b>	<b>1525.00</b>	<b>2387.00</b>	<b>3030.00</b>	<b>1081.00</b>	<b>221.00</b>
<b>Of it foreign, in L . . . . .</b>	<b>56.64</b>	<b>51.15</b>	<b>65.35</b>	<b>68.65</b>	<b>68.55</b>	<b>100.00</b>

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**Total Current Investment in 1000 US \$**

Year . . . . .	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	961.08	0.00	-12.50
<b>Total current investment costs . . . . .</b>	<b>961.08</b>	<b>0.00</b>	<b>-12.50</b>
<b>Of it foreign, 1 . . . . .</b>	<b>86.22</b>	<b>0.00</b>	<b>0.00</b>



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Total Production Costs in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	25.00	25.00	25.00	25.00	25.00	25.00
Raw material 1 . . . . .	1469.21	1469.21	1469.21	1469.21	1469.21	1469.21
Other raw materials . . . . .	195.43	195.43	195.43	195.43	195.43	195.43
Utilities . . . . .	2.80	2.80	2.80	2.80	2.80	2.80
Energy . . . . .	31.30	31.30	31.30	31.30	31.30	31.30
Labour, direct . . . . .	166.38	166.38	166.38	166.38	166.38	166.38
Repair, maintenance . . . . .	71.88	71.88	71.88	71.88	71.88	71.88
Spares . . . . .	28.00	28.00	28.00	28.00	28.00	28.00
Factory overheads . . . . .	60.00	60.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	2025.00	2025.00	1965.00	1965.00	1965.00	1965.00
Administrative overheads . . . . .	75.36	75.36	75.36	75.36	75.36	75.36
indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	568.65	568.65	548.65	528.65	528.65	496.45
Financial costs . . . . .	442.00	386.75	331.50	276.25	221.00	165.75
Total production costs . . . . .	3111.01	3055.76	2920.51	2845.26	2790.01	2702.56
Costs per unit ( single product ) .	1.56	1.53	1.46	1.42	1.40	1.35
Of it foreign, % . . . . .	65.91	65.29	64.37	64.13	63.42	63.43
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	241.74	241.74	241.74	241.74	241.74	241.74





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**Total Production Costs in 1000 US \$**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	25.00	25.00	25.00	25.00	25.00	25.00
Raw material I . . . . .	1469.21	1469.21	1469.21	1469.21	1469.21	1469.21
Other raw materials . . . . .	195.43	195.43	195.43	195.43	195.43	195.43
Utilities . . . . .	2.80	2.80	2.80	2.80	2.80	2.80
Energy . . . . .	31.30	31.30	31.30	31.30	31.30	31.30
Labour, direct . . . . .	166.38	166.38	166.38	166.38	166.38	166.38
Repair, maintenance . . . . .	71.88	71.88	71.88	71.88	71.88	71.88
Spares . . . . .	28.00	28.00	28.00	28.00	28.00	28.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1965.00</b>	<b>1965.00</b>	<b>1965.00</b>	<b>1965.00</b>	<b>1965.00</b>	<b>1965.00</b>
Administrative overheads . . . . .	75.36	75.36	75.36	75.36	75.36	75.36
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	496.45	496.45	496.45	405.20	199.86	0.00
Financial costs . . . . .	110.50	55.25	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>2647.31</b>	<b>2592.06</b>	<b>2536.81</b>	<b>2445.56</b>	<b>2240.22</b>	<b>2040.36</b>
<b>Costs per unit ( single product ) .</b>	<b>1.32</b>	<b>1.30</b>	<b>1.27</b>	<b>1.22</b>	<b>1.12</b>	<b>1.02</b>
Of it foreign, % . . . . .	62.66	61.87	61.04	63.31	61.27	58.89
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>241.74</b>	<b>241.74</b>	<b>241.74</b>	<b>241.74</b>	<b>241.74</b>	<b>241.74</b>



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**Net Working Capital in 1000 US \$**

Year		1990	1991	1992	1993-2004
Coverage	odc coto				
<b>Current assets &amp;</b>					
Accounts receivable	30 12.0	175.03	175.03	170.63	170.03
Inventory and materials	136 2.7	627.70	627.70	627.70	627.70
Energy	1 360.0	0.09	0.09	0.09	0.09
Spares	360 1.0	28.00	28.00	28.00	28.06
Work in progress	1 360.0	5.62	5.62	5.46	5.46
Finished products	30 12.0	175.03	175.03	170.63	170.03
Cash in hand	15 24.0	16.73	16.73	14.23	14.23
Total current assets		1028.21	1028.21	1015.54	1015.54
<b>Current liabilities and</b>					
Accounts payable	12 29.5	67.13	67.13	66.96	66.96
Net working capital		961.08	961.08	948.58	948.58
Increase in working capital		961.08	0.00	-12.50	0.00
Net working capital, local		132.39	132.39	132.39	132.39
Net working capital, foreign		828.69	828.69	816.19	816.19

Note: odc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	3841.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	4420.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	4420.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	221.00
Total funds .....	8261.00	0.00	221.00

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Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50
Current liabilities	67.13	0.00	-0.17	0.00	0.00	0.00	0.00
Bank overdraft ....	1395.94	379.61	251.86	209.11	153.86	98.61	49.70
Total funds .....	910.57	-172.89	-300.81	-343.39	-398.64	-453.89	-502.80

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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1997	1998-99	2000- 2	2003
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-552.50	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-552.50	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	22.00	-558.05	-512.42	-349.42
Total funds .....	-530.42	-558.05	-512.42	-349.42

INDUSTRIAL EXPLOSIVES --- February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	8261.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	8261.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	459.00	1525.00	2387.00	3030.00	1081.00	221.00
Total assets . . . .	459.00	1525.00	2387.00	3030.00	860.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	221.00	221.00
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	7802.00	-1525.00	-2387.00	-3030.00	-1081.00	-221.00
Cumulated cash balance	7802.00	6277.00	3890.00	860.00	-221.00	-442.00
Inflow, local . . . .	3841.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	199.00	745.00	827.00	950.00	340.00	0.00
Surplus ( deficit ) .	3642.00	-745.00	-827.00	-950.00	-340.00	0.00
Inflow, foreign . . .	4420.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	260.00	780.00	1560.00	2080.00	741.00	221.00
Surplus ( deficit ) .	4160.00	-780.00	-1560.00	-2080.00	-741.00	-221.00
Net cashflow . . . . .	-459.00	-1525.00	-2387.00	-3030.00	-860.00	0.00
Cumulated net cashflow	-459.00	-1984.00	-4371.00	-7401.00	-8261.00	-8261.00



COMFAR 2.0 - SALES & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2727.13	2660.00	2660.00	2660.00	2660.00	2660.00
Financial resources .	67.13	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	2660.00	2660.00	2660.00	2660.00	2660.00	2660.00
Total cash outflow . .	4123.07	3039.61	2911.86	2869.11	2813.86	2756.61
Total assets . . . .	1028.21	0.00	-12.67	0.00	0.00	0.00
Operating costs . . .	2100.36	2100.36	2040.36	2040.36	2040.36	2040.36
Cost of finance . . .	442.00	386.75	331.50	276.25	221.00	165.75
Repayment . . . . .	552.50	552.50	552.67	552.50	552.50	552.50
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1395.94	-379.61	-251.86	-209.11	-153.86	-98.61
Cumulated cash balance	-1857.94	-2217.55	-2469.41	-2678.52	-2832.38	-2930.99
Inflow, local . . . .	2723.62	2660.00	2660.00	2660.00	2660.00	2660.00
Outflow, local . . . .	1034.83	838.82	838.82	836.82	838.62	838.82
Surplus ( deficit ) .	1688.79	1821.18	1821.18	1821.18	1821.18	1821.18
Inflow, foreign . . . .	3.50	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	3088.24	2200.79	2073.04	2030.29	1975.04	1919.79
Surplus ( deficit ) .	-3084.73	-2200.79	-2073.04	-2030.29	-1975.04	-1919.79
Net cashflow . . . . .	-401.44	559.64	632.14	619.64	619.64	619.64
Cumulated net cashflow	-8652.44	-8102.80	-7470.66	-6851.02	-6231.38	-5611.74



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COMFAR 2.0 - BALING & CO. S.R.L., HILANG

Cashflow tables, production in 1000 US \$

Year .....	1996	1997	1998	1999	2000	2001
Total cash inflow ..	2660.00	2660.00	2660.00	2660.00	2660.00	2660.00
Financial resources ..	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	2660.00	2660.00	2660.00	2660.00	2660.00	2660.00
Total cash outflow ..	2709.70	2682.08	2101.95	2101.95	2147.58	2147.58
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs .....	2040.36	2040.36	2040.36	2040.36	2040.36	2040.36
Cost of finance .....	110.50	55.25	0.00	0.00	0.00	0.00
Repayment .....	552.50	552.50	0.00	0.00	0.00	0.00
Corporate tax .....	6.34	33.97	61.59	61.59	107.22	107.22
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) ..	-49.70	-22.08	558.05	558.05	512.42	512.42
Cumulated cash balance	-2980.69	-3002.77	-2444.72	-1886.68	-1374.26	-861.83
Inflow, local .....	2660.00	2660.00	2660.00	2660.00	2660.00	2660.00
Outflow, local .....	845.16	872.79	900.41	900.41	946.04	946.04
Surplus ( deficit ) ..	1814.84	1787.21	1759.59	1759.59	1713.96	1713.96
Inflow, foreign .....	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign .....	1864.54	1809.29	1201.54	1201.54	1201.54	1201.54
Surplus ( deficit ) ..	-1864.54	-1809.29	-1201.54	-1201.54	-1201.54	-1201.54
Net cashflow .....	613.30	585.67	558.05	558.05	512.42	512.42
Cumulated net cashflow	-4998.44	-4412.77	-3854.73	-3296.68	-2784.26	-2271.63



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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	2660.00	2660.00	2660.00
Financial resources . .	0.00	0.00	0.00
Sales, net of tax . .	2660.00	2660.00	2660.00
Total cash outflow . .	2147.58	2250.25	2350.18
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2040.36	2040.36	2040.36
Cost of finance . . .	0.00	0.00	0.00
Resaveent . . . . .	0.00	0.00	0.00
Corporate tax . . .	107.22	209.89	309.82
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) . .	512.42	409.75	309.82
Cumulated cash balance	-349.41	60.34	370.16
Inflow, local . . . .	2660.00	2660.00	2660.00
Outflow, local . . . .	946.04	1048.71	1148.64
Surplus ( deficit ) . .	1713.96	1611.29	1511.36
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	1201.54	1201.54	1201.54
Surplus ( deficit ) . .	-1201.54	-1201.54	-1201.54
Net cashflow . . . . .	512.42	409.75	309.82
Cumulated net cashflow	-1759.41	-1349.66	-1039.84





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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

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**Cashflow Discountings:**

a) Equity paid versus Net income flow:		
Net present value .....	-4354.14 at	10.00 %
Internal Rate of Return (IRRE1) ..	-11.54 %	
b) Net Worth versus Net cash returns:		
Net present value .....	-4186.15 at	10.00 %
Internal Rate of Return (IRRE2) ..	-0.54 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-4112.39 at	10.00 %
Internal Rate of Return ( IRR ) ..	1.55 %	

Net Worth = Equity paid plus reserves

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INDUSTRIAL EXPLOSIVES — February 92



CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
variable margin . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2669.01	2669.01	2589.01	2569.01	2569.01
Operational margin . . . . .	-9.01	-9.01	70.99	90.99	90.99
As % of total sales . . . . .	-0.34	-0.34	2.67	3.42	3.42
Cost of finance . . . . .	442.00	386.75	331.50	276.25	221.00
Gross profit . . . . .	-451.01	-395.76	-260.51	-185.26	-130.01
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-451.01	-395.76	-260.51	-185.26	-130.01
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-451.01	-395.76	-260.51	-185.26	-130.01
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-451.01	-395.76	-260.51	-185.26	-130.01
Accumulated undistributed profit . . .	-451.01	-846.78	-1107.29	-1292.55	-1422.56
Gross profit, % of total sales . . . .	-16.96	-14.88	-9.79	-6.96	-4.89
Net profit, % of total sales . . . .	-16.96	-14.88	-9.79	-6.96	-4.89
ROE, Net profit, % of equity . . . .	-11.74	-10.30	-6.78	-4.82	-3.38
ROI, Net profit+interest, % of invest.	-0.10	-0.10	0.77	0.99	0.99



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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2536.81	2536.81	2536.81	2536.81	2536.81
Operational margin . . . . .	123.19	123.19	123.19	123.19	123.19
As % of total sales . . . . .	4.63	4.63	4.63	4.63	4.63
Cost of finance . . . . .	165.75	110.50	55.25	0.00	0.00
Gross profit . . . . .	-42.56	12.69	67.94	123.19	123.19
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-42.56	12.69	67.94	123.19	123.19
Tax . . . . .	0.00	6.34	33.97	61.59	61.59
Net profit . . . . .	-42.56	6.34	33.97	61.59	61.59
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-42.56	6.34	33.97	61.59	61.59
Accumulated undistributed profit . . .	-1465.13	-1458.78	-1424.82	-1363.22	-1301.63
Gross profit, % of total sales . . . . .	-1.60	0.48	2.55	4.63	4.63
Net profit, % of total sales . . . . .	-1.60	0.24	1.28	2.32	2.32
ROE, Net profit, % of equity . . . . .	-1.11	0.17	0.88	1.60	1.60
ROI, Net profit+interest, % of invest.	1.34	1.27	0.97	0.67	0.67



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2445.56	2445.56	2445.56	2240.22	2040.36
Operational margin . . . . .	214.44	214.44	214.44	419.78	619.64
As % of total sales . . . . .	8.06	8.06	8.06	15.78	23.29
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	214.44	214.44	214.44	419.78	619.64
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	214.44	214.44	214.44	419.78	619.64
Tax . . . . .	107.22	107.22	107.22	209.89	309.82
Net profit . . . . .	107.22	107.22	107.22	209.89	309.82
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	107.22	107.22	107.22	209.89	309.82
Accumulated undistributed profit . . .	-1194.41	-1087.19	-979.97	-776.08	-460.26
Gross profit, % of total sales . . . . .	8.06	8.06	8.06	15.78	23.29
Net profit, % of total sales . . . . .	4.03	4.03	4.03	7.89	11.65
ROE, Net profit, % of equity . . . . .	2.79	2.79	2.79	5.46	8.07
ROI, Net profit+interest, % of invest.	1.16	1.16	1.16	2.28	3.36



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Total assets .....</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8482.00</b>	<b>8703.00</b>
Fixed assets, net of depreciation	0.00	459.00	1984.00	4371.00	7401.00	8487.00
Construction in progress .....	459.00	1525.00	2387.00	3030.00	1081.00	221.00
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available ..	7802.00	6277.00	3890.00	860.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8261.00</b>	<b>8482.00</b>	<b>8703.00</b>
Equity capital .....	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	4420.00	4420.00	4420.00	4420.00	4420.00	4420.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required ..	0.00	0.00	0.00	0.00	221.00	442.00
<b>Total debt .....</b>	<b>4420.00</b>	<b>4420.00</b>	<b>4420.00</b>	<b>4420.00</b>	<b>4641.00</b>	<b>4862.00</b>
<b>Equity, % of liabilities .....</b>	<b>46.50</b>	<b>46.50</b>	<b>46.50</b>	<b>46.50</b>	<b>45.28</b>	<b>44.13</b>



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1990	1991	1992	1993	1994	1995
Total assets	9613.57	9440.68	9139.87	8796.48	8397.84	7943.95
Fixed assets, net of depreciation	8134.35	7565.69	7017.04	6488.39	5959.74	5463.28
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	1011.47	1011.47	1001.31	1001.31	1001.31	1001.31
Cash, bank	16.73	16.73	14.23	14.23	14.23	14.23
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward	0.00	451.01	846.78	1107.29	1292.55	1422.56
Loss	451.01	395.76	260.51	185.26	130.01	42.56
Total liabilities	9613.57	9440.68	9139.87	8796.48	8397.84	7943.95
Equity capital	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	3867.50	3315.00	2762.50	2210.00	1657.50	1105.00
Current liabilities	67.13	67.13	66.96	66.96	66.96	66.96
Bank overdraft, finance required	1837.94	2217.55	2469.41	2678.52	2832.38	2930.99
Total debt	5772.57	5599.68	5298.87	4955.48	4556.84	4102.95
Equity, % of liabilities	39.95	40.69	42.02	43.67	45.74	48.35



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	7447.50	6944.70	6414.28	5856.24	5389.44	4877.02
Fixed assets, net of depreciation	4966.83	4470.38	3973.92	3477.47	3072.27	2667.06
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1001.31	1001.31	1001.31	1001.31	1001.31	1001.31
Cash, bank .....	14.23	14.23	14.23	14.23	14.23	14.23
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	1465.13	1458.78	1424.82	1363.22	1301.63	1194.41
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	7447.50	6944.70	6414.28	5856.24	5389.44	4877.02
Equity capital .....	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	6.34	33.97	61.59	61.59	107.22	107.22
Long and medium term debt .....	552.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	66.96	66.96	66.96	66.96	66.96	66.96
Bank overdraft, finance required ..	2980.70	3002.78	2444.73	1884.68	1374.26	861.84
Total debt .....	3600.16	3069.74	2511.69	1953.64	1441.22	928.80
Equity, % of liabilities .....	51.57	55.31	59.88	65.59	71.27	78.76



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COMEFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

year	2002	2003	2004
Total assets	4364.60	4117.85	4217.78
Fixed assets, net of depreciation	2261.86	2062.00	2062.00
Construction in progress	0.00	0.00	0.00
Current assets	1001.31	1001.31	1001.31
Cash, bank	14.23	14.23	14.23
Cash surplus, finance available	0.00	60.33	370.15
Loss carried forward	1087.19	979.97	770.08
Loss	0.00	0.00	0.00
Total liabilities	4364.60	4117.85	4217.78
Equity capital	3841.00	3841.00	3841.00
Reserves, retained profit	0.00	0.00	0.00
Profit	107.22	209.89	309.82
Long and medium term debt	0.00	0.00	0.00
Current liabilities	66.96	66.96	66.96
Bank overdraft, finance required	349.42	0.00	0.00
Total debt	416.38	66.96	66.96
Equity, % of liabilities	88.00	93.28	91.07



**Industrial explosives**

**ANNEXE 2**

**FINANCIAL ANALYSIS**  
**FOR SCENARIO B**

**Production of 6,000 tons/year**



CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

INDUSTRIAL EXPLOSIVES  
 February 88  
 Scenario B - Max Production: 8000 t/y

3 year(s) of construction, 15 years of production  
 currency conversion rates:  
 foreign currency 1 unit = 1.0000 units accounting currency  
 local currency 1 unit = 1.0000 units accounting currency  
 accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	6703.00	64.828 % foreign
current assets:	0.00	0.000 % foreign
total assets:	6703.00	64.828 % foreign

**Source of funds during construction phase**

equity & grants:	3841.00	0.000 % foreign
foreign loans:	4420.00	
local loans:	0.00	
total funds:	8261.00	53.504 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	2100.36	2445.11	3766.09
depreciation :	568.65	568.65	548.65
interest :	442.00	386.75	331.50
production costs	3111.01	3400.51	4646.24
thereof foreign	65.91 %	65.72 %	66.30 %
total sales :	2660.00	3060.00	4660.00
gross income :	-451.01	-340.51	13.76
net income :	-451.01	-340.51	6.88
cash balance :	-1395.94	-504.12	-705.93
net cashflow :	-401.44	435.13	178.07

Net Present Value at: 10.00 % = -3204.40  
 Internal Rate of Return on total investment: 4.91 %  
 Equity paid versus Net income flow (IRRZ): 1.71 %  
 Net Worth versus Net Cash Return (IRRZ): 3.88 %

**Index of Schedules produced by CONFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Initial Investment in 1,000 US \$**

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	50.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	550.00	550.00	550.00	175.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	304.00	910.00	1822.00	2430.00	609.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>454.00</b>	<b>1510.00</b>	<b>2372.00</b>	<b>2980.00</b>	<b>784.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	50.00	297.00	221.00
Net working capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>459.00</b>	<b>1525.00</b>	<b>2387.00</b>	<b>3030.00</b>	<b>1081.00</b>	<b>221.00</b>
<b>Of it foreign, in % . . . . .</b>	<b>56.64</b>	<b>51.15</b>	<b>65.35</b>	<b>68.65</b>	<b>68.55</b>	<b>100.00</b>

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994
<b>Fixed investment costs</b>					
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00
Working capital . . . . .	961.08	179.76	708.96	1063.41	721.47
<b>Total current investment costs . . .</b>	<b>961.08</b>	<b>179.76</b>	<b>708.96</b>	<b>1063.41</b>	<b>721.47</b>
Of it foreign, % . . . . .	86.22	90.40	90.27	90.45	90.44

**Total Production Costs in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
Z of max. capacity (single product).	25.00	30.00	50.00	80.00	100.00	100.00
Raw material I .....	1469.21	1763.05	2938.42	4701.47	5876.84	5876.84
Other raw materials .....	195.43	234.52	390.85	625.37	781.71	781.71
Utilities .....	2.80	3.36	5.60	8.97	11.21	11.21
Energy .....	31.30	37.56	62.60	100.15	125.19	125.19
Labour, direct .....	166.38	166.38	166.38	166.38	166.38	166.38
Repair, maintenance .....	71.88	71.88	71.88	71.88	71.88	71.88
Spares .....	28.00	33.00	35.00	89.00	111.00	111.00
Factory overheads .....	60.00	60.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2025.00</b>	<b>2369.75</b>	<b>3690.73</b>	<b>5763.22</b>	<b>7144.21</b>	<b>7144.21</b>
Administrative overheads .....	75.36	75.36	75.36	75.36	75.36	75.36
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	568.65	568.65	548.65	528.65	528.65	496.45
Financial costs .....	442.00	386.75	331.50	276.25	221.00	165.75
<b>Total production costs .....</b>	<b>3111.01</b>	<b>3400.51</b>	<b>4646.24</b>	<b>6643.48</b>	<b>7969.22</b>	<b>7801.77</b>
<b>Costs per unit ( single product ) .</b>	<b>1.56</b>	<b>1.42</b>	<b>1.16</b>	<b>1.04</b>	<b>1.00</b>	<b>0.99</b>
Of it foreign, Z .....	65.91	65.72	66.30	67.25	67.42	67.47
Of it variable, Z .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	241.74	241.74	241.74	241.74	241.74	241.74



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Total Production Costs in 1000 US \$

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
2 of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material i . . . . .	5876.84	5876.84	5876.84	5876.84	5876.84	5876.84
Other raw materials . . . . .	781.71	781.71	781.71	781.71	781.71	781.71
Utilities . . . . .	11.21	11.21	11.21	11.21	11.21	11.21
Energy . . . . .	125.19	125.19	125.19	125.19	125.19	125.19
Labour, direct . . . . .	166.38	166.38	166.38	166.38	166.38	166.38
Repair, maintenance . . . . .	71.00	71.00	71.00	71.00	71.00	71.00
Spares . . . . .	111.00	111.00	111.00	111.00	111.00	111.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	7144.21	7144.21	7144.21	7144.21	7144.21	7144.21
Administrative overheads . . . . .	75.36	75.36	75.36	75.36	75.36	75.36
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	496.45	496.45	496.45	405.20	199.06	0.00
Financial costs . . . . .	110.50	55.25	0.00	0.00	0.00	0.00
Total production costs . . . . .	7826.52	7771.27	7716.02	7624.77	7419.43	7219.57
Costs per unit ( single product ) .	0.98	0.97	0.96	0.95	0.93	0.90
Of it foreign, % . . . . .	67.24	67.01	66.77	67.57	67.07	66.56
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	241.74	241.74	241.74	241.74	241.74	241.74

**Net Working Capital in 1000 US \$**

Year .....		1990	1991	1992	1993	1994
Coverage .....	cdc cote					
<b>Current assets &amp;</b>						
Accounts receivable . . . . .	30 12.0	175.03	203.76	313.04	486.55	601.63
Inventory and materials . . . . .	136 2.7	627.70	753.24	1255.40	2008.65	2510.81
Energy . . . . .	1 360.0	0.09	0.10	0.17	0.28	0.35
Spares . . . . .	340 1.0	28.00	33.00	55.00	89.00	111.00
Work in progress . . . . .	1 360.0	5.62	6.50	10.25	16.01	19.85
Finished products . . . . .	30 12.0	175.03	203.76	313.04	486.55	601.63
Cash in hand . . . . .	15 24.0	16.73	16.94	15.36	16.78	17.69
<b>Total current assets . . . . .</b>		<b>1028.21</b>	<b>1217.39</b>	<b>1963.87</b>	<b>3103.81</b>	<b>3862.96</b>
<b>Current liabilities and</b>						
Accounts payable . . . . .	11 34.0	67.13	76.55	114.06	170.59	208.27
<b>Net working capital . . . . .</b>		<b>961.08</b>	<b>1140.85</b>	<b>1849.81</b>	<b>2933.22</b>	<b>3654.69</b>
<b>Increase in working capital . . . . .</b>		<b>961.08</b>	<b>179.76</b>	<b>708.96</b>	<b>1083.41</b>	<b>721.47</b>
<b>Net working capital, local . . . . .</b>		<b>132.39</b>	<b>149.64</b>	<b>218.63</b>	<b>322.13</b>	<b>391.12</b>
<b>Net working capital, foreign . . . . .</b>		<b>828.69</b>	<b>991.21</b>	<b>1631.18</b>	<b>2611.09</b>	<b>3263.57</b>

Note: cdc = average days of coverage ; cote = coefficient of turnover .



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Net Working Capital in 1000 US \$

Year ..... 1995-2004

Coverage ..... *ndc* *coto*

Current assets &

Accounts receivable . . .	30	12.0	601.63
Inventory and materials .	156	2.7	2510.81
Energy . . . . .	1	360.0	0.35
Spares . . . . .	360	1.0	111.00
work in progress . . . .	1	360.0	19.85
Finished products . . .	30	12.0	601.63
Cash in hand . . . . .	15	24.0	17.69
Total current assets . . . . .			3862.96
Current liabilities and			
Accounts payable . . . . .	11	34.0	208.27
Net working capital . . . . .			3654.69
Increase in working capital . . . . .			6.00
Net working capital, local . . . . .			391.12
Net working capital, foreign . . . . .			3263.57

Note: *ndc* = minimum days of coverage ; *coto* = coefficient of turnover .

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	3841.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	4420.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	4420.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	221.00
Total funds .....	8261.00	0.00	221.00

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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50	-552.50
Current liabilities	67.13	9.42	37.51	56.53	37.68	0.00	0.00
Bank overdraft ....	1395.94	504.12	705.93	899.00	399.93	-333.07	-366.69
Total funds .....	910.57	-38.96	190.95	403.03	-114.89	-885.57	-913.19

INDUSTRIAL EXPLOSIVES --- February 88

CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1997	1998-99	2000	2001
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-552.50	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-552.50	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	-388.32	-968.44	-922.82	-405.15
Total funds .....	-940.82	-968.44	-922.82	-405.15

INDUSTRIAL EXPLOSIVES --- February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	8261.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	8261.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	459.00	1525.00	2387.00	3030.00	1081.00	221.00
Total assets . . . .	459.00	1525.00	2387.00	3030.00	860.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	221.00	221.00
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	7802.00	-1525.00	-2387.00	-3030.00	-1081.00	-221.00
Cumulated cash balance	7802.00	6277.00	3890.00	860.00	-221.00	-442.00
Inflow, local . . . .	3841.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	199.00	745.00	827.00	950.00	340.00	0.00
Surplus ( deficit ) .	3642.00	-745.00	-827.00	-950.00	-340.00	0.00
Inflow, foreign . . . .	4420.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	260.00	780.00	1560.00	2080.00	741.00	221.00
Surplus ( deficit ) .	4160.00	-780.00	-1560.00	-2080.00	-741.00	-221.00
Net cashflow . . . . .	-459.00	-1525.00	-2387.00	-3030.00	-860.00	0.00
Cumulated net cashflow	-459.00	-1984.00	-4371.00	-7401.00	-8261.00	-8261.00



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Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2727.13	3069.42	4697.51	7116.53	8697.68	8660.00
Financial resources .	67.13	9.42	37.51	56.53	37.68	6.00
Sales, net of tax . .	2660.00	3060.00	4660.00	7060.00	8660.00	8660.00
Total cash outflow . .	4123.07	3573.54	5403.45	8015.53	9097.61	8326.93
Total assets . . . .	1628.21	189.18	746.48	1139.94	759.15	0.00
Operating costs . . .	2100.36	2445.11	3766.09	5636.58	7219.57	7219.57
Cost of finance . . .	442.00	386.75	331.50	276.25	221.00	165.75
Repayment . . . . .	552.50	552.50	552.50	552.50	552.50	552.50
Corporate tax . . . .	0.00	0.60	6.88	208.28	345.39	389.11
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) . .	-1395.94	-504.12	-705.93	-899.00	-399.93	333.07
Cumulated cash balance	-1837.94	-2342.07	-3048.00	-3947.00	-4346.93	-4013.86
Inflow, local . . . .	2723.62	2668.75	2695.01	2712.52	2695.01	2660.00
Outflow, local . . . .	1034.83	969.86	1474.90	2358.52	2863.80	2803.51
Surplus (deficit) . .	1688.79	1698.89	1220.12	354.00	-168.78	-143.51
Inflow, foreign . . .	3.50	406.67	2002.50	4404.01	6002.67	6000.00
Outflow, foreign . . .	3088.24	2603.68	3928.55	5657.00	6233.82	5523.42
Surplus (deficit) . .	-3084.73	-2203.02	-1926.05	-1253.00	-231.15	476.58
Net cashflow . . . . .	-401.44	435.13	178.07	-76.25	373.57	1051.32
Cumulated net cashflow	-8662.44	-8227.32	-8049.25	-8119.50	-7745.93	-6694.61



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Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	8660.00	8660.00	8660.00	8660.00	8660.00	8660.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	8660.00	8660.00	8660.00	8660.00	8660.00	8660.00
Total cash outflow . .	8299.31	8271.68	7691.56	7691.56	7737.18	7737.18
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	7219.57	7219.57	7219.57	7219.57	7219.57	7219.57
Cost of finance . . .	110.50	53.25	0.00	0.00	0.00	0.00
Repayment . . . . .	552.50	552.50	0.00	0.00	0.00	0.00
Corporate tax . . . .	416.74	444.36	471.99	471.99	517.61	517.61
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) . .	360.69	389.32	968.44	968.44	922.82	922.82
Accumulated cash balance	-3653.17	-3264.85	-2296.41	-1327.97	-405.15	517.67
Inflow, local . . . . .	2660.00	2660.00	2660.00	2660.00	2660.00	2660.00
Outflow, local . . . .	2831.14	2858.76	2886.39	2886.39	2932.01	2932.01
Surplus (deficit) . .	-171.14	-198.76	-226.39	-226.39	-272.01	-272.01
Inflow, foreign . . . .	6000.00	6000.00	6000.00	6000.00	6000.00	6000.00
Outflow, foreign . . .	5468.17	5412.92	4805.17	4805.17	4805.17	4805.17
Surplus (deficit) . .	531.83	587.08	1194.83	1194.83	1194.83	1194.83
Net cashflow . . . . .	1023.69	996.07	968.44	968.44	922.82	922.82
Accumulated net cashflow	-5670.92	-4674.85	-3706.41	-2737.97	-1815.15	-892.34



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Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	8660.00	8660.00	8660.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	8660.00	8660.00	8660.00
Total cash outflow . .	7737.18	7839.85	7939.78
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	7219.57	7219.57	7219.57
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	517.61	620.28	720.22
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) . .	922.82	820.15	720.22
Cumulated cash balance	1440.48	2260.63	2980.84
Inflow, local . . . . .	2660.00	2660.00	2660.00
Outflow, local . . . .	2932.01	3034.68	3134.61
Surplus ( deficit ) . .	-272.01	-374.68	-474.62
Inflow, foreign . . . .	6000.00	6000.00	6000.00
Outflow, foreign . . .	4805.17	4805.17	4805.17
Surplus ( deficit ) . .	1194.83	1194.83	1194.83
Net cashflow . . . . .	922.82	820.15	720.22
Cumulated net cashflow	30.48	850.63	1570.84



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-2580.33 at	10.00 %
Internal Rate of Return (IRRE1) ..	1.71 %	
b) Net Worth versus Net cash returns:		
Net present value .....	-3278.14 at	10.00 %
Internal Rate of Return (IRRE2) ..	3.88 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-3204.40 at	10.00 %
Internal Rate of Return ( IRR ) ..	4.91 %	
Net Worth = Equity paid plus reserves		

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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1990	1991	1992	1993	1994
Total sales, incl. sales tax	2660.00	3060.00	4660.00	7060.00	8660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	2660.00	3060.00	4660.00	7060.00	8660.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2669.01	3013.76	4314.74	6367.23	7748.22
Operational margin	-9.01	46.24	345.26	692.77	911.78
As % of total sales	-0.34	1.51	7.41	9.81	10.53
Cost of finance	442.00	386.75	331.50	276.25	221.00
Gross profit	-451.01	-340.51	13.76	416.52	690.78
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	-451.01	-340.51	13.76	416.52	690.78
Tax	0.00	0.00	6.88	208.26	345.39
Net profit	-451.01	-340.51	6.88	208.26	345.39
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	-451.01	-340.51	6.88	208.26	345.39
Accumulated undistributed profit	-451.01	-791.53	-784.65	-576.39	-231.00
Gross profit, % of total sales	-16.96	-11.13	0.30	5.90	7.98
Net profit, % of total sales	-16.96	-11.13	0.15	2.95	3.99
ROE, Net profit, % of equity	-11.74	-8.87	0.18	5.42	8.99
ROI, Net profit+interest, % of invest.	-0.10	0.49	3.35	4.33	4.75





CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	8660.00	8660.00	8660.00	8660.00	8660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	8660.00	8660.00	8660.00	8660.00	8660.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	7716.02	7716.02	7716.02	7716.02	7716.02
Operational margin . . . . .	943.98	943.98	943.98	943.98	943.98
As % of total sales . . . . .	10.90	10.90	10.90	10.90	10.90
Cost of finance . . . . .	165.75	110.50	55.25	0.00	0.00
Gross profit . . . . .	778.23	833.48	888.73	943.98	943.98
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	778.23	833.48	888.73	943.98	943.98
Tax . . . . .	389.11	416.74	444.36	471.99	471.99
Net profit . . . . .	389.11	416.74	444.36	471.99	471.99
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	389.11	416.74	444.36	471.99	471.99
Accumulated undistributed profit . . .	158.11	574.85	1019.22	1491.21	1963.19
Gross profit, % of total sales . . . . .	8.99	9.62	10.26	10.90	10.90
Net profit, % of total sales . . . . .	4.49	4.81	5.13	5.45	5.45
ROE, Net profit, % of equity . . . . .	10.13	10.85	11.57	12.29	12.29
ROI, Net profit+interest, % of invest.	4.66	4.42	4.19	3.96	3.96



CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	8660.00	8660.00	8660.00	8660.00	8660.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
variable margin . . . . .	8660.00	8660.00	8660.00	8660.00	8660.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	7624.77	7624.77	7624.77	7419.43	7219.57
Operational margin . . . . .	1035.23	1035.23	1035.23	1240.57	1440.43
As % of total sales . . . . .	11.95	11.95	11.95	14.33	16.63
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	1035.23	1035.23	1035.23	1240.57	1440.43
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1035.23	1035.23	1035.23	1240.57	1440.43
Tax . . . . .	517.61	517.61	517.61	620.28	720.22
Net profit . . . . .	517.61	517.61	517.61	620.28	720.22
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	517.61	517.61	517.61	620.28	720.22
Accumulated undistributed profit . . .	2480.81	2998.42	3516.04	4136.32	4856.54
Gross profit, % of total sales . . . .	11.95	11.95	11.95	14.33	16.63
Net profit, % of total sales . . . .	5.98	5.98	5.98	7.16	8.32
ROE, Net profit, % of equity . . . .	13.48	13.48	13.48	16.15	18.75
ROI, Net profit+interest, % of invest.	4.34	4.34	4.34	5.21	6.04



COMFAR<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets .....	8261.00	8261.00	8261.00	8261.00	8482.00	8703.00
Fixed assets, net of depreciation	0.00	459.00	1984.00	4371.00	7401.00	8482.00
Construction in progress .....	459.00	1525.00	2387.00	3030.00	1001.00	221.00
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available .	7002.00	6277.00	3890.00	860.00	0.00	0.00
Less carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Less .....	3.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	8261.00	8261.00	8261.00	8261.00	8482.00	8703.00
Equity capital .....	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	4420.00	4420.00	4420.00	4420.00	4420.00	4420.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	221.00	442.00
Total debt .....	4420.00	4420.00	4420.00	4420.00	4641.00	4862.00
Equity, % of liabilities .....	46.50	46.50	46.50	46.50	45.28	44.15



CONIFAR 2.0 - BALBO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1990	1991	1992	1993	1994	1995
Total assets	9613.57	9574.61	9772.44	10376.84	10399.09	9557.24
Fixed assets, net of depreciation	8134.35	7565.69	7017.04	6486.39	5959.74	5463.28
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	1011.47	1200.45	1946.51	3067.03	3845.27	3845.27
Cash, bank	16.73	16.94	15.36	16.78	17.69	17.69
Cash surplus, finance available	0.00	0.06	0.00	0.00	0.00	0.00
Loss carried forward	0.00	451.01	791.53	784.65	576.39	231.00
Loss	451.01	340.51	0.90	0.00	0.00	0.00
Total liabilities	9613.57	9574.61	9772.44	10376.84	10399.09	9557.24
Equity capital	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	6.88	206.26	345.39	389.11
Long and medium term debt	3867.50	3315.00	2762.50	2210.00	1657.50	1165.00
Current liabilities	67.13	76.55	114.06	170.59	208.27	208.27
Bank overdraft, finance required	1637.94	2342.07	3048.00	3947.00	4346.93	4013.86
Total debt	5772.57	5733.61	5924.56	6327.59	6212.70	5327.13
Equity, % of liabilities	39.95	40.12	39.30	37.02	36.94	40.19



**CONFAR**  
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CONFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	8829.79	8333.34	7836.00	7340.43	6935.23	7047.69
Fixed assets, net of depreciation	4966.83	4470.38	3973.92	3477.47	3072.27	2667.06
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	3845.27	3845.27	3845.27	3845.27	3845.27	3845.27
Cash, bank .....	17.69	17.69	17.69	17.69	17.69	17.69
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	517.66
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	8829.79	8333.34	7836.00	7340.43	6935.23	7047.69
Equity capital .....	3841.00	3841.00	3841.00	3841.00	3841.00	3841.00
Reserves, retained profit .....	158.11	574.85	1019.22	1491.21	1963.19	2480.81
Profit .....	416.74	444.36	471.99	471.99	517.61	517.61
Long and medium term debt .....	532.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	208.27	208.27	208.27	208.27	208.27	208.27
Bank overdraft, finance required.	3633.17	3764.85	2296.41	1327.97	405.15	0.00
Total debt .....	4413.94	3473.12	2504.68	1536.24	613.42	208.27
Equity, % of liabilities .....	43.50	46.09	49.01	52.33	55.38	54.50



COMFER 2.0 - BALBO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	2002	2003	2004
Total assets	7565.30	8185.59	8905.80
Fixed assets, net of depreciation	2261.86	2062.00	2062.00
Construction in progress	0.00	0.00	0.00
Current assets	3845.27	3845.27	3845.27
Cash, bank	17.69	17.69	17.69
Cash surplus, finance available	1440.48	2260.63	2980.84
Loss carried forward	0.00	0.00	0.00
LOSS	0.00	0.00	0.00
Total liabilities	7565.30	8185.59	8905.80
Equity capital	3841.00	3841.00	3841.00
Reserves, retained profit	2998.42	3516.04	4136.32
Profit	517.61	620.28	720.22
Long and medium term debt	0.00	0.00	0.00
Current liabilities	208.27	208.27	208.27
Bank overdraft, finance required	0.00	0.00	0.00
Total debt	208.27	208.27	208.27
Equity, % of liabilities	50.77	46.92	43.13

**Industrial explosives**

**ANNEXE 3**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (5TH YEAR OF PRODUCTION OF THE "SCENARIO B"). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>8660.00</u>
2) VARIABLE COSTS:	<u>6961.33</u>
. RAW MATERIALS	6658.55
. UTILITIES	11.21
. ENERGY	125.19
. LABOUR	166.38
3) FIXED COSTS	<u>1007.89</u>
. REPAIR-MAINTENANCE	71.88
. SPARES	111.00
. ADMINISTRATION	75.36
. DEPRECIATION	528.65
. FINANCIAL COSTS	221.00
4) TOTAL PRODUCTION COSTS	<u>7969.22</u>

$$\text{BEP} = \frac{1007.89}{8660 - 6961.33} \times 100 = 59\%$$



**Industrial explosives**

**ANNEXE 4**

**FOREIGN EXCHANGE EFFECT EVALUATION**

## SCENARIO A



COMFAR 2.1 - BALDO &amp; CO. S.R.L., MILANO

## Foreign Exchange Effect in 1000 US \$

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	.....construction.....						
	grand total	total constr.	total produc.	1986.1	1987.2	1987.1	1988.2
total foreign inflow ..	423.50	420.00	3.50	420.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	423.50	420.00	3.50	420.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	2925.60	5642.00	23593.60	260.00	780.00	1560.00	2080.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	4238.00	5200.00	-962.00	260.00	780.00	1560.00	2080.00
imported materials . . .	18143.10	0.00	18143.10	0.00	0.00	0.00	0.00
repayment loans & overd.	423.50	0.00	423.50	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	2431.00	442.00	1989.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-24812.09	-1222.00	-23590.09	4160.00	-780.00	-1560.00	-2080.00
import substit'n effect	30000.00	0.00	30000.00	0.00	0.00	0.00	0.00
net forgn exchge effect	5187.90	-1222.00	6409.90	4160.00	-780.00	-1560.00	-2080.00
present values at 10.00 %							
foreign exchange flow .	-12178.21						
net forgn exchge effect	393.82						



**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		production				
	1988.1	1989.2	1992	1993	1994	1995	1996
total foreign inflow ..	0.00	0.00	3.50	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	3.50	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	741.00	221.00	3088.24	2200.79	2073.04	2030.29	1975.04
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	520.00	0.00	832.20	0.00	-12.67	0.00	0.00
imported materials . . .	0.00	0.00	1261.54	1261.54	1201.54	1201.54	1201.54
repayment loans & overd.	0.00	0.00	552.50	552.50	552.67	552.50	552.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	221.00	221.00	442.00	386.75	331.50	276.25	221.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-741.00	-221.00	-3084.73	-2200.79	-2073.04	-2030.29	-1975.04
import substit'n effect	0.00	0.00	2000.00	2000.00	2000.00	2000.00	2000.00
net foregn exchge effect	-741.00	-221.00	-1084.73	-200.79	-73.04	-30.29	24.96
present values at 10.00 %							
foreign exchange flow .	-12178.21						
net foregn exchge effect	373.82						



**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .							
total foreign outflow .	1919.79	1864.54	1809.29	1201.54	1201.54	1201.54	1201.54
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	1201.54	1201.54	1201.54	1201.54	1201.54	1201.54	1201.54
repayment loans & overd.	552.50	552.50	552.50	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	165.75	110.50	55.25	0.00	0.00	0.00	0.00
indirect costs . . . . .							
net foreign exchge flow	-1919.79	-1864.54	-1809.29	-1201.54	-1201.54	-1201.54	-1201.54
import substit'n effect	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00
net foreign exchge effect	80.21	135.46	190.71	798.46	798.46	798.46	798.46
present values at foreign exchange flow .	10.00 %						
net foreign exchge effect	-12178.21						
	393.82						



**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CI = 100.00 units local CI

	2004	production 2005	2006	2007
total foreign inflow . .	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	1201.54	1201.54	1201.54	-1778.19
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-1781.53
imported materials . . .	1201.54	1201.54	1201.54	0.00
repayment loans & overd.	0.00	0.00	0.00	3.34
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchge flow	-1201.54	-1201.54	-1201.54	1778.19
import substit'n effect	2000.00	2000.00	2000.00	0.00
net forgn exchge effect	798.46	798.46	798.46	1778.19
present values at 10.00 %				
foreign exchange flow .	-12178.21			
net forgn exchge effect	393.82			

S C E N A R I O   B



COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	77233.34	4420.00	72813.34	4420.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	4433.35	4420.00	13.35	4420.00	0.00	0.00	0.00
exports . . . . .	72800.00	0.00	72800.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	72968.43	5642.00	67326.43	260.00	780.00	1560.00	2080.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	4238.00	5200.00	-962.00	260.00	780.00	1560.00	2080.00
imported materials . . .	61866.08	0.00	61866.08	0.00	0.00	0.00	0.00
repayment loans & overd.	4433.35	0.00	4433.35	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	2431.00	442.00	1989.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	4264.93	-1222.00	5486.93	4160.00	-780.00	-1560.00	-2080.00
import substit'n effect	30000.00	0.00	30000.00	0.00	0.00	0.00	0.00
net foreign exchange effect	34264.93	-1222.00	35486.93	4160.00	-780.00	-1560.00	-2080.00
present values at	10.00 %						
foreign exchange flow .	-2758.55						
net foreign exchange effect	9813.48						



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		production				
	1988.1	1989.2	1992	1993	1994	1995	1996
total foreign inflow ..	0.00	0.00	3.50	400.67	2002.50	4404.01	6002.67
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	3.50	0.67	2.50	4.01	2.67
exports . . . . .	0.00	0.00	0.00	400.00	2000.00	4400.00	6000.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	741.00	221.00	3088.24	2603.68	3928.55	5657.00	6233.82
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	520.00	0.00	832.20	163.18	642.47	983.92	655.15
imported materials . . .	0.00	0.00	1261.54	1501.25	2402.08	3844.33	4805.17
repayment loans & overd.	0.00	0.00	552.50	552.50	552.50	552.50	552.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	221.00	221.00	442.00	386.75	331.50	276.25	221.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-741.00	-221.00	-3084.73	-2203.02	-1926.05	-1253.00	-231.15
import substit'n effect	0.00	0.00	2000.00	2000.00	2000.00	2000.00	2000.00
net foreign exchange effect	-741.00	-221.00	-1084.73	-203.02	73.95	747.00	1768.85
present values at 10.00 %							
foreign exchange flow .	-2758.55						
net foreign exchange effect	9813.48						



COMFAR<sup>®</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	6000.00	6000.00	6000.00	6000.00	6000.00	6000.00	6000.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	6000.00	6000.00	6000.00	6000.00	6000.00	6000.00	6000.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	5523.42	5468.17	5412.92	4805.17	4805.17	4805.17	4805.17
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	4805.17	4805.17	4805.17	4805.17	4805.17	4805.17	4805.17
repayment loans & overd.	552.50	552.50	552.50	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	165.75	110.50	55.25	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	476.58	531.83	587.08	1194.83	1194.83	1194.83	1194.83
import substit'n effect	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00	2000.00
net foreign exchge effect	2476.58	2531.83	2587.08	3194.83	3194.83	3194.83	3194.83
present values at	10.00 %						
foreign exchange flow .	-2758.55						
net foreign exchge effect	9813.48						





**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow .	6000.00	6000.00	6000.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	6000.00	6000.00	6000.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	4805.17	4805.17	4805.17	4225.57
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	4238.92
imported materials . . .	4805.17	4805.17	4805.17	0.00
repayment loans & overd.	0.00	0.00	0.00	13.35
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	1194.83	1194.83	1194.83	4225.57
import substit'n effect	2000.00	2000.00	2000.00	0.00
net foreign exchange effect	3194.83	3194.83	3194.83	4225.57
present values at 10.00 %				
foreign exchange flow .	-2758.55			
net foreign exchange effect	9613.48			

DRW. B.162 - 2 -1

SITE LAY OUT

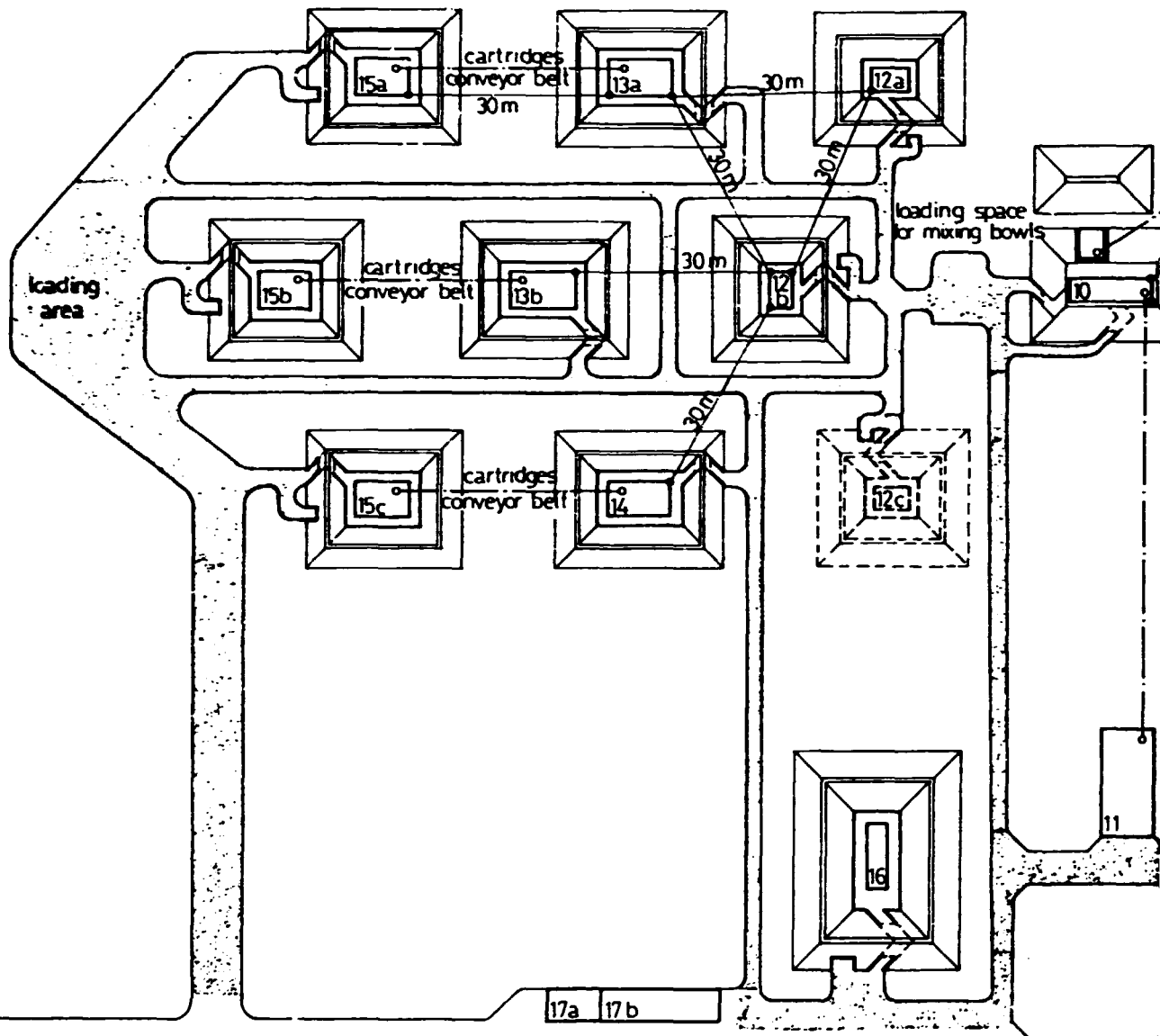
DRW. B.162 - 2 -2

PROCESS BLOCK DIAGRAM

DRW. B.162 - 2 -3

FLOW DIAGRAM OF GLYCERINE-GLYCOL NITRATION UNIT

# SECTION 1

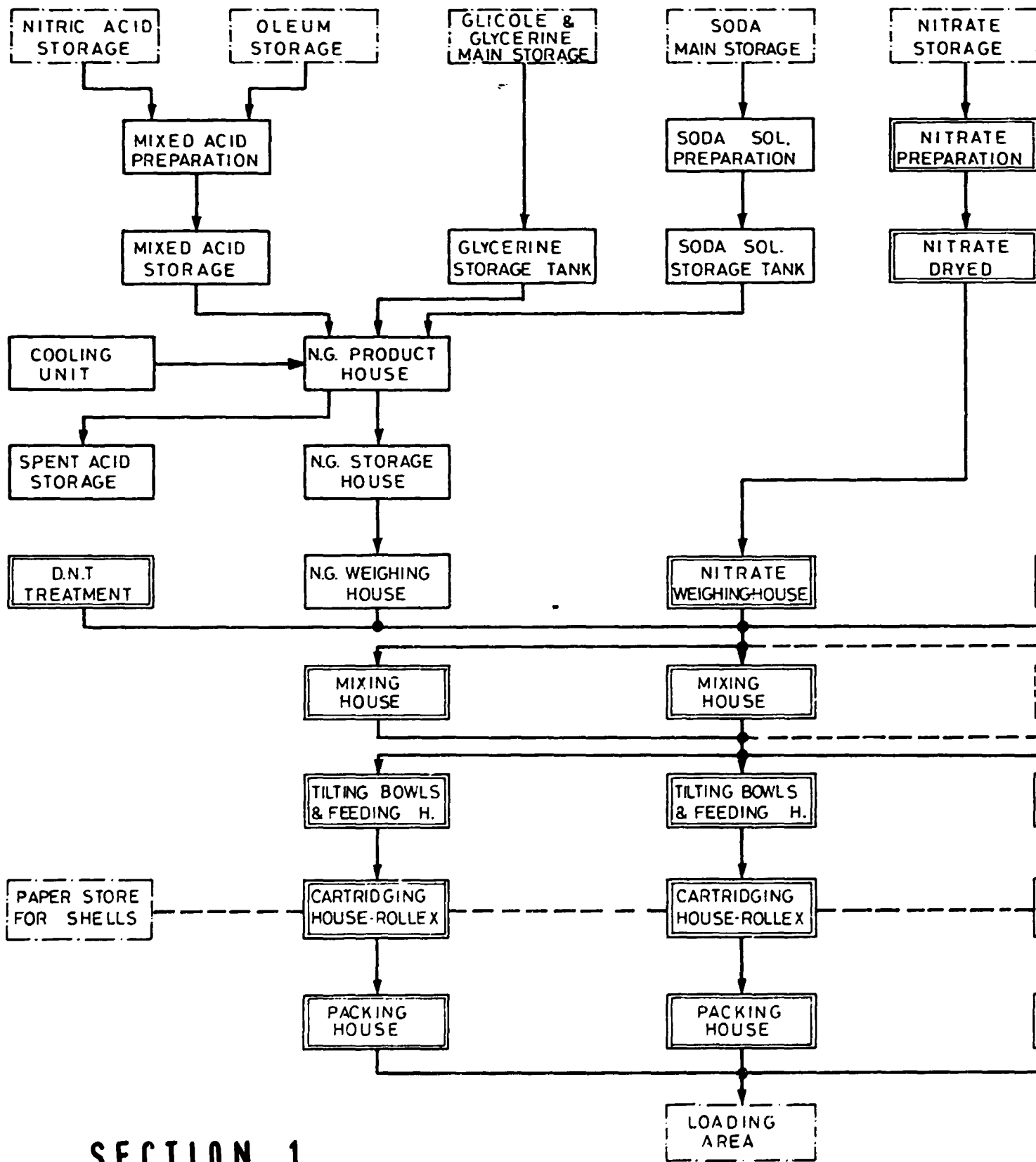


## LEGEND

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| 1 _ Control house                     | 11 _ Nitrate treatment house       |
| 2 _ Utility house                     | 12a-12b-12c _ Mixing house         |
| 3 _ Glycerine tanks                   | 13a-13b _ ROLLEX cartridging house |
| 4 _ Glicole tanks                     | 14 _ LD EX-701 cartridging house   |
| 5 _ Soda preparation                  | 15a-15b-15c _ Paching house        |
| 6 _ Acid tank farm                    | 16 _ NC drying house               |
| 7 _ Spent acid tank farm              | 17a _ Paper store for shells       |
| 8 _ NG production house               | 17b _ Inert storage & weigh house  |
| 9 _ NG storage                        |                                    |
| 10 _ NG-NC-DNT-NITRATE weighing house |                                    |

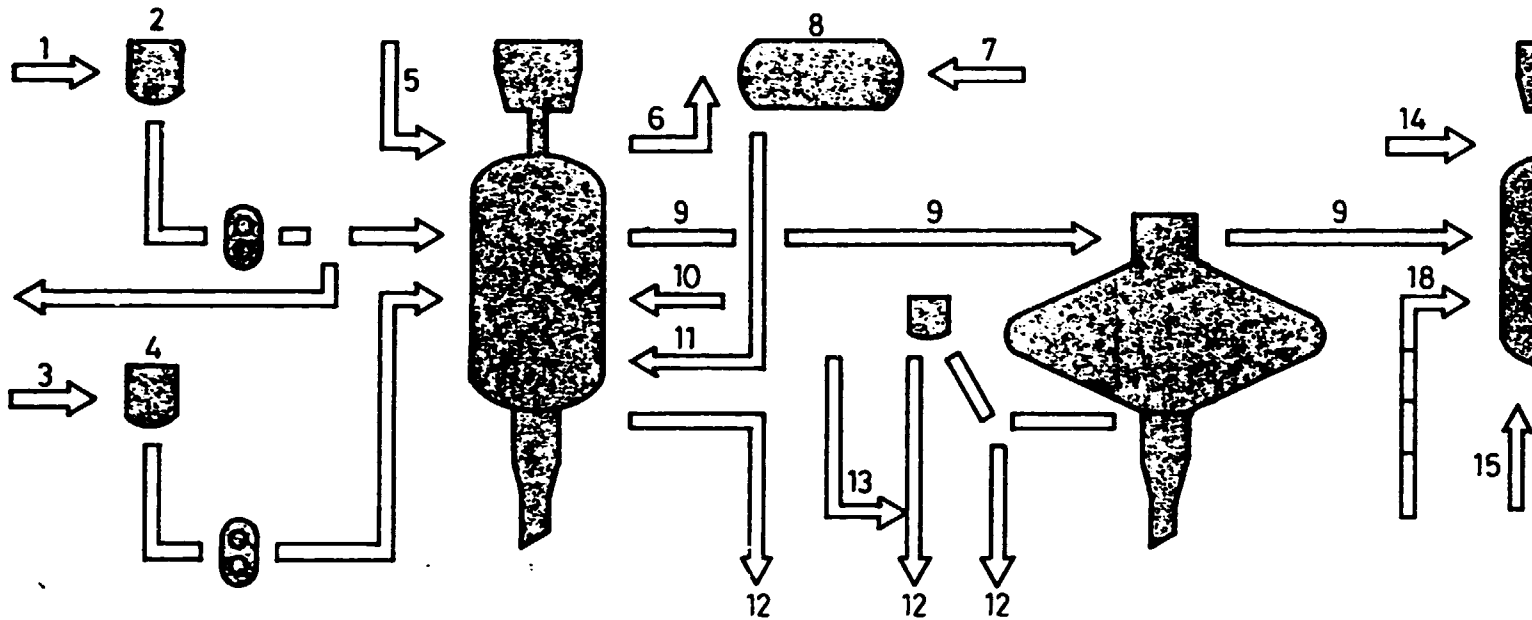
all the distances between building are the minimum according to safety rules





SECTION 1

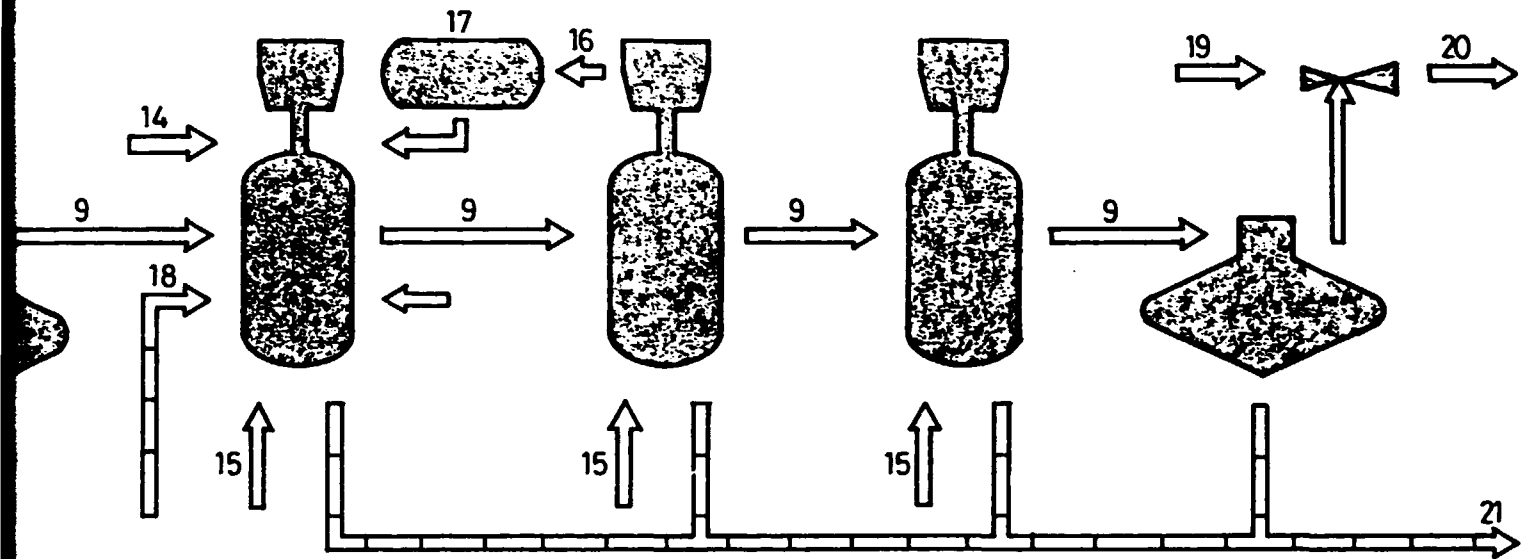




- 1- GLYCERINE PUMP
- 2- GLYCERINE TANK
- 3- SULPHO-NITRIC ACID PUMP
- 4- SULPHO-NITRIC ACID TANK
- 5- BRINE
- 6- FAN
- 7- SPENT ACID PUMP
- 8- SPENT ACID TANK
- 9- NITRATED PRODUCT DISCHARGE
- 10- DEPLACEMENT OF SPENT ACID
- 11- SPENT ACID FEED
- 12- SPENT ACID DISCHARGE
- 13- DILUTION WATER
- 14- FILLING WATER

- 15- AIR FOR AGITATION
- 16- SODA ASH SOLUTION PUMP
- 17- SODA ASH SOLUTION TANK
- 18- RICYCLE OF NITRATE PRODUCT
- 19- WATER IN
- 20- NITRATE-WATER EMULSION TO STORAGE
- 21- WASTE WATER

## SECTION 1



P  
K  
PRODUCT  
N TO STORAGE

## SECTION 2

IND. EXPLOSIVES PLANT FLOW DIAGRAM OF GLYCERINE - GLYCOL NITRATION UNIT.		DIS. N° DWG N°  <b>B. 162 - 2 - 3</b>
<b>baldo &amp; c.</b> CONSULTING ENGINEERS	Via Stillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	REV.



**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF CALCIUM CARBIDE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

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**ANNEXE 2 - FINANCIAL EVALUATION - HYPOTHESIS 2  
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**ANNEXE 4 - FOREIGN EXCHANGE EFFECT EVALUATION**

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FACTORY**

**ANNEXE 6 - DRW. B.162 - 8 - 1 - PROCESS BLOCK DIAGRAM  
DRW. B.162 - 8 - 2 - PROCESS EQUIPMENT LAY OUT  
DRW. B.162 - 8 - 3 - ACETYLENE LAMP**

0. SUMMARY AND CONCLUSIONS

The present study deals with the opportunity of producing Calcium Carbide in Ethiopia. Calcium Carbide is a solid chemical product that is presently imported to produce acetylene for welding operations.

The production of Calcium carbide for this application only (1,000 tons per year) would not be viable; however calcium carbide may be used for a variety of other purposes. One of the most attractive, also taking into account the social impact, is home lighting where electricity is not available (calcium carbide reacting with water generates acetylene that burns in a simple lamp) and another, also of great importance, in an agriculture based economy such as Ethiopia, is the production of Calcium Cyanamide, a nitrogen fertilizer. Furthermore, there is no production of calcium carbide in the region (including the Arabian Peninsula) but all these Countries import from Europe. There is, then a current export potential.

The plant will produce 7,000 tons/year calcium carbide and the fixed investment has been evaluated in the range of 7.55 Million \$ (5.8 of foreign exchange).

Main inputs are:

- limestone: available in large quantities in several parts of the Country
- charcoal: available from the industrial plants whose implementation is now under consideration in several sites
- electric energy: 21 Million kWh are needed. It is the main input, accounting for more of 80% of factory costs.

The cost of electric energy is 0.2 Birr/kWh and, at this cost, the production of calcium carbide is not viable. Taking into consideration the great socio-economic importance of this product a scenario with lower electric energy cost has been simulated. Assuming it to be 0.05 birr/kWh the project becomes interesting and the IRR is 12.84% with a BEP OF 48%; the foreign exchange effect is negative and its discounted net value is (-4,370,000\$).

The study has also carried out a comprehensive analysis of the possibility of integrating this plant with an unit for the production of Calcium Cyanamide, a fertilizer that uses Calcium Carbide as one of the most important inputs.

This scenario shows an I.R.R. of 13.5% and a positive net foreign exchange effect.

The results of the study shows that the carrying out of a feasibility study for a plant producing calcium carbide and calcium cyanamide is recommended.

1. INTRODUCTION

Calcium carbide,  $\text{CaC}_2$ , when pure, is a transparent and colourless solid, with a specific gravity of 2,22 at  $18^\circ\text{C}$ . Pure  $\text{CaC}_2$  is a rarity, and the general properties of calcium carbide have been determined by extrapolation from values obtained on high purity commercial carbide. Commercial  $\text{CaC}_2$  varies in colour from steel-gray to reddish brown, depending on the impurities and the method of manufacture.

The characteristics of technical  $\text{CaC}_2$  are as follows:

purity = 80%

balance= $\text{CaO}$  and 2-5% of other impurities

developable acetylene = 300 l from 1 kg of  $\text{CaC}_2$

$\text{PH}_3$  content in acetylene = 0.05 - 0.07% (max 0.09%)

size : from 15 to 80 mm (1)

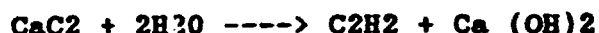
Bull density = 2.2

(1) Sizes ranging from 2 to 4 mm are sometimes used for acetylene production.

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The outstanding property of CaC<sub>2</sub> is the reaction with water to produce acetylene according to the following equation:



In the past commercial CaC<sub>2</sub> was the main source of acetylene used as a raw material in the synthesis of many organic chemicals, resins and plastics. CaC<sub>2</sub> is still the main source of acetylene for oxyacetylene welding and cutting of metals. CaC<sub>2</sub> is also the main raw material for the production of calcium cyanamide by the fixation of atmospheric nitrogen, used as a fertilizer and as a basis for a series of chemicals according to the following equation:



Smaller amounts of CaC<sub>2</sub> are used as a dehydrating agent and as a reducing and desulfurizing agent in metallurgical processes. Another very important use of calcium carbide is as a source of acetylene to burn in a lamp for lighting purposes where electricity or petroleum is not available. The acetylene flame is very luminous; so in the past calcium carbide was the only source of light in the mines and is still extensively used on fishing boats. The lamp is very simple, and quite efficient (1).

- (1) 300 gr of CaC<sub>2</sub> can provide illumination equivalent to 12 Watts for eight hours; that is, 1100 h/y of light using 40 Kg of calcium carbide. A drawing of a lamp (with description and cost estimate) is attached as Annexe 6. Lamps of this kind were widely spread in Europe and America in the twenties as portable lamps (especially into the mines) or mounted on bicycles, cars, railway engines and carts as well as for home lighting.

Even without precise comparative calculations, it can be stated that calcium carbide can be considered, now and for many years to come, as a very economical way of producing lighting in many rural areas where electricity could not be brought without a tremendous economic effort.

## 2.2 Forecast demand and plant capacity

Calcium carbide is presently imported as raw material for the production of acetylene; presently the only use of this gas is for welding; there are two factories (Chora gas and Fana) that produce and bottle acetylene starting from calcium carbide; but the majority of acetylene is directly produced by the users with small gasogenes fed by calcium carbide.

Import figures for the last years are as follows:

	Quantity (kg)	Value (birr)	Unit value (b/kg)
1982	516,989	371,724	0.719
1983	539,980	833,207	1.543
1984	879,075	958,121	1.090
1985	423,796	246,701	0.582

Average 82/85 = 589.960 kg/y at 1.021 birr/kg

It is anticipated that the consumption of calcium carbide for acetylene production only will increase at the same pace as the economy, 6% per year to a total need of approximately 1,000 tons/year by the early nineties. In addition other applications for calcium carbide, presently not exploited, could become popular



if this product could be made available locally in reasonable quantity and at low price; one of the most attractive, also taking into account the social impact, is domestic lighting where electricity is not available. In addition the possibility of exporting is a real one; even if figures are not available, it is known that Saudi Arabia imports large quantities of calcium carbide and no production facility is known to operate in East Africa.

For all these reasons a capacity of 7,000 t/y CaC<sub>2</sub> 80% (working continuously for 330 days/y) has been selected; this capacity is also considered as the minimum economical size suitable to feed the calcium cyanamide production unit whose setting up is presently under proposal and for which an opportunity study has been prepared.

### 2.3 Sales prices and total revenues

The present average price of the imported product is 1021 birr/t = 493 \$/t C.I.F. Assab. The selling price on the retail market is not known, but considering the usual charges for clearing, unloading, loading, bank commissions and transportation, a selling price of at least 600 \$/t, ex works, can be assumed.

On this basis the total annual revenues at full capacity results:

$$7,000 \text{ t/y} \times 600 \text{ \$/t} = 4,200,000 \text{ \$/y}$$

3. MATERIAL AND INPUTS

3.1 Chemistry

The preparation of CaC<sub>2</sub> takes place according to the following equation



Thus the main raw materials are lime or limestone, coal and electric energy. Limestone is very abundant in the country and can be found in sufficient quality without difficulty at a price of 50 birr/t. The required quality, referring to calcined limestone, should be as follows:

MgO content, less than 2%

CaO content, more than 95%.

Many types of coal can be used (coke, anthracite, charcoal) but the latter, if produced from wood or other good agricultural wastes in an efficient industrial carbonization plant, is considered the most suitable.

The production of charcoal in Ethiopia is presently under analysis because several studies (World Bank, the Energy study financed by the Italian Government, etc.) have indicated this way as one of the most suitable to overcome the shortage of fuel energy the country is facing. It is therefore assumed that charcoal will be available in future and its cost has been assumed in the range of 40 birr/ton.

The process also requires a large quantity of energy, but Ethiopia's hydropower potential is reasonably high, and the required amounts should not present problems.

3.2 Materials and utilities requirement and costs

The complete list of raw materials and utilities to be supplied annually to the plant at full capacity (7,000 t/y) is as follows:

<u>Raw materials</u>	LC	FC
<b>Limestone</b>		
14,000x50 birr/t	700,000 b/y	-
<b>Charcoal</b>		
5,250tx40 birr/t	210,000 b/y	-
<b>Electricity</b>		
21,10 <sup>6</sup> kWhx0,2 birr/kWh	4,200,000 b/y	-
<b>Electrodes</b>		
210,000 Kgx0,385 \$/Kg	-	80,769
	-----	-----
Total	5,110,000 b/y	80,769 \$/y

Utilities

<b>Electricity</b>		
105,000 kWhx0,2 b/kWh	21,000 b/y	-
<b>Fuel oil</b>		
980 t x 466 b/t	91,400 b/y	365,600b/y
	-----	-----
Total	112,400 b/y	365,600b/y

For the financial evaluations these costs are grouped as follows:

raw materials (LC)	910,000 b/y =	439,613 \$/y
raw materials (FC)		80,769 \$/y
energy (fuel) (FC)	456,980 b/y =	220,763 \$/y

energy (electricity) (LC) 4,221,000 b/y = 2,039,130 \$/y

Total 2,780,268 \$/y

3.3 Raw material and purchasing programme

Since the raw materials are all of local production, except for electrodes, it is not necessary to keep a large stock of them; an amount equivalent to one month's consumption at full capacity is advisable for charcoal and fuel oil as well as for limestone. For the electrodes filling material, which is imported, a six month equivalent stock is required.

As a result the following stocks must be considered as minimum:

- limestone	
1166 t equivalent to	28,180 \$
- charcoal	
438 t equivalent to	8,454 \$
- fuel oil	
82 t equivalent to	18,384 \$
- electrodes	
105 t equivalent to	42,350 \$
	-----
Total	97,368 \$

4. LOCATION

The location will take into consideration the availability in the vicinity of limestone, electricity and transport facilities; locations with high humidity climates should be avoided.

If subsequent studies show a good export potential, Dire Dawa Town could be an excellent site (railroad available, raw materials available, etc.)

5. PROJECT ENGINEERING

5.1 Process and main equipment description

Please refer to the attached block diagram b.162-8-1  
Firstly, limestone must be calcined to obtain calcium oxide as required by the process reaction.

For this purpose the plant is provided with a kiln using oil as fuel; its minimum standard capacity is 40 t/d, but in this case the size will be reduced to 25-35 t/d, even if the investment cost will remain in practice unchanged.

The calcined limestone and the charcoal are then transferred to the furnace area by belt conveyors and discharged into weighing hoppers and from there to the furnace. The charge is carried out once every 3-4 hours, while the kiln is continuously operating. The furnace, where the carbide is produced, consists of a basin where the raw materials, loaded in the prefixed ratio, are melted by means of electric power; the electricity is fed by three electrodes immersed in the melting mass: a voltage difference of 75-125 Volts among the electrodes causes the flowing of direct current through the melting mass increasing its temperature to about 2000°C; the electrode heads are refrigerated by circulating water. Every hour, the liquid carbide is discharged from the furnace into ingot moulds, where it is left to solidify and cool for 24 hours. Afterwards, the solidified carbide is crushed and reduced to commercial size: (18-80mm). While the furnace is operated continuously, the crushing can be accomplished in a shift only. The crushing equipment is complete with a cyclone type removal system. After the crushing, the product is

poured into steel drums; this operation is performed under inert atmosphere to avoid the risk of ignition or explosion of the product. Carbon Dioxide produced during limestone calcination can be used for this purpose.

## 5.2 Packaging

The product is normally distributed in drums, 150-200 Kg each. The drums are made of carbon steel with gasketed clamp-bolted cover. For special uses as well as for export, it is also possible to fill and ship tanks of larger size, i.e. 2000-3000 Kg each.

The cost of the drums can be estimated at about 35 \$/piece, and considering a partial recovery of the drums the annual expenditure can be assumed as 600,000 \$/y.

## 5.3 Lay-out and civil works

The general equipment lay-out is shown in the attached drawing. The total area covered by the process plant, including the electric substation and the stocks of raw materials and finished products, is of 1400 sq.mt. The whole area is covered by a simple shelter, except for the electric auxiliary equipment which is located in a separate building (but transformers can be installed outdoors).

Administrative offices, laboratory, warehouse and workshop are located in a two-storey building of 200 sq.mt.

The shelter has a steel structure; the roof is insulated with mineral wool lagging covered with corrugated

asbestos cement; the floor is of reinforced concrete with a hard aggregate as finishing surface; reinforced concrete walls of limited height are employed to contain the raw material stocks; the electric substation building has a reinforced concrete structure.

5.4 Investment costs: depreciation and maintenance

The investment costs relating to machinery and equipment for the process plant as well as for utilities and general facilities are as follows:

	FC	LC	Total
	M\$	M\$	M\$
Limestone kiln complete of auxiliaries, FOB European port	1.077		
Machinery and equipment for CaC2 plant and utilities, FOB European port	3.463		
	-----		
	4.540	-	4.540
Transportation (sea and inland)	0.454	0.454	0.908
Erection	0.230	0.677	0.907
Insulation & painting	0.011	0.030	0.041



Site preparation	-	0.039	0.039
Civil works	-	0.400	0.400
Spare parts	0.091	-	0.091
	-----	-----	-----
	5.326	1.600	6.926
Contingencies	0.474	0.150	0.624
	-----	-----	-----
Grand total	5.800	1.750	7.550

The life cycle of the plant can be estimated at 15 years.

The annual cost for plant maintenance is equivalent to approximately 2% of the machinery and equipment cost.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

machinery	FC	5.800 million \$
machinery	LC	1.161 million \$
site preparation	LC	0.039 million \$
civil works	LC	0.550 million \$
		-----
Total		7.550 million \$

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit complete with its own utilities and facilities operating under the direction of the N.C.C.

7. MANPOWER

No particular skills are required for any of the positions listed below except for the technical manager, the production manager, the workshop engineer and the chemist, who must have through training in the technology involved in the process (with particular regard to analysis of raw materials and finished product, hazard control, maintenance of the furnace, electric equipment performance). The requirements for all the other positions are not different from those required in any other chemical factory.

7.1 Management

		birr/m	birr/y
General Manager	n.1	1,500	
Technical manager	n.1	1,200	
	---	-----	-----
	n.2	2,700	32,400

7.2 Administrative department

Senior accountant	n.1	1,000	
Accountants	n.2	700	
Purchasing dep.head	n.1	400	
Warehouse keepers	n.2	750	
Sales dep.head	n.1	400	
Clerks and secretaries	n.6	1,800	
Guards	n.8	1,200	
Drivers	n.3	1,050	
Others	n.3	600	
	---	-----	-----
	n.27	7,900	94,800
Total 94,800 + 32,400 = 127,200 birr/y (61,449 \$/y)			

7.3 Production and maintenance dep.

		birr/m	birr/y
A) Production dep.			
Production man.	n.1	1,000	
Shift foreman	n.8	3,200	
Shift operators	n.32	11,200	
Chemist	n.1	700	
Clerk	n.1	350	
	---	-----	-----
	n.43	16,450	197,400
			(95,362 \$/y)
B) Maintenance department			
Engineer	n.1	800	
Supervisors	n.2	800	
Electricians	n.4	1,600	
Mechanics	n.4	1,600	
Semi-skilled workers	n.4	1,400	
Unskilled workers	n.2	400	
	---	-----	-----
	n.17	6,600	79,200
			(38,261 \$/y)

8. IMPLEMENTATION SCHEDULING

24 months are needed for the design, construction and commissioning of the plant.

9. FINANCIAL EVALUATION

The Comfar financial evaluations are attached as Annexe 1 and Annexe 2.

These evaluations have been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (one year) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "other raw materials"

- the production programme has been assumed as follows:

1st year: 3000 t (about 43% capacity)

2nd year: 5000 t (about 71% capacity)

from 3rd year to 15th year: 7000 t (100% capacity)

Selling price 600 \$/t

Electric power 0.2 (Hypothesis 1) and 0.05 birr/kWh (Hypothesis 2)

As a result the evaluation yields an IRR of 0.10 for the Hypothesis 1 and 12.84 for the Hypothesis 2; for this last alternative the estimated BEP results 48%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 4.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to 1000 t/y that is equal to the forecast demand for the present uses (production of acetylene for welding)
- cost of import equal to the present CIF price in Assab, that is 493 \$/t

Both the net foreign exchange and the net foreign exchange effect are negative; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the net foreign exchange effect of (4,374,000 \$) and of the foreign exchange flow of (7,783,000 \$).

In case the calcium cyanamide production is carried out in conjunction with the calcium cyanamide one (see paragraph 11) the discounted (10%) net foreign exchange effect is 1,115,000 \$.

11. CALCIUM CARBIDE AND CALCIUM CYANAMIDE INTEGRATED FACTORY

The financial advantage deriving from the production in a same factory of calcium carbide and calcium cyanamide, has also been analysed.

The main advantages are:

- a) The utilities (in particular the electrical substations), can be unified and the relevant reduction in investment costs has been evaluated at 538,000 \$.
- b) Some buildings (administrative offices and social services) can be shared in common and this yields another reduction of about 140,000 \$.
- c) Administrative and maintenance personnel number can be reduced and this leads to a reduction of 26,080 \$/y for the maintenance and 46,100 \$/y for the administrative department.
- d) Packaging: the supply of calcium carbide to the calcium cyanamide production plant does not require any particular packaging; so this expenditure which was estimated about 600,000 \$/y in case of separated plant at full capacity, can be reduced, with the same assumptions, to 86,000 \$/y. In fact only the calcium carbide sold as such domestically has to be packed; the bulk of calcium carbide to be transferred into calcium cyanamide does not need any packaging.



e) The calcium carbide is supplied to the calcium cyanamide at the production cost.

The sale programme at 100% capacity and the annual revenues result modified as follows:

- calcium carbide	
1000 t/y x 600 \$/t	= 600,000 \$/y
- calcium cyanamide	
9000 t/y x 600 \$/t	= 5,400,000 \$/y
	-----
	6,000,000 \$/y

On these basis and assuming 0.05 birr/kWh as electricity cost a financial evaluation (Annexe 5) has been prepared: as a result an IRR of 13.51 has been found. The discounted net foreign exchange effect is 1,115,000 \$.

Calcium Carbide

ANNEXE 1

FINANCIAL EVALUATION

HYPOTHESIS 1 : ELECTRIC POWER AT 0.2 birr/kWh



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Hypothesis 1 - Power at 0.2 birr/kWh

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	8163.00	77.092 % foreign
current assets:	0.00	0.000 % foreign
total assets:	8163.00	77.092 % foreign

**Source of funds during construction phase**

equity & grants:	2740.00	0.000 % foreign
foreign loans :	4930.00	
local loans :	0.00	
total funds :	7670.00	64.276 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1742.75	2674.41	3666.13
depreciation :	523.60	523.60	519.70
interest :	493.00	431.38	369.75
production costs	2759.35	3629.38	4555.58
thereof foreign	40.16 %	30.27 %	25.22 %
total sales :	1800.00	3000.00	4200.00
gross income :	-959.35	-629.38	-355.58
net income :	-959.35	-629.38	-355.58
cash balance :	-1341.40	-874.06	-616.74
net cashflow :	-232.15	173.57	369.26

Net Present Value at: 10.00 % = -4288.84  
Internal Rate of Return on total investment: 0.10 %  
Equity paid versus Net income flow (IRR): -16.36 %  
Net worth versus Net Cash Return (IRR): -3.11 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projectee balance sheet
Total production costs	Net income statement



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**Total Initial Investment in 1000 US \$**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	39.00	0.00
Buildings and civil works .....	385.00	165.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	1392.00	5569.00
<b>Total fixed investment costs . . . .</b>	<b>1816.00</b>	<b>5734.00</b>
Pre-production capital expenditures.	20.00	593.00
Net working capital .....	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>1836.00</b>	<b>6327.00</b>
Of it foreign, in Z .....	63.18	81.13

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Total Current Investment in 1000 US \$

Year . . . . .	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	289.40	152.02	164.61
<b>Total current investment costs . . .</b>	<b>289.40</b>	<b>152.02</b>	<b>164.61</b>
Of it foreign, Z . . . . .	36.75	32.83	37.96

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Total Production Costs in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
I of non. capacity (single product).	42.86	71.43	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	223.02	371.79	520.37	520.37	520.37	520.37
Other raw materials . . . . .	257.14	428.57	600.00	600.00	600.00	600.00
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	968.52	1614.21	2259.89	2259.89	2259.89	2259.89
Labour, direct . . . . .	95.36	95.36	95.36	95.36	95.36	95.36
Repair, maintenance . . . . .	38.26	38.26	38.26	38.26	38.26	38.26
Spares . . . . .	39.00	64.86	90.00	90.00	90.00	90.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1681.30</b>	<b>2612.96</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>
Administrative overheads . . . . .	61.45	61.45	61.45	61.45	61.45	61.45
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	523.60	523.60	519.70	515.00	515.00	491.00
Financial costs . . . . .	493.00	431.38	369.75	306.13	246.50	184.00
<b>Total production costs . . . . .</b>	<b>2759.35</b>	<b>3629.38</b>	<b>4555.58</b>	<b>4490.05</b>	<b>4428.43</b>	<b>4342.00</b>
<b>Costs per unit ( single product ) .</b>	<b>0.92</b>	<b>0.73</b>	<b>0.65</b>	<b>0.64</b>	<b>0.63</b>	<b>0.62</b>
Of it foreign, 1 . . . . .	40.16	30.27	25.22	24.22	23.16	22.20
Of it variable, 2 . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	156.81	156.81	156.81	156.81	156.81	156.81

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**Total Production Costs in 1000 US \$**

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
Z of non. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I . . . . .	520.37	520.37	520.37	520.37	520.37	520.37
Other raw materials . . . . .	600.00	600.00	600.00	600.00	600.00	600.00
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	2259.89	2259.89	2259.89	2259.89	2259.89	2259.89
Labour, direct . . . . .	95.36	95.36	95.36	95.36	95.36	95.36
Repair, maintenance . . . . .	38.26	38.26	38.26	38.26	38.26	38.26
Spares . . . . .	90.80	90.80	90.80	90.80	90.80	90.80
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>	<b>3604.68</b>
Administrative overheads . . . . .	61.45	61.45	61.45	61.45	61.45	61.45
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	491.80	491.80	491.80	464.30	229.01	0.00
Financial costs . . . . .	123.25	61.63	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>4281.18</b>	<b>4215.55</b>	<b>4157.93</b>	<b>4130.43</b>	<b>3895.14</b>	<b>3666.13</b>
<b>Costs per unit ( single product ) .</b>	<b>0.61</b>	<b>0.60</b>	<b>0.59</b>	<b>0.59</b>	<b>0.56</b>	<b>0.52</b>
Of it foreign, Z . . . . .	21.08	19.93	18.74	18.86	14.97	10.70
Of it variable, Z . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>

CALCIUM CARBIDE --- February 88



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Net Working Capital in :000 US \$

Year .....			1989	1990	1991	1992-2003
Coverage .....	ndc	coto				
Current assets &						
Accounts receivable . . .	30	12.0	145.23	222.87	305.51	305.51
Inventory and materials .	41	8.8	54.43	90.73	127.01	127.01
Energy .....	4	93.9	10.31	17.19	24.06	24.06
Spares .....	360	1.0	39.00	64.86	90.80	90.80
Work in progress . . . .	1	360.0	4.67	7.26	10.01	10.01
Finished products . . . .	30	12.0	145.23	222.87	305.51	305.51
Cash in hand .....	15	24.0	12.25	10.83	11.91	11.91
Total current assets .....			411.13	636.60	874.82	874.82
Current liabilities and						
Accounts payable .....	27	13.4	121.72	195.17	268.79	268.79
Net working capital .....			289.40	441.43	606.03	606.03
Increase in working capital .....			289.40	152.02	164.61	0.00
Net working capital, local .....			183.05	285.17	387.29	387.29
Net working capital, foreign .....			106.35	156.25	218.75	218.75

Note: ndc = average days of coverage ; coto = coefficient of turnover .





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Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	2740.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	4930.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	4930.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	493.00
Total funds .....	7670.00	493.00

CALCIUM CARBIDE --- February 88



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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994	1995
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25
Current liabilities	121.72	73.45	73.61	0.00	0.00	0.00	0.00
Bank overdraft ....	1341.40	874.06	616.74	390.51	328.88	267.26	205.63
Total funds .....	846.88	331.25	74.10	-225.74	-287.37	-348.99	-410.62

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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1996	1997-98	1999-2001	2002	2003
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-616.25	0.00	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-616.25	0.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00	0.00
Bank overdraft ....	144.01	-512.83	-499.08	-381.44	-266.93
Total funds .....	-472.24	-512.83	-499.08	-381.44	-266.93

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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1967	1968
Total cash inflow . .	7670.00	0.00
Financial resources .	7670.60	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	1836.00	6327.00
Total assets . . . .	5834.00	5834.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	493.00
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	5834.00	-6327.00
Accumulated cash balance	5834.00	-493.00
Inflow, local . . . .	2740.00	0.00
Outflow, local . . . .	676.00	1194.00
Surplus ( deficit ) .	2064.00	-1194.00
Inflow, foreign . . .	4930.00	0.00
Outflow, foreign . . .	1160.00	5133.00
Surplus ( deficit ) .	3770.00	-5133.00
Net cashflow . . . . .	-1836.00	-5834.00
Accumulated net cashflow	-1836.00	-7670.00



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Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	1921.72	3073.45	4273.61	4200.00	4200.00	4200.00
Financial resources .	121.72	73.45	73.61	0.00	0.00	0.00
Sales, net of tax . .	1800.00	3000.00	4200.00	4200.00	4200.00	4200.00
Total cash outflow . .	3263.13	3947.50	4890.35	4590.50	4528.80	4467.25
Total assets . . . .	411.13	225.47	238.22	0.00	0.00	0.00
Operating costs . . .	1742.75	2674.41	3666.13	3666.13	3666.13	3666.13
Cost of finance . . .	493.00	431.38	369.75	308.13	246.50	184.88
Repayment . . . . .	616.25	616.25	616.25	616.25	616.25	616.25
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1341.40	-874.06	-616.74	-390.50	-328.80	-267.25
Cumulated cash balance	-1834.40	-2708.46	-3325.20	-3715.70	-4044.58	-4311.84
Inflow, local . . . . .	1921.09	3073.30	4273.30	4200.00	4200.00	4200.00
Outflow, local . . . .	1818.67	2569.59	3449.23	3273.81	3273.81	3273.81
Surplus ( deficit ) .	102.42	503.71	824.07	926.19	926.19	926.19
Inflow, foreign . . . .	0.63	0.14	0.31	0.00	0.00	0.00
Outflow, foreign . . .	1444.45	1377.91	1441.12	1316.70	1255.07	1193.45
Surplus ( deficit ) .	-1443.82	-1377.77	-1440.81	-1316.70	-1255.07	-1193.45
Net cashflow . . . . .	-232.15	173.57	369.26	533.87	533.87	533.87
Cumulated net cashflow	-7902.15	-7728.58	-7359.32	-6825.46	-6291.58	-5757.71

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Total cash outflow . .	4405.63	4344.00	3687.17	3687.17	3700.92	3700.92
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	3666.13	3666.13	3666.13	3666.13	3666.13	3666.13
Cost of finance . . .	123.25	61.63	0.00	0.00	0.00	0.00
Repayment . . . . .	616.25	616.25	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	21.04	21.04	34.79	34.79
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-205.63	-144.00	512.83	512.83	499.08	499.08
Cumulated cash balance	-4517.47	-4661.47	-4148.64	-3635.80	-3136.72	-2637.64
Inflow, local . . . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Outflow, local . . . .	3273.81	3273.81	3294.85	3294.85	3308.60	3308.60
Surplus ( deficit ) .	926.19	926.19	905.15	905.15	891.40	891.40
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	1131.82	1070.20	392.32	392.32	392.32	392.32
Surplus ( deficit ) .	-1131.82	-1070.20	-392.32	-392.32	-392.32	-392.32
Net cashflow . . . . .	533.87	533.87	512.83	512.83	499.08	499.08
Cumulated net cashflow	-5223.84	-4689.97	-4177.14	-3664.31	-3165.22	-2666.14



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COMFAR 2.0 - DALPO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	4200.00	4200.00	4200.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	4200.00	4200.00	4200.00
Total cash outflow . .	3700.92	3818.56	3933.06
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	3666.13	3666.13	3666.13
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	34.79	152.43	266.93
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	499.08	381.44	266.94
Accumulated cash balance	-2138.55	-1757.11	-1490.17
Inflow, local . . . .	4200.00	4200.00	4200.00
Outflow, local . . . .	3308.60	3426.24	3540.75
Surplus ( deficit ) .	891.40	773.76	659.25
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	392.32	392.32	392.32
Surplus ( deficit ) .	-392.32	-392.32	-392.32
Net cashflow . . . . .	499.08	381.44	266.93
Accumulated net cashflow	-2167.05	-1785.61	-1518.68



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-4536.68 at	10.00 %
Internal Rate of Return (IRRE1) ..	-16.36 %	
b) Net Worth versus Net cash return:		
Net present value .....	-4371.02 at	10.00 %
Internal Rate of Return (IRRE2) ..	-3.11 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-4288.84 at	10.00 %
Internal Rate of Return (IRR) ..	0.10 %	
Net Worth = Equity paid plus reserves		

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CALCIUM CARBIDE --- February 88



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**Net Income Statement in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	1800.00	3000.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1800.00	3000.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2266.35	3198.01	4185.83	4181.93	4181.93
Operational margin . . . . .	-466.35	-198.01	14.17	18.07	18.07
As % of total sales . . . . .	-25.91	-6.60	0.34	0.43	0.43
Cost of finance . . . . .	493.00	431.38	369.75	308.13	246.50
Gross profit . . . . .	-959.35	-629.38	-355.58	-290.05	-228.43
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-959.35	-629.38	-355.58	-290.05	-228.43
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-959.35	-629.38	-355.58	-290.05	-228.43
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-959.35	-629.38	-355.58	-290.05	-228.43
Accumulated undistributed profit . . .	-959.35	-1588.73	-1944.31	-2234.37	-2462.79
Gross profit, % of total sales . . . .	-53.30	-20.98	-8.47	-6.91	-5.44
Net profit, % of total sales . . . .	-53.30	-20.98	-8.47	-6.91	-5.44
ROE, Net profit, % of equity . . . .	-35.01	-22.97	-12.98	-10.59	-8.34
ROI, Net profit+interest, % of invest.	-5.86	-2.44	0.17	0.22	0.22





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**Net Income Statement in 1000 US \$**

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	4157.93	4157.93	4157.93	4157.93	4157.93
Operational margin . . . . .	42.07	42.07	42.07	42.07	42.07
As % of total sales . . . . .	1.00	1.00	1.00	1.00	1.00
Cost of finance . . . . .	184.88	123.25	61.63	0.00	0.00
Gross profit . . . . .	-142.80	-81.18	-19.55	42.07	42.07
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-142.80	-81.18	-19.55	42.07	42.07
Tax . . . . .	0.00	0.00	0.00	21.04	21.04
Net profit . . . . .	-142.80	-81.18	-19.55	21.04	21.04
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-142.80	-81.18	-19.55	21.04	21.04
Accumulated undistributed profit . . .	-2605.60	-2686.78	-2706.33	-2685.30	-2664.26
Gross profit, % of total sales . . . .	-3.40	-1.93	-0.47	1.00	1.00
Net profit, % of total sales . . . .	-3.40	-1.93	-0.47	0.50	0.50
ROE, Net profit, % of equity . . . .	-5.21	-2.96	-0.71	0.77	0.77
ROI, Net profit+interest, % of invest.	0.51	0.51	0.51	0.25	0.25

CALCIUM CARBIDE --- February 88



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**Net Income Statement in 1000 US \$**

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax. . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	4130.43	4130.43	4130.43	3895.14	3666.13
Operational margin . . . . .	69.57	69.57	69.57	304.86	533.87
As % of total sales . . . . .	1.66	1.66	1.66	7.26	12.71
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	69.57	69.57	69.57	304.86	533.87
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	69.57	69.57	69.57	304.86	533.87
Tax . . . . .	34.79	34.79	34.79	152.43	266.93
Net profit . . . . .	34.79	34.79	34.79	152.43	266.93
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	34.79	34.79	34.79	152.43	266.93
Accumulated undistributed profit . . . . .	-2629.48	-2594.69	-2559.91	-2407.48	-2140.54
Gross profit, % of total sales . . . . .	1.66	1.66	1.66	7.26	12.71
Net profit, % of total sales . . . . .	0.83	0.83	0.83	3.63	6.36
ROE, Net profit, % of equity . . . . .	1.27	1.27	1.27	5.56	9.74
ROI, Net profit+interest, % of invest. . . . .	0.42	0.42	0.42	1.84	3.23



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year .....	1987	1988
Total assets .....	7670.00	8163.00
Fixed assets, net of depreciation	0.00	1836.00
Construction in progress .....	1836.00	6327.00
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	5834.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	7670.00	8163.00
Equity capital .....	2740.00	2740.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	4930.00	4930.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	493.00
Total debt .....	4930.00	5423.00
Equity, % of liabilities .....	35.72	33.57

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1987	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>9009.88</b>	<b>9341.13</b>	<b>9415.24</b>	<b>9189.49</b>	<b>8902.12</b>	<b>8553.13</b>
Fixed assets, net of depreciation	7639.40	7115.80	6596.10	6080.30	5564.50	5072.71
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Current assets .....</b>	<b>398.87</b>	<b>625.77</b>	<b>862.91</b>	<b>862.91</b>	<b>862.91</b>	<b>862.91</b>
Cash, bank .....	12.25	10.83	11.91	11.91	11.91	11.91
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	959.35	1588.73	1944.31	2234.37	2462.79
Loss .....	959.35	629.38	355.58	290.05	228.43	142.00
<b>Total liabilities .....</b>	<b>9009.88</b>	<b>9341.13</b>	<b>9415.24</b>	<b>9189.49</b>	<b>8902.12</b>	<b>8553.13</b>
Equity capital .....	2740.00	2740.00	2740.00	2740.00	2740.00	2740.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	4313.75	3697.50	3081.25	2465.00	1848.75	1232.50
Current liabilities .....	121.72	195.17	268.79	268.79	268.79	268.79
Bank overdraft, finance required.	1834.40	2708.46	3325.20	3715.70	4044.58	4311.84
<b>Total debt .....</b>	<b>6269.88</b>	<b>6601.13</b>	<b>6675.24</b>	<b>6449.49</b>	<b>6162.12</b>	<b>5813.13</b>
<b>Equity, % of liabilities .....</b>	<b>30.41</b>	<b>29.33</b>	<b>29.10</b>	<b>29.82</b>	<b>30.78</b>	<b>32.04</b>

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>8142.51</b>	<b>7670.26</b>	<b>7178.46</b>	<b>6645.63</b>	<b>6180.29</b>	<b>5681.21</b>
Fixed assets, net of depreciation	4580.91	4089.11	3597.31	3105.51	2641.21	2176.91
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	862.91	862.91	862.91	862.91	862.91	862.91
Cash, bank .....	11.91	11.91	11.91	11.91	11.91	11.91
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00
Less carried forward .....	2605.60	2684.78	2704.33	2685.30	2644.24	2629.48
Loss .....	81.18	19.55	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>8142.51</b>	<b>7670.26</b>	<b>7178.46</b>	<b>6645.63</b>	<b>6180.29</b>	<b>5681.21</b>
Equity capital .....	2740.00	2740.00	2740.00	2740.00	2740.00	2740.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	21.04	21.04	34.79	34.79
Long and medium term debt .....	616.25	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	268.79	268.79	268.79	268.79	268.79	268.79
Bank overdraft, finance required.	4517.47	4641.47	4148.64	3635.81	3134.72	2637.64
<b>Total debt .....</b>	<b>5402.51</b>	<b>4930.26</b>	<b>4417.43</b>	<b>3904.59</b>	<b>3405.51</b>	<b>2906.42</b>
<b>Equity, % of liabilities .....</b>	<b>33.65</b>	<b>35.72</b>	<b>38.17</b>	<b>41.11</b>	<b>44.33</b>	<b>48.23</b>

CALCIUM CARBIDE --- February 88



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**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>5182.12</b>	<b>4918.33</b>	<b>4765.90</b>
Fixed assets, net of depreciation	1712.61	1483.60	1483.60
Construction in progress .....	0.00	0.00	0.00
Current assets .....	862.91	862.91	862.91
Cash, bank .....	11.91	11.91	11.91
Cash surplus, finance available .	0.00	0.00	0.00
Less carried forward .....	2594.69	2559.91	2407.48
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>5182.12</b>	<b>4918.33</b>	<b>4765.90</b>
Equity capital .....	2740.00	2740.00	2740.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	34.79	152.43	266.93
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	268.79	268.79	268.79
Bank overdraft, finance required.	2138.55	1757.11	1490.18
<b>Total debt .....</b>	<b>2407.34</b>	<b>2025.90</b>	<b>1758.96</b>
<b>Equity, % of liabilities .....</b>	<b>52.87</b>	<b>55.71</b>	<b>57.49</b>

CALCIUM CARBIDE --- February 88

Calcium carbide

ANNEXE 2

FINANCIAL EVALUATION

HYPOTHESIS 2 : ELECTRIC POWER AT 0.05 birr/kWh



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**CALCIUM CARBIDE**

February 88

Hipohesis 2 -Power at 0.05 birr/kWh

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	8163.00	77.092 I foreign
current assets:	0.00	0.000 I foreign
total assets:	8163.00	77.092 I foreign

**Source of funds during construction phase**

equity & grants:	2740.00	0.000 I foreign
foreign loans :	4930.00	
local loans :	0.00	
total funds :	7670.00	64.276 I foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1087.32	1581.42	2136.78
depreciation :	523.60	523.60	519.70
interest :	493.00	431.38	369.75
production costs	2103.92	2536.39	3026.23
thereof foreign	52.67 I	43.28 I	37.97 I
total sales :	1800.00	3000.00	4200.00
gross income :	-303.92	463.61	1173.77
net income :	-303.92	231.80	586.89
cash balance :	-627.71	26.37	364.17
net cashflow :	481.54	1074.00	1350.17

Net Present Value at: 10.00 I = 1393.49  
Internal Rate of Return on total investment: 12.84 I  
Equity paid versus Net income flow (IRRZ): 14.02 I  
Net Worth versus Net Cash Return (IRRZ): 13.81 I

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet





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**Total Initial Investment in 1000 US \$**

Year . . . . .	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	39.00	0.00
Buildings and civil works . . . . .	385.00	165.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00
Plant machinery and equipment . . .	1392.00	5549.00
<b>Total fixed investment costs . . . .</b>	<b>1816.00</b>	<b>5734.00</b>
Pre-production capital expenditures.	20.00	593.00
Net working capital . . . . .	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>1836.00</b>	<b>6327.00</b>
Of it foreign, in % . . . . .	63.18	81.13

CALCIUM CARBIDE --- February 88



**Total Current Investment in 1000 US \$**

Year .....	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital .....	231.14	112.78	126.17
<b>Total current investment costs . . .</b>	<b>231.14</b>	<b>112.78</b>	<b>126.17</b>
Of it foreign, Z .....	46.01	43.09	49.85



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**Total Production Costs in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of max. capacity (single product).	42.04	71.43	100.00	100.00	100.00	100.00
Raw materials I . . . . .	223.02	371.10	520.37	520.37	520.37	520.37
Other raw materials . . . . .	257.14	428.57	600.00	600.00	600.00	600.00
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	313.09	521.82	730.54	730.54	730.54	730.54
Labour, direct . . . . .	95.36	95.36	95.36	95.36	95.36	95.36
Repair, maintenance . . . . .	38.26	38.26	38.26	38.26	38.26	38.26
Spares . . . . .	39.00	44.86	90.00	90.00	90.00	90.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	1025.87	1519.97	2075.33	2075.33	2075.33	2075.33
Administrative overheads . . . . .	61.45	61.45	61.45	61.45	61.45	61.45
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.67
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	523.60	523.60	519.70	515.00	515.00	491.00
Financial costs . . . . .	493.00	431.38	369.75	308.13	246.50	184.00
Total production costs . . . . .	2103.92	2536.39	3026.23	2960.70	2899.08	2813.45
Costs per unit (single product) . . . . .	0.70	0.51	0.43	0.42	0.41	0.40
Of it foreign, % . . . . .	52.67	43.28	37.97	36.72	35.38	34.27
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	156.81	156.81	156.81	156.81	156.81	156.81

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**Total Production Costs in 1000 US \$**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
Z of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I .....	520.37	520.37	520.37	520.37	520.37	520.37
Other raw materials .....	600.00	600.00	600.00	600.00	600.00	600.00
Utilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Energy .....	730.54	730.54	730.54	730.54	730.54	730.54
Labour, direct .....	95.36	95.36	95.36	95.36	95.36	95.36
Repair, maintenance .....	38.26	38.26	38.26	38.26	38.26	38.26
Spares .....	90.80	90.80	90.80	90.80	90.80	90.80
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2075.33</b>	<b>2075.33</b>	<b>2075.33</b>	<b>2075.33</b>	<b>2075.33</b>	<b>2075.33</b>
Administrative overheads .....	61.45	61.45	61.45	61.45	61.45	61.45
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	491.00	491.00	491.00	464.30	229.01	0.00
Financial costs .....	123.25	61.63	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>2751.83</b>	<b>2690.20</b>	<b>2628.58</b>	<b>2601.08</b>	<b>2365.79</b>	<b>2136.78</b>
<b>Costs per unit (single product) .</b>	<b>0.39</b>	<b>0.38</b>	<b>0.38</b>	<b>0.37</b>	<b>0.34</b>	<b>0.31</b>
Of it foreign, Z .....	32.79	31.25	29.64	29.96	24.65	18.36
Of it variable, Z .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour .....</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>	<b>156.81</b>

CALCIUM CARBIDE --- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US \$**

Year	1989	1990	1991	1992-2003
Coverage . . . . . ndc coto				
Current assets &				
Accounts receivable . . . 30 12.0	90.61	131.78	178.07	178.07
Inventory and materials . 41 8.8	54.43	90.43	127.01	127.01
Energy . . . . . 10 36.9	8.49	14.15	19.81	19.81
Spares . . . . . 360 1.0	39.00	64.86	90.80	90.80
Work in progress . . . . 1 360.0	2.85	4.22	5.76	5.76
Finished products . . . 30 12.0	90.61	131.78	178.06	178.06
Cash in hand . . . . . 15 24.0	12.25	10.83	11.91	11.91
Total current assets . . . . .	298.25	448.06	611.43	611.43
Current liabilities and				
Accounts payable . . . . . 24 14.7	67.10	104.14	141.34	141.34
Net working capital . . . . .	231.14	343.92	470.09	470.09
Increase in working capital . . . . .	231.14	112.78	126.17	0.00
Net working capital, local . . . . .	124.79	188.07	251.35	251.35
Net working capital, foreign . . . . .	106.35	155.85	218.75	218.75

Note: ndc = minima days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	2740.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	4930.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	4930.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	493.00
Total funds .....	7670.00	493.00

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in :000 US \$

Year .....	1989	1990	1991	1992	1993	1994-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-616.25	-616.25	-616.25	-616.25	-616.25	-616.25
Current liabilities	67.10	37.03	37.20	0.00	0.00	0.00
Bank overdraft ....	627.71	-26.37	-364.17	-519.20	-210.98	0.00
Total funds .....	78.57	-605.59	-943.21	-1135.45	-827.23	-616.25

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	7670.00	0.00
Financial resources .	7670.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	1836.00	6327.00
Total assets . . . .	1836.00	5834.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	493.00
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	5834.00	-6327.00
Cumulated cash balance	5834.00	-493.00
Inflow, local . . . . .	2740.00	0.00
Outflow, local . . . .	676.00	1194.00
Surplus ( deficit ) .	2064.00	-1194.00
Inflow, foreign . . . .	4930.00	0.00
Outflow, foreign . . . .	1160.00	5133.00
Surplus ( deficit ) .	3770.00	-5133.00
Net cashflow . . . . .	-1836.00	-5834.00
Cumulated net cashflow	-1836.00	-7670.00

CALCIUM CARBIDE --- February 88





COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	1867.10	3037.03	4237.20	4200.00	4200.00	4200.00
Financial resources .	67.10	37.03	37.20	0.00	0.00	0.00
Sales, net of tax . .	1800.00	3000.00	4200.00	4200.00	4200.00	4200.00
Total cash outflow . .	2494.82	3010.66	3873.04	3680.80	3649.99	3631.18
Total assets . . . .	298.25	149.81	163.37	0.00	0.00	0.00
Operating costs . . .	1087.32	1581.42	2136.78	2136.78	2136.78	2136.78
Cost of finance . . .	493.00	431.38	369.75	308.13	246.50	184.88
Repayment . . . . .	616.25	616.25	616.25	616.25	616.25	616.25
Corporate tax . . . .	0.00	231.80	586.89	619.65	650.46	693.27
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-627.71	26.37	364.17	519.20	550.01	568.82
Cumulated cash balance	-1120.71	-1094.34	-730.18	-210.98	339.03	907.85
Inflow, local . . . . .	1866.47	3036.89	4236.89	4200.00	4200.00	4200.00
Outflow, local . . . .	1050.36	1633.75	2431.51	2364.11	2394.92	2437.73
Surplus ( deficit ) .	816.11	1403.14	1805.38	1835.89	1805.08	1762.27
Inflow, foreign . . . .	0.63	0.14	0.31	0.00	0.00	0.00
Outflow, foreign . . . .	1444.45	1376.91	1441.52	1316.70	1255.07	1193.45
Surplus ( deficit ) .	-1443.82	-1376.77	-1441.21	-1316.70	-1255.07	-1193.45
Net cashflow . . . . .	481.54	1074.00	1350.17	1443.57	1412.76	1369.95
Cumulated net cashflow	-7188.46	-6114.47	-4764.30	-3320.73	-1907.97	-538.02

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Total cash outflow . .	3600.37	3569.55	2922.49	2922.49	2936.24	2936.24
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	2136.78	2136.78	2136.78	2136.78	2136.78	2136.78
Cost of finance . . .	123.25	61.63	0.00	0.00	0.00	0.00
Repayment . . . . .	616.25	616.25	0.00	0.00	0.00	0.00
Corporate tax . . . .	724.09	754.90	785.71	785.71	799.46	799.46
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	599.63	630.45	1277.51	1277.51	1263.76	1263.76
Cumulated cash balance	1507.48	2137.93	3415.44	4692.95	5956.71	7220.47
Inflow, local . . . .	4200.00	4200.00	4200.00	4200.00	4200.00	4200.00
Outflow, local . . . .	2468.55	2499.36	2530.17	2530.17	2543.92	2543.92
Surplus ( deficit ) .	1731.45	1700.64	1669.83	1669.83	1656.08	1656.08
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	1131.82	1070.20	392.32	392.32	392.32	392.32
Surplus ( deficit ) .	-1131.82	-1070.20	-392.32	-392.32	-392.32	-392.32
Net cashflow . . . . .	1339.13	1308.32	1277.51	1277.51	1263.76	1263.76
Cumulated net cashflow	801.11	2109.43	3386.94	4664.45	5928.21	7191.97

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	4200.00	4200.00	4200.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	4200.00	4200.00	4200.00
Total cash outflow . .	2936.24	3053.88	3168.39
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2136.78	2136.78	2136.78
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	799.46	917.10	1031.61
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	1263.76	1146.12	1031.61
Cumulated cash balance	8484.23	9630.34	10661.95
Inflow, local . . . . .	4200.00	4200.00	4200.00
Outflow, local . . . .	2543.92	2661.56	2776.07
Surplus ( deficit ) .	1656.08	1538.44	1423.93
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	392.32	392.32	392.32
Surplus ( deficit ) .	-392.32	-392.32	-392.32
Net cashflow . . . . .	1263.76	1146.12	1031.61
Cumulated net cashflow	8455.73	9601.84	10633.45

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	1068.65	at 10.00 %
Internal Rate of Return (IRRE1) ..	14.02 %	
b) Net Worth versus Net cash return:		
Net present value .....	1311.31	at 10.00 %
Internal Rate of Return (IRRE2) ..	13.01 %	
c) Internal Rate of Return on total investment:		
Net present value .....	1393.49	at 10.00 %
Internal Rate of Return (IRR) ..	12.04 %	

Net Worth = Equity paid plus reserves

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**Net Income Statement in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	1800.00	3000.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1800.00	3000.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1610.92	2105.02	2656.48	2652.58	2652.58
Operational margin . . . . .	189.08	894.98	1543.52	1547.42	1547.42
As % of total sales . . . . .	10.50	29.83	36.75	36.84	36.84
Cost of finance . . . . .	493.60	431.30	369.75	308.13	246.50
Gross profit . . . . .	-303.92	463.61	1173.77	1239.30	1300.92
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-303.92	463.61	1173.77	1239.30	1300.92
Tax . . . . .	0.00	231.00	586.89	619.65	650.46
Net profit . . . . .	-303.92	231.60	586.89	619.65	650.46
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-303.92	231.60	586.89	619.65	650.46
Accumulated undistributed profit . . .	-303.92	-72.12	514.77	1134.42	1784.88
Gross profit, % of total sales . . . . .	-16.88	15.45	27.95	29.51	30.97
Net profit, % of total sales . . . . .	-16.88	7.73	13.97	14.75	15.49
ROE, Net profit, % of equity . . . . .	-11.09	8.46	21.42	22.61	23.74
ROI, Net profit+interest, % of invest.	2.39	8.28	11.75	11.40	11.02



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2628.58	2628.58	2628.58	2628.58	2628.58
Operational margin . . . . .	1571.42	1571.42	1571.42	1571.42	1571.42
As % of total sales . . . . .	37.41	37.41	37.41	37.41	37.41
Cost of finance . . . . .	104.00	123.25	61.63	0.00	0.00
Gross profit . . . . .	1386.55	1448.17	1509.00	1571.42	1571.42
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1386.55	1448.17	1509.00	1571.42	1571.42
Tax . . . . .	693.27	724.09	754.90	785.71	785.71
Net profit . . . . .	693.27	724.09	754.90	785.71	785.71
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	693.27	724.09	754.90	785.71	785.71
Accumulated undistributed profit . . .	2478.15	3202.24	3957.13	4742.85	5528.56
Gross profit, % of total sales . . . .	33.01	34.48	35.95	37.41	37.41
Net profit, % of total sales . . . .	16.51	17.24	17.97	18.71	18.71
ROE, Net profit, % of equity . . . .	25.30	26.43	27.55	28.68	28.68
ROI, Net profit+interest, % of invest.	10.79	10.41	10.03	9.65	9.65

CALCIUM CARBIDE --- February 88



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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	4200.00	4200.00	4200.00	4200.00	4200.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2601.00	2601.00	2601.00	2365.79	2136.70
Operational margin . . . . .	1598.92	1598.92	1598.92	1834.21	2063.72
As % of total sales . . . . .	38.07	38.07	38.07	43.67	49.12
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	1598.92	1598.92	1598.92	1834.21	2063.22
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1598.92	1598.92	1598.92	1834.21	2063.22
Tax . . . . .	799.46	799.46	799.46	917.10	1031.61
Net profit . . . . .	799.46	799.46	799.46	917.10	1031.61
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	799.46	799.46	799.46	917.10	1031.61
Accumulated undistributed profit . . .	6320.02	7127.48	7926.94	8844.04	9875.65
Gross profit, % of total sales . . . . .	38.07	38.07	38.07	43.67	49.12
Net profit, % of total sales . . . . .	19.03	19.03	19.03	21.84	24.56
ROE, Net profit, % of equity . . . . .	29.10	29.10	29.10	33.47	37.65
ROI, Net profit+interest, % of invest.	9.82	9.82	9.82	11.27	12.67

CALCIUM CARBIDE --- February 00



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COMFAR 2.0 - BALBO & CO. S.R.L., NILAND

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
<b>Total assets .....</b>	<b>7670.00</b>	<b>8163.00</b>
Fixed assets, net of depreciation	0.00	1836.00
Construction in progress .....	1836.00	6327.00
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	5834.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>7670.00</b>	<b>8163.00</b>
Equity capital .....	2740.00	2740.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	4930.00	4930.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	493.00
<b>Total debt .....</b>	<b>4930.00</b>	<b>5423.00</b>
<b>Equity, % of liabilities .....</b>	<b>35.72</b>	<b>33.57</b>





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1989	1990	1991	1992	1993	1994
Total assets	8241.57	7867.78	7279.65	6691.74	6514.97	6591.99
Fixed assets, net of depreciation	7639.40	7115.00	6596.10	6000.30	5564.50	5072.71
Construction in progress	6.00	0.00	0.00	0.00	0.00	0.00
Current assets	285.99	437.23	599.52	599.52	599.52	599.52
Cash, bank	17.25	10.83	11.91	11.91	11.91	11.91
Cash surplus, finance available	0.00	0.00	0.00	0.00	339.03	907.85
Loss carried forward	0.00	303.92	72.12	0.00	0.00	0.00
Loss	303.92	0.00	0.00	0.00	0.00	0.00
Total liabilities	8241.57	7867.78	7279.65	6691.74	6514.97	6591.99
Equity capital	2740.00	2740.00	2740.00	2740.00	2740.00	2740.00
Reserves, retained profit	0.00	0.00	0.00	514.77	1134.42	1784.08
Profit	0.00	231.00	586.89	619.65	650.46	693.27
Long and medium term debt	4313.75	3697.50	3081.25	2465.00	1848.75	1232.50
Current liabilities	67.10	104.14	141.34	141.34	141.34	141.34
Bank overdraft, finance required	1120.71	1094.34	730.17	210.98	0.00	0.00
Total debt	5501.57	4895.98	3952.76	2817.32	1990.09	1373.84
Equity, % of liabilities	33.25	34.83	37.64	40.95	42.06	41.57

CALCIUM CARBIDE — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	1995	1996	1997	1998	1999	2000
Total assets .....	6699.83	6838.48	7624.19	8409.90	9209.36	10008.82
Fixed assets, net of depreciation	4580.91	4089.11	3597.31	3105.51	2641.21	2176.91
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	599.52	599.52	599.52	599.52	599.52	599.52
Cash, bank .....	11.91	11.91	11.91	11.91	11.91	11.91
Cash surplus, finance available .	1507.49	2137.93	3415.44	4692.95	5956.71	7220.47
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	6699.83	6838.48	7624.19	8409.90	9209.36	10008.82
Equity capital .....	2740.00	2740.00	2740.00	2740.00	2740.00	2740.00
Reserves, retained profit .....	2478.15	3202.24	3957.13	4742.85	5528.56	6328.02
Profit .....	724.09	754.90	785.71	785.71	799.46	799.46
Long and medium term debt .....	616.25	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	141.34	141.34	141.34	141.34	141.34	141.34
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt .....	757.59	141.34	141.34	141.34	141.34	141.34
Equity, % of liabilities .....	40.90	40.07	35.94	32.58	29.75	27.38

CALCIUM CARBIDE --- Februar 8



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	2001	2002	2003
Total assets .....	10808.28	11725.38	12756.99
Fixed assets, net of depreciation	1712.61	1483.60	1483.60
Construction in progress .....	0.00	0.00	0.00
Current assets .....	599.52	599.52	599.52
Cash, bank .....	11.91	11.91	11.91
Cash surplus, finance available .	8484.23	9630.35	10661.96
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	10808.28	11725.38	12756.99
Equity capital .....	2740.00	2740.00	2740.00
Reserves, retained profit .....	7127.48	7926.94	8844.04
Profit .....	799.46	917.10	1031.61
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	141.34	141.34	141.34
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	141.34	141.34	141.34
Equity, % of liabilities .....	25.35	23.37	21.48

CALCIUM CARBIDE --- February 88

Calcium Carbide

ANNEXE 3

BEP EVALUATION

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	HYP. 2	HYP. 1
1) TOTAL REVENUES	<u>4200</u>	<u>4200</u>
2) VARIABLE COSTS:	<u>1946.27</u>	<u>3475.62</u>
. RAW MATERIALS	1120.37	1120.37
. UTILITIES	-	-
. ENERGY	730.54	2259.89
. LABOUR	95.36	95.36
3) FIXED COSTS	<u>1079.96</u>	<u>1079.96</u>
. REPAIR-MAINTENANCE	38.26	38.26
. SPARES	90.80	90.80
. ADMINISTRATION	61.45	61.45
. DEPRECIATION	519.70	519.70
. FINANCIAL COSTS	369.75	369.75
4) TOTAL PRODUCTION COSTS	<u>3026.23</u>	<u>4555.58</u>
BEP	1079.96	
(HYP.2) ----- x 100 =	47.9%	
4200 - 1946.27		
BEP	1079.96	
(HYP.1) ----- X 100 =		higher than
4200 - 3475.62		100 %

**BEP EVALUATION**

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>5982</u>
2) VARIABLE COSTS:	<u>1810.89</u>
. RAW MATERIALS	779.62
. UTILITIES	3.60
. ENERGY	836.08
. LABOUR	191.59
3) FIXED COSTS	<u>1871.52</u>
. REPAIR-MAINTENANCE	65.51
. SPARES	268.30
. ADMINISTRATION	77.68
. DEPRECIATION	856.93
. FINANCIAL COSTS	623.10
4) TOTAL PRODUCTION COSTS	<u>3682.41</u>

$$\text{BEP} = \frac{1871.52}{5982 - 1810.89} \times 100 = 44.8\%$$

Calcium Carbide

ANNEXE 4

FOREIGN EXCHANGE EFFECT EVALUATION



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow . . .	4931.09	4930.00	1.09	4930.00	0.00	0.63	0.14
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	4931.09	4930.00	1.09	4930.00	0.00	0.63	0.14
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . . .	17977.61	6293.00	11684.61	1160.00	5133.00	1444.45	1376.91
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	4727.00	5800.00	-1073.00	1160.00	4640.00	106.98	49.65
imported materials . . . .	5608.02	0.00	5608.02	0.00	0.00	228.22	279.44
repayment loans & overd.	4931.09	0.00	4931.09	0.00	0.00	616.25	616.25
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	2711.50	493.00	2218.50	0.00	493.00	493.00	431.38
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-13046.52	-1363.00	-11683.52	3770.00	-5133.00	-1443.82	-1376.77
import substit'n effect	7395.00	0.00	7395.00	0.00	0.00	493.00	493.00
net foreign exchnge effect	-5651.52	-1363.00	-4288.52	3770.00	-5133.00	-950.82	-883.77
present values at 10.00 %							
foreign exchange flow . . .	-7783.12						
net foreign exchnge effect	-4374.22						





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Foreign Exchange Effect in 1000 US \$  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	0.31	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.31	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .							
total foreign outflow .	1441.52	1316.70	1255.07	1193.45	1131.82	1070.20	392.32
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	63.20	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	392.32	392.32	392.32	392.32	392.32	392.32	392.32
repayment loans & overd.	616.25	616.25	616.25	616.25	616.25	616.25	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	369.75	308.13	246.50	184.88	123.25	61.63	0.00
indirect costs . . . . .							
net foreign exchnge flow	-1441.21	-1316.70	-1255.07	-1193.45	-1131.82	-1070.20	-392.32
import substit'n effect	493.00	493.00	493.00	493.00	493.00	493.00	493.00
net foreign exchnge effect	-948.21	-823.70	-762.07	-700.45	-638.82	-577.20	100.68
present values at 10.00 %							
foreign exchange flow .	-7783.12						
net foreign exchnge effect	-4374.22						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overcraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	392.32	392.32	392.32	392.32	392.32	392.32	-1291.75
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-1292.84
imported materials . . .	392.32	392.32	392.32	392.32	392.32	392.32	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	1.09
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-392.32	-392.32	-392.32	-392.32	-392.32	-392.32	1291.75
import substit'n effect	493.00	493.00	493.00	493.00	493.00	493.00	0.00
net foreign exchange effect	100.68	100.68	100.68	100.68	100.68	100.68	1291.75
present values at 10.00 %							
foreign exchange flow .	-7783.12						
net foreign exchange effect	-4374.22						

Calcium Carbide

ANNEXE 5

FINANCIAL AND FOREIGN EXCHANGE EVALUATIONS  
FOR THE CALCIUM CARBIDE  
AND CALCIUM CYANAMIDE INTEGRATED FACTORY



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**CALCIUM CARBIDE & CALCIUM CYANAMIDE**

February 88

Power at 0.05 birr/kWh

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	13520.00	78.433 I foreign
current assets:	0.00	0.000 I foreign
total assets:	13520.00	78.433 I foreign

**Source of funds during construction phase**

equity & grants:	4382.00	0.000 I foreign
foreign loans:	8308.00	
local loans:	0.00	
total funds:	12690.00	65.469 I foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1281.70	1579.73	2202.32
depreciation :	865.73	865.73	856.93
interest :	830.80	726.95	623.10
production costs	2978.23	3172.41	3682.41
thereof foreign	62.63 I	56.01 I	50.84 I
total sales :	2658.00	3987.60	5982.00
gross income :	-320.23	815.19	2299.59
net income :	-320.23	407.60	1149.80
cash balance :	-852.86	116.65	755.82
net cashflow :	1016.44	1882.10	2417.42

Net Present Value at: 10.00 I = 2845.72

Internal Rate of Return on total investment: 13.51 I

Equity paid versus Net income flow (IRR): 14.96 I

Net Worth versus Net Cash Return (IRR): 14.56 I

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Total Initial Investment in 1000 US \$

Year . . . . .	1987	1988	1989
Fixed investment costs			
Land, site preparation, development	88.00	0.00	0.00
Buildings and civil works . . . . .	400.00	600.00	63.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant machinery and equipment . . . . .	977.40	3745.10	6626.50
Total fixed investment costs . . . . .	1465.40	4345.10	6689.50
Pre-production capital expenditures.	20.00	30.00	970.00
Net working capital . . . . .	0.00	0.00	0.00
Total initial investment costs . . . . .	1485.40	4375.10	7660.30
Of it foreign, in % . . . . .	65.00	73.72	83.57

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US \$**

Year .....	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Working capital .....</b>	<b>359.86</b>	<b>118.17</b>	<b>212.40</b>
<b>Total current investment costs ...</b>	<b>359.86</b>	<b>118.17</b>	<b>212.40</b>
<b>Of it foreign, Z .....</b>	<b>62.14</b>	<b>64.90</b>	<b>70.71</b>

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994	1995
1 of non. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	252.20	378.37	567.62	567.62	567.62	567.62
Other raw materials . . . . .	94.22	141.34	212.00	212.00	212.00	212.00
Utilities . . . . .	1.60	2.40	3.60	3.60	3.60	3.60
Energy . . . . .	371.47	557.32	836.00	836.00	836.00	836.00
Labour, direct . . . . .	191.59	191.59	191.59	191.59	191.59	191.59
Repair, maintenance . . . . .	65.51	65.51	65.51	65.51	65.51	65.51
Spares . . . . .	107.43	165.52	248.30	248.30	248.30	248.30
Factory overheads . . . . .	120.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1204.02</b>	<b>1502.05</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>
Administrative overheads . . . . .	77.68	77.68	77.68	77.68	77.68	77.68
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	865.73	865.73	856.93	848.13	848.13	810.13
Financial costs . . . . .	330.00	726.95	623.10	519.25	415.40	311.55
<b>Total production costs . . . . .</b>	<b>2978.23</b>	<b>3172.41</b>	<b>3682.41</b>	<b>3569.76</b>	<b>3465.91</b>	<b>3324.06</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, Z . . . . .	62.62	56.01	50.04	49.53	48.02	46.95
Of it variable, Z . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	269.27	269.27	269.27	269.27	269.27	269.27

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year .....	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I .....	567.62	567.62	567.62	567.62	567.62	567.62
Other raw materials .....	212.00	212.00	212.00	212.00	212.00	212.00
Utilities .....	3.60	3.60	3.60	3.60	3.60	3.60
Energy .....	836.00	836.00	836.00	836.00	836.00	836.00
Labour, direct .....	191.59	191.59	191.59	191.59	191.59	191.59
Repair, maintenance .....	65.51	65.51	65.51	65.51	65.51	65.51
Spares .....	248.30	248.30	248.30	248.30	248.30	248.30
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>
Administrative overheads .....	77.68	77.68	77.68	77.68	77.68	77.68
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	810.13	810.13	810.13	756.98	373.38	0.00
Financial costs .....	207.70	103.85	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>3220.21</b>	<b>3116.36</b>	<b>3012.51</b>	<b>2959.36</b>	<b>2575.75</b>	<b>2202.38</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	45.24	43.41	41.46	42.20	35.66	27.11
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	269.27	269.27	269.27	269.27	269.27	269.27

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 83





**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year		1990	1991	1992	1993-2004
Coverage	ndc coto				
Current assets &					
Accounts receivable	30 12.0	106.81	131.64	183.53	183.53
Inventory and materials	54 6.6	52.57	78.87	118.32	118.32
Energy	9 41.6	8.93	13.40	20.11	20.11
Spares	360 1.0	107.43	165.52	248.30	248.30
Work in progress	7 51.4	23.41	29.21	41.31	41.31
Finished products	30 12.0	106.81	131.64	183.53	183.53
Cash in hand	15 24.0	23.43	20.85	24.30	24.30
Total current assets		429.39	571.14	819.39	819.39
Current liabilities and					
Accounts payable	22 16.5	69.53	93.11	128.96	128.96
Net working capital		359.86	478.03	690.43	690.43
Increase in working capital		359.86	118.17	212.40	0.00
Net working capital, local		136.23	177.71	239.92	239.92
Net working capital, foreign		223.62	300.32	450.51	450.51

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988	1989
Equity, ordinary ..	4382.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	8308.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	8308.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	830.80
Total funds .....	12690.00	0.00	830.80

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., NZLANO

Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994-97
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1038.50	-1038.50	-1038.50	-1038.50	-1038.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1038.50	-1038.50	-1038.50	-1038.50	-1038.50
Current liabilities	69.53	23.58	35.85	0.00	0.00
Bank overdraft ....	852.86	-116.65	-755.82	-811.18	0.00
Total funds .....	-116.11	-1131.58	-1758.47	-1849.68	-1038.50

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988	1989
Total cash inflow . .	12690.00	0.00	0.00
Financial resources .	12690.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00
Total cash outflow . .	1485.40	4375.10	7660.30
Total assets . . . .	1485.40	4375.10	6829.50
Operating costs . . .	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	830.80
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	11204.60	-4375.10	-7660.30
Cumulated cash balance	11204.60	6829.50	-830.80
Inflow, local . . . . .	4382.00	0.00	0.00
Outflow, local . . . .	508.00	1149.70	1258.30
Surplus ( deficit ) .	3874.00	-1149.70	-1258.30
Inflow, foreign . . . .	8308.00	0.00	0.00
Outflow, foreign . . .	977.40	3225.40	6402.00
Surplus ( deficit ) .	7330.60	-3225.40	-6402.00
Net cashflow . . . . .	-1485.40	-4375.10	-6829.50
Cumulated net cashflow	-1485.40	-5860.50	-12690.00

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2727.53	4011.18	6017.85	5982.00	5982.00	5982.00
Financial resources .	69.53	23.58	35.85	0.00	0.00	0.00
Sales, net of tax . .	2658.00	3987.60	5982.00	5982.00	5982.00	5982.00
Total cash outflow . .	3580.39	3894.52	5262.03	4966.25	4944.33	4881.40
Total assets . . . .	429.39	141.75	248.26	0.00	0.00	0.00
Operating costs . . .	1281.70	1579.73	2202.38	2202.38	2202.38	2202.38
Cost of finance . . .	830.80	726.95	623.10	519.25	415.40	311.55
Repayment . . . . .	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50
Corporate tax . . . .	0.00	407.60	1149.80	1206.12	1258.05	1328.97
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) . .	-852.86	116.65	755.82	1015.75	1067.67	1100.60
Cumulated cash balance	-1683.66	-1567.01	-811.18	204.57	1272.24	2372.84
Inflow, local . . . . .	2726.47	4011.13	6017.30	5982.00	5982.00	5982.00
Outflow, local . . . .	1104.01	1654.31	2852.62	2811.43	2863.36	2934.28
Surplus (deficit) . .	1622.46	2356.82	3164.68	3170.57	3118.64	3047.72
Inflow, foreign . . . .	1.06	0.04	0.55	0.00	0.00	0.00
Outflow, foreign . . .	2476.38	2240.21	2409.41	2154.82	2050.97	1947.12
Surplus (deficit) . .	-2475.31	-2240.17	-2408.86	-2154.82	-2050.97	-1947.12
Net cashflow . . . . .	1016.44	1882.10	2417.42	2573.50	2521.57	2450.65
Cumulated net cashflow	-11673.56	-9791.46	-7374.03	-4600.53	-2278.96	171.69

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88

## Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Total cash outflow . .	4829.48	4777.55	3687.13	3687.13	3713.70	3713.70
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	2202.38	2202.38	2202.38	2202.38	2202.38	2202.38
Cost of finance . . .	207.70	103.85	0.00	0.00	0.00	0.00
Repayment . . . . .	1038.50	1038.50	0.00	0.00	0.00	0.00
Corporate tax . . . .	1380.90	1432.82	1484.75	1484.75	1511.32	1511.32
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1152.52	1204.45	2294.87	2294.87	2268.30	2268.30
Cumulated cash balance	3525.36	4729.81	7024.69	9319.56	11587.86	13856.16
Inflow, local . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Outflow, local . . . .	2986.21	3038.13	3090.06	3090.06	3116.63	3116.63
Surplus ( deficit ) .	2995.79	2943.87	2891.94	2891.94	2865.37	2865.37
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	1843.27	1739.42	597.07	597.07	597.07	597.07
Surplus ( deficit ) .	-1843.27	-1739.42	-597.07	-597.07	-597.07	-597.07
Net cashflow . . . . .	2398.72	2346.80	2294.87	2294.87	2268.30	2268.30
Cumulated net cashflow	2570.41	4917.21	7212.09	9506.96	11775.26	14043.56



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	5982.00	5982.00	5982.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	5982.00	5982.00	5982.00
Total cash outflow . .	3713.70	3905.50	4092.19
Total assets . . . .	0.00	9.00	0.00
Operating costs . . .	2202.38	2202.38	2202.38
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	1511.32	1703.12	1889.81
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	2268.30	2076.50	1889.81
Cumulated cash balance	16124.46	18200.96	20090.77
Inflow, local . . . .	5982.00	5982.00	5982.00
Outflow, local . . . .	3116.63	3308.43	3495.12
Surplus ( deficit ) .	2865.37	2673.57	2486.88
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	597.07	597.07	597.07
Surplus ( deficit ) .	-597.07	-597.07	-597.07
Net cashflow . . . . .	2268.30	2076.50	1889.81
Cumulated net cashflow	16311.86	18388.36	20278.17

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	2389.72	at 10.00 %
Internal Rate of Return (IRRE1) ..	14.96 %	
b) Net Worth versus Net cash return:		
Net present value .....	2704.59	at 10.00 %
Internal Rate of Return (IRRE2) ..	14.56 %	
c) Internal Rate of Return on total investment:		
Net present value .....	2845.72	at 10.00 %
Internal Rate of Return ( IRR ) ..	13.51 %	

Net Worth = Equity paid plus reserves

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CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88





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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2658.00	3987.60	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2658.00	3987.60	5982.00	5982.00	5982.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2147.43	2445.46	3059.31	3050.51	3050.51
Operational margin . . . . .	510.57	1542.14	2922.69	2931.49	2931.49
As % of total sales . . . . .	19.21	38.67	48.86	49.01	49.01
Cost of finance . . . . .	830.80	726.95	623.10	519.25	415.40
Gross profit . . . . .	-320.23	815.19	2299.59	2412.24	2516.09
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-320.23	815.19	2299.59	2412.24	2516.09
Tax . . . . .	0.00	407.60	1149.80	1206.12	1258.05
Net profit . . . . .	-320.23	407.60	1149.80	1206.12	1258.05
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-320.23	407.60	1149.80	1206.12	1258.05
Accumulated undistributed profit . . .	-320.23	87.37	1237.16	2443.28	3701.33
Gross profit, % of total sales . . . .	-12.05	20.44	38.44	40.32	42.06
Net profit, % of total sales . . . .	-12.05	10.22	19.22	20.16	21.03
RDE, Net profit, % of equity . . . . .	-7.31	9.30	26.24	27.52	28.71
ROI, Net profit+interest, % of invest.	3.91	8.62	13.25	12.89	12.51



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3012.51	3012.51	3012.51	3012.51	3012.51
Operational margin . . . . .	2969.49	2969.49	2969.49	2969.49	2969.49
As % of total sales . . . . .	49.64	49.64	49.64	49.64	49.64
Cost of finance . . . . .	311.55	207.70	103.85	0.00	0.00
Gross profit . . . . .	2657.94	2761.79	2865.64	2969.49	2969.49
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2657.94	2761.79	2865.64	2969.49	2969.49
Tax . . . . .	1328.97	1380.90	1432.82	1484.75	1484.75
Net profit . . . . .	1328.97	1380.90	1432.82	1484.75	1484.75
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1328.97	1380.90	1432.82	1484.75	1484.75
Accumulated undistributed profit . . .	5030.30	6411.19	7844.01	9328.76	10813.50
Gross profit, % of total sales . . . . .	44.43	46.17	47.90	49.64	49.64
Net profit, % of total sales . . . . .	22.22	23.08	23.95	24.82	24.82
ROE, Net profit, % of equity . . . . .	30.33	31.51	32.70	33.88	33.88
ROI, Net profit+interest, % of invest.	12.26	11.87	11.48	11.10	11.10



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2959.36	2959.36	2959.36	2575.76	2202.38
Operational margin . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
As % of total sales . . . . .	50.53	50.53	50.53	56.94	63.18
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
Tax . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Net profit . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Accumulated undistributed profit . . .	12324.83	13836.15	15347.47	17050.59	18940.40
Gross profit, % of total sales . . . .	50.53	50.53	50.53	56.94	63.18
Net profit, % of total sales . . . .	25.26	25.26	25.26	28.47	31.59
ROE, Net profit, % of equity . . . .	34.49	34.49	34.49	38.87	43.13
ROI, Net profit+interest, % of invest.	11.30	11.30	11.30	12.73	14.12

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year .....	1987	1988	1989
Total assets .....	12690.00	12690.00	13520.80
Fixed assets, net of depreciation	0.00	1485.40	5860.50
Construction in progress .....	1485.40	4375.10	7660.30
Current assets .....	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00
Cash surplus, finance available .	11204.60	6829.50	0.00
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	12690.00	12690.00	13520.80
Equity capital .....	4382.00	4382.00	4382.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	8308.00	8308.00	8308.00
Current liabilities .....	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	830.80
Total debt .....	8308.00	8308.00	9138.80
Equity, % of liabilities .....	34.53	34.53	32.41

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 1989



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1990	1991	1992	1993	1994	1995
Total assets	13404.69	12680.71	11751.81	11108.24	11327.79	11618.26
Fixed assets, net of depreciation	12655.07	11789.34	10932.41	10084.28	9236.16	8426.03
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	405.96	550.29	795.10	795.10	795.10	795.10
Cash, bank	23.43	20.85	24.30	24.30	24.30	24.30
Cash surplus, finance available	0.00	0.00	0.00	204.57	1272.24	2372.84
Loss carried forward	0.00	320.23	0.00	0.00	0.00	0.00
Loss	320.23	0.00	0.00	0.00	0.00	0.00
Total liabilities	13404.69	12680.71	11751.81	11108.24	11327.79	11618.26
Equity capital	4382.00	4382.00	4382.00	4382.00	4382.00	4382.00
Reserves, retained profit	0.00	0.00	87.37	1237.16	2443.28	3701.33
Profit	0.00	407.60	1149.80	1206.12	1258.05	1328.97
Long and medium term debt	7269.50	6231.00	5192.50	4154.00	3115.50	2077.00
Current liabilities	69.53	93.11	128.96	128.96	128.96	128.96
Bank overdraft, finance required	1683.66	1567.00	811.18	0.00	0.00	0.00
Total debt	9022.69	7891.11	6132.64	4282.96	3244.46	2205.96
Equity, % of liabilities	32.69	34.56	37.29	39.45	38.68	37.72

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
<b>Total assets .....</b>	<b>11960.66</b>	<b>12354.97</b>	<b>13839.72</b>	<b>15324.47</b>	<b>16835.79</b>	<b>18347.11</b>
Fixed assets, net of depreciation	7615.90	6805.77	5995.64	5185.51	4428.53	3671.55
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	795.10	795.10	795.10	795.10	795.10	795.10
Cash, bank .....	24.30	24.30	24.30	24.30	24.30	24.30
Cash surplus, finance available .	3525.36	4729.81	7024.69	9319.56	11587.86	13856.16
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>11960.66</b>	<b>12354.97</b>	<b>13839.72</b>	<b>15324.47</b>	<b>16835.79</b>	<b>18347.11</b>
Equity capital .....	4382.00	4382.00	4382.00	4382.00	4382.00	4382.00
Reserves, retained profit .....	5030.30	6411.19	7844.01	9328.76	10813.50	12324.83
Profit .....	1380.90	1432.82	1484.75	1484.75	1511.32	1511.32
Long and medium term debt .....	1038.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	128.96	128.96	128.96	128.96	128.96	128.96
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1167.46</b>	<b>128.96</b>	<b>128.96</b>	<b>128.96</b>	<b>128.96</b>	<b>128.96</b>
<b>Equity, % of liabilities .....</b>	<b>36.64</b>	<b>35.47</b>	<b>31.66</b>	<b>28.59</b>	<b>26.03</b>	<b>23.88</b>

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



**COMFAR**  
20 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>19858.43</b>	<b>21561.55</b>	<b>23451.36</b>
Fixed assets, net of depreciation	2914.57	2541.20	2541.20
Construction in progress .....	0.00	0.00	0.00
Current assets .....	795.10	795.10	795.10
Cash, bank .....	24.30	24.30	24.30
Cash surplus, finance available .	16124.46	18200.96	20090.77
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>19858.43</b>	<b>21561.55</b>	<b>23451.36</b>
Equity capital .....	4382.00	4382.00	4382.00
Reserves, retained profit .....	13836.15	15347.47	17050.59
Profit .....	1511.32	1703.12	1889.81
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	128.96	128.96	128.96
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>128.96</b>	<b>128.96</b>	<b>128.96</b>
<b>Equity, % of liabilities .....</b>	<b>22.07</b>	<b>20.32</b>	<b>18.69</b>

CALCIUM CARBIDE & CALCIUM CYANAMIDE --- February 88



**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow . .	8309.66	8308.00	1.66	8308.00	0.00	0.00	1.06
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	8309.66	8308.00	1.66	8308.00	0.00	0.00	1.06
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	29387.18	10604.80	18782.38	977.40	3225.40	6402.00	2476.38
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	7965.80	9774.00	-1808.20	977.40	3225.40	5571.20	224.69
imported materials . . .	8542.32	0.00	8542.32	0.00	0.00	0.00	382.39
repayment loans & overd.	8309.66	0.00	8309.66	0.00	0.00	0.00	1038.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	4569.40	830.80	3738.60	0.00	0.00	830.80	830.80
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-21077.52	-2296.80	-18780.72	7330.60	-3225.40	-6402.00	-2475.31
import substit'n effect	30255.00	0.00	30255.00	0.00	0.00	0.00	1213.00
net foreign exchange effect	9177.48	-2296.80	11474.28	7330.60	-3225.40	-6402.00	-1262.31
present values at 10.00 %							
foreign exchange flow .	-11121.96						
net foreign exchange effect	1115.38						



7d


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 2.1 UNIDO

COMFAR 2.1 - BALSO &amp; CO. S.R.L., MILANO

Foreign Exchange Effect in 1000 US \$  
 Economic Analysis excluding indirect effects  
 100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	0.04	0.55	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsides, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.04	0.55	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .							
total foreign outflow .	2240.21	2409.41	2154.82	2050.97	1947.12	1843.27	1739.42
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	76.74	150.74	0.00	0.00	0.00	0.00	0.00
incurred materials . . .	398.02	597.07	597.07	597.07	597.07	597.07	597.07
repayment loans & overd.	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
reallocated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	726.95	623.10	519.25	415.40	311.95	207.70	103.85
indirect costs . . . . .							
net foreign exchange flow	-2240.17	-2408.86	-2154.82	-2050.97	-1947.12	-1843.27	-1739.42
import substit'n effect	1573.00	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00
net foreign exchange effect	-667.17	-295.86	-41.82	62.03	165.88	269.73	373.58
present values at 10.00 %							
foreign exchange flow .	-11121.96						
net foreign exchange effect	1115.38						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Foreign Exchange Effect in 1000 US \$  
Economic Analysis excluding indirect effects  
100 units foreign DJ = 100.00 units local DJ

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overcost . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	597.07	597.07	597.07	597.07	597.07	597.07	597.07
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	597.07	597.07	597.07	597.07	597.07	597.07	597.07
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-597.07	-597.07	-597.07	-597.07	-597.07	-597.07	-597.07
import substit'n effect	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00
net foren exchge effect	1515.93	1515.93	1515.93	1515.93	1515.93	1515.93	1515.93
present values at foreign exchange flow .	10.00 % -11121.96						
net foren exchge effect	1115.38						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	production 2005
total foreign inflow . .	0.00
equity capital . . . . .	0.00
subsidies, grants . . .	0.00
loans & overdraft . . .	0.00
exports . . . . .	0.00
indirect effects . . . . .	.....
total foreign outflow .	-258.71
royalties . . . . .	0.00
equipment . . . . .	-2260.37
imported materials . . .	0.00
repayment loans & overd.	1.66
other repayments . . . .	0.00
repatriated wages . . .	0.00
dividends paid . . . . .	0.00
interests . . . . .	0.00
indirect costs . . . . .	.....
net foreign exchange flow	258.71
import substit'n effect	0.00
net foreign exchange effect	258.71
present values at 10.00 %	
foreign exchange flow .	-11121.96
net foreign exchange effect	1115.38

DRW. B.162 - 8 - 1

PROCESS BLOCK DIAGRAM

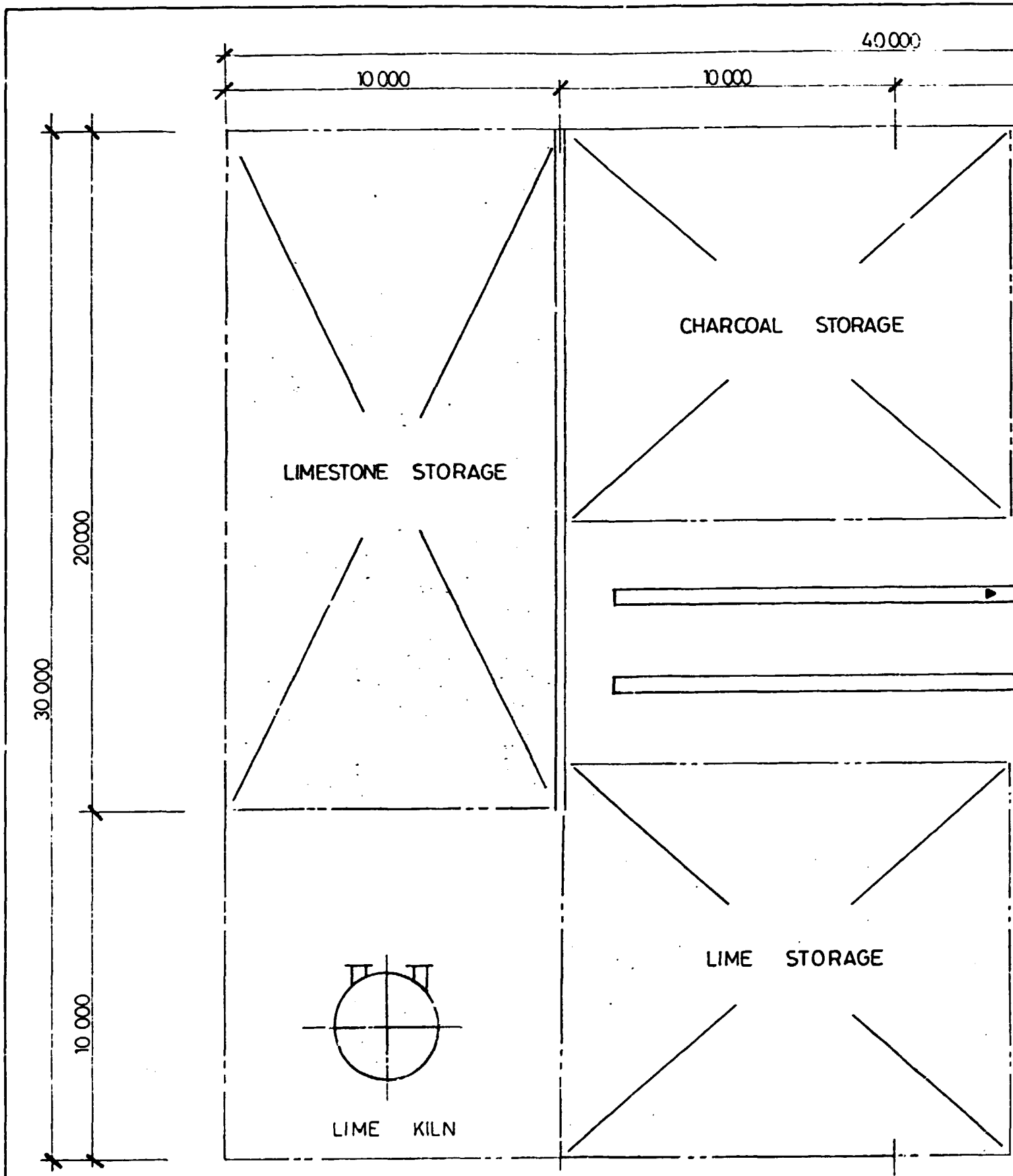
DRW. B.162 - 8 - 2

PROCESS EQUIPMENT LAYOUT

DRW. B.162 - 8 - 3

ACETYLENE LAMP





**SECTION 1**

40 000

10 000

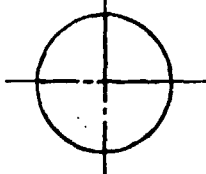
10 000

STORAGE

CARBIDE FURNACE

CARBIDE COOLING

CRUSHING & BARREL FILLING



PRODUCT STORAGE

### SECTION .2

CALCIUM CARBIDE PRODUCTION  
PROCESS EQUIPMENT LAY-OUT

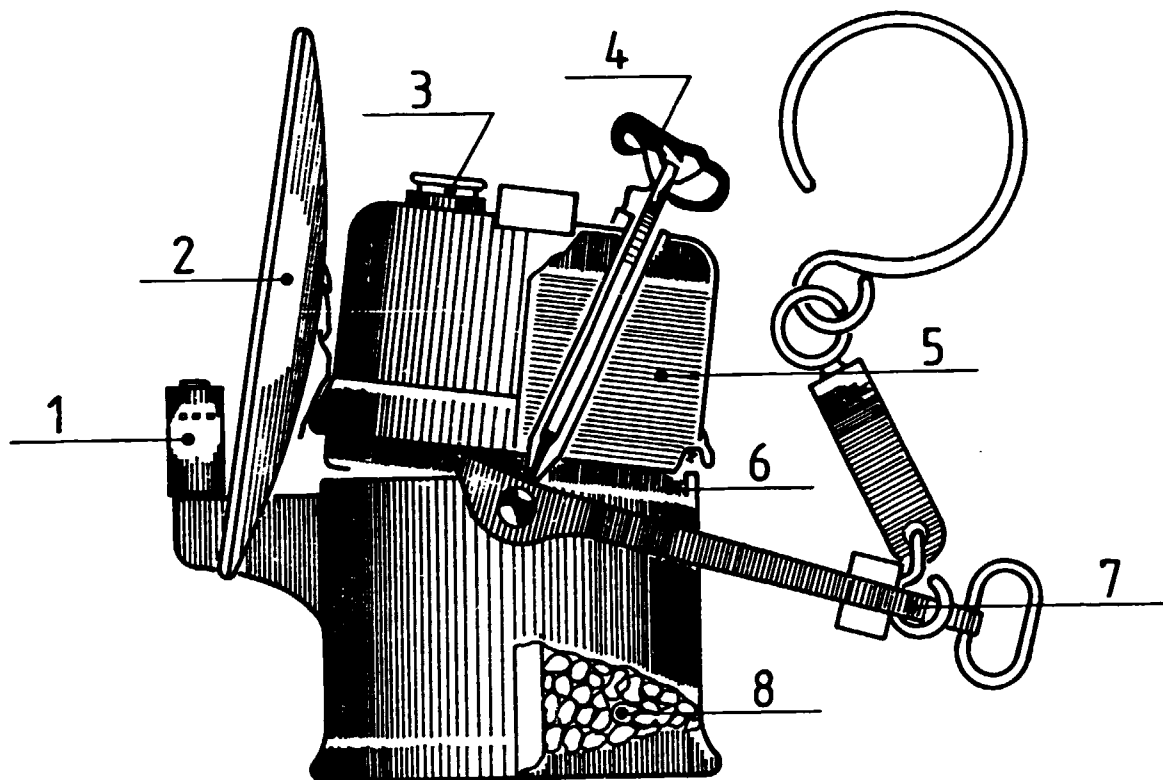
**baldo & c.**  
CONSULTING ENGINEERS

Via Stillicone 39, 20154 MILANO  
Ph. N. 3102 Tlx N. 330229

DIS. N°  
DWG N°

B.162 - 8 - 2

REV



SECTION 1





**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF CALCIUM CYANAMIDE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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FACTORY

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SITE LAY-OUT  
DRW. B.162 - 10 - 2  
ROTARY KILN

0. SUMMARY AND CONCLUSIONS

If the project for the production of Calcium carbide is implemented, the production of Calcium Cyanamide (which uses Calcium Carbide as main raw material) could be taken into consideration.

Calcium Cyanamide is mainly used as a nitrogen fertilizer. Its Nitrogen content is lower than Urea (approximately half) but its particular characteristics make its use extremely valuable in a number of cases, i.e., high acidity soils, seedbed preparation, etc.

In addition it has a herbicidal action (it accounts for the second major agricultural use of calcium cyanamide) and can therefore be used for the defoliation of cotton to allow mechanical pick-up or for the partial defoliation of plants to ensure complete sun-ripening just before harvesting, etc.

The relatively small amount of calcium cyanamide that could be produced by the proposed plant (9,000 tons/year) could easily find a market in a sector that is in need of larger inputs in terms of nutrients and phitochemicals to increase the yield.

In addition it is worth noting that all inputs to the plant are of local origin (Calcium carbide is produced from raw materials of local origin).

The fixed investment needed for the project implementation is in the range of 5,750,000 \$ and the plant will have a staff of 92.

The Internal rate of return is 4.73%

This IRR has been calculated by considering the cost of kWh at 0.2 birr. This process is, like the Calcium Carbide production one, high energy consumer. Therefore a second Comfar financial evaluation has been carried

out considering the cost of energy at 0.05 birr/kWh. In this case the IRR would be 7.55% and the BEP 68%. On the other hand the foreign exchange effect is positive being 3,724,000 \$, even if the import substitution effect has been assumed in a very conservative way. An alternate scenario has also been studied, taking in consideration the possibility of integration with the production of calcium carbide, with consequent savings in fixed capital investment and operation costs. The preparation of a detailed feasibility study is therefore recommended.

1. INTRODUCTION

Calcium cyanamide is one of the first chemicals to be commercially produced in large quantity. It was one of the first sources of artificially produced nitrogen, dating back to the last years of the nineteenth century.

Commercial calcium cyanamide is sold under the trade names Cyanamide in U.S.A., Lime Nitrogen or Nitrolime in England and Kalkstickstoff in Germany.

It is a gray material containing many impurities and it is produced as an anhydrous powder.

For agricultural uses it is hydrated with a small amount of water to remove calcium carbide remaining in the crude product. It is then either sold as a powder or in granulated form. It may be oiled to reduce dust. The chemical composition of calcium cyanamide varies according to the different manufacturing processes.

In any case a typical average chemical composition is the following:

CaCN <sub>2</sub>	60-65%	Free carbon	12%
Total Nitrogen	20-24%	CaC <sub>2</sub> less than	1%
Nitrogen from CaCn <sub>2</sub>	21-22%	CaS less than	1%
		CaCO <sub>3</sub> less than	1%
Insoluble nitrogen	1%	CaSO <sub>4</sub> about	0,1%
CaO content	63-65%	SiO <sub>2</sub>	1-2%
		Fe <sub>2</sub> O <sub>3</sub>	1-2%
Free CaO	20-21%	Al <sub>2</sub> O <sub>3</sub>	0,3-1%
		MgO	traces

The main physical properties of technical calcium cyanamide are

- melting point 1340°C (it sublimates above 1150-1200°C)

- density            2,29 g/cm<sup>3</sup>
- crystal system    rhombohedral
- heat of formation -69 kcal/mol
- physical state    black bright granules.



2. MARKET AND PLANT CAPACITY

2.1 Uses

The original purpose of calcium cyanamide production was to provide fertilizers and also a raw material for ammonia, nitric acid, ammonium nitrate and urea production. The synthesis of ammonia from hydrogen and nitrogen later replaced the cyanamide process as the cheapest method.

However a large amount of cyanamide continued to be used mainly as a fertilizer for direct application.

Although the cost per unit of fixed nitrogen is higher than that of other compound fertilizers it has maintained its sales strength because of some peculiar properties. One of these is its high alkalinity (pH about 12) which makes it especially suitable for high acid soils or as a neutralizer with acidic fertilizers. Another unique advantage of calcium cyanamide is its ability to speed equilibration in mixed fertilizers. Calcium cyanamide itself is actually a herbicide and this effect can be combined with the fertilizing one with good results.

Calcium cyanamide, when applied to the soil, hydrolyzes to form lime and urea and the latter undergoes hydrolysis to ammonia. Consequently when used as a fertilizer calcium cyanamide must be applied either before plantation or well away from plant seeds or roots.

Its herbicidal action, however, accounts for the second major agricultural use of calcium cyanamide. It has found wide application for the defoliation of cotton plants to permit mechanized collection and it is

increasingly used in partial defoliation of other plants to ensure complete sun-ripening just before harvest time. It is also used in seedbed preparation to sterilize the ground before planting and to accelerate the decomposition of crop wastes.

But calcium cyanamide has also a large use as a chemical intermediate especially for the production of melamine resins. The annexed fig.2.1 shows the possibility of producing several fine chemicals starting from calcium cyanamide.

## 2.2 Forecast demand and plant capacity

One of the main objectives of the Ethiopian Government is to achieve self sufficiency in food; therefore products related to agriculture become more and more important. The use of fertilizers and pesticides is the most expedient short and long-term solution to food shortage. An idea of the extent of benefits to be derived from the use of fertilizers can be obtained from the rate of fertilizer application per hectare of arable land and permanent crops: 6 kg in developing Africa compared to that of 37 kg in Asia and Latin America, 64 kg in the world on average and 205 kg in Europe. Considering that the land under crop in Ethiopia is in the range of 7,000,000 hectares and that the present use of fertilizers (all types) is 50,000 tons approx., the average fertilizer application rate is now 7-8 kg/hectare, less than one third of the averages for Asia and Latin America.

Past apparent demand

Imports of fertilizers are assured by a number of official institutions, those belonging to the Ministry of Agriculture being by far the most important. The following table shows the evolution of imports of the most important types of fertilizers:

Year	Quantity (tons)	Value (birr)
1975	17,247	23,870,000
1976	42,964	25,182,593
1977	30,767	11,175,897
1978	22,392	13,056,713
1979	129,041	47,343,233
1980	75,961	67,967,583
1981	15,770	8,249,117
1982	24,885	13,029,682
1983	44,315	20,669,785
1984	15,116	11,388,194
1985	29,635	15,281,630

It is reported that fertilizers are also imported as part of internationally financed development projects, or sent as grants etc and that these inputs may not be recorded. It is assumed that present consumption is in the range of 50,000 tons, much lower of actual needs.

A number of experimental trials carried out in the past in different localities show that the soils in the highlands are in general deficient in Nitrogen and Phosphorus but the Potash content is good. The soil is responsive to both single and combined applications of nitrogenous and phosphatic fertilizers, Urea being so far the most commonly used single nitrogenous fertilizer, and Diammonium Phosphate (DAP), the most popular compound fertilizer.

Complex fertilizers (such as DAP) are preferred to direct ones (such as Urea) because of savings in transport, handling and storage, easy application and lower purchasing cost.

Some information on the probable situation of the consumption of nutrients by 1990 shows that:

- the Ministry of Agriculture has estimated that by 1990-95 its actual need in fertilizers will be more than 200,000 tons/year;
- State Farms have been using up to 37,000 tons/year and while the amount of fertilizers per hectare should not change considerably, the amount of land under crop should increase from 300,000 hectares to 1,000,000 hectares with a consequent increase to 123,000 tons of fertilizer;
- the Sugar Corporation foresees a consumption of 15,000 tons of fertilizer.

The above data can be summarized in the following table:

User	Quantity (ton)
Ministry of agriculture	200,000
State Farms	123,000
Sugar Co.	15,000
Other organizations and unforeseen uses	12,000
	-----
	350,000

for a total value (at 1985 price) of approx. 180-200 million Birrs.

Again, this data can be considered conservative because they would correspond to an average of 50 kg/hectare, still less than the world average in 1980 (64 kg).

In fact, an appropriate average rate of fertilizer in

the Ethiopian condition could be as shown in the following table:

(most data come from the "Handbook on Crop Production in Ethiopia" by the Institute of agro-cultural Research, Addis Ababa, 1979).

Type of crop	Rate of application (kg/hectare)	
	DAP	UREA
Teff	130	50
Wheat	120	100
Barley	100	50
Sorghum	170	100
Maize	100	100
Dagusse	100	-
Oilseeds	100	50
Pulses	100	-
Fruit and vegetables	100	-
Pepper	150	50
Other food crops	100	11
Tobacco	150	-
Sugar cane	250	250
Cotton	100	-

Therefore assuming a very conservative average of 125 kg fertilizer/hectare and an increase to approx. 8 million hectares, of the area under crop, the theoretical consumption of fertilizers would reach at least 1 million tons .

According to these data any project that could provide, at acceptable costs, a source of nutrients for agriculture, would have a ready market.

The main raw material for manufacturing calcium cyanamide is calcium carbide. The plant has been fixed

on the basis of the available production of the calcium carbide plant already considered in another opportunity study. The capacity of that plant is 7000 t/y, out of which 1000 t/y can be presumed to be utilized in the oxyacetylene welding process; the remaining product can be used either as means of lighting or for calcium cyanamide production. On this basis, that is 6000 t/y of available calcium carbide, the capacity of the calcium cyanamide plant results 9000 t/y (with a content of 22% of fixed nitrogen). The plant is presumed as operating, continuously, on three shifts for 330 d/y (two shifts only for the packaging department).

### 2.3 Sales prices and total revenues

The present price in the international market is in the range of 400-450 \$/ton and its cost delivered to Addis could be considered 550-600 \$/t to take into account freight and other charges.

It has been seen that Calcium cyanamide contains 22% of fixed Nitrogen and, therefore it should be compared, from the point of view of quantity of nutrient, with Urea which contains 46% Nitrogen.

Urea price CIF Assab is in the range of 300 \$/ton that becomes 380 \$/ton once distributed in the highlands. Therefore if selling price should be fixed only on the basis of the amount of nutrient Calcium cyanamide should be sold at 180 \$/ton.

But Calcium cyanamide cannot really be compared with Urea, at least for extensive use. Its characteristics as a herbicide, in addition to the fertilizing effect,

make this product extremely valuable for high revenue crops like vegetables, cotton, etc. particularly when these products are grown for export (its use is increasing for instance in countries like Japan and United States, where very stringent pollution control standards are in force).

The following facts should therefore be considered:

- Ethiopian agriculture is in urgent need of fertilizers and phitochemicals to improve yield
- Calcium Cyanamide has a specific field of application for crops like vegetables and cotton that are quite important in the country
- all inputs are of local origin and therefore the portion in foreign exchange of the production cost is only the depreciation and the financial charges.

It is therefore assumed that the ex-works price for Calcium cyanamide be equivalent to the one estimated above for import, i.e. 600 \$/ton. (1)

Total revenues would be 9000 tons x 600 \$ = 5,400,000 \$/year.

- (1) This price, even if equal to the Calcium Carbide one, can be considered acceptable, since the specific consumption of Calcium Carbide for producing 1 ton of Calcium Cyanamide is 0.67 tons only.

3. MATERIAL AND INPUTS

3.1 Chemistry

Calcium cyanamide is produced by reaction of nitrogen with calcium carbide, at high temperature.



In addition to the raw materials shown by the reaction (calcium carbide and nitrogen) a small amount of calcium chloride is required for speeding-up the nitrogenation process

3.2 Materials and utilities: requirements and costs.

All the inputs necessary to the production of calcium cyanamide at full capacity of the plant (9000 t/y) are shown in table 3.2.



Table 3.2 Materials and utilities: requirements and costs for production of 9000 TPY of calcium cyanamide

DESCRIPTION	UNIT	CONSUMPTIONS FOR		UNIT COST \$		ANNUAL COST (US\$)		
		1 TON	1 YEAR	LC	FC	LC	FC	TOTAL
<u>Raw materials</u>								
Calcium carbide	t	0.67	6,000	600	-	3,600,000	-	3,600,000
Nitrogen (1)	cu.mt	244	2,200,000	-	-	-	-	-
Calcium chloride	t	0.0117	105	-	450	-	47,250	47,250
<b>TOTAL RAW MATERIALS</b>						<b>3,600,000</b>	<b>47,250</b>	<b>3,647,250</b>
<u>Utilities</u>								
Electric power								
a) for nitrogen production	kWh	195	1,760,000	0.0966	-	170,016	-	170,016
b) for CaCN <sub>2</sub> production	kWh	290	2,610,000	0.0966	-	252,126	-	252,126
Water	m <sup>3</sup>	20	180,000	0.02	-	3,600	-	3,600
<b>TOTAL UTILITIES</b>						<b>425,742</b>	<b>-</b>	<b>425,742</b>
<u>Packaging</u>								
Paper bags (50 Kg)	n°	20	180,000	0.7	-	126,000	-	126,000
<b>GRAND TOTAL \$/y</b>								<b>4,198,992</b>
<b>UNIT COST \$/T</b>								<b>466,55</b>

(1) The cost of the nitrogen consists of electricity only (the equipment cost has been considered included in the investment cost of the whole plant).

**3.2.1 Characteristics of the raw materials**

Calcium carbide: technical product from calcium carbide production

Calcium chloride: technical grade anhydrous powder

Nitrogen: obtained in the plant by an air separation unit - purity 99,8%

**3.3 Purchasing programme and storage volumes**

Raw materials supply and suggested storage volumes are shown in table 3.3

**Table 3.3 Purchasing programme and stocks**

PRODUCTS	ORIGIN (1)	PURCHASING PROG.		COST \$	STORAGE IN
		T	DAYS (3)		WAREHOUSE
					cov. surface sq.mt
Calcium carbide (2)	L	600	30	360,000	200
Calcium chloride	F	60	180	27,000	80
Paper bags	L	16000	30	11,200	100
Finished product	-	800	30		1100
Total purchasing cost				398,200	

(1) L= local      F= foreign

(2) Calcium carbide should be fed to the calcium cyanamide plant (milling section) directly from its production unit, and, in this case, particular storage facilities should not be needed. Conversely, if the two plants are not so close, a limited space for the storage of the carbide containers has been foreseen.

(3) Equivalent number of days of operation at full capacity.

4. LOCATION

The calcium cyanamide plant should be located adjacent to the calcium carbide factory in order to avoid the transportation cost of a dangerous and moisture sensitive product.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The plant consists of three main sections:

- nitrogen production
- calcium carbide milling
- nitrogenation.

Nitrogen production

The calcium cyanamide plant is equipped with a separation air plant, having a capacity of about 350 Nm<sup>3</sup>/h of nitrogen.

Calcium carbide milling

Calcium carbide, supplied to the plant with a particle size of about 15-80mm, will be further ground to reduce the size to 25mm maximum.

The carbide ground in this way is collected in a feed hopper; this hopper, together with a similar bin containing calcium chloride, feed through a variable-speed screw conveyor a ball mill which ensures an intimate mixture of the components while pulverizing them to a maximum size of 0.2 mm.

Because atmospheric moisture will react with the carbide to form explosive acetylene, the carbide mills and the conveyor are blanketed with nitrogen to exclude both moisture and oxygen. The nitrogen is supplied by the same equipment which feeds the nitrogenation kiln.

Nitrogenation of calcium carbide

The nitrogenation is carried out continuously in an equipment shown in the annexed drawing B.162-10-2.

The milled carbide mixed with calcium chloride through the hopper (a) is transferred to a feeder (b) and then continuously introduced into the rotary kiln (c).

At the same time nitrogen is continuously introduced from the opposite side of the kiln (f).

The inside surface of the kiln is jacketed with a 20 cm thickness of a silicon carbide fire-bricks.

The external surface is provided with special fins to improve the heat exchange. Several temperature detectors show the temperature value in various points of the kiln (i).

The gaseous effluents pass through a dust separator (g): anyway the dust is very limited. The outgoing product from the kiln is collected in a warm-silo (d), where the reaction is completed, and partially cooled.

The cooling is completed in a rotary cooler (e) sprayed with water on the external surface.

The granulated calcium cyanamide is collected and sent to the stores for packaging. The main figures of the process are:

- Feeding:
  - . calcium carbide (with calcium chloride) 0,75 t/h
  - . nitrogen 277 Ncu.mt/h
- Time of permanence 18 h
- Speed of rotation of the kiln: 0.4 rpm
- Working temperature: 700° (inlet of the kiln)  
1050° (center of the kiln)

- Production: 950' (end of the kiln)  
about 1,1 t/h

## 5.2 Packaging

Granular calcium cyanamide will be packed manually in 50 Kg paper bags. The product can be stocked for some months without problems.

## 5.3 Lay-out and civil works

The lay-out is represented in drawing B.162-10-1.

All the factory covers an area of about 9000 sq.mt, out of which:

- 2400 sq.mt are needed by the process equipment and the facilities for the storage of raw and finished materials
- 1200 sq.mt by the warehouse
- 915 sq.mt by administrative offices and other facilities.

The nitrogen production plant is installed outdoors on a reinforced concrete plane foundation.

All the other process equipment, packaging and storage facilities are installed under a simple roof; this roof is made-up of corrugated asbestos cement and supported by steel structure; the floors are of concrete with a hard aggregate as finishing surface.

The two buildings (warehouse and administrative offices) are both single storey; they have supporting structures made of reinforced concrete and partitions and external walls of brickwork; the roof is of corrugated

asbestos-cement insulated with mineral wool-lagging; the office floors are covered with cement tiles, while the others are made of concrete.

The courtyard is covered with gravel and rolled.

A fence made of a wire-netting supported by small steel poles encloses the entire area.



**5.4 Investment costs of machinery and equipments:  
depreciation, maintenance**

**5.4.1 Investment costs of machinery and equipments in US \$**

MACHINERY COST	LC	FC	TOTAL
Machinery and equipment			
FOB European port	-	3,150,000	3,150,000
Transportation	315,000	315,000	630,000
Erection	310,000	320,000	630,000
Site preparation	53,000	-	53,000
Civil works	536,000	-	536,000
Insulation and painting	30,000	40,000	70,000
Spare parts	-	157,000	157,000
	1,244,000	3,982,000	5,226,000
Contingencies	126,000	398,000	524,000
Grand total	1,370,000	4,380,000	5,750,000

The life cycle of the plant can be estimated at 15 years.

The annual expense for maintenance has been considered equivalent to the 5% of the machinery investment cost that is 157,000.

In the financial evaluation the investment cost (contingencies included) are so subdivided:

Machinery	FC 4,380,000 \$
Machinery	LC 655,000 \$
Site preparation	LC 53,000 \$
Civil works	LC 662,000 \$
	-----
	5,750,000 \$

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit complete with utilities and facilities operating under the direction of NCC.

In any case, as already stated, the opportunity to install such a plant in the same factory producing calcium carbide has to be emphasized: all the operation of milling and packaging of the calcium carbide (which in any case is an hazardous operation) can be simplified.

7. MANPOWER

The chemist, the production manager, the engineer and the foremen should be well trained. Comprehensive training should be provided in technologies specifically involved in the process as well as in the safety procedures and in the corrosion prevention systems of the machinery.

For all the other positions, the requirements are the same of other chemical factories.

7.1 Management department

		birr/m	birr/y
General manager	n.1	1,500	
Technical manager	n.1	1,200	
	----	-----	-----
	n.2	2,700	32,400

7.2 Administrative department

Financial manager	n.1	1,000	
Senior accountant	n.1	400	
Purchasing office head	n.1	400	
Sale office head	n.1	400	
Warehouse head	n.1	400	
Senior clerks	n.4	1,400	
Secretaries and clerks	n.6	1,800	
Drivers	n.3	1,050	
Guards	n.6	1,200	
	----	-----	-----
	n.24	8,050	96,600
Total management+administrative dept.			129,000
			(62,319\$/y)

**7.3 Production and maintenance department**

		birr/m	birr/y
<b>A) Production department</b>			
Production manager	n.1	1000	
Shift foremen	n.8	3200	
Shift operators	n.28	9800	
Chemist	n.1	700	
Analyst	n.1	350	
Clerk	n.1	350	
Unskilled workers	n.4	1200	
	-----	-----	-----
	n.44	16600	199200
			(96232 \$/y)
 <b>B) Maintenance department</b>			
Engineer	n.1	1000	
Supervisors	n.3	1200	
Electricians	n.4	1600	
Mechanics	n.10	4000	
Other maintenance person	n.4	1400	
	-----	-----	-----
	n.22	9200	110400
			(53335 \$/y)

8. IMPLEMENTATION SCHEDULING

Thirty months are required for the design, machinery and equipment supply and erection of the plant, up to the commissioning and start-up.

9. FINANCIAL EVALUATION

The Comfar financial evaluations are attached as Annexe 1 and Annexe 2.

These evaluations have been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (one year) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "other raw materials"

- the production programme has been assumed as follows:

1st year: 4000 t (about 44% capacity)

2nd year: 6000 t (about 67% capacity)

from 3rd year up to 15th year: 9000 t (100% capacity)

Selling price 600\$/t

Electric power rate: 0.2 (Hypothesis 1) and 0.05  
(Hypothesis 2) birr/kWh  
respectively

As a result the evaluation yields an IRR of 4.73% for the Hyp. 1 and 7.55 for the Hyp. 2; for this last alternative the estimated BEP results 68%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 2.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import equal to the cost of an equivalent (in terms of Nitrogen) amount of UREA; that is considering the cost of a same amount at 180 \$/t.

While the net foreign exchange flow results negative (no export is foreseen), the net foreign exchange effect is positive; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 3,724,000\$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, there would still be a surplus which in terms of present value would amount to 3,724,000 \$

11. CALCIUM CARBIDE AND CALCIUM CYANAMIDE INTEGRATED FACTORY

The financial advantage deriving from the production in a same factory of calcium carbide and calcium cyanamide, has also been analysed.

The main advantages are:

- a) The utilities (in particular the electrical substations), can be unified and the relevant reduction in investment costs has been evaluated at 538,000 \$.
- b) Some buildings (administrative offices and social services) can be shared in common and this yields another reduction of about 140,000 \$.
- c) Administrative and maintenance personnel number can be reduced and this leads to a reduction of 26,080 \$/y for the maintenance and 46,100 \$/y for the administrative department.
- d) Packaging: the supply of calcium carbide to the calcium cyanamide production plant does not require any particular packaging; so this expenditure which was estimated about 600,000 \$/y in case of separated plant at full capacity, can be reduced, with the same assumptions, to 86,000 \$/y. In fact only the calcium carbide sold as such domestically has to be packed; the bulk of calcium carbide to be transferred into calcium cyanamide does not need any packaging.



e) The calcium carbide is supplied to the calcium cyanamide at the production cost.

The sale programme at 100% capacity and the annual revenues result modified as follows:

- calcium carbide		
1000 t/y x 600 \$/t	=	600,000 \$/y
- calcium cyanamide		
9000 t/y x 600 \$/t	=	5,400,000 \$/y
		-----
		6,000,000 \$/y

On these basis and assuming 0.05 birr/kWh as electricity cost a financial evaluation (Annexe 5) has been prepared, as a result an IRR of 13.45 has been found. The discounted net foreign exchange effect is 1,115,000 \$

**Calcium Cyanamide**

**ANNEXE 1**

**FINANCIAL EVALUATION**

**HYPOTHESIS 1 : ELECTRIC POWER AT 0.2 birr/KWh**



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CALCIUM CYANAMIDE  
February 88  
Hypothesis 1 - Power at 0.2 birr/kWh

3 year(s) of construction, 15 years of production  
currency conversion rates:  
foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	6247.30	76.070 % foreign
current assets:	0.00	0.000 % foreign
total assets:	6247.30	76.070 % foreign

**Source of funds during construction phase**

equity & grants:	2152.00	0.000 % foreign
foreign loans :	3723.00	
local loans :	0.00	
total funds :	5875.00	63.370 % foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	2205.11	3116.22	4568.38
depreciation :	404.53	404.53	399.23
interest :	372.30	325.76	279.23
production costs	2981.95	3846.52	5246.84
thereof foreign	27.25 %	19.61 %	14.79 %
total sales :	2400.00	3600.00	5400.00
gross income :	-581.95	-246.52	153.16
net income :	-581.95	-246.52	76.58
cash balance :	-1079.76	-496.48	-296.56
net cashflow :	-242.08	294.65	458.04

Net Present Value at: 10.00 % = -1989.68  
Internal Rate of Return on total investment: 4.73 %  
Equity paid versus Net income flow (IRR): -0.49 %  
Net Worth versus Net Cash Return (IRR): 3.14 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US \$**

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	53.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	198.00	198.00	198.00	68.00	0.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment	219.00	857.00	1514.00	1952.00	493.00	0.00
<b>Total fixed investment costs</b>	<b>272.00</b>	<b>1055.00</b>	<b>1712.00</b>	<b>2150.00</b>	<b>561.00</b>	<b>0.00</b>
Pre-production capital expenditures	5.00	15.00	15.00	40.00	236.15	186.15
Net working capital	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs</b>	<b>277.00</b>	<b>1070.00</b>	<b>1727.00</b>	<b>2190.00</b>	<b>797.15</b>	<b>186.15</b>
Of it foreign, in Z	79.06	61.40	76.09	80.00	78.30	100.00

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Total Current Investment in 1000 US \$

Year . . . . .	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . . . . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	436.97	189.13	297.00
<b>Total current investment costs . . . . .</b>	<b>436.97</b>	<b>189.13</b>	<b>297.00</b>
<b>Of it foreign, Z . . . . .</b>	<b>24.59</b>	<b>21.37</b>	<b>24.89</b>



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**Total Production Costs in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	44.44	66.67	100.00	100.00	100.00	100.00
Raw material I . . . . .	1621.00	2431.50	3447.25	3447.25	3447.25	3447.25
Other raw materials . . . . .	56.00	84.00	126.00	126.00	126.00	126.00
Utilities . . . . .	1.60	2.40	3.60	3.60	3.60	3.60
Energy . . . . .	187.62	281.43	422.14	422.14	422.14	422.14
Labour, direct . . . . .	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance . . . . .	53.34	53.34	53.34	53.34	53.34	53.34
Spares . . . . .	67.00	105.00	157.50	157.50	157.50	157.50
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>2142.79</b>	<b>3053.90</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>
Administrative overheads . . . . .	62.32	62.32	62.32	62.32	62.32	62.32
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	404.53	404.53	399.23	393.93	393.93	368.93
Financial costs . . . . .	372.30	325.76	279.23	232.69	186.15	139.61
<b>Total production costs . . . . .</b>	<b>2981.95</b>	<b>3846.52</b>	<b>5246.84</b>	<b>5195.00</b>	<b>5148.46</b>	<b>5076.93</b>
<b>Costs per unit (single product) . . . . .</b>	<b>0.75</b>	<b>0.64</b>	<b>0.58</b>	<b>0.58</b>	<b>0.57</b>	<b>0.56</b>
Of it foreign, Z . . . . .	27.25	19.61	14.79	14.04	13.27	12.54
Of it variable, Z . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	158.55	158.55	158.55	158.55	158.55	158.55

CALCIUM CYANAMIDE --- February 88



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**Total Production Costs in 1000 US \$**

Year .....	1996	1997	1998-99	2000-2	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I .....	3647.25	3647.25	3647.25	3647.25	3647.25	3647.25
Other raw materials .....	126.00	126.00	126.00	126.00	126.00	126.00
Utilities .....	3.60	3.60	3.60	3.60	3.60	3.60
Energy .....	422.14	422.14	422.14	422.14	422.14	422.14
Labour, direct .....	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance .....	53.34	53.34	53.34	53.34	53.34	53.34
Spares .....	157.50	157.50	157.50	157.50	157.50	157.50
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>	<b>4506.06</b>
Administrative overheads .....	62.32	62.32	62.32	62.32	62.32	62.32
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	368.93	368.93	368.93	335.83	165.65	0.00
Financial costs .....	93.07	46.54	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>5030.39</b>	<b>4983.85</b>	<b>4937.31</b>	<b>4904.21</b>	<b>4734.02</b>	<b>4568.38</b>
<b>Costs per unit (single product) .</b>	<b>0.56</b>	<b>0.55</b>	<b>0.55</b>	<b>0.54</b>	<b>0.53</b>	<b>0.51</b>
Of it foreign, % .....	11.73	10.90	10.06	10.13	7.37	4.48
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	158.55	158.55	158.55	158.55	158.55	158.55

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**Net Working Capital in 1000 US \$**

Year .....		1990	1991	1992	1993-2004
Coverage .....	ndc coto				
<b>Current assets &amp;</b>					
Accounts receivable . . .	30 12.0	183.76	259.68	380.70	380.70
Inventory and materials .	32 11.3	148.50	222.76	334.14	334.14
Energy .....	1 360.0	0.52	0.78	1.17	1.17
Spares .....	360 1.0	67.00	105.00	157.50	157.50
Work in progress . . . . .	1 360.0	5.95	8.48	12.52	12.52
Finished products . . . . .	30 12.0	183.76	259.68	380.70	380.70
Cash in hand .....	15 24.0	14.12	13.20	15.39	15.39
Total current assets .....		603.62	849.60	1282.11	1282.11
<b>Current liabilities and</b>					
Accounts payable .....	29 12.6	166.64	243.50	359.01	359.01
Net working capital .....		436.97	626.10	923.10	923.10
Increase in working capital .....		436.97	189.13	297.00	0.00
Net working capital, local .....		329.51	478.22	701.29	701.29
Net working capital, foreign .....		107.46	147.88	221.81	221.81

Note: ndc = ninious days of coverage ; coto = coefficient of turnover .





Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	2152.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	3723.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	3723.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	186.15
Total funds .....	5875.00	0.00	186.15



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Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total loan .....</b>	<b>-465.38</b>	<b>-465.38</b>	<b>-465.38</b>	<b>-465.38</b>	<b>-465.38</b>	<b>-465.38</b>	<b>-465.38</b>
Current liabilities	166.64	76.85	115.52	0.00	0.00	0.00	0.00
Bank overdraft ....	1079.76	496.48	286.56	-31.06	-54.33	-65.10	-88.36
<b>Total funds .....</b>	<b>781.03</b>	<b>107.96</b>	<b>-63.30</b>	<b>-496.43</b>	<b>-519.70</b>	<b>-530.47</b>	<b>-553.74</b>

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Source of Finance, production in 1000 US \$

Year .....	1997	1998-99	2000	2001
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-465.38	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
<b>Total loan .....</b>	<b>-465.38</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	-111.63	-600.28	-583.73	-100.34
<b>Total funds .....</b>	<b>-577.01</b>	<b>-600.28</b>	<b>-583.73</b>	<b>-100.34</b>

CALCIUM CYANAMIDE --- February 88



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	5875.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	5875.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	277.00	1070.00	1727.00	2190.00	797.15	186.15
Total assets . . . .	277.00	1070.00	1727.00	2190.00	611.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	186.15	186.15
Depayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	5598.00	-1070.00	-1727.00	-2190.00	-797.15	-186.15
Cumulated cash balance	5598.00	4528.00	2801.00	611.00	-186.15	-372.30
Inflow, local . . . .	2152.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	58.00	413.00	413.00	438.00	173.00	0.00
Surplus ( deficit ) .	2094.00	-413.00	-413.00	-438.00	-173.00	0.00
Inflow, foreign . . .	3723.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	219.00	657.00	1314.00	1752.00	624.15	186.15
Surplus ( deficit ) .	3504.00	-657.00	-1314.00	-1752.00	-624.15	-186.15
Net cashflow . . . . .	-277.00	-1070.00	-1727.00	-2190.00	-611.00	0.00
Cumulated net cashflow	-277.00	-1347.00	-3074.00	-5264.00	-5875.00	-5875.00



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2566.64	3676.88	5515.52	5400.00	5400.00	5400.00
Financial resources . .	166.64	76.88	115.52	0.00	0.00	0.00
Sales, net of tax . .	2400.00	3600.00	5400.00	5400.00	5400.00	5400.00
Total cash outflow . .	3646.40	4173.37	5802.00	5368.94	5345.67	5334.90
Total assets . . . .	603.62	265.98	412.52	0.00	0.00	0.00
Operating costs . . .	2205.11	3116.22	4568.38	4568.38	4568.38	4568.38
Cost of finance . . .	372.30	325.76	279.23	232.69	186.15	139.61
Repayment . . . . .	465.38	465.41	465.38	465.38	465.38	465.38
Corporate tax . . . .	0.00	0.00	76.58	102.50	125.77	161.54
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	-1079.76	-496.48	-286.56	31.06	54.33	65.10
Cumulated cash balance	-1452.06	-1948.54	-2235.10	-2204.04	-2149.72	-2084.62
Inflow, local . . . . .	2566.23	3676.88	5515.33	5400.00	5400.00	5400.00
Outflow, local . . . .	2552.86	3205.31	4778.60	4466.13	4489.40	4525.17
Surplus ( deficit ) . .	13.38	471.57	736.73	933.87	910.60	874.83
Inflow, foreign . . . .	0.41	0.00	0.19	0.00	0.00	0.00
Outflow, foreign . . . .	1093.54	968.05	1023.48	902.81	856.28	809.74
Surplus ( deficit ) . .	-1093.13	-968.05	-1023.29	-902.81	-856.28	-809.74
Net cashflow . . . . .	-242.08	294.65	458.04	729.12	705.85	670.08
Cumulated net cashflow	-6117.08	-5822.43	-5364.39	-4635.27	-3929.42	-3259.33

CALCIUM CYANAMIDE — February 88



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	5400.00	5400.00	5400.00	5400.00	5400.00	5400.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	5400.00	5400.00	5400.00	5400.00	5400.00	5400.00
Total cash outflow . .	5311.63	5288.37	4799.72	4799.72	4816.27	4816.27
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	4568.38	4568.38	4568.38	4568.38	4568.38	4568.38
Cost of finance . . .	93.07	46.54	0.00	0.00	0.00	0.00
Repayment . . . . .	465.38	465.39	0.00	0.00	0.00	0.00
Corporate tax . . . .	184.80	208.07	231.34	231.34	247.89	247.89
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	88.37	111.63	600.28	600.28	583.73	583.73
Cumulated cash balance	-1996.26	-1884.62	-1284.34	-684.07	-100.34	483.39
Inflow, local . . . .	5400.00	5400.00	5400.00	5400.00	5400.00	5400.00
Outflow, local . . . .	4568.43	4571.70	4594.97	4594.97	4611.52	4611.52
Surplus ( deficit ) .	831.57	828.30	805.03	805.03	788.48	788.48
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	763.20	716.66	204.75	204.75	204.75	204.75
Surplus ( deficit ) .	-763.20	-716.66	-204.75	-204.75	-204.75	-204.75
Net cashflow . . . . .	646.82	623.55	600.28	600.28	583.73	583.73
Cumulated net cashflow	-2612.52	-1988.97	-1388.69	-788.42	-204.69	379.04

CALCIUM CYANAMIDE --- February 88



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	5400.00	5400.00	5400.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	5400.00	5400.00	5400.00
Total cash outflow . .	4816.27	4901.37	4984.19
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	4568.38	4568.38	4568.38
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	247.89	332.99	415.81
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	583.73	498.63	415.81
Cumulated cash balance	1067.12	1565.75	1981.56
Inflow, local . . . .	5400.00	5400.00	5400.00
Outflow, local . . . .	4611.52	4696.62	4779.44
Surplus ( deficit ) .	788.48	703.38	620.56
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	204.75	204.75	204.75
Surplus ( deficit ) .	-204.75	-204.75	-204.75
Net cashflow . . . . .	583.73	498.63	415.81
Cumulated net cashflow	962.77	1461.40	1877.21

CALCIUM CYANAMIDE --- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-1847.74 at	10.00 %
Internal Rate of Return (IRRE1) ..	-0.49 %	
b) Net Worth versus Net cash returns:		
Net present value .....	-1948.11 at	10.00 %
Internal Rate of Return (IRRE2) ..	3.14 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-1989.69 at	10.00 %
Internal Rate of Return (IRR) ..	4.73 %	

Net Worth = Equity paid plus reserves

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CALCIUM CYANIDE --- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2400.00	3600.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2400.00	3600.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2609.65	3520.75	4967.61	4962.31	4962.31
Operational margin . . . . .	-209.65	79.25	432.39	437.69	437.69
As % of total sales . . . . .	-8.74	2.20	8.01	8.11	8.11
Cost of finance . . . . .	372.30	325.76	279.23	232.69	186.15
Gross profit . . . . .	-581.95	-246.52	153.16	205.00	251.54
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-581.95	-246.52	153.16	205.00	251.54
Tax . . . . .	0.00	0.00	76.58	102.50	125.77
Net profit . . . . .	-581.95	-246.52	76.58	102.50	125.77
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-581.95	-246.52	76.58	102.50	125.77
Accumulated undistributed profit . . .	-581.95	-828.46	-751.88	-649.38	-523.62
Gross profit, % of total sales . . . . .	-24.25	-6.85	2.84	3.80	4.66
Net profit, % of total sales . . . . .	-24.25	-6.85	1.42	1.90	2.33
ROE, Net profit, % of equity . . . . .	-27.04	-11.46	3.56	4.76	5.84
ROI, Net profit+interest, % of invest.	-3.32	1.22	5.23	4.93	4.59





**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	4937.31	4937.31	4937.31	4937.31	4937.31
Operational margin . . . . .	462.69	462.69	462.69	462.69	462.69
As % of total sales . . . . .	8.57	8.57	8.57	8.57	8.57
Cost of finance . . . . .	139.61	93.07	46.54	0.00	0.00
Gross profit . . . . .	323.07	369.61	416.15	462.69	462.69
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	323.07	369.61	416.15	462.69	462.69
Tax . . . . .	161.54	184.80	208.07	231.34	231.34
Net profit . . . . .	161.54	184.80	208.07	231.34	231.34
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	161.54	184.80	208.07	231.34	231.34
Accumulated undistributed profit . . .	-362.08	-177.27	30.80	262.14	493.48
Gross profit, % of total sales . . . . .	5.98	6.84	7.71	8.57	8.57
Net profit, % of total sales . . . . .	2.99	3.42	3.85	4.28	4.28
ROE, Net profit, % of equity . . . . .	7.51	8.59	9.67	10.75	10.75
ROI, Net profit+interest, % of invest.	4.43	4.09	3.75	3.40	3.40



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - DALING & CO. S.R.L., NIZLAND

**Net Income Statement in 1000 US \$**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	4904.21	4904.21	4904.21	4734.02	4568.38
Operational margin . . . . .	495.79	495.79	495.79	665.98	831.62
As % of total sales . . . . .	9.18	9.18	9.18	12.33	15.40
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	495.79	495.79	495.79	665.98	831.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	495.79	495.79	495.79	665.98	831.62
Tax . . . . .	247.89	247.89	247.89	332.99	415.81
Net profit . . . . .	247.89	247.89	247.89	332.99	415.81
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	247.89	247.89	247.89	332.99	415.81
Accumulated undistributed profit . . .	741.38	989.27	1237.16	1570.15	1985.96
Gross profit, % of total sales . . . . .	9.18	9.18	9.18	12.33	15.40
Net profit, % of total sales . . . . .	4.59	4.59	4.59	6.17	7.70
ROE, Net profit, % of equity . . . . .	11.52	11.52	11.52	15.47	19.32
ROI, Net profit+interest, % of invest.	3.65	3.65	3.65	4.90	6.12



**COMFAR**<sup>®</sup>  
2.0 UNIO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	5875.00	5875.00	5875.00	5875.00	6061.15	6247.30
Fixed assets, net of depreciation	0.00	277.00	1347.00	3874.00	5264.00	6061.15
Construction in progress	277.00	1078.00	1727.00	2190.00	797.15	186.15
Current assets	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	5598.00	4528.00	2801.00	611.00	0.00	0.00
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	5875.00	5875.00	5875.00	5875.00	6061.15	6247.30
Equity capital	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	3723.00	3723.00	3723.00	3723.00	3723.00	3723.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	166.15	372.30
Total debt	3723.00	3723.00	3723.00	3723.00	3909.15	4695.30
Equity, % of liabilities	36.63	36.63	36.63	36.63	35.50	34.45

CALCIUM CYANAMIDE — February 87



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALLO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets</b> .....	<b>7028.33</b>	<b>7136.29</b>	<b>7149.57</b>	<b>6679.05</b>	<b>6182.62</b>	<b>5687.92</b>
Fixed assets, net of depreciation	5842.75	5438.23	5038.99	4645.06	4251.12	3882.19
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	589.50	856.39	1266.72	1266.72	1266.72	1266.72
Cash, bank .....	14.12	13.20	15.39	15.39	15.39	15.39
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Less carried forward .....	0.00	581.95	828.46	751.88	649.38	523.62
Loss .....	581.95	246.52	0.00	0.00	0.00	0.00
<b>Total liabilities</b> .....	<b>7028.33</b>	<b>7136.29</b>	<b>7149.57</b>	<b>6679.05</b>	<b>6182.62</b>	<b>5687.92</b>
Equity capital .....	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	76.58	182.50	125.77	161.54
Long, and medium term debt .....	3257.63	2792.25	2326.88	1861.50	1396.13	930.75
Current liabilities .....	166.64	243.50	359.01	359.01	359.01	359.01
Bank overdraft, finance required ..	1452.06	1948.54	2235.10	2204.04	2149.72	2084.62
<b>Total debt</b> .....	<b>4876.33</b>	<b>4984.29</b>	<b>4920.99</b>	<b>4424.56</b>	<b>3904.85</b>	<b>3374.38</b>
<b>Equity, % of liabilities</b> .....	<b>30.62</b>	<b>30.16</b>	<b>30.10</b>	<b>32.22</b>	<b>34.81</b>	<b>37.83</b>

CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>®</sup>  
2.0 UNIO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
<b>Total assets</b> .....	<b>5157.45</b>	<b>4603.71</b>	<b>4057.50</b>	<b>3600.56</b>	<b>3352.73</b>	<b>3500.28</b>
Fixed assets, net of depreciation	3513.25	3144.32	2775.30	2406.45	2070.61	1734.78
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1266.72	1266.72	1266.72	1266.72	1266.72	1266.72
Cash, bank .....	15.39	15.39	15.39	15.39	15.39	15.39
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	483.39
Loss carried forward .....	362.08	177.27	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities</b> .....	<b>5157.45</b>	<b>4603.71</b>	<b>4057.50</b>	<b>3600.56</b>	<b>3352.73</b>	<b>3500.28</b>
Equity capital .....	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit .....	0.00	0.00	30.00	262.14	493.48	741.38
Profit .....	184.00	208.07	231.34	231.34	247.89	247.89
Long and medium term debt .....	465.38	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	359.01	359.01	359.01	359.01	359.01	359.01
Bank overdraft, finance required.	1996.26	1884.62	1284.34	684.07	100.34	0.00
<b>Total debt</b> .....	<b>2820.64</b>	<b>2243.63</b>	<b>1643.36</b>	<b>1043.08</b>	<b>459.35</b>	<b>359.01</b>
<b>Equity, % of liabilities</b> .....	<b>41.73</b>	<b>46.74</b>	<b>53.04</b>	<b>58.34</b>	<b>64.19</b>	<b>61.48</b>

CALCIUM CYANAMIDE — February 93



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>3748.17</b>	<b>4081.16</b>	<b>4496.97</b>
Fixed assets, net of depreciation	1398.94	1233.30	1233.30
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1266.72	1266.72	1266.72
Cash, bank .....	15.39	15.39	15.39
Cash surplus, finance available .	1067.12	1565.75	1981.56
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>3748.17</b>	<b>4081.16</b>	<b>4496.97</b>
Equity capital .....	2152.00	2152.00	2152.00
Reserves, retained profit .....	989.27	1237.16	1576.15
Profit .....	247.89	332.99	415.81
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	359.01	359.01	359.01
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>359.01</b>	<b>359.01</b>	<b>359.01</b>
<b>Equity, % of liabilities .....</b>	<b>57.41</b>	<b>52.73</b>	<b>47.85</b>

CALCIUM CYANAMIDE — February 88

Calcium Cyanamide

ANNEXE 2

**FINANCIAL EVALUATION**

**HYPOTHESIS 2 : ELECTRIC POWER AT 0.05 birr/kWh**



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CALCIUM CYANAMIDE  
February 88  
Hypothesis 2 - Power at 0.05 barr/kWh

3 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	6247.30	76.070 % foreign
current assets:	0.00	0.000 % foreign
total assets:	6247.30	76.070 % foreign

**Source of funds during construction phase**

equity & grants:	2152.00	0.000 % foreign
foreign loans:	3723.00	
local loans:	0.00	
total funds:	5875.00	63.370 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	2064.40	2905.14	4251.78
depreciation :	404.53	404.53	399.23
interest :	372.30	325.76	279.23
production costs	2841.23	3635.44	4930.24
thereof foreign :	28.59 %	20.75 %	15.74 %
total sales :	2400.00	3600.00	5400.00
gross income :	-441.23	-35.44	469.76
net income :	-441.23	-35.44	234.88
cash balance :	-926.54	-279.15	-118.88
net cashflow :	-88.87	511.99	625.72

Net Present Value at: 10.00 % = -957.34  
Internal Rate of Return on total investment: 7.55 %  
Equity paid versus Net income flow (IRR%): 5.81 %  
Net Worth: versus Net Cash Return (IRR%): 6.83 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance





**Total Initial Investment in 1000 US \$**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	53.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	198.00	198.00	198.00	63.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment ...	219.00	857.00	1514.00	1752.00	473.00	0.00
<b>Total fixed investment costs .....</b>	<b>272.00</b>	<b>1055.00</b>	<b>1712.00</b>	<b>2150.00</b>	<b>561.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	40.00	236.15	186.15
Net working capital .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs ...</b>	<b>277.00</b>	<b>1070.00</b>	<b>1727.00</b>	<b>2190.00</b>	<b>797.15</b>	<b>186.15</b>
<b>Of it foreign, in % .....</b>	<b>79.06</b>	<b>61.40</b>	<b>76.09</b>	<b>80.00</b>	<b>78.30</b>	<b>100.00</b>



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Total Current Investment in 1000 US \$

Year . . . . .	1990	1991	1992
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs . . . .	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	424.47	182.87	287.62
Total current investment costs . . .	424.47	182.87	287.62
Of it foreign, % . . . . .	25.32	22.10	25.71

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**Total Production Costs in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	44.44	66.67	100.00	100.00	100.00	100.00
Raw material 1 .....	1621.00	2431.50	3647.25	3647.25	3647.25	3647.25
Other raw materials .....	56.00	84.00	126.00	126.00	126.00	126.00
Utilities .....	1.60	2.40	3.60	3.60	3.60	3.60
Energy .....	46.91	70.35	105.54	105.54	105.54	105.54
Labour, direct .....	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance .....	53.34	53.34	53.34	53.34	53.34	53.34
Spares .....	67.00	105.00	157.50	157.50	157.50	157.50
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2002.08</b>	<b>2842.82</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>
Administrative overheads .....	62.32	62.32	62.32	62.32	62.32	62.32
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	404.53	404.53	399.23	393.93	393.93	368.93
Financial costs .....	372.30	325.76	279.23	232.69	186.15	139.61
<b>Total production costs .....</b>	<b>2841.23</b>	<b>3635.44</b>	<b>4930.24</b>	<b>4878.40</b>	<b>4831.86</b>	<b>4760.33</b>
<b>Costs per unit ( single product ) .</b>	<b>0.71</b>	<b>0.61</b>	<b>0.55</b>	<b>0.54</b>	<b>0.54</b>	<b>0.53</b>
Of it foreign, % .....	28.59	20.75	15.74	14.96	14.14	13.37
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	158.55	158.55	158.55	158.55	158.55	158.55

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**Total Production Costs in 1000 US \$**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	3647.25	3647.25	3647.25	3647.25	3647.25	3647.25
Other raw materials . . . . .	126.00	126.00	126.00	126.00	126.00	126.00
Utilities . . . . .	3.60	3.60	3.60	3.60	3.60	3.60
Energy . . . . .	105.54	105.54	105.54	105.54	105.54	105.54
Labour, direct . . . . .	96.23	96.23	96.23	96.23	96.23	96.23
Repair, maintenance . . . . .	53.34	53.34	53.34	53.34	53.34	53.34
Spares . . . . .	157.50	157.50	157.50	157.50	157.50	157.50
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>	<b>4189.46</b>
Administrative overheads . . . . .	62.32	62.32	62.32	62.32	62.32	62.32
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	368.93	368.93	368.93	335.83	165.65	0.00
Financial costs . . . . .	93.07	46.54	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>4713.79</b>	<b>4667.25</b>	<b>4620.71</b>	<b>4587.61</b>	<b>4417.42</b>	<b>4251.78</b>
<b>Costs per unit ( single product ) .</b>	<b>0.52</b>	<b>0.52</b>	<b>0.51</b>	<b>0.51</b>	<b>0.49</b>	<b>0.47</b>
Of it foreign, % . . . . .	12.52	11.64	10.75	10.83	7.90	4.82
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	158.55	158.55	158.55	158.55	158.55	158.55



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Net Working Capital in 1000 US \$

Year		1990	1991	1992	1993-2004
Coverage	mdc coto				
Current assets &					
Accounts receivable	. . . . . 30 12.0	172.03	242.10	354.32	354.32
Inventory and materials	. . . . . 32 11.3	148.50	222.76	334.14	334.14
Energy	. . . . . 1 360.0	0.13	0.20	0.29	0.29
Spares	. . . . . 360 1.0	67.00	105.00	157.50	157.50
Work in progress	. . . . . 1 360.0	5.56	7.90	11.64	11.64
Finished products	. . . . . 30 12.0	172.03	242.10	354.32	354.32
Cash in hand	. . . . . 15 24.0	14.12	13.20	15.39	15.39
Total current assets		579.38	833.24	1227.59	1227.59
Current liabilities and					
Accounts payable	. . . . . 29 12.6	154.92	225.91	332.63	332.63
Net working capital		424.47	607.34	894.96	894.96
Increase in working capital		424.47	182.87	287.62	0.00
Net working capital, local		317.01	459.46	673.15	673.15
Net working capital, foreign		107.46	147.88	221.81	221.81

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	2152.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	3723.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	3723.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	186.15
Total funds .....	5875.00	0.00	186.15

CALCIUM CYANAMIDE — February 88

## Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38	-465.38
Current liabilities	154.92	70.99	106.72	0.00	0.00	0.00	0.00
Bank overdraft ....	926.54	279.15	118.88	-189.36	-212.63	-223.40	-246.66
Total funds .....	616.08	-115.24	-239.77	-654.73	-678.00	-688.77	-712.04

CALCIUM CYANAMIDE — February 88

## Source of Finance, production in 1000 US \$

Year .....	1997	1998
Equity, ordinary ..	0.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	-465.38	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	-465.38	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	-289.93	-554.89
Total funds .....	-755.31	-554.89

CALCIUM CYANAMIDE — February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	5875.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	5875.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	277.00	1070.00	1727.00	2190.00	797.15	186.15
Total assets . . . .	277.00	1070.00	1727.00	2190.00	611.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	186.15	186.15
Payment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	5598.00	-1070.00	-1727.00	-2190.00	-797.15	-186.15
Cumulated cash balance	5598.00	4528.00	2801.00	611.00	-186.15	-372.30
Inflow, local . . . .	2152.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	58.00	413.00	413.00	438.00	173.00	0.00
Surplus ( deficit ) .	2094.00	-413.00	-413.00	-438.00	-173.00	0.00
Inflow, foreign . . .	3723.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	219.00	657.00	1314.00	1752.00	624.15	186.15
Surplus ( deficit ) .	3504.00	-657.00	-1314.00	-1752.00	-624.15	-186.15
Net cashflow . . . . .	-277.00	-1070.00	-1727.00	-2190.00	-611.00	0.00
Cumulated net cashflow	-277.00	-1347.00	-3074.00	-5264.00	-5875.00	-5875.00





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Cashflow tables, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995
Total cash inflow ..	2554.92	3671.02	5506.72	9400.00	9400.00	9400.00
Financial resources .	154.92	71.02	106.72	0.00	0.00	0.00
Sales, net of tax ..	2400.00	3600.00	5400.00	9400.00	9400.00	9400.00
Total cash outflow ..	3481.46	3950.17	5625.60	5210.64	5187.37	5176.60
Total assets .....	579.38	253.86	374.34	0.00	0.00	0.00
Operating costs ...	2064.40	2905.14	4251.78	4251.78	4251.78	4251.78
Cost of finance ...	372.30	325.76	279.23	232.69	186.15	139.61
Repayment .....	465.38	465.41	465.38	465.38	465.38	465.38
Corporate tax ...	0.00	0.00	234.88	260.80	284.07	319.84
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-926.54	-279.15	-118.88	189.36	212.63	223.40
Cumulated cash balance	-1298.84	-1577.99	-1696.87	-1507.51	-1294.89	-1071.49
Inflow, local .....	2554.51	3671.02	5506.53	9400.00	9400.00	9400.00
Outflow, local .....	2387.91	2982.12	4602.13	4307.83	4331.10	4366.87
Surplus ( deficit ) .	166.59	688.91	904.41	1092.17	1068.90	1033.13
Inflow, foreign ...	0.41	0.00	0.19	0.00	0.00	0.00
Outflow, foreign ...	1093.54	968.05	1023.48	902.81	856.28	809.74
Surplus ( deficit ) .	-1093.13	-968.05	-1023.29	-902.81	-856.28	-809.74
Net cashflow .....	-88.87	511.99	625.72	887.42	864.15	828.38
Cumulated net cashflow	-5963.87	-5451.88	-4826.16	-3938.74	-3074.59	-2246.20

CALCULI D'AMBITO — February 89



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Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	5400.00	5400.00	5400.00	5400.00	5400.00	5400.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	4251.78	4251.78	4251.78	4251.78	4251.78	4251.78
Total cash outflow . .	5153.33	5130.07	4641.42	4641.42	4657.97	4657.97
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	4251.78	4251.78	4251.78	4251.78	4251.78	4251.78
Cost of finance . . .	93.07	43.54	0.00	0.00	0.00	0.00
Repayment . . . . .	465.38	465.38	0.00	0.00	0.00	0.00
Corporate tax . . . .	343.10	366.37	389.64	389.64	406.19	406.19
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	246.67	269.93	758.58	758.58	742.03	742.03
Cumulated cash balance	-624.82	-554.89	203.69	962.26	1704.29	2446.32
Inflow, local . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00	5400.00
Outflow, local . . . . .	4396.14	4413.40	4436.67	4436.67	4453.22	4453.22
Surplus ( deficit ) . .	1009.86	986.60	963.33	963.33	946.78	946.78
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	763.20	716.66	204.75	204.75	204.75	204.75
Surplus ( deficit ) . .	-763.20	-716.66	-204.75	-204.75	-204.75	-204.75
Net cashflow . . . . .	805.11	781.85	758.58	758.58	742.03	742.03
Cumulated net cashflow	-1441.09	-659.24	99.34	857.91	1599.94	2341.97



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Cashflow tables, production in 1000 US \$

Year .....	2002	2003	2004
Total cash inflow ..	9400.00	9400.00	9400.00
Financial resources ..	0.00	0.00	0.00
Sales, net of tax ..	9400.00	9400.00	9400.00
Total cash outflow ..	4657.97	4743.07	4825.89
Total assets .....	0.00	0.00	0.00
Operating costs .....	4251.78	4251.78	4251.78
Cost of finance .....	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00
Corporate tax .....	406.19	491.29	574.11
Dividends paid .....	0.00	0.00	0.00
Surplus ( deficit ) ..	742.03	656.93	574.11
Cumulated cash balance	3188.35	3845.28	4419.39
Inflow, local .....	9400.00	9400.00	9400.00
Outflow, local .....	4653.22	4538.32	4621.14
Surplus ( deficit ) ..	946.78	861.68	778.86
Inflow, foreign .....	0.00	0.00	0.00
Outflow, foreign .....	204.75	204.75	204.75
Surplus ( deficit ) ..	-204.75	-204.75	-204.75
Net cashflow .....	742.03	656.93	574.11
Cumulated net cashflow	3084.00	3740.93	4315.04

Calcium Cyanamide — February 58



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**Cashflow Discounting:**

a) Equity paid versus Net income flow		
Net present value .....	-825.63 at	10.00 %
Internal Rate of Return (IRRE1) ..	5.81 %	
b) Net Worth versus Net cash return		
Net present value .....	-915.77 at	10.00 %
Internal Rate of Return (IRRE2) ..	6.83 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-957.34 at	10.00 %
Internal Rate of Return (IRR) ..	7.55 %	

Net Worth = Equity paid plus reserves

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CALCULUM CYANIDE — February 88



Net Income Statement in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2400.00	3600.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2400.00	3600.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2468.93	3309.68	4651.02	4445.72	4445.72
Operational margin . . . . .	-68.93	290.33	748.98	754.28	754.28
As % of total sales . . . . .	-2.67	8.06	13.87	13.97	13.97
Cost of finance . . . . .	372.30	325.76	279.23	232.69	186.15
Gross profit . . . . .	-441.23	-35.44	469.76	521.60	568.13
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	-441.23	-35.44	469.76	521.60	568.13
Tax . . . . .	0.00	0.00	234.88	260.80	284.07
Net profit . . . . .	-441.23	-35.44	234.88	260.80	284.07
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-441.23	-35.44	234.88	260.80	284.07
Accumulated undistributed profit . . . .	-441.23	-476.67	-241.79	19.01	303.07
Gross profit, % of total sales . . . . .	-18.38	-0.98	8.70	9.66	10.52
Net profit, % of total sales . . . . .	-18.38	-0.98	4.35	4.83	5.26
ROE, Net profit, % of equity . . . . .	-20.50	-1.65	10.91	12.12	13.20
ROI, Net profit+interest, % of invest.	-1.09	4.48	7.59	7.29	6.95



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	4620.72	4620.72	4620.72	4620.72	4620.72
Operational margin . . . . .	779.28	779.28	779.28	779.28	779.28
As % of total sales . . . . .	14.43	14.43	14.43	14.43	14.43
Cost of finance . . . . .	139.61	93.07	46.54	0.00	0.00
Gross profit . . . . .	639.67	686.21	732.75	779.28	779.28
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	639.67	686.21	732.75	779.28	779.28
Tax . . . . .	319.84	343.10	366.37	389.64	389.64
Net profit . . . . .	319.84	343.10	366.37	389.64	389.64
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	319.84	343.10	366.37	389.64	389.64
Accumulated undistributed profit . . . . .	622.91	966.01	1332.39	1722.03	2111.67
Gross profit, % of total sales . . . . .	11.85	12.71	13.57	14.43	14.43
Net profit, % of total sales . . . . .	5.92	6.35	6.78	7.22	7.22
ROE, Net profit, % of equity . . . . .	14.86	15.94	17.02	18.11	18.11
ROI, Net profit+interest, % of invest. . . . .	6.79	6.44	6.10	5.76	5.76



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5400.00	5400.00	5400.00	5400.00	5400.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	4587.62	4587.62	4587.62	4417.45	4251.78
Operational margin . . . . .	812.38	812.38	812.38	982.57	1148.22
As % of total sales . . . . .	15.04	15.04	15.04	18.20	21.26
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	812.38	812.38	812.38	982.57	1148.22
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	812.38	812.38	812.38	982.57	1148.22
Tax . . . . .	406.19	406.19	406.19	491.29	574.11
Net profit . . . . .	406.19	406.19	406.19	491.29	574.11
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	406.19	406.19	406.19	491.29	574.11
Accumulated undistributed profit . . .	2517.87	2924.06	3330.25	3821.54	4395.65
Gross profit, % of total sales . . . . .	15.04	15.04	15.04	18.20	21.26
Net profit, % of total sales . . . . .	7.52	7.52	7.52	9.10	10.63
RCE, Net profit, % of equity . . . . .	18.88	18.88	18.88	22.83	26.68
ROI, Net profit+interest, % of invest.	6.00	6.00	6.00	7.26	8.48



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets .....	5875.00	5875.00	5875.00	5875.00	6061.15	6247.30
Fixed assets, net of depreciation	0.00	277.00	1347.00	3074.00	5264.00	6061.15
Construction in progress .....	277.00	1070.00	1727.00	2190.00	797.15	186.15
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	5598.00	4528.00	2801.00	611.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	5875.00	5875.00	5875.00	5875.00	6061.15	6247.30
Equity capital .....	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	3723.00	3723.00	3723.00	3723.00	3723.00	3723.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	186.15	372.30
Total debt .....	3723.00	3723.00	3723.00	3723.00	3909.15	4095.30
Equity, % of liabilities .....	36.63	36.63	36.63	36.63	35.50	34.45

CALCIUM CYANAMIDE — February 88





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>6863.38</b>	<b>6748.14</b>	<b>6743.25</b>	<b>6114.44</b>	<b>5478.71</b>	<b>5109.78</b>
Fixed assets, net of depreciation	5842.76	5438.23	5038.99	4645.06	4251.12	3882.19
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	565.26	820.04	1212.20	1212.20	1212.20	1212.20
Cash, bank .....	14.12	13.20	15.39	15.39	15.39	15.39
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	441.23	476.67	241.79	0.00	0.00
Loss .....	441.23	35.44	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>6863.38</b>	<b>6748.14</b>	<b>6743.25</b>	<b>6114.44</b>	<b>5478.71</b>	<b>5109.78</b>
Equity capital .....	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	19.01	303.07
Profit .....	0.00	0.00	234.88	260.80	284.07	319.84
Long and medium term debt .....	3257.63	2792.25	2326.88	1861.50	1396.13	930.75
Current liabilities .....	154.92	225.91	332.63	332.63	332.63	332.63
Bank overdraft, finance required.	1298.84	1577.99	1696.87	1507.51	1294.88	1071.49
<b>Total debt .....</b>	<b>4711.38</b>	<b>4596.14</b>	<b>4356.37</b>	<b>3701.64</b>	<b>3023.64</b>	<b>2334.87</b>
<b>Equity, % of liabilities .....</b>	<b>31.35</b>	<b>31.89</b>	<b>31.91</b>	<b>35.20</b>	<b>39.24</b>	<b>42.12</b>

CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>(E)</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	4740.84	4371.91	4206.66	4596.30	5002.49	5408.69
Fixed assets, net of depreciation	3513.25	3144.32	2775.38	2406.45	2070.61	1734.78
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1212.20	1212.20	1212.20	1212.20	1212.20	1212.20
Cash, bank .....	15.39	15.39	15.39	15.39	15.39	15.39
Cash surplus, finance available .	0.00	0.00	203.69	962.26	1704.29	2446.32
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	4740.84	4371.91	4206.66	4596.30	5002.49	5408.69
Equity capital .....	2152.00	2152.00	2152.00	2152.00	2152.00	2152.00
Reserves, retained profit .....	622.91	966.01	1332.39	1722.03	2111.67	2517.87
Profit .....	343.10	366.37	339.64	389.64	406.19	406.19
Long and medium term debt .....	465.38	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	332.63	332.63	332.63	332.63	332.63	332.63
Bank overdraft, finance required.	824.82	554.89	0.00	0.00	0.00	0.00
Total debt .....	1622.83	887.52	332.63	332.63	332.63	332.63
Equity, % of liabilities .....	45.39	49.22	51.16	46.82	43.02	39.79



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	2002	2003	2004
Total assets .....	5814.68	6306.17	6880.27
Fixed assets, net of depreciation	1398.94	1233.30	1233.30
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1212.20	1212.20	1212.20
Cash, bank .....	15.39	15.39	15.39
Cash surplus, finance available .	3188.35	3945.28	4419.59
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	5814.88	6306.17	6880.27
Equity capital .....	2152.00	2152.00	2152.00
Reserves, retained profit .....	2924.06	3330.25	3821.54
Profit .....	40.19	491.29	574.11
Long and medium term debt .....	0	0.00	0.00
Current liabilities .....	332.63	332.63	332.63
bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	332.63	332.63	332.63
Equity, % of liabilities .....	37.01	34.13	31.28

**Calcium Cyanamide**

**ANNEXE 3**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	HYP. 2	HYP. 1
1) TOTAL REVENUES	<u>5400</u>	<u>5400</u>
2) VARIABLE COSTS:	<u>3978.62</u>	<u>4295.22</u>
. RAW MATERIALS	3773.25	3773.25
. UTILITIES	3.60	3.60
. ENERGY	105.54	422.14
. LABOUR	96.23	96.23
3) FIXED COSTS	<u>951.62</u>	<u>951.62</u>
. REPAIR-MAINTENANCE	53.34	53.34
. SPARES	157.50	157.50
. ADMINISTRATION	62.32	62.32
. DEPRECIATION	399.23	399.23
. FINANCIAL COSTS	279.23	279.23
4) TOTAL PRODUCTION COSTS	<u>4930.24</u>	<u>5246.84</u>
BEP	951.62	
(HYP.2) ----- X 100=	66,9 %	
5400 - 3978.62		
BEP	951.61	
(HYP.1) ----- X 100=		86,1 %
5400 - 4295.22		

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>5982</u>
2) VARIABLE COSTS:	<u>1810.89</u>
. RAW MATERIALS	779.62
. UTILITIES	3.60
. ENERGY	836.08
. LABOUR	191.59
3) FIXED COSTS	<u>1871.52</u>
. REPAIR-MAINTENANCE	65.51
. SPARES	268.30
. ADMINISTRATION	77.68
. DEPRECIATION	856.93
. FINANCIAL COSTS	623.10
4) TOTAL PRODUCTION COSTS	<u>3682.41</u>

$$\text{BEP} = \frac{1871.52}{5982 - 1810.89} \times 100 = 44.8\%$$

Calcium Cyanamide

ANNEXE 4

FOREIGN EXCHANGE EFFECT EVALUATION



**COMFAR**<sup>©</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 2000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow ..	3723.60	3723.00	0.60	3723.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	3723.60	3723.00	0.60	3723.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	12287.20	4752.30	7534.90	219.00	657.00	1314.00	1752.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	3569.70	4380.00	-810.30	219.00	657.00	1314.00	1752.00
imported materials . . .	2946.25	0.00	2946.25	0.00	0.00	0.00	0.00
repayment loans & overd.	3723.60	0.00	3723.60	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	2047.65	372.30	1675.35	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-8563.60	-1029.30	-7534.30	3504.00	-657.00	-1314.00	-1752.00
import substit'n effect	19620.00	0.00	19620.00	0.00	0.00	0.00	0.00
net foreign exchange effect	11056.40	-1029.30	12085.70	3504.00	-657.00	-1314.00	-1752.00
present values at	10.00 %						
foreign exchange flow .	-4741.37						
net foreign exchange effect	3723.90						





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		production				
	1988.1	1989.2	1992	1993	1994	1995	1996
total foreign inflow . .	0.00	0.00	0.41	0.00	0.19	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.41	0.00	0.19	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	624.15	186.15	1093.54	968.05	1023.48	902.81	856.28
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	438.00	0.00	107.87	40.38	74.13	0.00	0.00
imported materials . . .	0.00	0.00	148.00	136.50	204.75	204.75	204.75
repayment loans & overd.	0.00	0.00	465.38	465.41	465.38	465.38	465.38
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	186.15	186.15	372.30	325.76	279.23	232.69	186.15
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-624.15	-186.15	-1093.13	-968.05	-1023.29	-902.81	-856.28
import substit'n effect	0.00	0.00	720.00	1080.00	1620.00	1620.00	1620.00
net foreign exchange effect	-624.15	-186.15	-373.13	111.95	596.71	717.19	763.72
present values at 10.00 %							
foreign exchange flow .	-4741.37						
net foreign exchange effect	3723.50						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	809.74	763.20	716.66	204.75	204.75	204.75	204.75
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials ...	204.75	204.75	204.75	204.75	204.75	204.75	204.75
repayment loans & overd.	465.38	465.38	465.38	0.00	0.00	0.00	0.00
other repayments .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	139.61	93.07	46.54	0.00	0.00	0.00	0.00
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-809.74	-763.20	-716.66	-204.75	-204.75	-204.75	-204.75
import substit'n effect	1620.00	1620.00	1620.00	1620.00	1620.00	1620.00	1620.00
net foreign exchange effect	810.26	856.80	903.34	1415.25	1415.25	1415.25	1415.25
present values at 10.00 %							
foreign exchange flow .	-4741.37						
net foreign exchange effect	3723.90						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow . .	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	204.75	204.75	204.75	-1032.11
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-1032.68
imported materials . . .	204.75	204.75	204.75	0.00
repayment loans & overd.	0.00	0.00	0.00	0.57
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchge flow	-204.75	-204.75	-204.75	1032.11
import substit'n effect	1620.00	0.00	0.00	0.00
net forgn exchge effect	1415.25	-204.75	-204.75	1032.11
present values at 10.00 %				
foreign exchange flow .	-4741.37			
net forgn exchge effect	3723.90			

Calcium Cyanamide

ANNEXE 5

FINANCIAL AND FOREIGN EXCHANGE EVALUATIONS  
FOR THE CALCIUM CARBIDE  
AND CALCIUM CYANAMIDE INTEGRATED FACTORY



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CALCIUM CARBIDE & CALCIUM CYANAMIDE  
February 88  
Power at 0.05 birr/kWh

3 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

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**Total initial investment during construction phase**

fixed assets:	13520.80	78.433 % foreign
current assets:	0.00	0.000 % foreign
total assets:	13520.80	78.433 % foreign

---

**Source of funds during construction phase**

equity & grants:	4382.00	0.000 % foreign
foreign loans :	8308.00	
local loans :	0.00	
total funds :	12690.00	65.469 % foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	1281.70	1579.73	2202.38
depreciation :	865.73	865.73	856.93
interest :	830.80	726.95	623.10
production costs	2978.23	3172.41	3682.41
thereof foreign	62.63 %	56.01 %	50.84 %
total sales :	2658.00	3987.60	5982.00
gross income :	-320.23	815.19	2299.59
net income :	-320.23	407.60	1149.80
cash balance :	-852.86	116.65	755.82
net cashflow :	1016.44	1882.10	2417.42

Net Present Value at: 10.00 % = 2845.72

Internal Rate of Return: 13.51 %

Return on equity1: 14.96 %

Return on equity2: 14.56 %

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**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US \$**

Year .....	1987	1988	1989
<b>Fixed investment costs</b>			
Land, site preparation, development	88.00	0.00	0.00
Buildings and civil works .....	400.00	600.00	63.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant machinery and equipment ...	977.40	3745.10	6626.50
<b>Total fixed investment costs .....</b>	<b>1465.40</b>	<b>4345.10</b>	<b>6689.50</b>
Pre-production capital expenditures.	20.00	30.00	970.80
Net working capital .....	0.00	0.00	0.00
<b>Total initial investment costs ...</b>	<b>1485.40</b>	<b>4375.10</b>	<b>7660.30</b>
<b>Of it foreign, in % .....</b>	<b>65.80</b>	<b>73.72</b>	<b>83.57</b>

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**Total Current Investment in 1000 US \$**

Year .....	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital .....	359.86	118.17	212.40
<b>Total current investment costs ...</b>	<b>359.86</b>	<b>118.17</b>	<b>212.40</b>
<b>Of it foreign, % .....</b>	<b>62.14</b>	<b>64.90</b>	<b>70.71</b>



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Total Production Costs in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	252.20	378.37	567.62	567.62	567.62	567.62
Other raw materials . . . . .	94.22	141.34	212.00	212.00	212.00	212.00
Utilities . . . . .	1.60	2.40	3.60	3.60	3.60	3.60
Energy . . . . .	371.47	557.32	836.08	836.08	836.08	836.08
Labour, direct . . . . .	191.59	191.59	191.59	191.59	191.59	191.59
Repair, maintenance . . . . .	65.51	65.51	65.51	65.51	65.51	65.51
Spares . . . . .	107.43	165.52	248.30	248.30	248.30	248.30
Factory overheads . . . . .	120.00	0.00	0.00	0.00	0.00	0.00
Factory costs . . . . .	1204.02	1502.05	2124.70	2124.70	2124.70	2124.70
Administrative overheads . . . . .	77.68	77.68	77.68	77.68	77.68	77.68
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	865.73	865.73	856.93	848.13	848.13	810.13
Financial costs . . . . .	830.80	726.95	623.10	519.25	415.40	311.55
Total production costs . . . . .	2978.23	3172.41	3682.41	3569.76	3465.91	3324.06
Costs per unit ( single product ) .	0.00	0.00	0.00	0.00	0.00	0.00
Of it foreign, % . . . . .	62.62	56.01	50.84	49.53	48.02	46.95
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	269.27	269.27	269.27	269.27	269.27	269.27

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88





**COMFAR**  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year .....	1996	1997	1998-99	2000-2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	567.62	567.62	567.62	567.62	567.62	567.62
Other raw materials .....	212.00	212.00	212.00	212.00	212.00	212.00
Utilities .....	3.60	3.60	3.60	3.60	3.60	3.60
Energy .....	836.08	836.08	836.08	836.08	836.08	836.08
Labour, direct .....	191.59	191.59	191.59	191.59	191.59	191.59
Repair, maintenance .....	65.51	65.51	65.51	65.51	65.51	65.51
Spares .....	248.30	248.30	248.30	248.30	248.30	248.30
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>	<b>2124.70</b>
Administrative overheads .....	77.68	77.68	77.68	77.68	77.68	77.68
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	810.13	810.13	810.13	756.78	373.38	0.00
Financial costs .....	207.70	103.85	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>3220.21</b>	<b>3116.36</b>	<b>3012.51</b>	<b>2959.36</b>	<b>2575.75</b>	<b>2202.38</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	45.24	43.41	41.46	42.20	35.66	27.11
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour .....</b>	<b>269.27</b>	<b>269.27</b>	<b>269.27</b>	<b>269.27</b>	<b>269.27</b>	<b>269.27</b>

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 89



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year .....		1990	1991	1992	1993-2004
Coverage .....	ndc coto				
Current assets &					
Accounts receivable . . .	30 12.0	106.81	131.64	183.53	183.53
Inventory and materials .	54 6.6	52.57	78.87	118.32	118.32
Energy .....	9 41.6	8.93	13.40	20.11	20.11
Stores .....	360 1.0	107.43	145.52	248.30	248.30
Work in progress . . . .	7 51.4	23.41	29.21	41.31	41.31
Finished products . . . .	30 12.0	106.81	131.64	183.53	183.53
Cash in hand .....	15 24.0	23.43	20.85	24.30	24.30
Total current assets .....		429.39	571.14	819.39	819.39
Current liabilities and					
Accounts payable .....	22 16.5	69.53	93.11	128.96	128.96
Net working capital .....		359.86	478.03	690.43	690.43
Increase in working capital .....		359.86	118.17	212.40	0.00
Net working capital, local .....		136.23	177.71	239.92	239.92
Net working capital, foreign .....		223.62	300.32	450.51	450.51

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988	1989
Equity, ordinary ..	4382.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	8308.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	8308.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	830.80
Total funds .....	12690.00	0.00	830.80

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994-97
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1038.50	-1038.50	-1038.50	-1038.50	-1038.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1038.50	-1038.50	-1038.50	-1038.50	-1038.50
Current liabilities	69.53	23.58	35.85	0.00	0.00
Bank overdraft ....	852.86	-116.65	-755.82	-811.18	0.00
Total funds .....	-116.11	-1131.58	-1758.47	-1849.68	-1038.50

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year .....	1987	1988	1989
Total cash inflow ..	12690.00	0.00	0.00
Financial resources .	12690.00	0.00	0.00
Sales, net of tax ..	0.00	0.00	0.00
Total cash outflow ..	1485.40	4375.10	7660.30
Total assets .....	1485.40	4375.10	6829.50
Operating costs .....	0.00	0.00	0.00
Cost of finance .....	0.00	0.00	830.80
Repayment .....	0.00	0.00	0.00
Corporate tax .....	0.00	0.00	0.00
Dividends paid .....	0.00	0.00	0.00
Surplus ( deficit ) .	11204.60	-4375.10	-7660.30
Cumulated cash balance	11204.60	6829.50	-830.80
Inflow, local .....	4382.00	0.00	0.00
Outflow, local .....	508.00	1149.70	1258.30
Surplus ( deficit ) .	3874.00	-1149.70	-1258.30
Inflow, foreign .....	8308.00	0.00	0.00
Outflow, foreign .....	977.40	3225.40	6402.00
Surplus ( deficit ) .	7330.60	-3225.40	-6402.00
Net cashflow .....	-1485.40	-4375.10	-6829.50
Cumulated net cashflow	-1485.40	-5860.50	-12690.00

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 89



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2727.53	4011.18	6017.85	5982.00	5982.00	5982.00
Financial resources .	69.53	23.58	35.85	0.00	0.00	0.00
Sales, net of tax . .	2658.00	3987.60	5982.00	5982.00	5982.00	5982.00
Total cash outflow . .	3580.39	3894.52	5262.03	4966.25	4914.33	4881.40
Total assets . . . .	429.39	141.75	248.26	0.00	0.00	0.00
Operating costs . . .	1281.70	1579.73	2202.38	2202.38	2202.38	2202.38
Cost of finance . . .	830.80	728.95	623.10	519.25	415.40	311.55
Repayment . . . . .	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50
Corporate tax . . . .	0.00	407.60	1149.80	1206.12	1258.05	1328.97
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-852.86	116.65	755.82	1015.75	1067.67	1100.60
Cumulated cash balance	-1683.66	-1567.01	-811.18	204.57	1272.24	2372.84
Inflow, local . . . .	2726.47	4011.13	6017.30	5982.00	5982.00	5982.00
Outflow, local . . . .	1104.01	1654.31	2852.62	2811.43	2863.36	2934.28
Surplus ( deficit ) .	1622.46	2356.82	3164.68	3170.57	3118.64	3047.72
Inflow, foreign . . .	1.06	0.04	0.55	0.00	0.00	0.00
Outflow, foreign . . .	2476.38	2240.21	2409.41	2194.82	2050.97	1947.12
Surplus ( deficit ) .	-2475.31	-2240.17	-2408.86	-2194.82	-2050.97	-1947.12
Net cashflow . . . . .	1016.44	1882.10	2417.42	2573.50	2521.57	2460.65
Cumulated net cashflow	-11673.56	-9791.46	-7374.03	-4800.53	-2278.96	171.69

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow ..	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Total cash outflow ..	4829.48	4777.55	3687.13	3687.13	3713.70	3713.70
Total assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . . .	2202.38	2202.38	2202.38	2202.38	2202.38	2202.38
Cost of finance . . . .	207.70	103.85	0.00	0.00	0.00	0.00
Repayment . . . . .	1038.50	1038.50	0.00	0.00	0.00	0.00
Corporate tax . . . . .	1380.90	1432.82	1484.75	1484.75	1511.32	1511.32
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1152.52	1204.45	2294.87	2294.87	2268.30	2268.30
Cumulated cash balance	3525.36	4729.81	7024.69	9319.56	11587.86	13856.16
Inflow, local . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00	5982.00
Outflow, local . . . . .	2986.21	3038.13	3090.06	3090.06	3116.63	3116.63
Surplus ( deficit ) .	2995.79	2943.87	2891.94	2891.94	2865.37	2865.37
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	1843.27	1739.42	597.07	597.07	597.07	597.07
Surplus ( deficit ) .	-1843.27	-1739.42	-597.07	-597.07	-597.07	-597.07
Net cashflow . . . . .	2398.72	2346.80	2294.87	2294.87	2268.30	2268.30
Cumulated net cashflow	2570.41	4917.21	7212.09	9506.96	11775.26	14043.56



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	5982.00	5982.00	5982.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	5982.00	5982.00	5982.00
Total cash outflow . .	3713.70	3905.50	4092.19
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2202.38	2202.38	2202.38
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	1511.32	1703.12	1889.81
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	2268.30	2076.50	1889.81
Cumulated cash balance	16124.46	18200.96	20090.77
Inflow, local . . . . .	5982.00	5982.00	5982.00
Outflow, local . . . .	3116.63	3308.43	3495.12
Surplus ( deficit ) .	2865.37	2673.57	2486.88
inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	597.07	597.07	597.07
Surplus ( deficit ) .	-597.07	-597.07	-597.07
Net cashflow . . . . .	2268.30	2076.50	1889.81
Cumulated net cashflow	16311.86	18388.36	20278.17





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	2389.72 at	10.00 %
Internal Rate of Return (IRRE1) ..	14.96 %	
b) Net Worth versus Net cash return:		
Net present value .....	2704.59 at	10.00 %
Internal Rate of Return (IRRE2) ..	14.56 %	
c) Internal Rate of Return on total investment:		
Net present value .....	2845.72 at	10.00 %
Internal Rate of Return ( IRR ) ..	13.51 %	

Net Worth = Equity paid plus reserves

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CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 83



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALOO & CO. S.R.L., MILANO — —

Net Income Statement in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2658.00	3987.60	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2658.00	3987.60	5982.00	5982.00	5982.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2147.43	2445.46	3059.31	3050.51	3050.51
Operational margin . . . . .	510.57	1542.14	2922.69	2931.49	2931.49
As % of total sales . . . . .	19.21	38.67	48.86	49.01	49.01
Cost of finance . . . . .	830.80	726.95	623.10	519.25	415.40
Gross profit . . . . .	-320.23	815.19	2299.59	2412.24	2516.09
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-320.23	815.19	2299.59	2412.24	2516.09
Tax . . . . .	0.00	407.60	1149.80	1206.12	1258.05
Net profit . . . . .	-320.23	407.60	1149.80	1206.12	1258.05
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-320.23	407.60	1149.80	1206.12	1258.05
Accumulated undistributed profit . . . .	-320.23	87.37	1237.16	2443.28	3701.33
Gross profit, % of total sales . . . . .	-12.05	20.44	38.44	40.32	42.06
Net profit, % of total sales . . . . .	-12.05	10.22	19.22	20.16	21.03
ROE, Net profit, % of equity . . . . .	-7.31	9.30	26.24	27.52	28.71
ROI, Net profit+interest, % of invest.	3.91	8.62	13.25	12.89	12.51



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1995	1996	1997	1998	1999
Total sales, incl. sales tax	5982.00	5982.00	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax	0.00	0.00	0.00	0.00	0.00
Variable margin	5982.00	5982.00	5982.00	5982.00	5982.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3012.51	3012.51	3012.51	3012.51	3012.51
Operational margin	2969.49	2969.49	2969.49	2969.49	2969.49
As % of total sales	49.64	49.64	49.64	49.64	49.64
Cost of finance	311.55	207.70	103.85	0.00	0.00
Gross profit	2657.94	2761.79	2865.64	2969.49	2969.49
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	2657.94	2761.79	2865.64	2969.49	2969.49
Tax	1328.97	1380.90	1432.82	1484.75	1484.75
Net profit	1328.97	1380.90	1432.82	1484.75	1484.75
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	1328.97	1380.90	1432.82	1484.75	1484.75
Accumulated undistributed profit	5030.30	6411.19	7844.01	9328.76	10812.50
Gross profit, % of total sales	44.43	46.17	47.90	49.64	49.64
Net profit, % of total sales	22.22	23.08	23.95	24.82	24.82
ROE, Net profit, % of equity	30.33	31.51	32.70	33.88	33.88
ROI, Net profit+interest, % of invest.	12.26	11.87	11.48	11.10	11.10



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	5982.00	5982.00	5982.00	5982.00	5982.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2959.36	2959.36	2959.36	2575.76	2722.38
Operational margin . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
As % of total sales . . . . .	50.53	50.53	50.53	56.94	63.18
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	3022.64	3022.64	3022.64	3406.24	3779.62
Tax . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Net profit . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1511.32	1511.32	1511.32	1703.12	1889.81
Accumulated undistributed profit . . .	12324.83	13836.15	15347.47	17050.59	18940.40
Gross profit, % of total sales . . . .	50.53	50.53	50.53	56.94	63.18
Net profit, % of total sales . . . .	25.26	25.26	25.26	28.47	31.59
ROE, Net profit, % of equity . . . .	34.49	34.49	34.49	38.87	43.13
ROI, Net profit+interest, % of invest.	11.30	11.30	11.30	12.73	14.12



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988	1989
Total assets .....	12690.00	12690.00	13520.80
Fixed assets, net of depreciation	0.00	1485.40	5860.50
Construction in progress .....	1485.40	4375.10	7660.30
Current assets .....	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00
Cash surplus, finance available .	11204.60	6829.50	0.00
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	12690.00	12690.00	13520.80
Equity capital .....	4382.00	4382.00	4382.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	8308.00	8308.00	8308.00
Current liabilities .....	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	830.80
Total debt .....	8308.00	8308.00	9138.80
Equity, % of liabilities .....	34.53	34.53	32.41

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88

## Projected Balance Sheets, Production in 1000 US \$

Year	1990	1991	1992	1993	1994	1995
Total assets	13404.69	12680.71	11751.81	11108.24	11327.79	11618.26
Fixed assets, net of depreciation	12655.07	11789.34	10932.41	10084.28	9236.16	8426.03
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	405.96	550.29	795.10	795.10	795.10	795.10
Cash, bank	24.43	20.85	24.30	24.30	24.30	24.30
Cash surplus, finance available	0.00	0.00	0.00	204.57	1272.24	2372.84
Loss carried forward	0.00	320.23	0.00	0.00	0.00	0.00
Loss	320.23	0.00	0.00	0.00	0.00	0.00
Total liabilities	13404.69	12680.71	11751.81	11108.24	11327.79	11618.26
Equity capital	4382.00	4382.00	4382.00	4382.00	4382.00	4382.00
Reserves, retained profit	0.00	0.00	87.37	1237.16	2443.28	3701.33
Profit	0.00	407.60	1149.80	1206.12	1258.05	1328.97
Long and medium term debt	7269.50	6231.00	5192.50	4154.00	3115.50	2077.00
Current liabilities	69.53	93.11	128.96	128.96	128.96	128.96
Bank overdraft, finance required	1683.66	1567.00	811.18	0.00	0.00	0.00
Total debt	9022.69	7891.11	6132.64	4282.96	3244.46	2205.96
Equity, % of liabilities	32.69	34.56	37.29	39.46	38.68	37.72

CALCIUM CARBIDE &amp; CALCIUM CYANAMIDE — February 88

COMFAR 2.1 - BALDO &amp; CO. S.R.L., MILANO

## Projected Balance Sheets, Production in 1000 US \$

Year	1996	1997	1998	1999	2000	2001
Total assets	11960.66	12354.97	13839.72	15324.47	16835.79	18347.11
Fixed assets, net of depreciation	7615.90	6805.77	5954.41	5185.51	4428.53	3671.55
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	795.10	795.10	795.10	795.10	795.10	795.10
Cash, bank	24.30	24.30	24.30	24.30	24.30	24.30
Cash surplus, finance available	3525.36	4729.81	7024.69	9319.56	11587.86	13856.16
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	11960.66	12354.97	13839.72	15324.47	16835.79	18347.11
Equity capital	4382.00	4382.00	4382.00	4382.00	4382.00	4382.00
Reserves, retained profit	5030.30	6411.19	7844.01	9328.76	10813.50	12324.83
Profit	1380.90	1432.82	1484.75	1484.75	1511.32	1511.32
Long and medium term debt	1038.50	0.00	0.00	0.00	0.00	0.00
Current liabilities	128.96	128.96	128.96	128.96	128.96	128.96
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	1167.46	128.96	128.96	128.96	128.96	128.96

Equity, % of liabilities . . . .	36.64	35.47	31.66	28.59	26.03	23.58
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CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALCO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2002	2003	2004
Total assets .....	19858.43	21561.55	23451.36
Fixed assets, net of depreciation	2914.57	2941.20	2941.20
Construction in progress .....	0.00	0.00	0.00
Current assets .....	795.10	795.10	795.10
Cash, bank .....	24.30	24.30	24.30
Cash surplus, finance available .	16124.46	18200.96	20090.77
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	19858.43	21561.55	23451.36
Equity capital .....	4382.00	4382.00	4382.00
Reserves, retained profit .....	13836.15	15347.47	17050.59
Profit .....	1511.32	1703.12	1889.81
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	128.96	128.96	128.96
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	128.96	128.96	128.96
Equity, % of liabilities .....	22.07	20.32	18.69

CALCIUM CARBIDE & CALCIUM CYANAMIDE — February 88





**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	8309.66	8308.00	1.66	8308.00	0.00	0.00	1.06
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	8309.66	8308.00	1.66	8308.00	0.00	0.00	1.06
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	29387.18	10604.80	18782.38	977.40	3225.40	6402.00	2476.38
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	7965.80	9774.00	-1808.20	977.40	3225.40	5571.20	224.69
imported materials . . .	8542.32	0.00	8542.32	0.00	0.00	0.00	382.39
repayment loans & overd.	8309.66	0.00	8309.66	0.00	0.00	0.00	1038.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	4569.40	830.80	3738.60	0.00	0.00	830.80	830.80
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-21077.52	-2296.80	-18780.72	7330.60	-3225.40	-6402.00	-2475.31
import substit'n effect	30255.00	0.00	30255.00	0.00	0.00	0.00	1213.00
net foreign exch'g effect	9177.48	-2296.80	11474.28	7330.60	-3225.40	-6402.00	-1262.31
present values at 10.00 %							
foreign exchange flow .	-11121.96						
net foreign exch'g effect	1115.38						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Foreign Exchange Effect in: 1000 US \$  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	0.04	0.55	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.04	0.55	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	2240.21	2409.41	2154.82	2050.97	1947.12	1843.27	1739.42
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	76.74	150.74	0.00	0.00	0.00	0.00	0.00
imported materials . . .	398.02	597.07	597.07	597.07	597.07	597.07	597.07
repayment loans & overd.	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50	1038.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	726.95	623.10	519.25	415.40	311.55	207.70	103.85
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-2240.17	-2408.86	-2154.82	-2050.97	-1947.12	-1843.27	-1737.42
import substit'n effect	1573.00	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00
net forgn exchge effect	-667.17	-295.86	-41.82	62.03	165.88	269.73	373.58
present values at 10.00 %							
foreign exchange flow . .	-11121.96						
net forgn exchge effect	1115.38						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	597.07	597.07	597.07	597.07	597.07	597.07	597.07
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . . .	597.07	597.07	597.07	597.07	597.07	597.07	597.07
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-597.07	-597.07	-597.07	-597.07	-597.07	-597.07	-597.07
import substit'n effect	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00	2113.00
net forgn exchge effect	1515.93	1515.93	1515.93	1515.93	1515.93	1515.93	1515.93
present values at foreign exchange flow . .	10.00 %	-11121.96					
net forgn exchge effect		1115.38					



**COMFAR**<sup>2.1</sup>  
UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Foreign Exchange Effect in 1000 US \$  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	production 2005
total foreign inflow . .	0.00
equity capital . . . . .	0.00
subsidies, grants . . .	0.00
loans & overdraft . . .	0.00
exports . . . . .	0.00
indirect effects . . . . .	.....
total foreign outflow .	-2258.71
royalties . . . . .	0.00
equipment . . . . .	-2260.37
imported materials . . .	0.00
repayment loans & overd.	1.66
other repayments . . . .	0.00
repatriated wages . . .	0.00
dividends paid . . . . .	0.00
interests . . . . .	0.00
indirect costs . . . . .	.....
net foreign exchange flow	2258.71
import substit'n effect	0.00
net foreign exchange effect	2258.71
present values at	10.00 %
foreign exchange flow .	-11121.96
net foreign exchange effect	1115.38

**baldo & c.**  
CONSULTING ENGINEERS

Calcium Cyanamide

ANNEXE 6

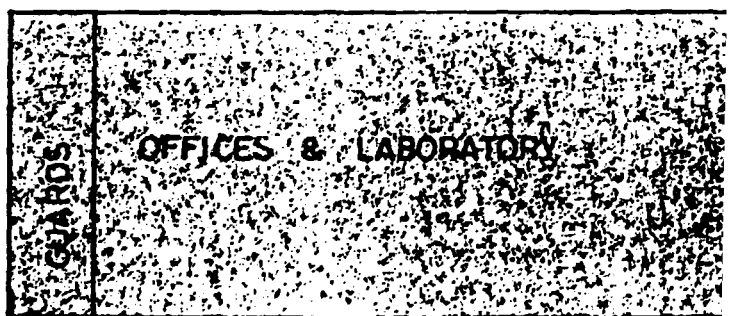
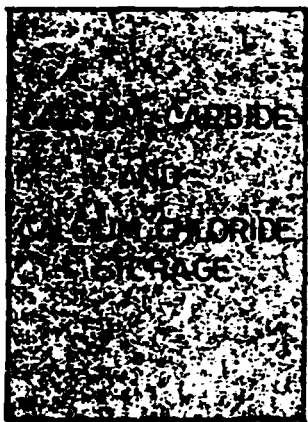
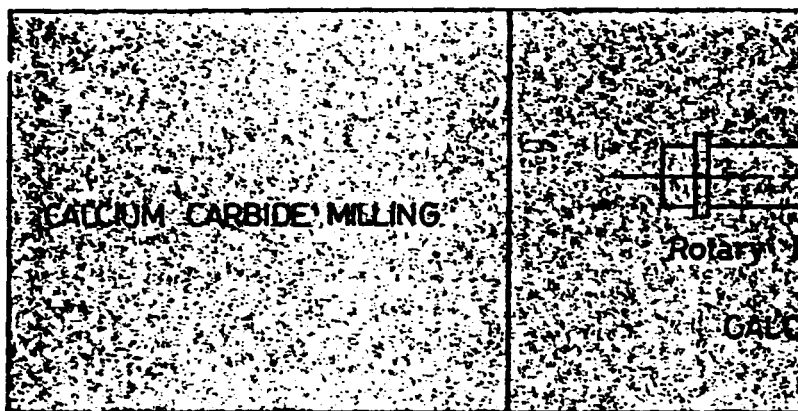
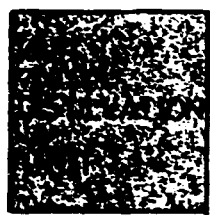
DRW. B.162 - 10 - 1

SITE LAY-OUT

DRW. B.162 - 10 - 2

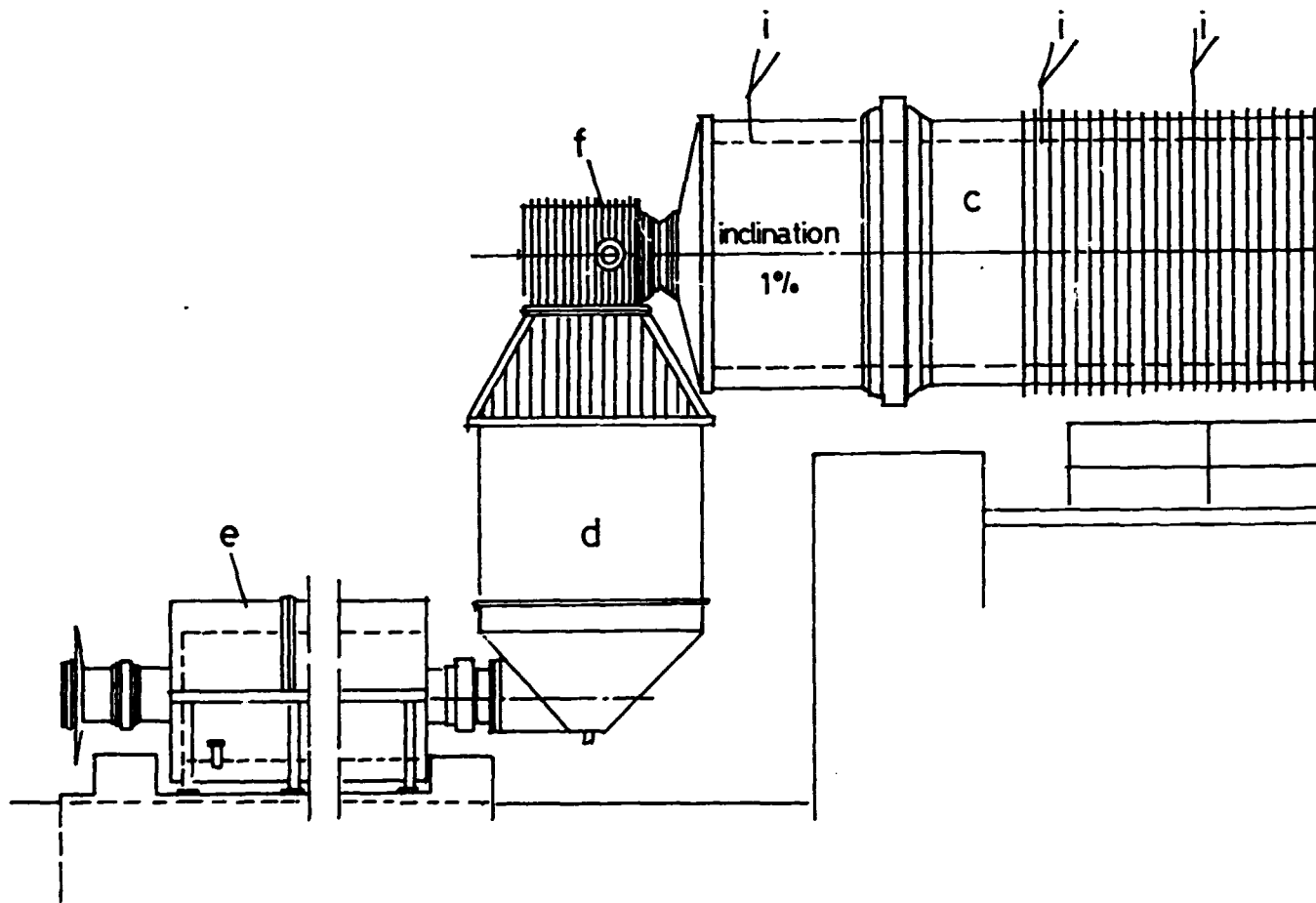
ROTARY KILN

70 000



SECTION 1





**ROTARY KILN FOR CONTINUOUS MANUFACTURING OF CALCIUM CYANAMIDE**

a - HOPPER

h - SEAL FLANGE

b - FEEDER

k - COG WHEEL

c - ROTARY KILN

i - TEMPERATURE CONTROL

d - WARM SILO

e - COOLER

f - NITROGEN INLET

g - DUST SEPARATOR

**SECTION 1**





SUMMARY

1st VOLUME

BASIC ASSUMPTIONS FOR THE PREPARATION OF FINANCIAL ANALYSIS OF ALL PROJECTS

INVESTMENT PROMOTION SUGGESTIONS

ANIMAL FEED FROM AGRICULTURAL WASTES

INDUSTRIAL CANVAS

HYGIENIC PRODUCTS

CHLOR-ALKALI

BIOMASS BASED CHEMICALS

INDUSTRIAL EXPLOSIVES

CALCIUM CARBIDE

CALCIUM CYANAMIDE

2nd VOLUME

BLEACHING EARTH FROM BENTONITE

DIATOMITE

HYDROGEN PEROXIDE

BONE BASED CHEMICALS

SULPHONATION CHEMICALS

INDUSTRIAL ADHESIVES

CALCIUM HYPOCHLORITE

DIVERSIFICATION OF CEMENT USES

**3rd VOLUME**

**FURFURAL**

**LEATHER & CANVAS SHOES**

**BROMINE**

**ESSENTIAL OILS**

**CANNED FISH**

U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPGRTUNITY STUDY FOR THE  
PRODUCTION OF BLEACHING EARTH  
FROM BENTONITE IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

**I N D E X**

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - DRW. B162-3-1  
SITE LAY OUT**

**DRW. B162-3-2  
PROCESS FLOW DIAGRAM**

0. SUMMARY AND CONCLUSIONS

This opportunity study analyses the possibility of processing locally available bentonite to produce bleaching earth, a product that is used as a filter and decolourizing agent in both the food and chemical industries.

Ethiopia is presently importing 100-200 tons per year of bleaching earth, mainly for the edible oil processing (but this could develop to 500 tons/y within a few years). The minimum economic size, however, of a processing unit is in the range of 3,000 tons per year, far beyond the domestic market needs: an export outlet must therefore be found. Several European countries are importing activated bentonite, therefore their markets have been considered but the ex-works selling prices that should be considered to make final import cost attractive to dealers is very low compared with the production cost (300\$ ex-work selling price versus 300 \$ for input costs only in the most favourable alternative).

Export to neighbouring countries could also be considered (In East Africa for example, the process of edible oils is relatively well-developed as a base industry). In this case the selling price could be higher (lower freight charges) and could reach 500\$, the total revenue being:

- sales to domestic food industry		
500 tons x 630 \$/t =		315,000 \$/y
- sales to neighbouring countries		
2,500 tons x 500 \$/t =		1,250,000 \$/y
		-----
		1,565,000 \$/y

Once again the plant would not recover the operational costs that, in the most favourable case, are:

- inputs	901,800 \$
- depreciation	494,000 \$
- personnel	200,000 \$

-----  
1,595,800

In the case of subsidizing of local freight charges, (estimated in the range of \$ 50 per ton), the ex-works selling price could increase to \$ 550 per ton and the total revenues to \$ 1,690,000 per ton.

Also in this case the profit margin is very low. Further action is therefore not recommended but it may be useful to carry out a market survey in neighbouring countries to ascertain the amount of activated bentonite imported and at what price. If the selling price ex-works could be above 600\$ the preparation of a feasibility study could be considered.



1. INTRODUCTION

The present study deals with the production of bleaching earth from Bentonite, a particular kind of clay whose presence in Ethiopia has been proven in several sites. Bentonite is a clay derived from volcanic ash and consists mainly of montmorillonite, with minor amounts of illite, kaolinite, cristobalite and other minerals.

Bentonite has strong colloidal properties and, when in contact with water, increases its volume severalfold by swelling, forming a tixotropic, gelatinous substance.

Its main uses take advantages of these colloidal properties: as well as being a bleaching agent other applications are the preparation of drilling muds, foundry sands, absorbents, fillers and as an additive in foundation soils.

When used as a bleaching agent Bentonite should have the following chemical analysis and physical characteristics:

SiO <sub>2</sub>	65-70%
Al <sub>2</sub> O <sub>3</sub>	12-14%
Fe <sub>2</sub> O <sub>3</sub>	2.5-3.5%
MgO	1.6-2.8%
CaO	0.9-1%
K <sub>2</sub> O	0.15-0.16%
Na <sub>2</sub> O	0.5-0.6%
TiO <sub>2</sub>	1.2-1.9%

specific surface	250-300 m <sup>2</sup> /g
exchange capacity	50-55 meq/100g
volume of pores	greater than 250Å = 0,73 cu.cm/g (macropores)
	less than 250Å = 0,38 cu.cm/g (micropores) -----
	1,11 cu.cm/g

Free acidity	0.4mg KOH/g
pH	3.4-3.5
water content (at 120°C)	6-10%
apparent specific weight	0.40-0.60 kg/l
residue over a 40μ sieve	15-30%
retention (of filtered oil)	40-60%

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The present study deals with the production of bentonite as bleaching earth, that is as a filtering and decolorizing agent to be used mainly in the production of mineral oils and greases; in the production of vegetable oils and fats, fish oils and animal fats; in the regeneration of exhausted lube oils; in the regeneration of solvent as used in dry-cleaning machines.

The main characteristic of the bleaching earth is its decolorizing power, that is the property of the earth of absorbing selectively certain pigments rather than others according to the characteristics of the product to be decolourized (acidity, oxidation degree, origin and biological state, etc).

### 2.2 Forecast demand and plant capacity

The present Ethiopian consumption of bentonite for bleaching is of about 100 t/y, considering only the needs of the National Food Co.

This figures should increase within the next 5-10 years to 200 t/y, but considering the total edible oil production as possible source of use of bleaching earth, the future consumption can be estimated at 500 t/y.

In any case, as far as regards plant capacity, the economical size of 3000 tons per year, has been considered; this capacity has been based on a working time of three shifts a day for 300 d/y.

2.3 Sales prices and total revenues

Activated bentonite is presently imported in Ethiopia from Europe at a price of 1304 birr/t (equivalent to 630 US\$/t), free at the Mojo edible oil factory.

In the European market the sales price is about 500 US\$/t.

The difference between the European and Ethiopian prices is consistent with the transportation charges (about 130 US\$/t up to the Mojo plant).

Due to the great difference between plant size and domestic consumption, the hypothesis of an Ethiopian export must be taken into consideration in order to make the project profitable.

In any case it is to be seriously considered that the present European market is rather saturated and widely covered by several producers, the major ones being:

Südchemie AG, München - (W.Germany) (Tonsil)

Laporte Ind. - England - (Flumont)

Harrow - U.S.A.

Misuzawa - Japan

Caffaro - Italy (Prolit)

On the basis of the aforesaid considerations, the maximum selling price, ex works, for the Ethiopian product can be estimated at 295-300 \$/t, taking into account that the freight charges are around 130 \$/t and a wholesale discount of the 15% equivalent to \$ 75 U.S. will have to be granted.

On this basis (100% export to Europe) the total revenues would be:

$300 \times 3000t = 900.000 \text{ US } \$/\text{year}$

Of course, in case of export in the surrounding countries, the lower transportation costs could raise

the total revenues (oil mills are located in several countries of the region and bleaching earth must be imported). Therefore a more realistic calculation of revenues could be the following:

- sales to domestic food industry	
500 t/y x 630 \$/t =	315,000 \$/y
- export to neighbouring countries	
2,500 t/y x 500 \$/t	1,250,000 \$/y
	-----
	1,565,000 \$/y

and if the transportation costs of the export market could be subdivided:

- sales in the domestic market	
500 t/y x 630 \$/t	315,000 \$/y
- sales in the export market	
2,500 t/y x 550 \$/t	1,375,000 \$/y
	-----
	1,690,000 \$/y

### 3. MATERIAL AND INPUTS

#### 3.1 Technology

The natural decolouring power of bentonite is very low, but it can be greatly increased by an acid treatment which generates the so-called "activated earths".

The acid treatment of bentonite eliminates alkalies and calcium and reduces its content of magnesium, iron and aluminium.

The acid treatment can be carried out by using either sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) or hydrogen chloride (HCl).

The raw materials are therefore the following:

- Bentonite: is available in several parts of the country in large quantities. Samples taken in the area of Lake Abiate have been tested by the National Food Corporation. Results have shown that non-activated crude local samples have 50% of the bleaching power of the presently imported bleaching earth. This indicates that after activation bleaching power can reach appreciable values. This impression is confirmed by a preliminary examination of the samples carried out in Italy at a Bentonite processing plant, but in contrast with the report prepared by a Czechoslovakian consulting Institution, the Kutna Hora Institute of Raw materials, that stated that

the tested bentonite was not suitable for the bleaching purpose.

Further tests and pre-industrial tests should be carried out if it is decided to go ahead with a feasibility study.

- Sulphuric acid: sulphuric acid is preferred because (or Hydrogen chloride) it will be soon available in the Country. The NCC is in fact presently finalizing a project for the production of H<sub>2</sub>SO<sub>4</sub> starting from imported sulphur. However, the output of the plant will not be enough to supply H<sub>2</sub>SO<sub>4</sub> to all new projects proposed. As pointed out in the Summary and conclusions, on the other hand, the price of 1,110 birr/ton is too high, nearly double the price that could be obtained by buying the Sulphuric Acid in bulk. The idea is therefore to build a Sulphuric Acid terminal at Assab harbour, with a storage capacity of 20,000 tons, able to supply (by tank-truck and, in future by railroad) the following plants that are major users of sulphuric acid: Bentonite (1,500 tons/year H<sub>2</sub>SO<sub>4</sub>), Bone based chemicals (16,000 tons) Furfural (1,000 tons). In this case the following prices could be considered for further

evaluation:

- international price ranges from  
70-120 \$/ton FOB
  - cost CIF Assab:  
120 + 100 \$ = 220 \$/ton
  - inland transportation  
and other charges 85 \$
- 305 \$/ton

The proposed Sulphuric Acid terminal in Assab will receive two-three ships carrying Acid in bulk per year. The fixed investment is estimated at 500,000 \$ and the operating expenses at 50,000 \$ per year. The depreciation + operating expenses will increase the cost of acid delivered at the factory site at \$ 310.

- Calcium oxide: is used for the neutralization of the spent acid. It is largely available in Ethiopia.

### 3.2 Material and utilities requirements

The complete list of consumption of raw materials and utilities is given in the following table 3.2.1 and in table 3.2.2 the purchasing programme and storage volumes.



TABLE 3.2.1

**MATERIAL AND UTILITIES REQUIREMENTS AND COSTS**  
referring to a capacity of 3000 t/y

DESCRIPTION	UNIT	CONSUMPTIONS FOR		UNIT PRICE \$		ANNUAL COSTS \$/y		
		1 T	1 YEAR	LC	FC	LC	FC	TOTAL
<u>Raw materials</u>								
Raw ore	t	1.2	3,600	12.07	-	43,452	-	43,452
Sulphuric acid (98%) (1)	t	0.5	1,500	601	-	901,500	-	901,500
Calcium oxide	t	0.046	138	54.09	-	<u>7,464</u>	-	<u>7,464</u>
1° SUB TOTAL (Raw materials)						952,416	-	952,416
<u>Utilities</u>								
Electric power (2)	kWh	235	705,000	0.0966	-	68,103	-	68,103
Steam (10 bar)	t	1	3,000	-	17.25	-	51,750	51,750
Water	m3	48	144,000	0.02	-	2,880	-	2,880
L.P.G.	kg	150	450,000		0.565	-	<u>254,250</u>	<u>254,250</u>
2° SUB TOTAL (Utilities)						70,983	306,000	376,983
<u>Packaging</u>								
Paper bag	n°	40	120,000	0.5	-	<u>60,000</u>	-	<u>60,000</u>
3° SUB TOTAL (Packing)						60,000	-	60,000
<b>TOTAL COST \$/y (3)</b>							<b>1,389,399</b>	
<b>UNIT COST \$/t (3)</b>							<b>463</b>	

- (1) This cost would be reduced from 901,500 to 465,000 \$/y in the case of the implementation of the Sulphuric Acid Terminal as proposed in point 3.1
- (2) An alternate could be to consider the cost of electricity at 0.05 Birr/kWh. This cost would be reduced from 68,103 to 17,025 \$/y.
- (3) If the above two alternatives are considered, the annual cost would be reduced to from 1,389,399 to 901,821 and the unit cost from 463 to 300.6

RAW MATERIALS PURCHASING PROGRAMME AND STORAGE VOLUME

PRODUCT	ORIGIN (1)	PURCHASING PROGRAMME				STORAGE				
		QUANTITY		DAYS (2)	COST \$	N°	TANKS CAPACITY cu.mt		MAT (3)	WAREHOUSE SURFACE
		t	cu. mt.				EACH	TOTAL		
Raw bentonite	L	360	-	30	4,345	-	-	-	300 sq.mt open air	
Sulphuric acid 98%	L	150	80	30	90,150	3	40	120	-	
Calcium oxide	L	14	-	30	768	-	-	-	50	
					----- 95,263					
LPG	F	45	100	30	25,425	3	50	150	C	
Fuel oil	F	23	24	30	5,175	1	30	30	C	
					----- 30,600					
Number of paper bags	L	12000		30	6,000	-	-	-	100	
Finished product	-	-	-	30	-	-	-	-	600	
<b>TOTAL PURCHASING COST \$</b>					<b>131,863</b>					

- (1) L=local origin F=foreign origin  
(2) Equivalent number of days of operation at full capacity  
(3) Construction material: C = carbon steel

4. LOCATION

The plant should be located as close as possible to the bentonite quarry, provided that good facilities (railway, roads) for the transportation of the finished product are available. If the results of the pre-industrial tests confirm the suitability of the already tested product, the plant could be located near the lake Abiata area.

5. PROJECT ENGINEERING

5.1 Description of process and main equipment - Please refer to attached flow sheet B.162-3-2

The crude clay is mixed with water to form a suspension to which sulphuric acid is added. The mixture is then heated by steam in a mixing tank up to a temp. of 40°C and kept at this temperature for about 4 hours. Then the mixture is heated to 180°C for one hour. After cooling the suspension is filtered through a filter press and washed in order to eliminate excess acidity. The cake of the activated earth is then dried through a pneumatic conveyor by hot air (700°C). The product is collected in a depot and then packed.

The fuel that is utilized for the drying must not pollute the final product by odour or other impurities. For this reason natural gas or LPG are generally used, while the use of the fuel oil is to be avoided (it tends to have an incomplete combustion, and soot is generated which is harmful for the characteristics of the activated bentonite).

5.2 Packing

The activated earth is packed in kraft-paper bags of 25 kg each. Filling operations are carried out manually.

### 5.3 Layout and civil works

The general lay-out of the factory is shown in the attached drawing B.162-3-1.

The total area required by the plant is 9000 sq.mt approximately.

In this area four main sections can be identified as follows:

- a) an area of about 300 sq.mt for the storage of the crude bentonite
- b) the process plant, covering an area of 1200 sq.mt
- c) a shelter for the storage and packing of the finished product (900 sq.mt)
- d) a building for administrative offices and other facilities (850 sq.mt)

The area where the crude bentonite is stored is simply covered with gravel and rolled; the entire area should be higher than the surrounding ground and its surface must be adjusted to an appropriate slope to facilitate the drainage of water to the sewer.

The process equipment is suitable for outdoor installation and protected by a shelter only; steel structure is proposed for the shelter that will use corrugated asbestos-cement as cover; the floor is of reinforced concrete with a hard aggregate as finishing surface.

Both the storage/packing building and the office building have a structure in reinforced concrete; external and partition walls are of brickwork; the roof is of corrugated asbestos-cement, insulated with a mineral wool lagging; the floors of the offices, laboratory and social facilities are covered with cement tiles while those of the other rooms are of concrete.

The courtyard is covered with gravel and rolled; a fence made of a wire-netting supported by small steel poles surrounds the entire factory.

5.4 Investment costs: depreciation and maintenance

The investment costs for the process plant installation including the utilities and all the civil works are as follows:

	LC	FC	TOTAL
	\$	\$	\$
Machinery and equipment,			
FOB European port (1)	-	4,200,000	4,200,000
Transportation	445,000	445,000	890,000
Erection	200,000	256,000	456,000
Site preparation	75,000		75,000
Civil works	755,000	-	756,000
Insulation & painting	42,000	90,000	132,000
Spare parts (2 years)		223,000	223,000
	-----	-----	-----
	1,518,000	5,214,000	6,732,000
Contingencies	152,000	526,000	678,000
Grand total	1,670,000	5,740,000	7,410,000

The industrial life of this plant can be estimated as being in the range of 15 years.

The annual cost of maintenance has been assumed to be 4.5% of the value of the machinery, i.e. 200,000\$

(1) Three trucks of 20 ql capacity are also included, with a total value of 150,000 \$

In the financial evaluation the investment costs (contingencies included) have been so subdivided:

Machinery	FC 5740
Machinery	LC 687
Site preparation	LC 75
Civil works	LC 908
	-----
	7410

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit, complete with necessary utilities and facilities, operating under the direction of the Ethiopian Mineral Resources Development Co.



7. MANPOWER

No particular skills are required of the technical personnel except for the chemist, the production manager and the chief engineer, who should have a through training in the technology involved in the problems of machinery corrosion and erosion. For all the other positions the requirements are the same as those of other chemical factories.

7.1 Management

		birr/m	birr/y
General manager	1	1500	
Technical manager	1	1200	
	---	----	-----
	2	2700	32,400

7.2 Administrative department

Financial manager	1	1000	
Senior accountant	1	400	
Purchasing office head	1	400	
Sale office head	1	400	
Warehouse head	1	400	
Secretaries and clerks	8	2800	
Drivers (including the bentonite transportation)	8	2800	
Guards	9	1800	
	---	----	-----
	30	10,000	120,000
Total Manag. and Adm. dept.			152,400 b/y (73,623 \$/y)

7.3 Production and maintenance departments

		birr/m	birr/y
<u>Production dep.</u>			
Production manager	1	1000	
Shift foremen	4	1600	
Shift operators	24	8400	
Chemist	1	700	
Analyst	1	350	
Clerk	1	350	
Unskilled workers	4	800	
	---	-----	-----
	36	13200	158,400
			(76,521 \$/y)
 <u>Maintenance dep.</u>			
Chief engineer	1	1000	
Supervisors	2	800	
Electricians	4	1600	
Mechanics	6	2400	
Handymen	4	1600	
Unskilled workers	4	800	
	---	-----	-----
	21	8200	98,400
			(47,536 \$/y)

8. IMPLEMENTATION SCHEDULE

Thirty months are required for the design, equipment supply and construction of the plant, up to commissioning and start-up.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	30
work in progress	1	1

- the assistance of two foreign experts for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- sulfuric acid price has been assumed as 310 \$/t

- electricity price has been assumed 0.05 birr/kWh

- packaging costs have been included in "other raw materials"

- the production programme has been assumed as follows:

1st year: 50% capacity: 1250 t for export market.  
250 t for domestic market

2nd year: 75% capacity: 1875 t for export market  
375 t for domestic market

from the 3rd

to the 15th year: 100% capacity: 2500 t for export market  
500 t for domestic market

Selling prices: 550 \$/t for export market

630 4/t for domestic market

As a result the evaluation yields no significant IRR, while the BEP is more than 1.

10. FOREIGN EXCHANGE EFFECT EVALUATION

After the negative results of the financial and BEP evaluations, no computation of the foreign exchange effect has been carried out.

**Bleaching earth**

**ANNEXE 1**

**FINANCIAL EVALUATION**



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BLEACHING EARTH FROM BENTONITE  
February 88  
Reduced price for Power and H2SO4

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

---

**Total initial investment during construction phase**

fixed assets:	7997.90	77.869 % foreign
current assets:	0.00	0.000 % foreign
total assets:	7997.90	77.869 % foreign

---

**Source of funds during construction phase**

equity & grants:	2631.00	0.000 % foreign
foreign loans :	4879.00	
local loans :	0.00	
total funds :	7510.00	64.967 % foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	808.59	1024.05	1299.50
depreciation :	509.08	509.08	501.58
interest :	487.90	426.91	365.92
production costs	1805.57	1960.04	2167.01
thereof foreign	65.56 %	60.68 %	57.90 %
total sales :	845.00	1267.50	1690.00
gross income :	-960.57	-692.54	-477.01
net income :	-960.57	-692.54	-477.01
cash balance :	-1313.82	-885.22	-689.68
net cashflow :	-216.04	151.57	286.12

Net Present Value at: 10.00 % = -4710.36  
Internal Rate of Return on total investment: -1.62 %  
Equity paid versus Net income flow (IPR%): -24.55 %  
Net Worth versus Net Cash Return (IRR%): -5.17 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US \$**

Year . . . . .	1987.1	1987.2	1988.1	1989.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	75.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	270.00	270.00	270.00	98.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . . . .	300.00	850.00	1850.00	2550.00	877.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>375.00</b>	<b>1120.00</b>	<b>2120.00</b>	<b>2820.00</b>	<b>975.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	25.00	283.95	243.95
Net working capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs . . . . .</b>	<b>380.00</b>	<b>1135.00</b>	<b>2135.00</b>	<b>2845.00</b>	<b>1258.95</b>	<b>243.95</b>
Of it foreign, in % . . . . .	78.95	74.89	79.63	80.84	66.24	100.00





Total Current Investment in 1000 US \$

Year . . . . .	1990	1991	1992
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs . . . .	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	252.45	91.88	104.38
Total current investment costs . . .	252.45	91.88	104.38
Of it foreign, % . . . . .	67.97	72.97	76.20



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Total Production Costs in 1000 US \$

Year	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product)	50.00	75.00	100.00	100.00	100.00	100.00
Raw material 1	257.94	386.94	515.92	515.92	515.92	515.92
Other raw materials	30.00	45.00	60.00	60.00	60.00	60.00
Utilities	1.44	2.16	2.88	2.88	2.88	2.88
Energy	161.51	242.27	323.02	323.02	323.02	323.02
Labour, direct	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance	47.54	47.54	47.54	47.54	47.54	47.54
Spares	100.00	150.00	200.00	200.00	200.00	200.00
Factory overheads	60.00	0.00	0.00	0.00	0.00	0.00
Factory costs	734.97	950.43	1225.88	1225.88	1225.88	1225.88
Administrative overheads	73.62	73.62	73.62	73.62	73.62	73.62
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	509.08	509.08	501.58	494.08	494.08	474.08
Financial costs	487.90	426.91	365.92	304.94	243.95	182.96
Total production costs	1805.57	1960.04	2167.01	2098.52	2037.53	1956.54
Costs per unit (single product)	1.20	0.87	0.72	0.70	0.68	0.65
Of it foreign, %	65.56	60.68	57.90	56.87	55.60	54.78
Of it variable, %	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	150.14	150.14	150.14	150.14	150.14	150.14



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**Total Production Costs in 1000 US \$**

Year .....	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	515.92	515.92	515.92	515.92	515.92	515.92
Other raw materials .....	60.00	60.00	60.00	60.00	60.00	60.00
Utilities .....	2.88	2.88	2.88	2.88	2.88	2.88
Energy .....	323.02	323.02	323.02	323.02	323.02	323.02
Labour, direct .....	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance .....	47.54	47.54	47.54	47.54	47.54	47.54
Spares .....	200.00	200.00	200.00	200.00	200.00	200.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1225.88</b>	<b>1225.88</b>	<b>1225.88</b>	<b>1225.88</b>	<b>1225.88</b>	<b>1225.88</b>
Administrative overheads .....	73.62	73.62	73.62	73.62	73.62	73.62
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	474.08	474.08	474.08	428.66	211.45	0.00
Financial costs .....	121.97	60.99	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>1895.56</b>	<b>1834.57</b>	<b>1773.58</b>	<b>1728.18</b>	<b>1510.95</b>	<b>1299.50</b>
Costs per unit ( single product ) .	0.63	0.61	0.59	0.58	0.50	0.43
Of it foreign, % .....	53.33	51.77	50.12	51.43	45.99	38.94
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	150.14	150.14	150.14	150.14	150.14	150.14

BLEACHING EARTH FROM BENTONITE — February 88



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year		1990	1991	1992	1993-2004
Coverage	mdc coto				
<b>Current assets &amp;</b>					
Accounts receivable	30 12.0	67.38	85.34	108.29	108.29
Inventory and materials	30 12.1	24.00	36.00	48.00	48.00
Energy	28 12.6	12.77	19.16	25.55	25.55
Spares	350 1.0	100.00	150.00	200.00	200.00
Work in progress	1 360.0	2.04	2.64	3.41	3.41
Finished products	30 12.0	67.38	85.34	108.29	108.29
Cash in hand	15 24.0	14.90	14.49	16.57	16.57
<b>Total current assets</b>		<b>289.48</b>	<b>392.96</b>	<b>510.11</b>	<b>510.11</b>
<b>Current liabilities and</b>					
Accounts payable	18 20.0	36.03	48.63	61.40	61.40
<b>Net working capital</b>		<b>252.45</b>	<b>344.33</b>	<b>448.71</b>	<b>448.71</b>
<b>Increase in working capital</b>		<b>252.45</b>	<b>91.88</b>	<b>104.38</b>	<b>0.00</b>
<b>Net working capital, local</b>		<b>80.87</b>	<b>105.71</b>	<b>130.54</b>	<b>130.54</b>
<b>Net working capital, foreign</b>		<b>171.58</b>	<b>238.63</b>	<b>318.17</b>	<b>318.17</b>

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	2651.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	4879.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	4879.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	243.95
Total funds .....	7510.00	0.00	243.95

BLEACHING EARTH FROM BENTONITE — February 88



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-609.88	-609.88	-609.88	-609.88	-609.88	-609.88	-609.88
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-609.88	-609.88	-609.88	-609.88	-609.88	-609.88	-609.88
Current liabilities	36.03	12.60	12.76	0.00	0.00	0.00	0.00
Bank overdraft ....	1313.82	885.22	689.68	524.31	463.32	402.34	341.35
Total funds .....	739.97	287.94	92.57	-85.56	-146.55	-207.94	-268.52

BLEACHING EARTH FROM BENTONITE — February 88

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1997	1998-2002	2003	2004
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-609.88	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-609.88	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	280.36	-390.50	-300.97	-195.25
Total funds .....	-329.51	-390.50	-300.97	-195.25

BLEACHING EARTH FROM BENTONITE — February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow ..	7510.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	7510.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow ..	380.00	1135.00	2135.00	2845.00	1258.95	243.95
Total assets .....	380.00	1135.00	2135.00	2845.00	1015.00	0.00
Operating costs ....	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance ....	0.00	0.00	0.00	0.00	243.95	243.95
Repayment .....	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax ....	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid ....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	7130.00	-1135.00	-2135.00	-2845.00	-1258.95	-243.95
Cumulated cash balance	7130.00	5995.00	3860.00	1015.00	-243.95	-487.90
Inflow, local .....	2631.00	0.00	0.00	0.00	0.00	0.00
Outflow, local .....	80.00	285.00	435.00	545.00	425.00	0.00
Surplus ( deficit ) .	2551.00	-285.00	-435.00	-545.00	-425.00	0.00
Inflow, foreign ...	4879.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign ...	300.00	850.00	1700.00	2300.00	833.95	243.95
Surplus ( deficit ) .	4579.00	-850.00	-1700.00	-2300.00	-833.95	-243.95
Net cashflow .....	-380.00	-1135.00	-2135.00	-2845.00	-1015.00	0.00
Cumulated net cashflow	-380.00	-1515.00	-3650.00	-6495.00	-7510.00	-7510.00



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	881.03	1280.10	1702.76	1690.00	1690.00	1690.00
Financial resources .	36.03	12.60	12.76	0.00	0.00	0.00
Sales, net of tax . .	845.00	1267.50	1690.00	1690.00	1690.00	1690.00
Total cash outflow . .	2194.85	2165.32	2392.44	2214.31	2153.32	2092.34
Total assets . . . .	288.48	104.48	117.14	0.00	0.00	0.00
Operating costs . . .	808.59	1024.05	1299.50	1299.50	1299.50	1299.50
Cost of finance . . .	487.90	426.91	365.92	304.94	243.95	182.96
Repayment . . . . .	609.88	609.88	609.88	609.88	609.88	609.88
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1313.82	-885.22	-689.68	-524.31	-463.32	-402.34
Cumulated cash balance	-1801.72	-2736.93	-3376.61	-3900.93	-4364.25	-4766.59
Inflow, local . . . . .	192.66	241.66	327.41	315.00	315.00	315.00
Outflow, local . . . .	611.62	681.80	830.75	793.50	793.50	793.50
Surplus ( deficit ) .	-418.96	-433.14	-503.34	-478.50	-478.50	-478.50
Inflow, foreign . . . .	688.37	1031.43	1375.35	1375.00	1375.00	1375.00
Outflow, foreign . . .	1583.23	1483.51	1561.69	1420.81	1359.82	1298.84
Surplus ( deficit ) .	-894.86	-452.08	-186.34	-45.81	15.18	76.16
Net cashflow . . . . .	-216.04	151.57	286.12	390.50	390.50	390.50
Cumulated net cashflow	-7726.04	-7574.47	-7288.35	-6897.85	-6507.35	-6116.85





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year .....	1996	1997	1998	1999	2000	2001
Total cash inflow ..	1690.00	1690.00	1690.00	1690.00	1690.00	1690.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	1690.00	1690.00	1690.00	1690.00	1690.00	1690.00
Total cash outflow ..	2031.35	1970.36	1299.50	1299.50	1299.50	1299.50
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs ...	1299.50	1299.50	1299.50	1299.50	1299.50	1299.50
Cost of finance ...	121.97	60.99	0.00	0.00	0.00	0.00
Repayment .....	609.88	609.88	0.00	0.00	0.00	0.00
Corporate tax ...	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-341.35	-280.36	390.50	390.50	390.50	390.50
Cumulated cash balance	-5107.94	-5388.30	-4997.80	-4607.30	-4216.80	-3826.30
Inflow, local ....	315.00	315.00	315.00	315.00	315.00	315.00
Outflow, local ....	793.50	793.50	793.50	793.50	793.50	793.50
Surplus ( deficit ) .	-478.50	-478.50	-478.50	-478.50	-478.50	-478.50
Inflow, foreign ...	1375.00	1375.00	1375.00	1375.00	1375.00	1375.00
Outflow, foreign ...	1237.85	1176.86	506.00	506.00	506.00	506.00
Surplus ( deficit ) .	137.15	198.14	869.00	869.00	869.00	869.00
Net cashflow .....	390.50	390.50	390.50	390.50	390.50	390.50
Cumulated net cashflow	-5726.35	-5335.85	-4945.35	-4654.85	-4164.35	-3773.85



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	1690.00	1690.00	1690.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1690.00	1690.00	1690.00
Total cash outflow . .	1299.50	1389.03	1494.75
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1299.50	1299.50	1299.50
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	0.00	89.53	195.25
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	390.50	300.97	195.25
Cumulated cash balance	-3435.80	-3134.83	-2939.58
Inflow, local . . . .	315.00	315.00	315.00
Outflow, local . . . .	793.50	883.03	988.75
Surplus ( deficit ) .	-478.50	-568.03	-673.75
Inflow, foreign . . .	1375.00	1375.00	1375.00
Outflow, foreign . . .	506.00	506.00	506.00
Surplus ( deficit ) .	869.00	869.00	869.00
Net cashflow . . . . .	390.50	300.97	195.25
Cumulated net cashflow	-3383.35	-3082.38	-2887.13

BLEACHING EARTH FROM BENTONITE — February 88



**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-4826.15 at	10.00 %
Internal Rate of Return (IRRE1) ..	-24.55 %	
b) Net Worth versus Net cash return:		
Net present value .....	-4665.66 at	10.00 %
Internal Rate of Return (IRRE2) ..	-5.17 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-4710.36 at	10.00 %
Internal Rate of Return ( IRR ) ..	-1.62 %	
Net Worth = Equity paid plus reserves		



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	845.00	1267.50	1690.00	1690.00	1690.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	845.00	1267.50	1690.00	1690.00	1690.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1317.67	1533.13	1801.08	1793.58	1793.58
Operational margin . . . . .	-472.67	-265.63	-111.08	-103.58	-103.58
As % of total sales . . . . .	-55.94	-20.96	-6.57	-6.13	-6.13
Cost of finance . . . . .	487.90	426.91	365.92	304.94	243.95
Gross profit . . . . .	-960.57	-692.54	-477.01	-408.52	-347.53
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-960.57	-692.54	-477.01	-408.52	-347.53
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-960.57	-692.54	-477.01	-408.52	-347.53
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-960.57	-692.54	-477.01	-408.52	-347.53
Accumulated undistributed profit . . .	-960.57	-1653.11	-2130.12	-2538.64	-2886.17
Gross profit, % of total sales . . . .	-113.68	-54.64	-28.23	-24.17	-20.56
Net profit, % of total sales . . . .	-113.68	-54.64	-28.23	-24.17	-20.56
RCE, Net profit, % of equity . . . .	-36.51	-26.32	-18.13	-15.53	-13.21
ROI, Net profit+interest, % of invest.	-6.09	-3.38	-1.40	-1.30	-1.30



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	1690.00	1690.00	1690.00	1690.00	1690.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1690.00	1690.00	1690.00	1690.00	1690.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1773.58	1775.58	1773.58	1773.58	1773.58
Operational margin . . . . .	-83.58	-83.58	-83.58	-83.58	-83.58
As % of total sales . . . . .	-4.95	-4.95	-4.95	-4.95	-4.95
Cost of finance . . . . .	182.96	121.97	50.99	0.00	0.00
Gross profit . . . . .	-266.54	-205.56	-144.57	-83.58	-83.58
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-266.54	-205.56	-144.57	-83.58	-83.58
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-266.54	-205.56	-144.57	-83.58	-83.58
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-266.54	-205.56	-144.57	-83.58	-83.58
Accumulated undistributed profit . . .	-3152.71	-3358.27	-3502.84	-3586.42	-3670.00
Gross profit, % of total sales . . . . .	-15.77	-12.16	-8.55	-4.95	-4.95
Net profit, % of total sales . . . . .	-15.77	-12.16	-8.55	-4.95	-4.95
ROE, Net profit, % of equity . . . . .	-10.13	-7.81	-5.49	-3.18	-3.18
ROI, Net profit+interest, % of invest.	-1.05	-1.05	-1.05	-1.05	-1.05



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	1690.00	1690.00	1690.00	1690.00	1690.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1690.00	1690.00	1690.00	1690.00	1690.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1728.18	1728.18	1728.18	1510.95	1299.50
Operational margin . . . . .	-38.18	-38.18	-38.18	179.05	390.50
As % of total sales . . . . .	-2.26	-2.26	-2.26	10.59	23.11
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	-38.18	-38.18	-38.18	179.05	390.50
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-38.18	-38.18	-38.18	179.05	390.50
Tax . . . . .	0.00	0.00	0.00	89.53	195.25
Net profit . . . . .	-38.18	-38.18	-38.18	89.53	195.25
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-38.18	-38.18	-38.18	89.53	195.25
Accumulated undistributed profit . . . .	-3708.18	-3746.36	-3784.54	-3695.02	-3499.77
Gross profit, % of total sales . . . .	-2.26	-2.26	-2.26	10.59	23.11
Net profit, % of total sales . . . .	-2.26	-2.26	-2.26	5.30	11.55
RCE, Net profit, % of equity . . . .	-1.45	-1.45	-1.45	3.40	7.42
ROI, Net profit+interest, % of invest.	-0.48	-0.48	-0.48	1.12	2.45



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets .....	7510.00	7510.00	7510.00	7510.00	7753.95	7997.90
Fixed assets, net of depreciation	0.00	380.00	1515.00	3650.00	6495.00	7753.95
Construction in progress .....	380.00	1135.00	2135.00	2945.00	1258.95	243.95
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available ..	7130.00	5995.00	3860.00	1015.00	6.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	7510.00	7510.00	7510.00	7510.00	7753.95	7997.90
Equity capital .....	2631.00	2631.00	2631.00	2631.00	2631.00	2631.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	4879.00	4879.00	4879.00	4879.00	4879.00	4879.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required ..	0.00	0.00	0.00	0.00	243.95	487.90
Total debt .....	4879.00	4879.00	4879.00	4879.00	5122.95	5366.90
Equity, % of liabilities .....	35.03	35.03	35.03	35.03	33.93	32.90

BLEACHING EARTH FROM BENTONITE — February 88

**Projected Balance Sheets, Production in 100 US \$**

Year .....	1990	1991	1992	1993	1994	1995
Total assets .....	8737.87	9025.82	9118.38	9032.82	8886.27	8678.73
Fixed assets, net of depreciation	7488.82	6979.74	6478.16	5904.08	5489.99	5015.91
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	273.58	378.48	493.54	493.54	493.54	493.54
Cash, bank .....	14.90	14.49	16.57	16.57	16.57	16.57
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	960.57	1653.11	2130.12	2538.64	2886.17
Loss .....	960.57	692.54	477.01	408.52	347.53	266.54
Total liabilities .....	8737.87	9025.82	9118.38	9032.82	8886.27	8678.73
Equity capital .....	2631.00	2631.00	2631.00	2631.00	2631.00	2631.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	4269.13	3659.25	3049.38	2439.50	1829.63	1219.75
Current liabilities .....	36.03	48.63	61.40	61.40	61.40	61.40
Bank overdraft, finance required ..	1801.72	2686.93	3376.61	3900.93	4364.25	4766.59
Total debt .....	6106.87	6394.82	6487.38	6401.82	6255.27	6047.73
Equity, % of liabilities .....	30.11	29.15	28.85	29.13	29.61	30.32



**COMFAR**  
2.0 UNICO

COMFAR 2.0 - BALDO &amp; CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1986	1987	1988	1989	2000	2001
<b>Total assets .....</b>	<b>8410.21</b>	<b>8080.70</b>	<b>7690.20</b>	<b>7299.70</b>	<b>6909.20</b>	<b>6518.70</b>
Fixed assets, net of depreciation	4541.83	4067.75	3573.67	3119.59	2690.91	2262.23
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	493.54	493.54	493.54	493.54	493.54	493.54
Cash, bank .....	16.57	16.57	16.57	16.57	16.57	16.57
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	3152.71	3358.27	3502.84	3586.42	3670.00	3708.15
Loss .....	205.56	144.57	83.58	83.58	38.18	38.18
<b>Total liabilities .....</b>	<b>8410.21</b>	<b>8080.70</b>	<b>7690.20</b>	<b>7299.70</b>	<b>6909.20</b>	<b>6518.70</b>
Equity capital .....	2631.00	2631.00	2631.00	2631.00	2631.00	2631.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	609.88	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	61.40	61.40	61.40	61.40	61.40	61.40
Bank overdraft, finance required.	5107.94	5388.30	4997.80	4607.30	4216.80	3826.30
<b>Total debt .....</b>	<b>5779.21</b>	<b>5449.70</b>	<b>5059.20</b>	<b>4668.70</b>	<b>4278.20</b>	<b>3987.70</b>
<b>Equity, % of liabilities .....</b>	<b>31.28</b>	<b>32.56</b>	<b>34.21</b>	<b>36.04</b>	<b>38.08</b>	<b>40.36</b>



**COMFAR**<sup>®</sup>  
2.0 UNIGO

COMFAR 2.0 - BALDI & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	2002	2003	2004
Total assets .....	6128.20	5916.75	5827.22
Fixed assets, net of depreciation	1833.55	1622.10	1622.10
Construction in progress .....	0.00	0.00	0.00
Current assets .....	493.54	493.54	493.54
Cash, bank .....	16.57	16.57	16.57
Cash surplus, finance available .	0.00	0.00	0.00
Less carried forward .....	376.36	379.54	365.02
Loss .....	38.18	0.00	0.00
Total liabilities .....	6128.20	5916.75	5827.22
Equity capital .....	2631.00	2631.00	2631.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	89.53	195.25
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	61.40	61.40	61.40
Bank overdraft, finance required.	3435.80	3134.83	2939.58
Total debt .....	3497.20	3196.22	3000.97
Equity, % of liabilities .....	42.93	44.47	45.15

BLEACHING EARTH FROM BENTONITE — February 88

**Bleaching earth**

**ANNEXE 2**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>1690</u>
2) VARIABLE COSTS:	<u>978.34</u>
. RAW MATERIALS	575.92
. UTILITIES	2.88
. ENERGY	323.02
. LABOUR	76.52
3) FIXED COSTS	<u>1188.66</u>
. REPAIR-MAINTENANCE	47.54
. SPARES	200
. ADMINISTRATION	73.62
. DEPRECIATION	501.58
. FINANCIAL COSTS	365.92
4) TOTAL PRODUCTION COSTS	<u>2167</u>

$$\text{BEP} \quad \frac{1188.66}{1690 - 978.34} \times 100 =$$

higher than  
100 %

Bleaching earth

ANNEXE 3

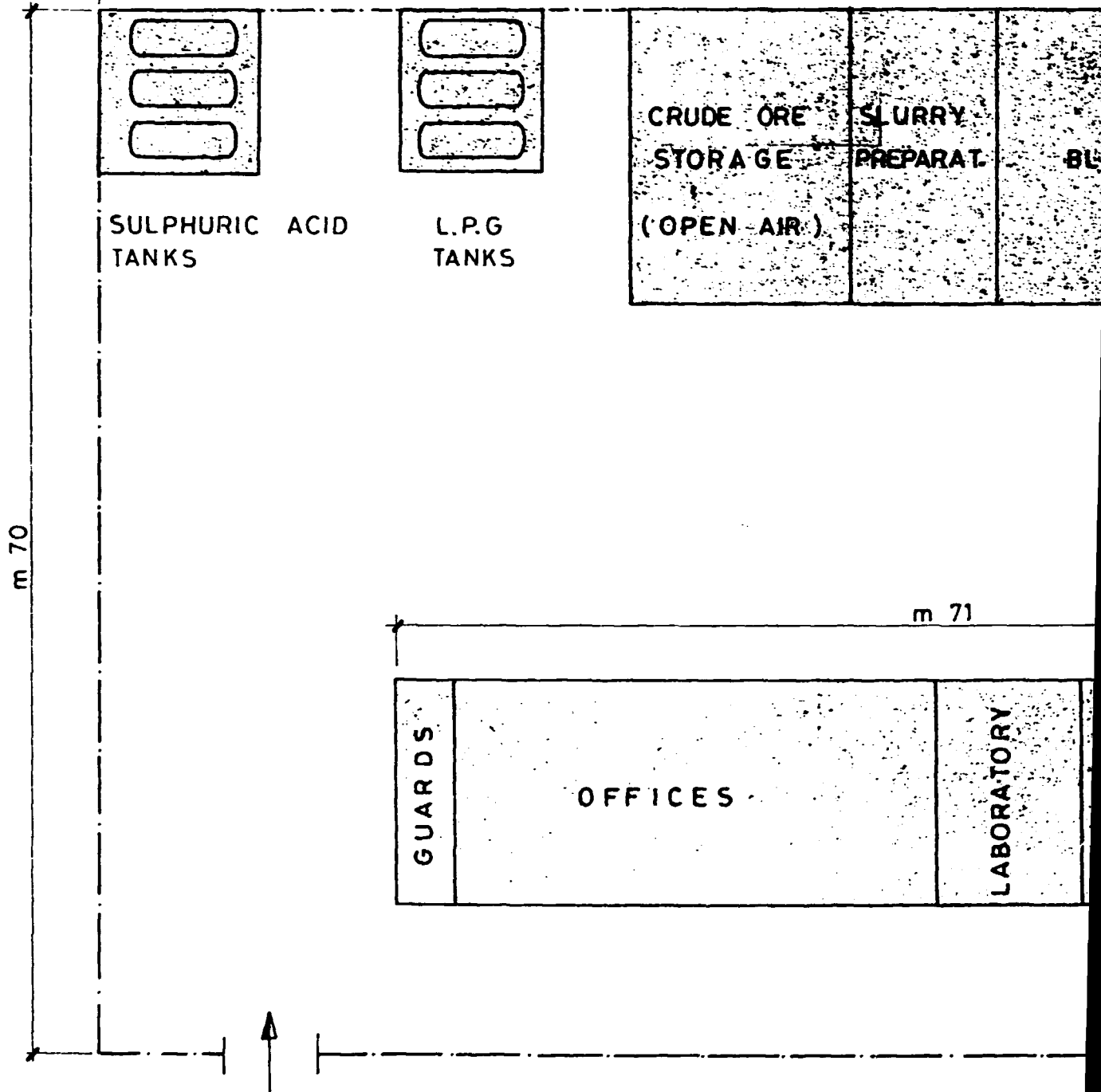
DRW. B162 -3-1

SITE LAY OUT

DRW. B162 - 3 - 2

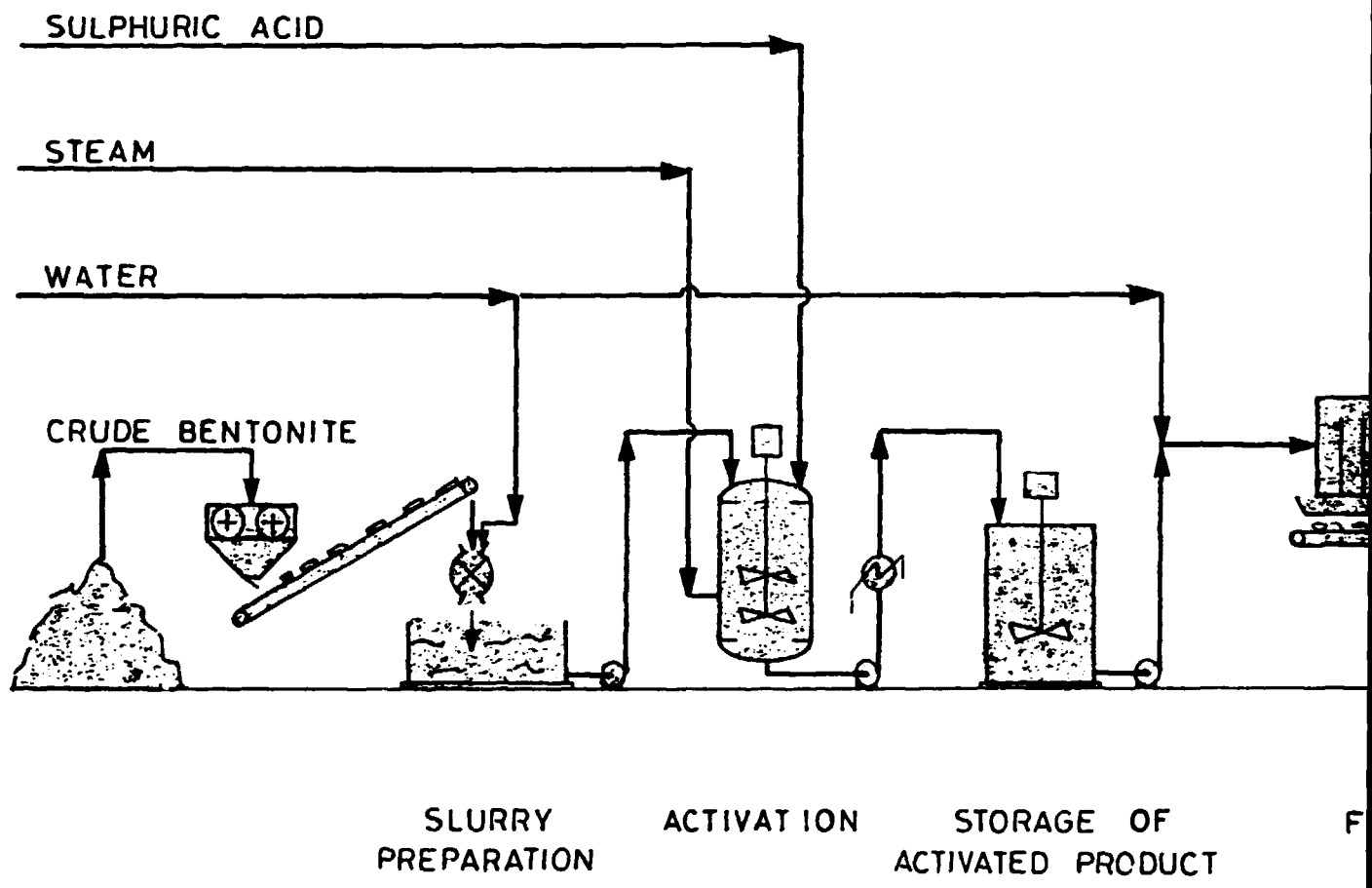
PROCESS FLOW DIAGRAM

m 126



SECTION 1





SECTION 1





**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF DIATOMITE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & ě.**  
CONSULTING ENGINEERS

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 4 - DRW. B162-7-1 - PROCESSING UNIT LAY OUT  
DRW. B162-7-2 - PROCESS FLOW DIAGRAM**

0. SUMMARY AND CONCLUSIONS

Various deposits of diatomite have been identified by the Ethiopian Mineral Resources Development Corporation in the Chefe Jila, Gademotte and Adami Tulu areas.

Preliminary investigations have shown that material quality is good and could be conveniently processed to obtain a product suitable for a number of applications.

In fact diatomite is used for the filtration of liquids (including beer), as a filler in the paint and paper industries and as an insulating agent.

The domestic market is very limited (60-80 tons/year) compared to the minimum economic size of the processing plant that is in the range of 6,000 tons/year: export potential has therefore been explored.

There is, in fact, a wide international market of 1.5 Million tons/year, and major distributors could be interested in marketing Ethiopian diatomite, mainly in Europe, if competitive.

The main constraint is the high freight costs. Diatomite is a very light product and current freight costs have been evaluated in 85 \$/ton inland transport from the plant site to harbour and 110 \$/ton for ocean freight.

In this case the selling price of diatomite in order to be competitive on the European markets would be too low and the project would not be profitable as the Comfar financial analysis has shown.

The project is of importance, however, because it means the development of a natural domestic resource

into an exportable product.

A Comfar financial analysis was carried out by taking into consideration the possibility that the inland freight be subsidized due to the importance of the project.

The selling price could increase to 255 \$/ton for caicined diatomite and to 350 \$/ton for fluxed diatomite.

The total revenues would therefore increase to 1,700,000 \$ and the I.R.R. to 3.32 and the discounted net foreign effect is 4,406,000 \$.

Due to the potential importance of the project, emphasized by the foreign exchange effect evaluation, the carrying out of a market study to analyse in detail the export potential to both Europe and neighbouring countries is recommended.

1. INTRODUCTION

Diatomite (diatomaceous earth) is a sedimentary rock of marine or lacustrine deposition.

It consists mainly of accumulated shells of hydrous silica secreted by diatoms, which are microscopic single-celled, flowerless plants of the class "Bacillarieae".

They still exist, although only in a fraction of their prehistoric population. The prehistoric diatom plants extracted silica from the water and used this substance to form an encasing shell or exoskeleton. There is a great variety of diatomite: over 10,000 of them have been classified.

Deposits of diatomite are known to exist in every continent, in nearly every country, in widely diversified and even unexpected environments.

Large deposits of diatomite are spread all over the USA; important deposits are also located in Europe (France, Germany, Italy and Denmark) and in Africa (Algeria, Kenya, Mozambique, Rhodesia, and South Africa) while large deposits are also located in the Caucasus Mountains in U.S.S.R.

From the chemical standpoint, diatomite consists primarily of  $SiO_2$ .

Possible impurities are: other aquatic fossils, sandy clay, volcanic ash, calcium carbonate, magnesium carbonate, soluble salts and organic matter.

The types and amounts of impurities are highly variable and depend upon the conditions of sedimentation at the time of diatom deposition.

Variations exist among deposits as well as among part of the same deposit.

A typical spectrographic analysis of diatomite, dry basis, is approximately.

SiO <sub>2</sub>	83-89%
Al <sub>2</sub> O <sub>3</sub>	3-4%
CaO	0,5-2,5%
MgO	0,2-0,6%
Fe <sub>2</sub> O <sub>3</sub>	1,5-2%
Na <sub>2</sub> O	0,8-1,6%
V <sub>2</sub> O <sub>5</sub>	0,05-0,8%
TiO <sub>2</sub>	0,15-0,8%
Ignition loss	3,6-5,3%

The colour of pure diatomite is white, or near white, but impurities may darken it.

The apparent density of powdered diatomite varies from 112 to 320 Kg/m<sup>3</sup> and may reach 960 Kg/m<sup>3</sup> for impure lump material.

Bed moisture may be over 65%, but in arid region it often varies from 15 to 25%

Various deposits of diatomite have been identified by the Ethiopian Mineral Resources Development Corporation in the Chefe Jila, Gademotte and Adami Tulu areas. Preliminary investigations have shown that the quality of this diatomite (and particularly that from Chefe Jila) is good and would be suitable, after appropriate processing, for use as a filtering agent and filler in a number of applications (chemical industry, food industry, etc.)



2. MARKET AND PLANT CAPACITY

2.1 Uses

Several hundred diatomite products are available, many of them processed for specific purposes.

They may be grouped as follows: filter aids, fillers or extenders, thermal insulation, absorbents, catalyst carriers, pesticide carriers or diluents, fertilizers conditioners and miscellaneous.

The use of diatomite products can be divided as follows (by application):

- 60% for filtration
- 35% as filler
- 5% for thermal insulation.

As filter: it is used in the filtration of various liquors, in refining cane, beet and corn sugar and in clarification of syrups, molasses, beer, various chemicals, water, solvents, antibiotics, oils, fat, etc. In recent years the increased emphasis on ecology has considerably increased the application of diatomite filtration for solid removal from waste streams from industrial plants.

As filler: it is typically used in the paint and paper industries which use it extensively as filler and extender pigments.

As insulating agent: diatomite is very efficient because of its high resistance to heat and its high porosity.

Among the other applications, its use as a carrier for

catalysts in petroleum refining, hydrogenation of oils and manufacturing of certain acids should be mentioned.

2.2 Forecast demand and plant capacity

2.2.1 Forecast demand

The present consumption of diatomite in Ethiopia is limited to the breweries. The consumption have been reported as being the following:

Location	1977	1978
Harar	19.9	14.2
Asmara	11.9	14
Addis Ababa	-	20.5
Meta	not available	
	-----	-----
	31.8	48.7

The production capacity of the above listed breweries is:

Harar	200,000 hl
Addis Ababa	160,000 hl
Meta	320,000 hl
Asmara	200,000 hl
	-----
	880,000 hl

The average consumption over 1977 and 1978 (EC) years has been 0.072 Kg diatomite for hl of beer produced. The average consumption would therefore be in the range of 63 tons per year.

A new brewery is presently under construction at Badele; it will have a production capacity of 250,000 hl/year, bringing the total production capacity in the Country to 1,130,000 hl.

The consumption of diatomite should therefore be in the range of 81 tons per year once the new brewery will be on stream (within three years).

As a matter of fact there is a wide export potential for good quality diatomite. The international market is evaluated in the range of 1.5 Million tons/y mostly located in USA (30%) and in Europe.

Main world producers, Mansville, Ceca, Diatom, etc, may be interested in distributing diatomite processed in Ethiopia if there will be an assured guarantee of quality.

### 2.2.2 Plant capacity

The minimum economic production capacity of a diatomite processing plant is 6,000 tons/year of finished product. The present opportunity study is based on this assumption and foresees the production of:

- natural diatomite 1,000 t/y
- calcined diatomite 0-2,000 t/y
- fluxed diatomite 3,000-5,000 t/y

Natural diatomite may have a future domestic use for the formulation of pesticides (a project is presently on pipeline).

2.3 Sales prices and total revenues

The current prices in the European market are the following:

- natural diatomite 200 \$/t
- calcined diatomite 430 \$/t
- fluxed diatomite 540 \$/t

The main constraint for the export of diatomite to Europe is due to the very high transportation costs. Taking into account that a 40 foot container contains approx. 20 tons of diatomite and that the freight from Djibuti to a European port is in the order of 2,200 \$, the freight cost is 110\$/t. The inland transport to Gibuti by railroad has been estimated in the range of 85.\$/t.

Considering that the importer usually charges 15% commission on the CIF prices the following table has been prepared for the calculation of the selling price of diatomite produced in Ethiopia.

**CALCULATED SELLING PRICES OF THE VARIOUS DIATOMITE TYPES  
PRODUCED IN ETHIOPIA**

Type of product	Current price in Europe US \$/ton	Transportation		Wholesaler commission 15% (US \$/t)	Total deduction US \$/ton	Max selling price ex-works US \$/ton
		to Europe	Inland US \$/ton			
Natural diatomite	200	110	85	30	225	(50) (1)
Calcined diatomite	430	110	85	65	260	170
Fluxed diatomite	540	110	85	81	276	264

(1) only for domestic market

Diatomite is also used in the Middle East and in neighbour African countries. There is, therefore, a potential export market apart from the European, a market where the ex-works prices can be higher taking into consideration that freight costs are lower.

On the other hand the export potential of this product is hampered by the very high inland transportation costs. The project foresees the exploitation of local material resources and therefore we assume that the Authorities will allow this component of the cost to be subsidized.

In this case revenues can be calculated as follows:

- Natural diatomite: to be sold in Ethiopia and neighbouring countries only at the price of 50\$/ton.  
Total production is 1,000t/y 50,000 US\$
  
  - Calcined diatomite: to be sold in small quantity (100 tons) in Ethiopia and the rest, approx. 900 tons exported at the price of 255\$/t  
Total production is 1000 t/y 255,000 US\$
  
  - Fluxed diatomite: mainly exported at the price of 350 \$/ton  
Total amount exported  
4,000 tons 1,400,000 US\$
- 
- TOTAL REVENUES 1,705,000 US\$

3. MATERIAL AND INPUTS

3.1 Chemistry

The processing of the mineral does not imply chemical reactions. It consists in drying and calcining the mineral for natural and calcined diatomite preparation; while for the fluxed type treatment with soda ash is required.

3.2 Materials and utilities: requirements and costs

3.2.1 Raw materials

	LC	FC	Total
	birr/y	birr/y	birr/y
Crude ore diatomite (dry basis) (1)7000 t/yx25 birr/t(2)	175,000	-	175,000
Soda ash 240 t/y x 514birr/t	123,360	-	123,360
	-----		-----
	298,360		298,360
			(144,135 \$/y)

(1) Taking into account a 16-17% of waste material

(2) Based on the evaluation of the quarry exploitation costs (personnel, machinery, transportation, etc.)

**3.2.2 Utilities**

Electric power 437 Kwh/t			
x 6,000 t/y x 0,2 b/t	524,400	-	524,400
LPG 623 t/y x 1830 b/t	-	1,140,090	1,140,090
	-----		
	524,400	1,140,090	1,664,490
	(253,333 \$/y)	(550,768 \$/y)	

**Grand total:**

as LC:	524,400 + 298,360 = 822,760 b/y = 397,468 \$/y
as FC:	1,140,000 birr/y = 550,768 \$/y
	-----
	948,236 \$/y

To this cost, the packaging cost (see para 5.2) must be added.

**3.3 Purchasing programme and storage volume**

The materials to be considered are soda ash and LPG; in both cases a stock equivalent to 30 days at full capacity seems advisable; on this basis:

- soda ash:	20 t equivalent to 10,280 \$
- LPG:	52 t equivalent to 95,000 \$
	-----
TOTAL	105,280



4. LOCATION

The plant should be located as close as possible to the mining location, provided that good road or railway connections are available.

5 PROJECT ENGINEERING

5.1 Description of process and main equipment

Three general types are produced that is natural, calcined and fluxed diatomite, with a range of grades for each of them.

5.1.1 Natural diatomite

The crude diatomite, which may contain up to 60% moisture is left to dry in the open air in order to reduce the H<sub>2</sub>O content to no greater than 30%.

Clearly in a dry climate this limit could be greatly lowered with economic advantages.

The raw material dried in this way, is first broken up in hammer mills (see attached process scheme); then the material is fed to a rotary kiln operating at relatively low temperature (600°-700°) where the moisture content is reduced to 4-6%

Coarse and gritty non-diatomaceous earth materials are removed in separators and preliminary particle-size separation is made in cyclones.

The product thus obtained, known as natural diatomite, has the following approximate characteristics:

H<sub>2</sub>O content            4-6% (maximum 8%)

Apparent density 150-250 g/liter

Particle size:        retained on 170 mesh 5-10%

pH                        6-7

The different types of natural diatomite which the plant can produce differ only from the point of view of the particle size.

### 5.1.2 Calcined diatomite

The calcined diatomite is produced from natural diatomite processed as above and also subjected to high temperature calcination in a rotary kiln at about 1000°C.

The calcined material is then milled again and classified to remove coarse agglomerates as well as extreme fines.

The main physical characteristics of the calcined diatomite are:

H<sub>2</sub>O content 1% max

apparent density 130-150 g/liter

particle size: retained on 150 mesh: 0,5% max

ph : 6 - 7

### 5.1.3 Flux calcined diatomite

The so called "fluxed-diatomite" is obtained by calcination of the natural product in the presence of a flux, generally soda-ash, although sodium chloride can also be employed. This type of processing has the effect of reducing the surface area of the particles, changing the colour from the natural buff cast to a true white and rendering various impurities insoluble.

In all processing of diatomite, the selection of the proper crude ore, the milling, calcination and classification are of extreme importance.

Each grade of material is manufactured to rigid specifications. The finished product must pass certain performance, chemical and physical tests to ensure compliances with these specifications.

The fuel that is utilised in the drying and calcination process must not pollute the final product with odour or other impurities.

For this purpose natural gas or LPG are generally used; the use of fuel oil is not advisable because it is very difficult to reach a very complete combustion and, as a consequence, to avoid the pollution of the product.

## 5.2 Packaging

The finished products will be packed in kraft-paper bags of 25 kg. The price of one bag is about 1 birr  
total  $\frac{6,000,000}{25} \times 1 = 240,000$  birr/y = 115,942 \$/y

25

to be added to the costs of para 3.2.1.

## 5.3 Layout

As shown on the drawing the installation covers an area of about 34,000 sq.mt subdivided in five zones:

- a first area of about 5000 sq.mt, where the mineral arriving from the quarry is accumulated.
- a second area of about 8000 sq.mt on which the mineral is spread for drying
- a third area which is occupied by two adjacent buildings including the administrative offices, the workshop, and the laboratory; altogether a total surface of about 700 sq.mt; the packaging department and the deposit of the finished product are only sheltered.
- a fourth area of 2700 sq.mt, in which the processing

plant is installed

- a fifth area, which is a large courtyard for the manouvering of the trucks.

Both the areas used for the mineral storage and drying, are simply covered by gravel and rolled; a ditch is excavated all around these areas to collect and discharge the rain water to the sewer.

The buildings have a reinforced concrete structure and internal and external walls of the brickwork type; the roof is insulated by mineral wool lagging covered with corrugated asbestos-cement; the floors of the offices are covered with tiles, while those of the other facilities are made up of concrete with a hard aggregate as finishing surface. The process plant is designed for outdoor installation, under a simple roof; a similar construction is used for the packaging department and deposit of the finished product; the roof is supported by steel columns and trusses, insulated with mineral wool lagging covered with corrugated asbestos-cement; the floor is made of reinforced concrete with a hard aggregate as finishing surface.

The courtyard is partly asphalted and a fence consisting of wire netting supported by small steel poles is installed all around the complex.

#### 5.4 Investment costs, depreciation and maintenance

The investment cost for the installation of the machinery and equipment for the process plants, utilities and general facilities, civil works included, are as follows:

	LC	FC	TOTAL
	\$	\$	\$
<b>Machinery and equipment</b>			
FOB European port (1)	-	1,538,000	1,538,000
Transportation	154,000	154,000	308,000
Erection	154,000	108,000	262,000
Site preparation	85,000	-	85,000
Civil works	855,000	-	855,000
Insulation and painting	15,000	23,000	38,000
Spare parts for 2 years	-	90,000	90,000
	-----	-----	-----
	1,263,000	1,913,000	3,176,000
Contingencies	127,000	187,000	314,000
	-----	-----	-----
<b>Grand total</b>	<b>1,390,000</b>	<b>2,100,000</b>	<b>3,490,000</b>

The life cycle of the process plant can be estimated as 15 years. The annual maintenance cost has been estimated as being in the range of 6% of the machinery cost.

In the financial evaluation the investment costs (contingencies included) have been so subdivided:

Machinery	FC 2.100	10 <sup>6</sup> \$
Machinery	LC 0.323	" "
Site preparation	LC 0.085	" "
Civil works	LC 0.982	" "
	-----	
	3.490	10 <sup>6</sup> \$

(1) Six trucks of 20 ql. capacity are also included, with a total value of 300,000 \$

6. PLANT ORGANIZATION

For the financial and economical evaluation, it is presumed that the factory will operate as an independent unit under the direction of the Eth.Mineral Resources Development Co.

7. MANPOWER

No particular skills are required of the factory personnel except for the production manager, the chemist and the engineer, who must be deeply trained in the technologies involved in the preparation of the various types of product, in the analysis of the mineral, in the quality control and in the key features of the main machines.

For all the other positions the requirements are the same as for any other chemical factory.

7.1 Management

		birr/month	birr/year
General manager	n.1	1500	18000
Technical manager	n.1	1200	
	---	----	-----
	n.2	2700	32400
			(15652 \$/y)

7.2 Administrative department

Senior accountant	n. 1	800	
Accountant	n. 1	400	
Purchasing officer	n. 1	400	
Sale officer	n. 1	400	
Warehouse keeper	n. 1	400	
Secretaries-clerks	n. 7	2450	
Drivers (1)	n.10	3500	
Guards	n. 8	1200	
	----	-----	-----
	n.30	9550	114600
			(55,362 \$/y)

(1) Drivers of the trucks for the transportation of the mineral, are included.



7.3 Production and maintenance department

a) Production dep.		birr/m	birr/y
Production manager	n. 1	1000	
Shift foremen	n. 4	1600	
Shift operators	n.20	7000	
Chemist	n. 1	700	
Analyst	n. 1	350	
Production clerk	n. 1	350	
Unskilled workers	n. 4	800	
	----	-----	-----
	n.32	11800	141600
			(68406 \$/y)
b) Maintenance dep.			
Engineer	n. 1	1000	
Supervisors	n. 2	800	
Electricians	n. 2	700	
Mechanics	n. 2	700	
Civil worker	n. 1	350	
Unskilled workers	n. 4	800	
	----	-----	-----
	n.12	4350	52200
			(25217 \$/y)

Summary:

Administration:	147,000 birr/y = 71014 \$/y
Production :	141,600 birr/y = 68406 \$/y
Maintenance :	52,200 birr/y = 25217 \$/y

8. IMPLEMENTATION SCHEDULE

Starting from the awarding of the orders for the main equipment, a total construction time of 24 months will be required.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	7	7

- the assistance of one foreign expert for the first period of operation (one year) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "other raw materials"

- the production programme has been assumed as follows:

1st year: 50% capacity : 500 t Nat. Diat. + 500 t  
Calcined Diat. + 2000 t Flux.Diat.

2nd year: 83% capacity : 833 t Nat.Diat. + 833 t  
Calcined Diat. + 3333 Flux.Diat.

from the 3rd to the 15th year: 100% capacity : 1000 t  
Nat.Diat. + 1000 t Calcined Diat.+ 4000 t  
Flux.Diat.

Selling price:

Natural diatomite 50 \$/t

Calcined diatomite 255 \$/t

Fluxed diatomite 350 \$/t

As a result the evaluation yields an IRR of 3.32% while the BEP is equal to 99%.

10. FOREIGN EXCHANGE EFFECT EVALUATION

The evaluation of the foreign exchange effect is reported in Annexe 2.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to COMFAR for the same items, except for the export sales, which has been supposed, according to a hypothesis advanced in the study as follows:

	1st Y	2nd Y	3rd to 15th Y
Natural diatomite	260 t	600	600
Calcined diatomite	400 t	733	900
Fluxed diatomite	2000 t	3333	4000

The selling prices are the same shown in the report. Due to the low value of the domestic consumption, this last has not been considered as import substitution. Consequently the net foreign exchange flow and the net foreign exchange effect are the same; by discounting the annual net value of this two indicators at the rate of 10% the calculation arrives at a present value amounting to 4,406,000 \$.

Hence the amount of foreign exchange earned by the implementation of this project would be such that in spite of repaying the foreign loan and a substantial cost for imported fuel, there would still be a surplus which in terms of present value would amount to 4,406,000 \$.

**baldo & c.**  
CONSULTING ENGINEERS

**Diatomite production**

**ANNEXE 1**

**FINANCIAL EVALUATION**



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - SALDO & CO. S.R.L., MILANO

DIAGRAMME  
February 88  
BASIC PROJECT

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

---

**Total initial investment during construction phase**

fixed assets:	3748.50	66.78% foreign
current assets:	0.00	0.00% foreign
total assets:	3748.50	66.78% foreign

---

**Source of funds during construction phase**

equity & grants:	1785.00	0.00% foreign
foreign loans:	1785.00	
local loans:	0.00	
total funds:	3570.00	50.61% foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	802.73	1120.46	1320.81
depreciation :	243.71	243.71	235.21
interest :	178.50	156.19	133.88
production costs	1224.94	1520.35	1689.90
thereof foreign	57.14 %	54.21 %	54.25 %
total sales :	850.50	1417.28	1701.00
gross income :	-374.44	-103.07	11.10
net income :	-374.44	-103.07	5.55
cash balance :	-563.03	-171.16	-47.54
net cashflow :	-161.41	208.15	309.46

Net Present Value at: 10.00 % = -1479.72  
Internal Rate of Return on total investment: 3.32 %  
Equity paid versus Net income flow (IRR): -5.97 %  
Net Worth versus Net Cash Return (IRR): 1.63 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Total Initial Investment in 1000 US \$		
Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	85.00	0.00
Buildings and civil works .....	291.00	291.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	420.00	2003.00
<b>Total fixed investment costs .....</b>	<b>1196.00</b>	<b>2294.00</b>
Pre-production capital expenditures.	20.00	238.50
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>1216.00</b>	<b>2532.50</b>
<b>Of it foreign, in % .....</b>	<b>34.54</b>	<b>73.37</b>

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**Total Current Investment in 1000 US \$**

Year .....	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital .....	209.18	88.68	65.18
<b>Total current investment costs ...</b>	<b>209.18</b>	<b>88.68</b>	<b>65.18</b>
<b>Of it foreign, % .....</b>	<b>68.50</b>	<b>71.76</b>	<b>80.79</b>

DIATONITE --- February 88





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product)	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	72.07	120.11	144.13	144.13	144.13	144.13
Other raw materials . . . . .	57.97	96.62	115.94	115.94	115.94	115.94
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	402.05	670.08	804.10	804.10	804.10	804.10
Labour, direct . . . . .	68.41	68.41	68.41	68.41	68.41	68.41
Repair, maintenance . . . . .	25.22	25.22	25.22	25.22	25.22	25.22
Spare parts . . . . .	44.00	69.00	92.00	92.00	92.00	92.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>731.72</b>	<b>1049.44</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>
Administrative overheads . . . . .	71.01	71.01	71.01	71.01	71.01	71.01
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	243.71	243.71	235.21	226.71	226.71	210.71
Financial costs . . . . .	178.50	156.19	133.88	111.56	89.25	66.94
<b>Total production costs . . . . .</b>	<b>1224.94</b>	<b>1520.35</b>	<b>1689.90</b>	<b>1659.09</b>	<b>1636.77</b>	<b>1598.46</b>
<b>Costs per unit (single product) . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	57.14	54.21	54.25	53.91	53.28	53.16
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	139.42	139.42	139.42	139.42	139.42	139.42



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product)	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	144.13	144.13	144.13	144.13	144.13	144.13
Other raw materials . . . . .	115.94	115.94	115.94	115.94	115.94	115.94
Utilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Energy . . . . .	804.10	804.10	804.10	804.10	804.10	804.10
Labour, direct . . . . .	68.41	68.41	68.41	68.41	68.41	68.41
Repair, maintenance . . . . .	25.22	25.22	25.22	25.22	25.22	25.22
Spares . . . . .	92.00	92.00	92.00	92.00	92.00	92.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>	<b>1249.80</b>
Administrative overheads . . . . .	71.01	71.01	71.01	71.01	71.01	71.01
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	210.71	210.71	210.71	161.61	79.72	0.00
Financial costs . . . . .	44.63	22.31	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>1576.15</b>	<b>1553.84</b>	<b>1531.52</b>	<b>1482.42</b>	<b>1400.53</b>	<b>1320.81</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	52.50	51.82	51.12	52.81	50.83	48.66
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>139.42</b>	<b>139.42</b>	<b>139.42</b>	<b>139.42</b>	<b>139.42</b>	<b>139.42</b>



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$					
Year		1989	1990	1991	1992-2003
Coverage	ndc coto				
<b>Current assets &amp;</b>					
Accounts receivable	30 12.0	66.89	93.37	110.07	110.07
Inventory and materials	30 12.0	10.84	18.06	21.67	21.67
Energy	21 17.3	23.30	38.83	46.60	46.60
Spares	360 1.0	46.00	69.00	92.00	92.00
Work in progress	7 51.4	14.23	20.41	24.30	24.30
Finished products	30 12.0	66.89	93.37	110.07	110.07
Cash in hand	15 24.0	11.28	9.74	10.69	10.69
Total current assets		239.43	342.78	415.40	415.40
<b>Current liabilities and</b>					
Accounts payable	15 23.8	30.25	44.92	52.37	52.37
Net working capital		209.18	297.85	363.03	363.03
Increase in working capital		209.18	88.68	65.18	0.00
Net working capital, local		65.89	90.94	103.46	103.46
Net working capital, foreign		143.28	206.92	259.57	259.57

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	1785.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1785.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1785.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	178.50
Total funds .....	3570.00	178.50

DIATONITE — February 88

**COMFAR**  
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COMFAR 2.0 - BALDO &amp; CO. S.R.L., MILANO

**Source of Finance, production in 1000 US \$**

Year .....	1989	1990	1991	1992	1993	1994	1995
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-223.13	-223.13	-223.13	-223.13	-223.13	-223.13	-223.13
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-223.13	-223.13	-223.13	-223.13	-223.13	-223.13	-223.13
Current liabilities	30.25	14.67	7.45	0.00	0.00	0.00	0.00
Bank overdraft ....	563.03	171.16	47.54	-24.55	-35.70	-38.86	-50.01
Total funds .....	370.16	-37.30	-168.14	-247.67	-258.83	-261.98	-273.14

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COMFAR 2.0 - BALDO &amp; CO. S.R.L., MILANO

**Source of Finance, production in 1000 US \$**

Year .....	1996	1997-98	1999
Equity, ordinary ..	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	-223.13	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	-223.13	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	-61.17	-295.45	-159.03
Total funds .....	-284.30	-295.45	-159.03

DIATOMITE — February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	3570.00	0.00
Financial resources .	3570.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	1216.00	2532.50
Total assets . . . .	1216.00	2354.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	178.50
Repayment . . . . .	0.00	0.00
Corporate tax . . .	0.00	0.00
Dividends paid . . .	0.00	0.00
Surplus ( deficit ) .	2354.00	-2532.50
Cumulated cash balance	2354.00	-178.50
Inflow, local . . . .	1785.00	0.00
Outflow, local . . . .	796.00	674.00
Surplus ( deficit ) .	989.00	-674.00
Inflow, foreign . . .	1785.00	0.00
Outflow, foreign . . .	420.00	1858.50
Surplus ( deficit ) .	1365.00	-1858.50
Net cashflow . . . . .	-1216.00	-2354.00
Cumulated net cashflow	-1216.00	-3570.00



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994
Total cash inflow ..	880.75	1431.95	1708.45	1701.00	1701.00	1701.00
Financial resources .	30.25	14.67	7.45	0.00	0.00	0.00
Sales, net of tax ..	850.50	1417.28	1701.00	1701.00	1701.00	1701.00
Total cash outflow ..	1443.78	1603.11	1755.99	1676.45	1665.30	1662.14
Total assets .....	239.43	103.35	72.63	0.00	0.00	0.00
Operating costs .....	802.73	1120.45	1320.81	1320.81	1320.81	1320.81
Cost of finance .....	178.50	156.19	133.88	111.56	89.25	66.94
Repayment .....	223.13	223.13	223.13	223.13	223.13	223.13
Corporate tax .....	0.00	0.00	5.55	20.96	32.11	51.27
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-563.03	-171.16	-47.54	24.55	35.70	38.86
Cumulated cash balance	-741.53	-912.69	-960.23	-935.68	-899.98	-861.12
Inflow, local .....	879.69	1431.54	1708.13	1701.00	1701.00	1701.00
Outflow, local .....	516.44	631.79	703.24	699.00	710.15	729.31
Surplus ( deficit ) .	363.26	799.75	1004.89	1002.00	990.85	971.69
Inflow, foreign .....	1.06	0.41	0.32	0.00	0.00	0.00
Outflow, foreign .....	927.35	971.32	1052.74	977.46	955.15	932.83
Surplus ( deficit ) .	-926.29	-970.91	-1052.43	-977.46	-955.15	-932.83
Net cashflow .....	-161.41	208.15	309.46	359.23	348.08	328.92
Cumulated net cashflow	-3731.41	-3523.25	-3213.79	-2854.56	-2506.48	-2177.56



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	1701.00	1701.00	1701.00	1701.00	1701.00	1701.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	1701.00	1701.00	1701.00	1701.00	1701.00	1701.00
Total cash outflow . .	1650.99	1639.83	1405.55	1405.55	1430.10	1430.10
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1320.81	1320.81	1320.81	1320.81	1320.81	1320.81
Cost of finance . . .	44.63	22.31	0.00	0.00	0.00	0.00
Repayment . . . . .	223.13	223.13	0.00	0.00	0.00	0.00
Corporate tax . . .	62.43	73.58	84.74	84.74	109.29	109.29
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	50.01	61.17	295.45	295.45	270.90	270.90
Cumulated cash balance	-811.11	-749.94	-454.49	-159.04	111.87	382.77
Inflow, local . . . .	1701.00	1701.00	1701.00	1701.00	1701.00	1701.00
Outflow, local . . . .	740.47	751.62	762.78	762.78	787.33	787.33
Surplus ( deficit ) .	960.53	949.38	938.22	938.22	913.67	913.67
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	910.52	888.21	642.77	642.77	642.77	642.77
Surplus ( deficit ) .	-910.52	-888.21	-642.77	-642.77	-642.77	-642.77
Net cashflow . . . . .	317.76	306.61	295.45	295.45	270.90	270.90
Cumulated net cashflow	-1859.80	-1553.19	-1257.74	-962.29	-691.38	-420.48





**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	1701.00	1701.00	1701.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1701.00	1701.00	1701.00
Total cash outflow . .	1430.10	1471.05	1510.91
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1320.81	1320.81	1320.81
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	109.29	150.24	190.09
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	270.90	229.95	190.09
Cumulated cash balance	653.67	883.62	1073.72
Inflow, local . . . . .	1701.00	1701.00	1701.00
Outflow, local . . . .	787.33	828.28	868.14
Surplus ( deficit ) .	913.67	872.72	832.86
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . .	42.77	42.77	42.77
Surplus ( deficit ) .	-42.77	-42.77	-42.77
Net cashflow . . . . .	270.90	229.95	190.09
Cumulated net cashflow	-149.58	80.37	270.47



**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-1815.36 at	10.00 %
Internal Rate of Return (IRRE1) ..	-5.97 %	
b) Net Worth versus Net cash return:		
Net present value .....	-1531.45 at	10.00 %
Internal Rate of Return (IRRE2) ..	1.63 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-1479.72 at	10.00 %
Internal Rate of Return (IRR) ..	3.32 %	
Net Worth = Equity paid plus reserves		



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year .....	1989	1990	1991	1992	1993
Total sales, incl. sales tax .....	850.50	1417.28	1701.00	1791.00	1701.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	850.50	1417.28	1701.00	1791.00	1701.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	1046.44	1364.16	1556.02	1547.52	1547.52
Operational margin .....	-195.94	53.12	144.98	153.48	153.48
As % of total sales .....	-23.04	3.75	8.52	9.02	9.02
Cost of finance .....	178.50	156.19	133.08	111.56	89.25
Gross profit .....	-374.44	-103.07	11.10	41.91	64.23
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	-374.44	-103.07	11.10	41.91	64.23
Tax .....	0.00	0.00	5.55	20.96	32.11
Net profit .....	-374.44	-103.07	5.55	20.96	32.11
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	-374.44	-103.07	5.55	20.96	32.11
Accumulated undistributed profit .....	-374.44	-477.51	-471.96	-451.01	-418.89
Gross profit, % of total sales .....	-44.03	-7.27	0.65	2.46	3.78
Net profit, % of total sales .....	-44.03	-7.27	0.33	1.23	1.89
ROE, Net profit, % of equity .....	-20.98	-5.77	0.31	1.17	1.80
ROI, Net profit+interest, % of invest. ....	-5.18	1.37	3.54	3.37	3.09



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COMFAR 2.0 - BLDG & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	1701.00	1701.00	1701.00	1701.00	1701.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	1701.00	1701.00	1701.00	1701.00	1701.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	1531.52	1531.52	1531.52	1531.52	1531.52
Operational margin .....	169.48	169.48	169.48	169.48	169.48
As % of total sales .....	9.9%	9.9%	9.9%	9.9%	9.9%
Cost of finance .....	66.94	44.63	22.31	0.00	0.00
Gross profit .....	102.54	124.85	147.16	169.48	169.48
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	102.54	124.85	147.16	169.48	169.48
Tax .....	51.27	62.43	73.58	84.74	84.74
Net profit .....	51.27	62.43	73.58	84.74	84.74
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	51.27	62.43	73.58	84.74	84.74
Accumulated undistributed profit .....	-367.62	-305.20	-231.62	-146.88	-62.14
Gross profit, % of total sales .....	6.03	7.34	8.65	9.9%	9.9%
Net profit, % of total sales .....	3.01	3.67	4.33	4.98	4.98
ROE, Net profit, % of equity .....	2.87	3.50	4.12	4.75	4.75
ROI, Net profit/interest, % of invest. ....	3.01	2.72	2.44	2.15	2.15

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year .....	1999	2000	2001	2002	2003
Total sales, incl. sales tax .....	1701.00	1701.00	1701.00	1701.00	1701.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
<b>Variable margin .....</b>	<b>1701.00</b>	<b>1701.00</b>	<b>1701.00</b>	<b>1701.00</b>	<b>1701.00</b>
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	1482.42	1482.42	1482.42	1400.53	1320.81
<b>Operational margin .....</b>	<b>218.58</b>	<b>218.58</b>	<b>218.58</b>	<b>300.47</b>	<b>380.19</b>
As % of total sales .....	12.85	12.85	12.85	17.66	22.35
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
<b>Gross profit .....</b>	<b>218.58</b>	<b>218.58</b>	<b>218.58</b>	<b>300.47</b>	<b>380.19</b>
Allowances .....	0.00	0.00	0.00	0.00	0.00
<b>Tangible profit .....</b>	<b>218.58</b>	<b>218.58</b>	<b>218.58</b>	<b>300.47</b>	<b>380.19</b>
Tax .....	109.29	109.29	109.29	150.24	190.09
<b>Net profit .....</b>	<b>109.29</b>	<b>109.29</b>	<b>109.29</b>	<b>150.24</b>	<b>190.09</b>
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	109.29	109.29	109.29	150.24	190.09
Accumulated undistributed profit .....	47.15	156.43	265.72	415.96	606.05
<b>Gross profit, % of total sales .....</b>	<b>12.85</b>	<b>12.85</b>	<b>12.85</b>	<b>17.66</b>	<b>22.35</b>
<b>Net profit, % of total sales .....</b>	<b>6.42</b>	<b>6.42</b>	<b>6.42</b>	<b>8.83</b>	<b>11.18</b>
<b>ROE, Net profit, % of equity .....</b>	<b>6.12</b>	<b>6.12</b>	<b>6.12</b>	<b>8.42</b>	<b>10.65</b>
<b>ROI, Net profit+interest, % of invest.</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>3.82</b>	<b>4.83</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
<b>Total assets .....</b>	<b>3570.00</b>	<b>3748.50</b>
Fixed assets, net of depreciation	0.00	1216.00
Construction in progress .....	1216.00	2532.50
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	2396.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>3570.00</b>	<b>3748.50</b>
Equity capital .....	1785.00	1785.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1785.00	1785.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	178.50
<b>Total debt .....</b>	<b>1785.00</b>	<b>1963.50</b>
<b>Equity, % of liabilities .....</b>	<b>50.00</b>	<b>47.62</b>

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>4118.66</b>	<b>4081.36</b>	<b>3918.78</b>	<b>3686.51</b>	<b>3438.84</b>	<b>3196.01</b>
Fixed assets, net of depreciation	3504.79	3261.07	3025.86	2799.14	2572.43	2361.72
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	228.15	333.04	404.71	404.71	404.71	404.71
Cash, bank .....	11.28	9.74	10.69	10.69	10.69	10.69
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	374.44	477.51	471.96	451.01	418.89
Loss .....	374.44	103.07	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>4118.66</b>	<b>4081.36</b>	<b>3918.78</b>	<b>3686.51</b>	<b>3438.84</b>	<b>3196.01</b>
Equity capital .....	1785.00	1785.00	1785.00	1785.00	1785.00	1785.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	5.55	20.96	32.11	51.27
Long and medium term debt .....	1561.88	1338.75	1115.63	892.50	669.38	446.25
Current liabilities .....	30.25	44.92	52.37	52.37	52.37	52.37
Bank overdraft, finance required.	741.53	912.69	960.23	935.68	899.98	861.12
<b>Total debt .....</b>	<b>2333.66</b>	<b>2296.36</b>	<b>2128.22</b>	<b>1880.55</b>	<b>1621.73</b>	<b>1359.74</b>
<b>Equity, % of liabilities .....</b>	<b>43.34</b>	<b>43.74</b>	<b>45.55</b>	<b>48.42</b>	<b>51.91</b>	<b>55.85</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>2934.03</b>	<b>2660.89</b>	<b>2376.59</b>	<b>2081.14</b>	<b>1946.66</b>	<b>1993.81</b>
Fixed assets, net of depreciation	2151.00	1940.29	1729.57	1518.86	1357.25	1195.63
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	404.71	404.71	404.71	404.71	404.71	404.71
Cash, bank .....	10.69	10.69	10.69	10.69	10.69	10.69
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	111.87	382.77
Loss carried forward .....	367.62	305.20	231.62	146.88	62.14	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2934.03</b>	<b>2660.89</b>	<b>2376.59</b>	<b>2081.14</b>	<b>1946.66</b>	<b>1993.81</b>
Equity capital .....	1785.00	1785.00	1785.00	1785.00	1785.00	1785.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	47.15
Profit .....	62.43	73.58	84.74	84.74	109.29	109.29
Long and medium term debt .....	223.13	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	52.37	52.37	52.37	52.37	-52.37	52.37
Bank overdraft, finance required ..	811.11	749.94	454.48	159.03	0.00	0.00
<b>Total debt .....</b>	<b>1086.60</b>	<b>802.31</b>	<b>506.86</b>	<b>211.40</b>	<b>52.37</b>	<b>52.37</b>
<b>Equity, % of liabilities .....</b>	<b>60.84</b>	<b>67.08</b>	<b>75.11</b>	<b>85.77</b>	<b>91.70</b>	<b>89.53</b>

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COMFAR 2.0 - BALDO & CO. S.R.L., NOLANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>2103.09</b>	<b>2253.33</b>	<b>2443.43</b>
Fixed assets, net of depreciation	1034.02	954.30	954.30
Construction in progress .....	0.00	0.00	0.00
Current assets .....	404.71	404.71	404.71
Cash, bank .....	10.69	10.69	10.69
Cash surplus, finance available .	453.67	883.63	1073.72
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2103.09</b>	<b>2253.33</b>	<b>2443.43</b>
Equity capital .....	1785.00	1785.00	1785.00
Reserves, retained profit .....	154.43	265.72	415.96
Profit .....	109.29	150.24	190.09
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	52.37	52.37	52.37
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>52.37</b>	<b>52.37</b>	<b>52.37</b>
<b>Equity, % of liabilities .....</b>	<b>84.87</b>	<b>79.22</b>	<b>73.05</b>

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**Diatomite production**

**ANNEXE 2**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>1701</u>
2) VARIABLE COSTS:	<u>1132.58</u>
. RAW MATERIALS	260.07
. UTILITIES	-
. ENERGY	804.10
. LABOUR	68.41
3) FIXED COSTS	<u>557.32</u>
. REPAIR-MAINTENANCE	25.22
. SPARES	92
. ADMINISTRATION	71.01
. DEPRECIATION	235.21
. FINANCIAL COSTS	133.88
4) TOTAL PRODUCTION COSTS	<u>1689.9</u>

$$\text{BEP} \frac{557.32}{1701 - 1132.58} \times 100 = 98 \%$$

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CONSULTING ENGINEERS

**Diatomite production**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	2558.76	1785.00	2377.76	1785.00	0.00	816.06	1383.88
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1786.79	1785.00	1.79	1785.00	0.00	1.06	0.41
exports . . . . .	2377.97	0.00	2377.97	0.00	0.00	815.00	1383.47
indirect effects . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1376.39	2278.50	11466.89	420.00	1858.50	927.35	971.32
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1711.50	2100.00	-388.50	420.00	1680.00	144.34	64.04
imported materials . . .	9265.36	0.00	9265.36	0.00	0.00	381.38	527.97
repayment loans & overd.	1786.79	0.00	1786.79	0.00	0.00	223.13	223.13
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	981.75	178.50	803.25	0.00	178.50	178.50	156.19
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	11813.36	-493.50	12306.86	1365.00	-1858.50	-111.29	412.56
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchge effect	11813.36	-493.50	12306.86	1365.00	-1858.50	-111.29	412.56
present values at 10.00 %							
foreign exchange flow .	4406.01						
net foreign exchge effect	4406.01						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	1659.82	1659.50	1659.50	1659.50	1659.50	1659.50	1659.50
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.32	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1659.50	1659.50	1659.50	1659.50	1659.50	1659.50	1659.50
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1052.74	977.46	955.15	932.83	910.52	888.21	842.77
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	52.97	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	842.77	842.77	842.77	842.77	842.77	842.77	842.77
repayment loans & overd.	223.13	223.13	223.13	223.13	223.13	223.13	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	133.88	111.56	89.25	66.94	44.63	22.31	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	607.07	682.04	704.35	726.67	748.98	771.29	1016.73
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	607.07	682.04	704.35	726.67	748.98	771.29	1016.73
present values at 10.00 %							
foreign exchange flow .	4406.01						
net forgn exchge effect	4406.01						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	1659.50	1659.50	1659.50	1659.50	1659.50	1659.50	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1659.50	1659.50	1659.50	1659.50	1659.50	1659.50	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	642.77	642.77	642.77	642.77	642.77	642.77	-648.07
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-649.86
imported materials . . .	642.77	642.77	642.77	642.77	642.77	642.77	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	1.79
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	1016.73	1016.73	1016.73	1016.73	1016.73	1016.73	648.07
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	1016.73	1016.73	1016.73	1016.73	1016.73	1016.73	648.07
present values at 10.00 %							
foreign exchange flow .	4406.01						
net foreign exchange effect	4406.01						

**Diatomite production**

**ANNEXE 4**

DRW. B162 - 7 - 1  
PROCESSING UNIT LAY OUT

DRW. B162 - 7 - 2  
PROCESS FLOW DIAGRAM

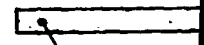


260000



L.P.G. tanks

AREA FOR NATURALS DIATOMITE DRYING



Rotary



PRODUCTION

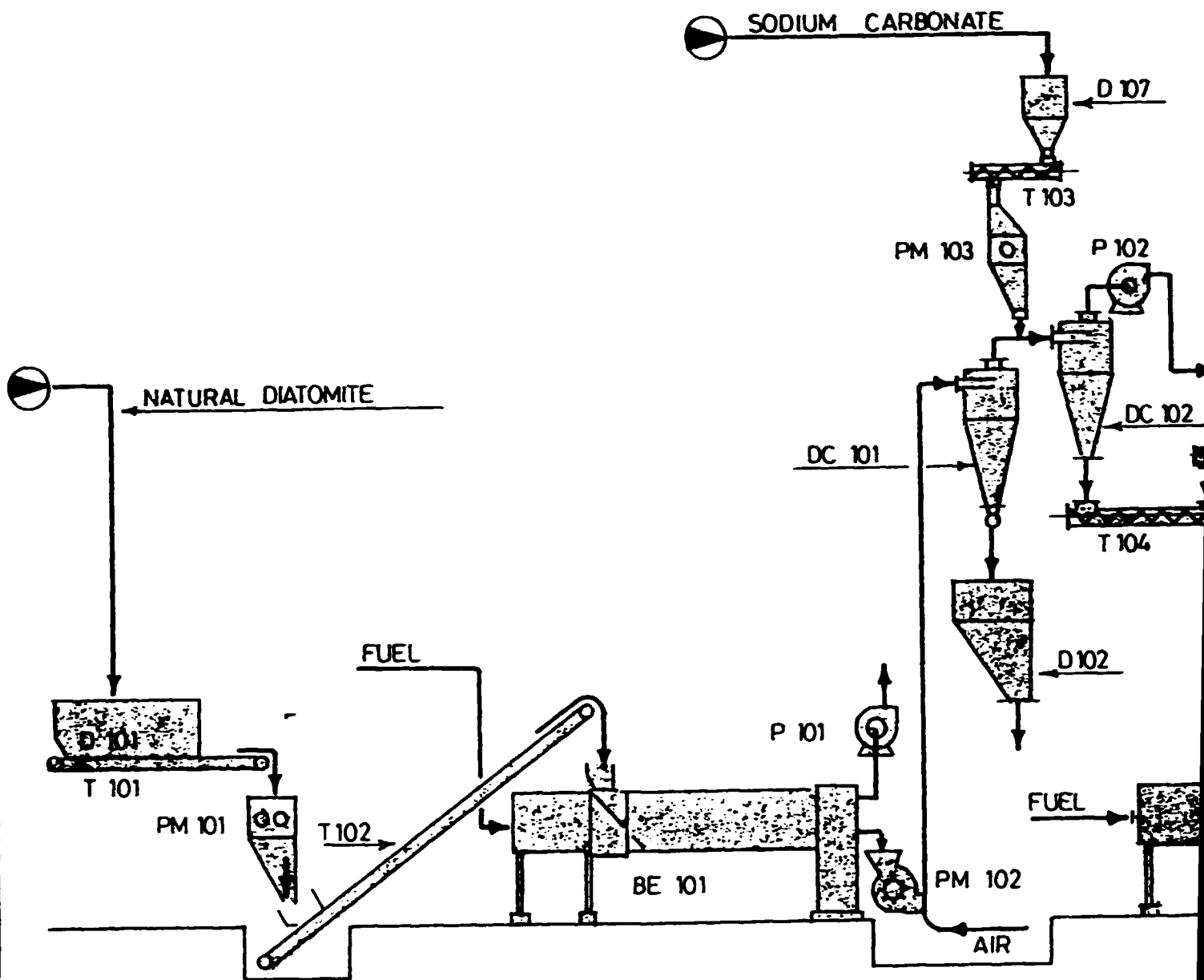
130,0 m

NATURAL DIATOMITE STORE



SECTION 1





BE 101	ROTARY DRIER	DC 101	CYCLONE	P 102	BLOWER	PM 102	HAMMER MILL
BE 102	" "	DC 102	"	P 103	"	PM 103	CRUSHER
D 101	HOPPER	DC 103	"	P 104	"	PM 104	HAMMER MILL
D 102	"	DC 104	"	P 105	"	T 101	BELT CONVEYOR
D 103	"	DC 105	"	P 106	"	T 102	" "
D 104	"	K 101	SCALE	P 107	"	T 103	SCREW "
D 105	"	K 102	"	PF 101	BAG FILTER	T 104	" "
D 106	"	K 103	"	PF 102	" "	T 105	" "
D 107	"	P 101	BLOWER	PM 101	CRUSHER	T 106	" "
						T 107	" "

## SECTION 1



**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF HYDROGEN PEROXIDE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

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**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

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**DRW. B162 - 4 - 2 - PROCESS FLOW DIAGRAM**

0. SUMMARY AND CONCLUSIONS

This opportunity study is devoted to the analysis of the possibility of producing Hydrogen Peroxide in Ethiopia. Hydrogen Peroxide is a chemical product mainly used as a bleaching and oxidizing agent in the textile, leather, pulp and paper, food and other industries and as an antiseptic and disinfecting agent in medicine, etc. Ethiopia presently imports less than 500 tons per year at a cost of approximately 800 \$ per ton. It is estimated that this quantity will increase to 1,200 tons within a few years.

On the other hand the minimum feasible size of the plant should be in the range of 2,000 tons and therefore a portion of the output should be exported. This ought not to be very difficult because Hydrogen Peroxide is widely used in the textile industry and this subsector is relatively developed in other countries of the region, such as Kenya, Tanzania and Sudan.

Problems, however, arise when the profitability of the plant is calculated.

The fixed investment is quite high, 12,700,000 \$ (10,100,000 \$ being the foreign exchange portion) too high if it is considered that its implementation would allow an import substitution of less than 1 Million \$ per year.

The production cost table shows that the major input is of local origin, electrical energy, accounting for 887,000 \$ per year or 69.4% of the total input cost. This input alone would represent a cost of 443 \$/ton that, added to 423 \$ per ton of depreciation renders the investment economically unviable. Even by subsidizing the cost of electrical energy and reducing it to 0.05



birr/kWh the situation does not improve substantially (total input costs plus depreciation at 1,459,000 \$ per year versus total theoretical revenues at 1,520,000 \$ per year).

The only solution would be to increase the capacity of the plant to 10-20,000 tons per year and to find the possibility of exporting a substantial quantity.

In this case the fixed investment would not be higher than 20 Million \$ with an incidence on the output of only 133-66 \$ ton/year.

It is therefore recommended that a market survey on the export potential in neighbouring countries be carried out. A feasibility study could be carried out only after obtaining positive results from this survey.

1. INTRODUCTION

Hydrogen peroxide is a familiar and well-established chemical product. The scale of its production and use have increased rapidly since 1925 when electrolytic processes for manufacture were introduced and industrial bleaching uses became increasingly important. More recently lower-cost non-electrolytic processes have been used to expand production. It is supplied commercially as an aqueous solution in a wide range of concentrations.

The major chemical properties and uses of hydrogen peroxide result from its structure which includes a covalent oxygen-oxygen bond. It is used to make other peroxygen compounds, for a variety of organic and inorganic oxidation reactions and, due to its highly exothermic decomposition to oxygen and water, as a propellant (ECT 2<sup>o</sup> Ed)

The production plant proposed in the present study is of the electrochemical type for reasons discussed in para 3.1.

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The main uses of the hydrogen peroxide can be summarized as follows:

- a) as a bleaching and oxidizing agent: in the manufacture of clothes, leather, furs, soaps, pulp and paper, fats, foods, adhesives; to destroy excess chlorine or compounds containing chlorine after previous treatment; as dyestuffs or a hair oxidizing agent; as a photographic developer; as an ingredient in chemical purification processes and in metal surface treatment; as a depolarizer; as an analytical reagent;
- b) as a gas source for manufacturing porous articles (concrete and ceramic articles) or foams from natural or synthetic rubber;
- c) as an active agent in many chemical synthesis: in polymerization and epoxidation processes; in the synthesis of organic peracids, organic intermediate compound, inorganic peroxides, sodium percarbonate, sodium perborate;
- d) as an active agent in biological processes: in medicine as an antiseptic and disinfecting agent, for the seed treatment, for food and drinks preservation;
- e) as a source of energy as propellant (in high concentrated solution) for submarines, torpedos and rocket propulsion.

The fields of application, especially with regard to (c), are in continuous expansion.

## 2.2 Forecast demand and plant capacity

By far the main current consumer is the National Textiles Corp. (NTC) with some 35 tonnes per month, or 420 tonnes/year.

Another user is the Pharmaceutical and Medical Supplies Corp. that imports it for use in hospitals. This consumption is very limited: presently, about 5,000 liters per year and it is not thought that consumption could increase much in the future. The extension of the network of health services in the countryside and the related increased use of pharmaceutical products will not imply a proportional growth of hydrogen peroxide consumption: other more stable disinfectants will be used. Conservatively, a future consumption of 10 tons per year can be assumed.

The NTC has an important programme of expansion, however. Its present capacity of a little more than 100 million m<sup>2</sup> of cotton fabrics will grow to approximately 150 million m<sup>2</sup> by 1993/4.

Capacity utilization is presently between 80 and 90%, but it is expected to increase as a result of both a growth of domestic demand fostered by expected higher levels of per capita income and possible exports of cotton fabrics.

Even if capacity utilization remains at present levels, the requirement of hydrogen peroxide could reach 620 tons per year. Adding the above 10 tons for hospitals plus some possible other consumption not recorded at present, total demand could be over 650 tonnes/year.

Alternatively, a linear regression equation based on 19 years past cotton fabric production and national GDP

series at factor cost (1) suggests that an annual growth of GDP close to 6 percent would create demand of over 170 million sq.mt by 1994/5. In turn, this would raise the demand for hydrogen peroxide by NTC to 840 tonnes per year. The total demand would therefore be in the range of 850 tonnes per year expressed as 50% content solution.

Hydrogen peroxide can be produced either by electrolytic or chemical processes based on anthraquinone. In both cases, due to the high investments required, plants are larger than that foreseen for Ethiopia. Smaller units using the electrochemical process are presently under test but not yet commercially available.

The smaller plant that may be considered and commercially available (electrolytic process) has a production capacity of 2,000 tons per year of 35% solution. As stated above the technical grade of the proposed product is 35% since the handling and utilization of this solution is easier. The operating time of the plant is 7,220 h/y.

### 2.3 Sales prices and total revenues

The price presently paid for this product imported and delivered to Addis Ababa, is 2.32 birr per Kg of 50% solution; this value means a price of 1.624 birr/Kg for the 35% solution that will be assumed as selling price in the present study.

(1)  $y = -12,205 + 12.64 x$  ( $r=0.88$ ), where  $y$  stands for cotton, fabrics in sq.m and  $x$  for GDP at factor cost in million birr.

On this basis the total annual revenue is as follows:

local demand: 1,200 tons x 1,624 birr/t (1) =	1,948,800 b/y
available for export: 800 tons x 1,500 birr/t =	1,200,000 b/y
(Hydrogen peroxide is widely used in neighbouring countries and it is all imported)	-----
	3,148,800 b/y
	(1,521,160\$/y)

- (1) 850 tons Hydrogen Peroxide expressed as solution at 50% corresponds to 1,200 tons solution at 35%

3. MATERIAL AND INPUTS

3.1 Chemistry

A short presentation of the technology available for the production of hydrogen peroxide is provided in this paragraph, with the object of clarifying the reasons for the Consultant's selection. The production technologies taken into consideration are two, namely:

- the auto-oxidation of anthraquinone
- the electrolytic process

Although the electrolytic process is still used in many plants, all new installations since 1953 have used new non-electrolytic processes, most of them based on the anthraquinone method.

This process is more economical from the point of view of the operating cost, but its economic size is very large, not less than 30,000 tons per year. In addition the reactions involved, even if simple in principle, require a highly experienced operating staff.

The electrolytic process, on the other hand, has a relatively higher operating cost, but it is simple to operate and its lower economic size is more acceptable for the Ethiopian situation (approx. 2000 tons per year).

In turn the electrolytic method can be subdivided into three different processes, based on different reactions, namely:

- ammonium persulphate process
- persulphoric acid process
- potassium persulphate process

The first is proposed because it is the most modern and offers the following advantages:

- lower investment cost
- simpler operation
- lower labour requirements
- higher efficiency.

This process can be represented by the following scheme:  
electrolysis:



hydrolysis and distillation:



The ammonium persulphate and sulphuric acid are then recycled.

As a result the main input to the process is electrical power as well as sulphuric acid and ammonium persulphate (in small quantities).

The plant uses a very large amount of electrical power. Energy is available (or can be made available) from hydraulic sources in Ethiopia and should not present major problems.

Sulphuric acid is presumed as being produced locally and so is available at 1110 birr/t (1), while ammonium persulfate must be imported and its price is estimated (on the basis of the European market price) 1920 birr/t = 927 \$/t.

(1) The National Chemical Corporation is in the final stage of planning the implementation of a sulphuric acid plant project.



3.2 Material and utility requirements and costs

The complete list of annual requirements of materials and utilities (including the consumption of the electrodes) at full capacity, is as follows:

<u>Raw materials</u>	LC	FC	TOTAL
	birr/y	birr/y	birr/y
Sulfuric acid 92-95%			
20t x 1110 birr/t =	22,200	-	22,200
 Ammonium persulphate			
24tx1920 birr/t =		46,080	46,080
 Platinum			
600 g x 45 birr/g =	-	27,000	27,000
 Electric power			
8,200,000 KWhx0,2 birr/KWh=1,640,000		-	1,640,000
	-----	-----	-----
TOTAL	1,662,200	73,080	1,735,280

Utilities

Electric power			
980,000 Kwh x 0,2 birr/Kwh=	196,000	-	196,000
 Steam 20,000t x 35.7 birr/t=		714,000	714,000
Cooling water			
20,000 m <sup>3</sup> x0,029 birr/m <sup>3</sup> =	580	-	580
	-----	-----	-----
TOTAL	196,580	714,000	910,580

These costs can be grouped as follows:

- raw materials (local)	22,200 b/y =	10,725 \$/y
- raw materials (foreign)	73,030 b/y =	35,304 \$/y
- energy (electricity)	1,836,000 b/y =	886,957 \$/y
- energy (fuel)	714,000 b/y =	344,927 \$/y
- utilities (other)	580 b/y =	280 \$/y
	-----	-----
TOTAL	2,645,860	1,278,193

Remarks:

- the steam (at 6 bar) is evaluated only as heat content, the generating plant being included in the investment cost; the boiler has a capacity of 2.5 t/h of steam at 6 bar
- the total installed electric power is 1,600 kW
- the figure indicated as cooling water represents only the make-up water

3.3 Raw material purchasing programme and storage volumes

For sulfuric acid, which is locally produced, a stock equivalent to one month's production, may be sufficient; the same for fuel oil; for ammonium persulphate, which is imported, a stock equivalent to six month's consumption may be advisable.

On this basis the minimum storage volumes will be as follows:

- sulfuric acid 92-95%  
1.7t equivalent to 894 \$
- ammonium sulfate  
12t equivalent to 11,130 \$

- fuel oil  
129 tons equivalent to 28,700 \$  
-----  
Total            40,724 \$

4. LOCATION

Any industrial area with good availability of electric power may be suitable.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

Hydrogen peroxide production by the ammonium persulphate process consists basically of the following steps (see annexed flow diagramme B 116 - 4 -2):

5.1.1 Electrolyte preparation

The electrolyte consists of a solution of ammonium sulphate and sulphuric acid. For its preparation the following materials are used:

Sulphuric acid 66 Bé

Ammonium sulphate

Deionized water

An accurate purification is necessary prior to the loading of the electrolysis cells.

5.1.2 Electrolysis

Anolyte and catholyte, at required conditions of purity, feed the electrolysis cell battery. The cells are arranged as in cascade so that the electrolyte flows through the whole battery.

Each cell is divided by means of diaphragms in anodic and cathodic compartments. In the anodic compartment the platinum anode is arranged (platinum is welded on special supports); cooling water passing through a special cooler makes it possible to keep constant the temperature of the anolyte.

In the cathodic compartment a lead cathode with catholite cooler is installed.

Anolyte and catholyte flow through the respective compartments of the cells of the battery; the catholyte emerging from the last cell is pumped to the anolyte feeding tank, so that it becomes anolyte and flows into the anodic compartment of the first cell of the battery. The anolyte going through the cell battery concentrates in ammonium persulphate so that it emerges from the last cell at a concentration of ammonium persulphate suitable for the distillation process (see table 5.1).

Table 5.1 Typical electrolyte analysis

		Cathodic compartment		Anodic compartments	
		IN	OUT	IN	OUT
H <sub>2</sub> SO <sub>4</sub>	g/l	285-290	215-220	215-220	185-200
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	g/l	285-290	325-335	325-325	135-140
(NH <sub>4</sub> ) <sub>2</sub> S <sub>2</sub> O <sub>8</sub>	g/l	-	-	-	260-270

### 5.1.3 Hydrolysis and distillation

Ammonium persulphate solution is heated so that ammonium persulphate is hydrolyzed to H<sub>2</sub>O<sub>2</sub> and NH<sub>4</sub>HSO<sub>4</sub>.

Hydrogen peroxide vapours together with water vapours, under vacuum, are separated from the electrolyte and delivered to the rectifying system.

Hydrolysis and distillation are carried out in a rising film evaporator, of the shell and tube type, steam heated.

Hydrogen peroxide and water vapours are separated from the electrolyte in an upper separator.

The whole operation takes place in two stages so that most of the hydrogen peroxide vapours are separated from the solution.

The electrolyte emerging from the separator is diluted, cooled and pumped to the catholyte tank and feeds the cathodic compartment of the first cell of a battery.

### 5.1.4 Rectification

Hydrogen peroxide and water vapours are delivered under vacuum in a rectification column where a solution up to 35% is obtained.

In a second column diluted solutions of  $H_2O_2$  are obtained which are used as reflux in the first column. In a system of condensers all water vapours and traces of  $H_2O_2$  vapours are condensed. The condensate is used to dilute the electrolyte emerging from the second stage of distillation.

#### 5.1.5 Stabilization

Concentrated hydrogen peroxide coming out from the first column is stored in tanks where it is prepared to the required commercial concentration and stabilized by addition of a suitable stabilizer.

#### 5.1.5 Stabilization

Concentrated hydrogen peroxide emerging from the first column is stored in tanks where prepared to the required commercial concentration and stabilized by addition of a suitable stabilizer.

#### 5.1.6 Electrolyte purification

From time to time it is necessary to purify a certain quantity of the electrolyte. Basically the electrolyte must be purified from the iron contamination. The iron removal is achieved by treating it with iron sulphocyanide.

The operation takes place in the purification tank, the same used for the electrolyte preparation at plant



start-up. The system is provided with recirculation and heating/cooling facilities.

After filtration in a pressure precoat filter the electrolyte is delivered to storage tanks.

## 5.2 Packaging

The 35% hydrogen peroxide being produced mostly for the internal market will be packaged in glass containers (50 l each); for other destination, polyethylene drums (150 l each) will be used.

The cost of packaging can be estimated as equivalent to 5% of the cost indicated at para 3.2.

## 5.3 Layout and civil works

The complex covers a total area of about 3,500 sq.m.

The process plant as well as the storage rooms, administrative office, laboratory and workshop are all located in adjacent buildings, one multistorey and the other single-storey as shown in the layout drawing B162-4-1.

The main building has the following dimensions:

- a) a single-storey wing measuring 48 x 9m, H=7m, for the storage rooms, workshop and warehouse
- b) a three storey body measuring 48 x 18, H=20m, for the process plant, utilities, offices and laboratory.

The second building measuring 10x27m, H=7m, is used for the purification of the electrolyte.

Both buildings have a supporting structure made of reinforced concrete; the partition and external walls

are of brickwork; all the floors are of reinforced concrete covered with tiles; the roof is insulated with mineral wool lagging covered with corrugated asbestos-cement sheets.

All the roads and yards for a total surface of about 1100 sq.mt are asphalted.

A fence, made of reinforced concrete poles supporting brickwork walls, encloses the entire complex.

Next to the main entrance, an underground weighing bridge is installed.

5.4 Investment costs: maintenance and depreciation

The investment costs are as follows:

	FC	LC	TOTAL
	M\$	M\$	M\$
Machinery and equipment for the process plant, F.O.B. European port	5.375	-	5.375
Platinum FOB European port	0.200	-	0.200
Machinery and equipment for electrical substation and conversion system and for other utilities and facilities, F.O.B. European port	2.077	-	2.077
	-----	-----	-----
	7.652	-	7.652

Transportation	0.765	0.765	1.530
Erection	0.500	0.400	0.900
Land and site prep.	-	0.115	0.115
Civil works	-	1.154	1.154
Spare parts	0.308	-	0.308
	-----	-----	-----
	9.225	2.434	11.659
Contingencies	0.875	0.166	1.041
	-----	-----	-----
Grand Total	10.100	2.600	12.700

The life cycle of such a plant can be estimated as 15 years.

As far as annual maintenance costs are concerned, an amount equivalent to 4% of the total machinery and equipment cost may be assumed.

In the financial evaluation, the investment costs (contingencies included) have been so subdivided:

Machinery	FC	10.100 million dollars	
Machinery	LC	1.165	" "
Site preparation	LC	0.115	" "
Civil works	LC	1.320	" "
		-----	
		12.700	" "

6. PLANT ORGANIZATION

As far as the financial evaluation is concerned the plant is considered as operating as an autonomous unit under the direction of the Nat.Chemicals Co.

7. MANPOWER

The skills and experience required for the various positions listed below are the same as those normally necessary for the personnel of equivalent level in a chemical factory, except for the technical manager, the production manager, the chemist, the workshop engineer, and the electricians, who will have a high level of training in the technology and machinery involved as well as experience in the problems connected with packaging, storage and end uses.

7.1 Management

		birr/m	birr/y
General manager	1	1,500	
Technical manager	1	1,200	
		-----	-----
		2,700	32,400
			(15652 \$/y)

7.2 Administrative department

Senior accountant	1	800	
Accountant	2	700	
Purchasing head	1	400	
Warehouse keepers	2	700	
Sale Head	1	400	
Clerks and secretaries	3	1,050	
Guards	6	1,200	
Drivers	<u>3</u>	<u>1,050</u>	
	19	6,300	75,600
			(36,521 \$/y)
Total: Management and Adm. Dep.			108,000 b/y
			(52,173 \$/y)

7.3 Production and maintenance department

Production department

Production manager	1	1,000	
Shift foremen	4	1,600	
Shift operators	20	7,000	
Chemist	1	700	
Analyst	4	1,400	
Production rec.clerk	1	350	
	--	-----	-----
	31	12,050	144,600
			(69,855 \$/y)

Maintenance department

Engineer	1	800	
Supervisors	2	800	
Electricians	4	1,600	
Mechanics	2	800	
	--	-----	-----
	9	4,000	48,000
			(23,188 \$/y)

8. IMPLEMENTATION SCHEDULING

Starting from the awarding of the order for the main equipment a total construction time of 30 months is required.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (one months) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "other raw materials"

- power cost : 0.05 birr/kwh

- the production programme has been assumed as follows:

1st year: 40% capacity: 800t/y (40% for export)

2nd year: 60% capacity:1200t/y (40% for export)

80% capacity:1600t/y (40% for export)

from the 4th to the 15th year: 100% capacity (2000 t/y  
(40% for export)

selling price : 724.64 \$/t for export market

784.54 \$/t for domestic market

The result of the evaluation is negative: at the discount rate of 10% no IRR has been found and the computation of the BEP yields a result higher than 1.



10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the 60% of the production programme;
- cost of the imported product equal to 572.71 \$/t CIF Assab against a present price in Addis Ababa of 784.54 (para 2.3).

The net foreign exchange flow results negative, as well as the net foreign exchange effect; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of (-5,054,000 \$).

**Hydrogen peroxide**

**ANNEX 1**

**FINANCIAL EVALUATION**



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**HYDROGEN PEROXIDE**  
February 88  
Power cost at 0.05 birr/kWh

3 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	13667.70	80.178 % foreign
current assets:	0.00	0.000 % foreign
total assets:	13667.70	80.178 % foreign

**Source of funds during construction phase**

equity & grants:	4224.20	0.028 % foreign
foreign loans :	8585.00	
local loans :	0.00	
total funds :	12809.20	67.032 % foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	600.41	738.00	936.59
depreciation :	862.04	862.04	850.54
interest :	858.50	731.19	643.88
production costs	2320.95	2351.22	2431.00
thereof foreign	80.41 %	78.09 %	76.79 %
total sales :	608.00	913.20	1217.60
gross income :	-1712.15	-1438.02	-1213.40
net income :	-1712.15	-1438.02	-1213.40
cash balance :	-2163.18	-1738.96	-1539.54
net cashflow :	-231.56	85.36	177.46

Net Present Value at: 10.00 % = -9521.15  
Internal Rate of Return on total investment: -4.81 %  
Equity paid versus Net income flow (IRR): -49.27 %  
Net Worth versus Net Cash Return (IRR): -9.19 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US \$**

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	115.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	407.40	407.40	407.40	99.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . . . .	525.00	1628.00	3503.00	4610.00	999.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>640.00</b>	<b>2035.40</b>	<b>3910.40</b>	<b>5017.40</b>	<b>1098.00</b>	<b>0.00</b>
<b>Pre-production capital expenditures.</b>	<b>5.00</b>	<b>15.00</b>	<b>15.00</b>	<b>30.00</b>	<b>472.25</b>	<b>429.25</b>
<b>Net working capital . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total initial investment costs . . . . .</b>	<b>645.00</b>	<b>2050.40</b>	<b>3925.40</b>	<b>5047.40</b>	<b>1570.25</b>	<b>429.25</b>
<b>Of it foreign, in % . . . . .</b>	<b>81.40</b>	<b>76.42</b>	<b>79.86</b>	<b>82.81</b>	<b>71.47</b>	<b>100.00</b>

HYDROGEN PEROXIDE --- February 88



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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US \$**

Year . . . . .	1990	1991	1992	1993
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	239.95	89.84	103.55	102.34
<b>Total current investment costs . . .</b>	<b>239.95</b>	<b>89.84</b>	<b>103.55</b>	<b>102.34</b>
<b>Of it foreign, Z . . . . .</b>	<b>84.94</b>	<b>92.56</b>	<b>93.55</b>	<b>93.47</b>

HYDROGEN PEROXIDE --- February 88



**COMFAR**  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994	1995
I of non. capacity (single product).	40.00	60.00	80.00	100.00	100.00	100.00
Raw material I . . . . .	18.41	27.61	36.82	46.02	46.02	46.02
Other raw materials . . . . .	20.00	42.00	56.00	70.00	70.00	70.00
Utilities . . . . .	0.11	0.17	0.22	0.28	0.28	0.28
Energy . . . . .	226.67	340.00	453.33	566.67	566.67	566.67
Labour, direct . . . . .	69.86	69.86	69.86	69.86	69.86	69.86
Repair, maintenance . . . . .	23.19	23.19	23.19	23.19	23.19	23.19
Spares . . . . .	122.00	183.00	245.00	306.00	306.00	306.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>548.24</b>	<b>685.83</b>	<b>884.42</b>	<b>1082.02</b>	<b>1082.02</b>	<b>1082.02</b>
Administrative overheads . . . . .	52.17	52.17	52.17	52.17	52.17	52.17
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	862.04	862.04	850.54	839.04	839.04	817.44
Financial costs . . . . .	853.50	751.19	643.88	536.56	429.25	321.94
<b>Total production costs . . . . .</b>	<b>2320.95</b>	<b>2351.22</b>	<b>2431.00</b>	<b>2509.79</b>	<b>2402.48</b>	<b>2273.56</b>
<b>Costs per unit (single product) .</b>	<b>2.90</b>	<b>1.96</b>	<b>1.52</b>	<b>1.25</b>	<b>1.20</b>	<b>1.14</b>
Of it foreign, Z . . . . .	80.41	78.09	76.79	73.56	74.47	73.97
Of it variable, Z . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	122.03	122.03	122.03	122.03	122.03	122.03



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
Z of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	46.02	46.02	46.02	46.02	46.02	46.02
Other raw materials . . . . .	70.00	70.00	70.00	70.00	70.00	70.00
Utilities . . . . .	0.28	0.28	0.28	0.28	0.28	0.28
Energy . . . . .	566.67	566.67	566.67	566.67	566.67	566.67
Labour, direct . . . . .	69.86	69.86	69.86	69.86	69.86	69.86
Repair, maintenance . . . . .	23.19	23.19	23.19	23.19	23.19	23.19
Spares . . . . .	306.00	306.00	306.00	306.00	306.00	306.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1082.02</b>	<b>1082.02</b>	<b>1082.02</b>	<b>1082.02</b>	<b>1082.02</b>	<b>1082.02</b>
Administrative overheads . . . . .	52.17	52.17	52.17	52.17	52.17	52.17
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	817.44	817.44	817.44	751.38	370.61	0.00
Financial costs . . . . .	214.63	107.31	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>2166.25</b>	<b>2058.94</b>	<b>1951.63</b>	<b>1885.57</b>	<b>1504.80</b>	<b>1134.19</b>
<b>Costs per unit ( single product ) .</b>	<b>1.08</b>	<b>1.03</b>	<b>0.98</b>	<b>0.94</b>	<b>0.75</b>	<b>0.57</b>
Of it foreign, Z . . . . .	72.68	71.26	69.68	72.12	67.68	60.50
Of it variable, Z . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	122.03	122.03	122.03	122.03	122.03	122.03



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COMFAR 2.0 - BALNO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US \$**

Year .....		1990	1991	1992	1993	1994-2004
Coverage .....	ndc coto					
<b>Current assets &amp;</b>						
Accounts receivable . . .	30 12.0	50.03	61.50	78.05	94.52	94.52
Inventory and materials .	75 4.8	9.75	14.63	19.50	24.38	24.38
Energy .....	19 19.3	11.74	17.62	23.49	29.36	29.36
Spares .....	360 1.0	122.60	183.00	245.00	306.00	306.00
Work in progress .....	1 360.0	1.52	1.91	2.46	3.01	3.01
Finished products . . .	30 12.0	50.03	61.50	78.05	94.52	94.52
Cash in hand .....	15 24.0	13.63	13.60	16.26	18.80	18.80
Total current assets .....		258.72	353.82	462.80	570.58	570.58
<b>Current liabilities and</b>						
Accounts payable .....	12 30.8	18.77	24.03	29.46	34.89	34.89
Net working capital .....		239.95	329.79	433.34	535.69	535.69
Increase in working capital .....		239.95	89.84	103.55	102.34	0.00
Net working capital, local .....		36.12	42.81	49.49	56.17	56.17
Net working capital, foreign .....		203.82	286.98	383.85	479.52	479.52

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1	1989.2
Equity, ordinary ..	4223.00	0.00	1.20	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	8585.00	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	8585.00	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	429.25	429.25
Total funds .....	12808.00	0.00	430.45	429.25

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13	-1073.13
Current liabilities	18.77	5.26	5.43	5.43	0.00	0.00	0.00
Bank overdraft ....	2163.18	1738.96	1539.54	1324.22	1114.57	1007.25	899.94
Total funds .....	1108.83	671.09	471.85	256.52	41.44	-65.87	-173.18

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1997	1998-2002	2003	2004
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-1073.13	0.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-1073.13	0.00	0.00	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft ....	792.63	-387.81	-379.21	-193.90
Total funds .....	-280.50	-387.81	-379.21	-193.90

HYDROGEN PEROXIDE --- February 8



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	12808.00	0.00	0.00	0.00	1.20	0.00
Financial resources .	12808.00	0.00	0.00	0.00	1.20	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	645.00	2050.40	3925.40	5047.40	1570.25	429.25
Total assets . . . .	645.00	2050.40	3925.40	5047.40	1141.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	429.25	429.25
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	12163.00	-2050.40	-3925.40	-5047.40	-1569.05	-429.25
Cumulated cash balance	12163.00	10112.60	6187.20	1139.80	-429.25	-858.50
Inflow, local . . . . .	4223.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	120.00	483.40	790.40	867.40	448.00	0.00
Surplus ( deficit ) .	4103.00	-483.40	-790.40	-867.40	-448.00	0.00
Inflow, foreign . . . .	8585.00	0.00	0.00	0.00	1.20	0.00
Outflow, foreign . . . .	525.00	1567.00	3135.00	4180.00	1122.25	429.25
Surplus ( deficit ) .	8060.00	-1567.00	-3135.00	-4180.00	-1121.05	-429.25
Net cashflow . . . . .	-645.00	-2050.40	-3925.40	-5047.40	-1141.00	0.00
Cumulated net cashflow	-645.00	-2695.40	-6620.80	-11668.20	-12809.20	-12809.20



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	627.57	918.46	1223.03	1527.43	1522.00	1522.00
Financial resources .	18.77	5.26	5.43	5.43	0.00	0.00
Sales, net of tax . .	608.80	913.20	1217.60	1522.00	1522.00	1522.00
Total cash outflow . .	2790.76	2657.42	2762.57	2851.65	2676.56	2529.25
Total assets . . . .	258.72	95.10	108.98	107.77	0.00	0.00
Operating costs . . .	600.41	738.00	936.59	1134.19	1134.19	1134.19
Cost of finance . . .	858.50	751.19	643.98	536.56	429.25	321.94
Repayment . . . . .	1073.13	1073.13	1073.13	1073.13	1073.13	1073.13
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2163.18	-1738.96	-1539.54	-1324.22	-1114.56	-1007.25
Cumulated cash balance	-3021.68	-4760.64	-6300.18	-7624.40	-8738.97	-9746.22
Inflow, local . . . .	394.65	570.24	758.65	947.05	942.00	942.00
Outflow, local . . . .	320.29	338.59	399.14	459.69	447.96	447.96
Surplus ( deficit ) .	74.36	231.66	359.51	487.36	494.04	494.04
Inflow, foreign . . .	232.93	348.21	464.38	580.38	580.00	580.00
Outflow, foreign . . .	2470.47	2318.83	2363.43	2391.96	2188.60	2081.29
Surplus ( deficit ) .	-2237.54	-1970.62	-1899.05	-1811.58	-1608.60	-1501.29
Net cashflow . . . . .	-231.56	85.36	177.46	285.47	387.81	387.81
Cumulated net cashflow	-13040.76	-12955.40	-12777.94	-12492.48	-12104.67	-11716.86



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	1522.00	1522.00	1522.00	1522.00	1522.00	1522.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	1522.00	1522.00	1522.00	1522.00	1522.00	1522.00
Total cash outflow . .	2421.94	2314.63	1134.19	1134.19	1134.19	1134.19
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1134.19	1134.19	1134.19	1134.19	1134.19	1134.19
Cost of finance . . .	214.63	167.31	0.00	0.00	0.00	0.00
Repayment . . . . .	1073.13	1073.13	0.00	0.00	0.00	0.00
Corporate tax . . .	0.06	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-899.94	-792.63	387.81	387.81	387.81	387.81
Cumulated cash balance	-10646.16	-11438.79	-11050.97	-10663.16	-10275.35	-9887.54
Inflow, local . . . .	942.00	942.00	942.00	942.00	942.00	942.00
Outflow, local . . . .	447.96	447.96	447.96	447.96	447.96	447.96
Surplus ( deficit ) .	494.04	494.04	494.04	494.04	494.04	494.04
Inflow, foreign . . .	580.00	580.00	580.00	580.00	580.00	580.00
Outflow, foreign . . .	1973.98	1866.67	686.23	686.23	686.23	686.23
Surplus ( deficit ) .	-1393.98	-1286.67	-106.23	-106.23	-106.23	-106.23
Net cashflow . . . . .	387.81	387.81	387.81	387.81	387.81	387.81
Cumulated net cashflow	-11329.05	-10941.24	-10553.43	-10165.62	-9777.80	-9389.99



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COMFAR 2.0 - BALDO & CO. S.R.L., NTLAND

Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	1522.00	1522.00	1522.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1522.00	1522.00	1522.00
Total cash outflow . .	1134.19	1142.79	1328.09
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1134.19	1134.19	1134.19
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.60	193.91
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	387.81	379.21	193.91
Cumulated cash balance	-9499.73	-9120.52	-8926.62
Inflow, local . . . . .	942.00	942.00	942.00
Outflow, local . . . .	447.96	456.56	641.87
Surplus ( deficit ) .	494.04	485.44	300.13
Inflow, foreign . . . .	580.00	580.00	580.00
Outflow, foreign . . .	686.23	686.23	686.23
Surplus ( deficit ) .	-106.23	-106.23	-106.23
Net cashflow . . . . .	387.61	379.21	193.91
Cumulated net cashflow	-9002.18	-8622.97	-8429.07

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-9621.54 at	10.00 %
Internal Rate of Return (IRRE1) ..	-49.27 %	
b) Net Worth versus Net cash return:		
Net present value .....	-9353.67 at	10.00 %
Internal Rate of Return (IRRE2) ..	-9.19 %	
c) Internal Rate of Return on total investments:		
Net present value .....	-9521.15 at	10.00 %
Internal Rate of Return (IRR) ..	-4.81 %	
Net Worth = Equity paid plus reserves		

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	608.00	913.20	1217.60	1522.00	1522.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	608.00	913.20	1217.60	1522.00	1522.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1462.45	1600.04	1787.13	1973.23	1973.23
Operational margin . . . . .	-853.65	-686.84	-569.53	-451.23	-451.23
As % of total sales . . . . .	-140.22	-75.21	-46.77	-29.65	-29.65
Cost of finance . . . . .	858.30	731.19	643.88	536.56	429.25
Gross profit . . . . .	-1712.15	-1438.02	-1213.40	-987.79	-880.48
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1712.15	-1438.02	-1213.40	-987.79	-880.48
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1712.15	-1438.02	-1213.40	-987.79	-880.48
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1712.15	-1438.02	-1213.40	-987.79	-880.48
Accumulated undistributed profit . . .	-1712.15	-3150.17	-4363.57	-5351.36	-6231.83
Gross profit, % of total sales . . . . .	-281.23	-157.47	-99.66	-64.90	-57.85
Net profit, % of total sales . . . . .	-281.23	-157.47	-99.66	-64.90	-57.85
ROE, Net profit, % of equity . . . . .	-40.53	-34.04	-28.72	-23.38	-20.84
ROI, Net profit+interest, % of invest.	-6.54	-5.23	-4.30	-3.38	-3.38





COMFAR 2.0 - BALNO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1995	1996	1997	1998	1999
Total sales, incl. sales tax	1522.00	1522.00	1522.00	1522.00	1522.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	1522.00	1522.00	1522.00	1522.00	1522.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1951.63	1951.63	1951.63	1951.63	1951.63
Operational margin	-429.63	-429.63	-429.63	-429.63	-429.63
As % of total sales	-28.23	-28.23	-28.23	-28.23	-28.23
Cost of finance	321.94	214.63	107.31	0.00	0.00
Gross profit	-751.56	-644.25	-536.94	-429.63	-429.63
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	-751.56	-644.25	-536.94	-429.63	-429.63
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	-751.56	-644.25	-536.94	-429.63	-429.63
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	-751.56	-644.25	-536.94	-429.63	-429.63
Accumulated undistributed profit	-6983.40	-7627.65	-8164.59	-8594.21	-9023.84
Gross profit, % of total sales	-49.38	-42.33	-35.28	-28.23	-28.23
Net profit, % of total sales	-49.38	-42.33	-35.28	-28.23	-28.23
ROE, Net profit, % of equity	-17.79	-15.25	-12.71	-10.17	-10.17
ROI, Net profit+interest, % of invest.	-3.22	-3.22	-3.22	-3.22	-3.22



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	1522.00	1522.00	1522.00	1522.00	1522.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1522.00	1522.00	1522.00	1522.00	1522.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1885.57	1885.57	1885.57	1504.80	1134.19
Operational margin . . . . .	-363.57	-363.57	-363.57	17.20	387.81
As % of total sales . . . . .	-23.89	-23.89	-23.89	1.13	25.48
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	-363.57	-363.57	-363.57	17.20	387.81
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-363.57	-363.57	-363.57	17.20	387.81
Tax . . . . .	0.00	0.00	0.00	8.60	193.91
Net profit . . . . .	-363.57	-363.57	-363.57	8.60	193.91
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-363.57	-363.57	-363.57	8.60	193.91
Accumulated undistributed profit . . .	-9387.41	-9750.97	-10114.54	-10105.94	-9912.04
Gross profit, % of total sales . . . . .	-23.89	-23.89	-23.89	1.13	25.48
Net profit, % of total sales . . . . .	-23.89	-23.89	-23.89	0.56	12.74
ROE, Net profit, % of equity . . . . .	-8.61	-8.61	-8.61	0.20	4.59
ROI, Net profit+interest, % of invest.	-2.72	-2.72	-2.72	0.06	1.45



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	12808.00	12808.00	12808.00	12808.00	13238.45	13667.70
Fixed assets, net of depreciation	9.00	645.00	2695.40	6620.80	11668.20	13238.45
Construction in progress	645.00	2050.40	3925.40	5047.40	1570.25	429.25
Current assets	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	12163.00	10112.60	6187.20	1139.80	0.00	0.00
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	12808.00	12808.00	12808.00	12808.00	13238.45	13667.70
Equity capital	4223.00	4223.00	4223.00	4223.00	4224.20	4224.20
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	8585.00	8585.00	8585.00	8585.00	8585.00	8585.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	429.25	858.50
Total debt	8585.00	8585.00	8585.00	8585.00	9014.25	9443.50
Equity, % of liabilities	32.97	32.97	32.97	32.97	31.91	30.91



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>14776.53</b>	<b>15447.62</b>	<b>15919.47</b>	<b>16175.99</b>	<b>16217.43</b>	<b>16151.56</b>
Fixed assets, net of depreciation	12905.66	11943.63	11093.09	10254.06	9415.02	8597.56
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	245.09	340.15	446.55	551.77	551.77	551.77
Cash, bank .....	13.63	13.68	16.26	18.80	18.80	18.80
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	1712.15	3150.17	4363.57	5351.36	6231.83
Loss .....	1712.15	1436.02	1213.40	987.79	880.48	751.56
<b>Total liabilities .....</b>	<b>14776.53</b>	<b>15447.62</b>	<b>15919.47</b>	<b>16175.99</b>	<b>16217.43</b>	<b>16151.56</b>
Equity capital .....	4224.20	4224.20	4224.20	4224.20	4224.20	4224.20
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	7511.88	6438.75	5365.63	4292.50	3219.38	2146.25
Current liabilities .....	18.77	24.03	29.46	34.89	34.89	34.89
Bank overdraft, finance required.	3021.68	4760.64	6300.18	7624.40	8738.97	9746.22
<b>Total debt .....</b>	<b>10552.33</b>	<b>11223.42</b>	<b>11695.27</b>	<b>11951.79</b>	<b>11993.23</b>	<b>11927.36</b>
<b>Equity, % of liabilities .....</b>	<b>28.59</b>	<b>27.35</b>	<b>26.55</b>	<b>26.11</b>	<b>26.05</b>	<b>26.15</b>

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COMFAR 2.0 - BALBO &amp; CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
<b>Total assets .....</b>	<b>15978.37</b>	<b>15697.88</b>	<b>15310.07</b>	<b>14922.25</b>	<b>14534.45</b>	<b>14146.64</b>
Fixed assets, net of depreciation	7780.15	6962.71	6145.28	5327.84	4576.46	3825.09
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	551.77	551.77	551.77	551.77	551.77	551.77
Cash, bank .....	18.80	18.80	18.80	18.80	18.80	18.80
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	6983.40	7627.65	8164.59	8594.21	9023.84	9387.41
Loss .....	644.25	536.94	429.63	429.63	363.57	-363.57
<b>Total liabilities .....</b>	<b>15978.37</b>	<b>15697.88</b>	<b>15310.06</b>	<b>14922.25</b>	<b>14534.45</b>	<b>14146.64</b>
Equity capital .....	4224.20	4224.20	4224.20	4224.20	4224.20	4224.20
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	1073.13	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	34.89	34.89	34.89	34.89	34.89	34.89
Bank overdraft, finance required.	10646.16	11438.79	11050.98	10663.17	10275.36	9887.55
<b>Total debt .....</b>	<b>11754.17</b>	<b>11473.68</b>	<b>11085.87</b>	<b>10698.05</b>	<b>10310.25</b>	<b>9922.44</b>
<b>Equity, % of liabilities .....</b>	<b>26.44</b>	<b>26.91</b>	<b>27.59</b>	<b>28.31</b>	<b>29.06</b>	<b>29.86</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>13758.83</b>	<b>13388.21</b>	<b>13379.62</b>
Fixed assets, net of depreciation	3073.71	2703.10	2703.10
Construction in progress .....	0.00	0.00	0.00
Current assets .....	551.77	551.77	551.77
Cash, bank .....	18.00	18.00	18.00
Cash surplus, finance available .	0.00	0.00	0.00
Loss carried forward .....	9750.97	10114.54	10105.94
Loss .....	363.57	0.00	0.00
<b>Total liabilities .....</b>	<b>13758.83</b>	<b>13388.21</b>	<b>13379.62</b>
Equity capital .....	4224.20	4224.20	4224.20
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	8.60	193.91
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	34.89	34.89	34.89
Bank overdraft, finance required.	9499.74	9120.53	8926.62
<b>Total debt .....</b>	<b>9534.63</b>	<b>9155.42</b>	<b>8961.51</b>
<b>Equity, % of liabilities .....</b>	<b>30.70</b>	<b>31.55</b>	<b>31.57</b>

HYDROGEN PEROXIDE --- February 68

**Hydrogen peroxide**

**ANNEXE 2**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (4TH YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>1522.00</u>	
2) VARIABLE COSTS:	<u>752.83</u>	
. RAW MATERIALS	116.02	
. UTILITIES	0.28	
. ENERGY	566.67	
. LABOUR	69.86	
3) FIXED COSTS	<u>1756.96</u>	
. REPAIR-MAINTENANCE	23.19	
. SPARES	306.00	
. ADMINISTRATION	52.17	
. DEPRECIATION	839.04	
. FINANCIAL COSTS	536.56	
4) TOTAL PRODUCTION COSTS	<u>2509.79</u>	
BEP	1756.96	
----- X 100 =		
1522 - 752.83		higher than 100 %



**Hydrogen peroxide**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow ..	16592.11	8586.20	8005.91	8585.00	0.00	0.00	0.00
equity capital .....	1.20	1.20	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	8586.91	8585.00	1.91	8585.00	0.00	0.00	0.00
exports .....	8004.00	0.00	8004.00	0.00	0.00	0.00	0.00
indirect effects .....							
total foreign outflow .	31069.33	10958.50	20110.83	525.00	1567.00	3135.00	4180.00
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	8231.50	10100.00	-1868.50	525.00	1567.00	3135.00	4180.00
imported materials ...	9529.17	0.00	9529.17	0.00	0.00	0.00	0.00
repayment loans & overd.	8586.91	0.00	8586.91	0.00	0.00	0.00	0.00
other repayments .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	4721.75	858.50	3863.25	0.00	0.00	0.00	0.00
indirect costs .....							
net foreign exchange flow	-14477.23	-2372.30	-12104.92	8060.00	-1567.00	-3135.00	-4180.00
import substit'n effect	9404.70	0.00	9404.70	0.00	0.00	0.00	0.00
net foreign exchange effect	-4992.52	-2372.30	-2620.22	8060.00	-1567.00	-3135.00	-4180.00
present values at 10.00 %							
foreign exchange flow .	-8790.93						
net foreign exchange effect	-5053.53						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		1992	1993	production		
	1988.1	1989.2			1994	1995	1996
total foreign inflow . .	1.20	0.00	232.93	348.21	464.38	580.38	580.00
equity capital . . . . .	1.20	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.93	0.21	0.38	0.38	0.00
exports . . . . .	0.00	0.00	232.00	348.00	464.00	580.00	580.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1122.25	429.25	2470.47	2318.83	2363.43	2391.96	2188.60
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	693.00	0.00	204.75	83.38	97.25	96.04	0.00
imported materials . . .	0.00	0.00	334.09	411.14	549.18	686.23	686.23
repayment loans & overd.	0.00	0.00	1073.13	1073.13	1073.13	1073.13	1073.13
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	429.25	429.25	858.50	751.19	643.88	536.56	429.25
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1121.05	-429.25	-2237.54	-1970.62	-1899.05	-1811.58	-1608.60
import substit'n effect	0.00	0.00	274.90	412.40	549.80	687.30	687.30
net foreign exchange effect	-1121.05	-429.25	-1962.64	-1558.22	-1349.25	-1124.28	-921.30
present values at	10.00 %						
foreign exchange flow .	-8790.93						
net foreign exchange effect	-5053.53						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow ..	580.00	580.00	580.00	580.00	580.00	580.00	580.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	580.00	580.00	580.00	580.00	580.00	580.00	580.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	2081.29	1973.98	1866.67	686.23	686.23	686.23	686.23
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	686.23	686.23	686.23	686.23	686.23	686.23	686.23
repayment loans & overd.	1073.13	1073.13	1073.13	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	321.94	214.63	107.31	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-1501.29	-1393.98	-1286.67	-106.23	-106.23	-106.23	-106.23
import substit'n effect	687.30	687.30	687.30	687.30	687.30	687.30	687.30
net forgn exchge effect	-813.99	-706.68	-599.37	581.07	581.07	581.07	581.07
present values at foreign exchange flow .	13.00 %	-8790.93					
net forgn exchge effect		-5053.53					

**Foreign Exchange Effect in 1000 US \$**  
 Economic Analysis excluding indirect effects  
 100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow . .	580.00	580.00	580.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	580.00	580.00	580.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	686.23	686.23	686.23	-2348.02
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-2349.92
imported materials . . .	686.23	686.23	686.23	0.00
repayment loans & overd.	0.00	0.00	0.00	1.91
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	-106.23	-106.23	-106.23	2348.02
import substit'n effect	687.30	687.30	687.30	0.00
net forgn exchange effect	581.07	581.07	581.07	2348.02
present values at	10.00.7			
foreign exchange flow .	-8790.93			
net forgn exchange effect	-5053.53			

**Hydrogen peroxide**

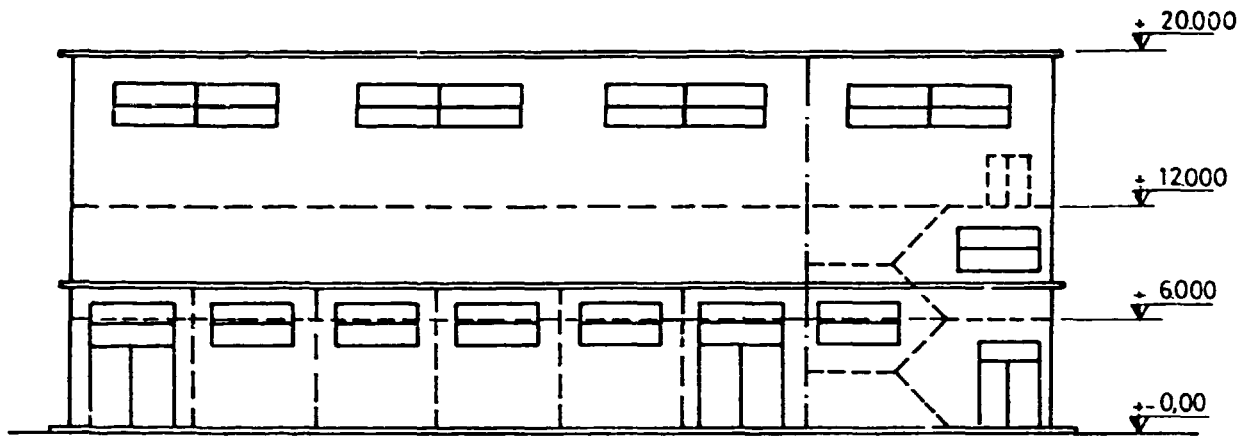
**ANNEXE 4**

**DRW. B162 - 4 - 1**

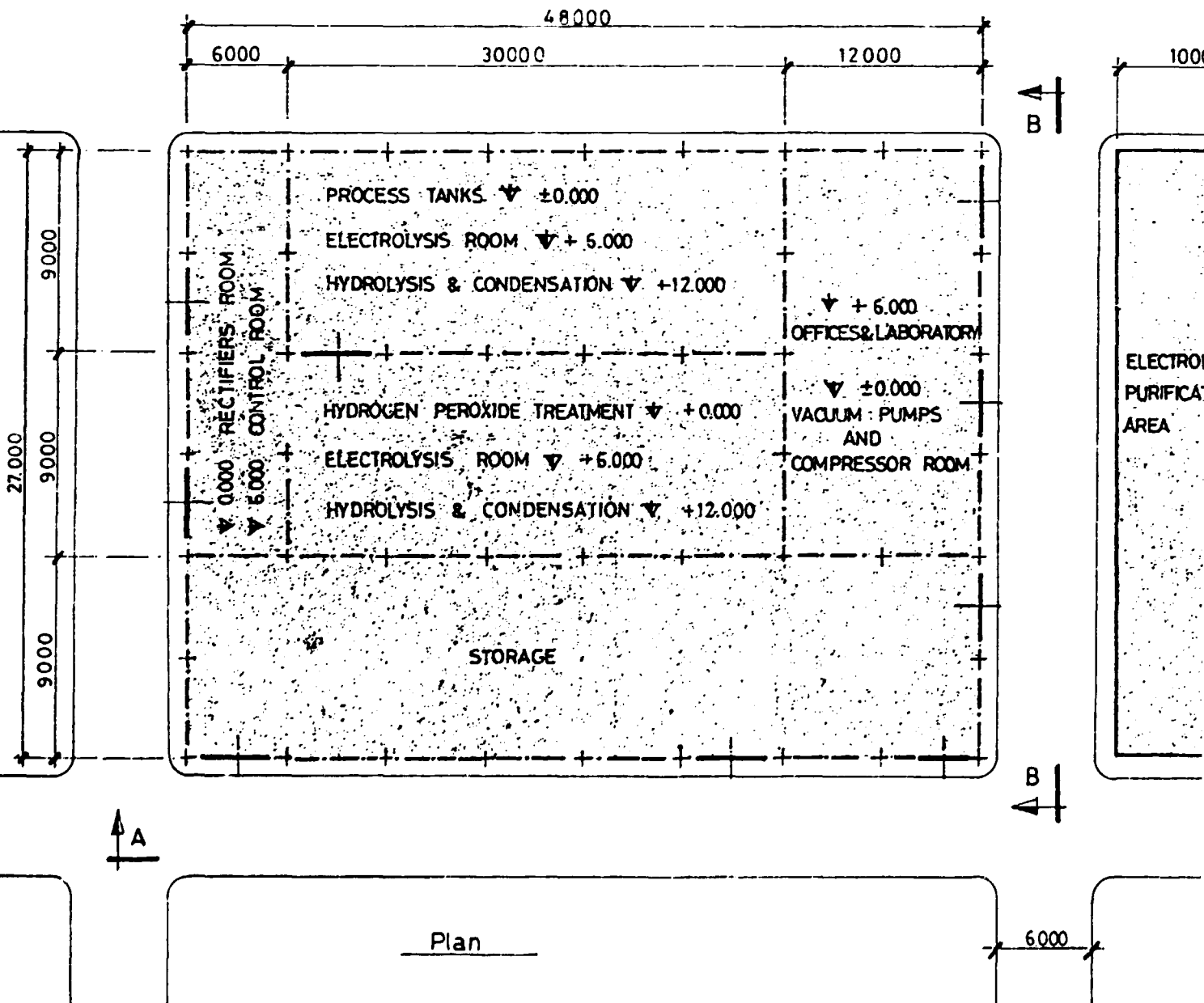
**GENERAL LAY OUT**

**DRW. B162 - 4 - 2**

**PROCESS FLOW DIAGRAM**

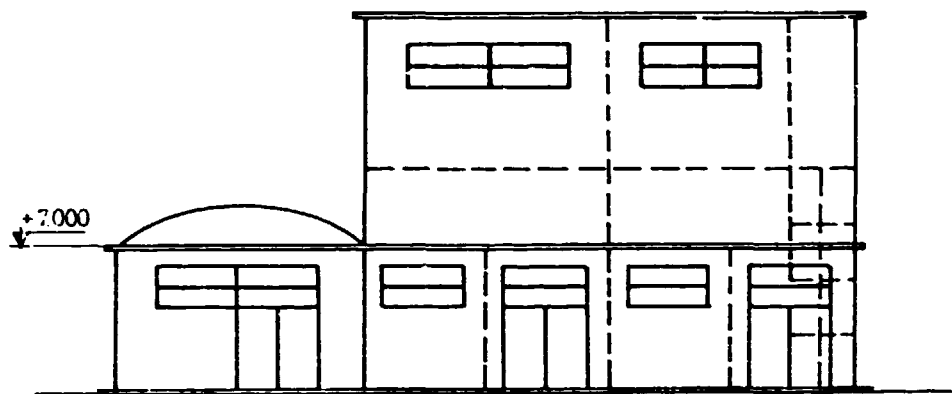
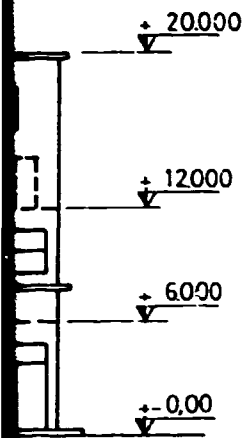


View A-A

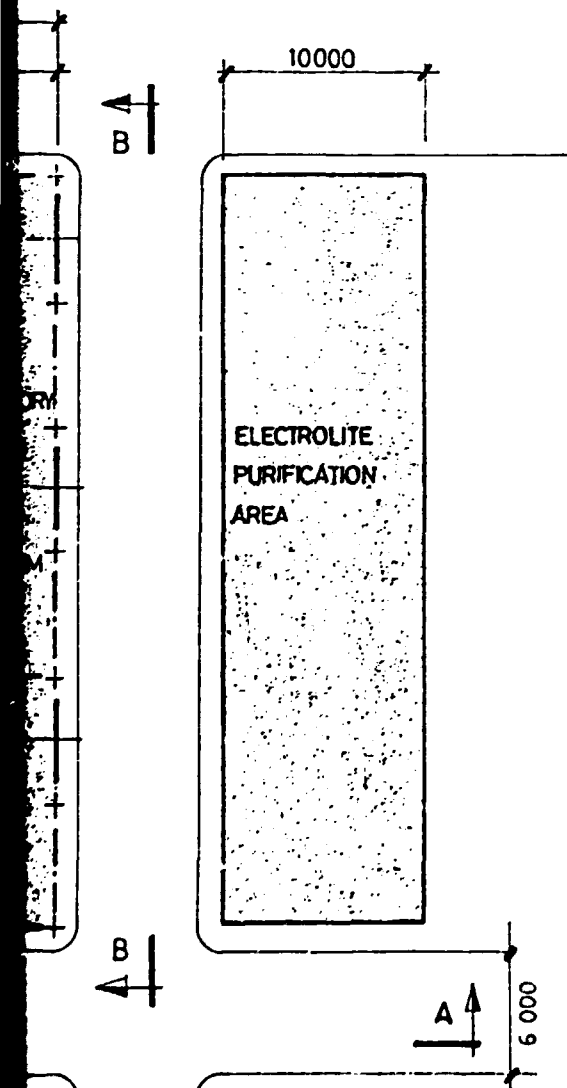


Plan

SECTION 1



View B-B



SECTION .2

HYDROGEN PEROXIDE PLANT  
GENERAL LAY-OUT

**baldo & c.**  
CONSULTING ENGINEERS

Via Stillicone 39, 20154 MILANO  
Ph. N. 3102 Tlx N. 330229

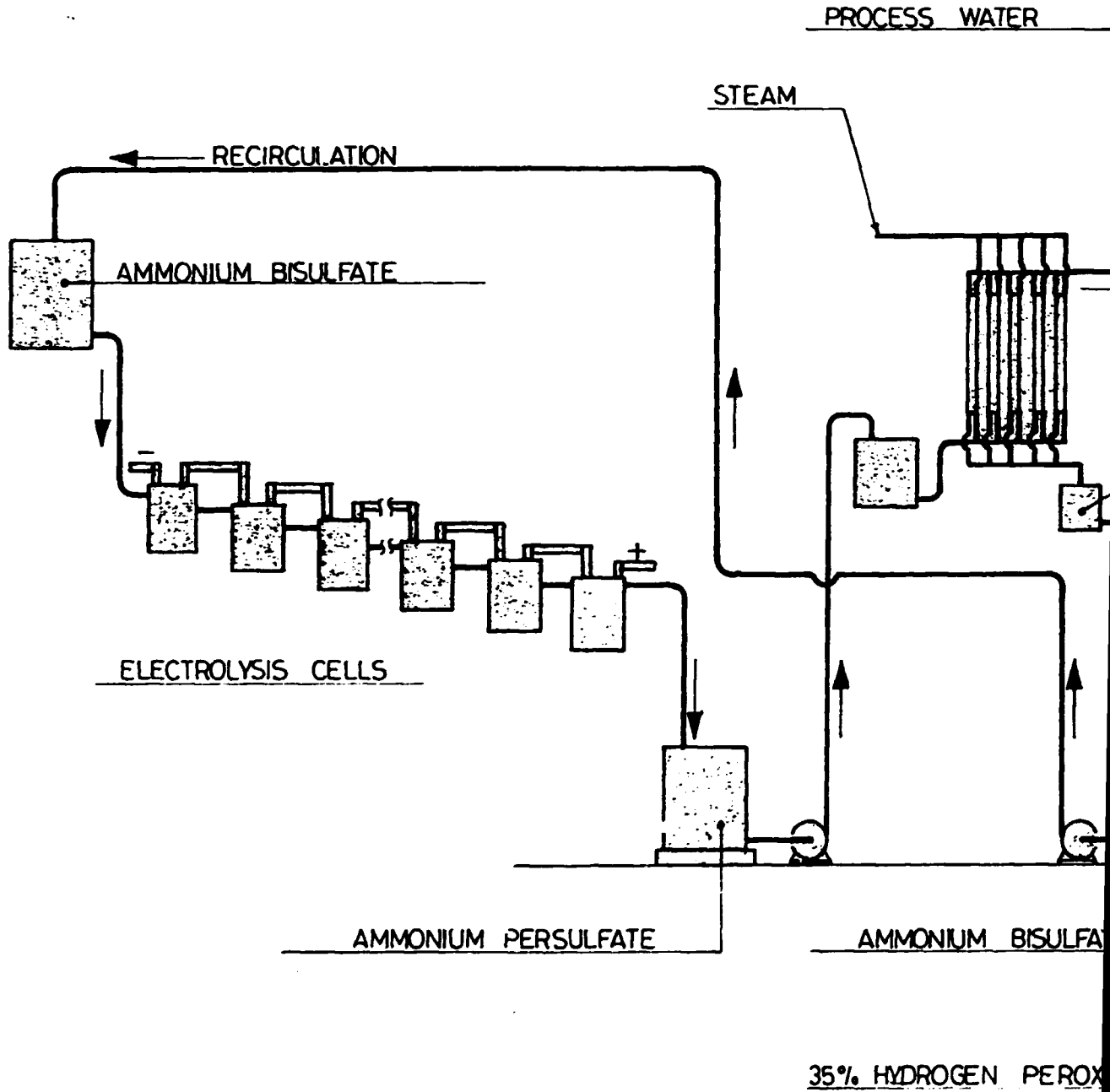
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B.162 - 4 - 1

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HYDROGEN PEROXIDE PLANT



**SECTION 1**



**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF BONE BASED CHEMICALS**  
**IN ETHIOPIA**

**PROJECT OP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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0. SUMMARY AND CONCLUSIONS

Livestock is one of the main resources of Ethiopia but one of its main by-products, the bones, is only marginally exploited. This study, then, assesses the suitability of bone processing with a view to the production of:

1,000 tons per year of fat

2,000 tons per year of glue

30,000 tons per year of normal super phosphate

Fat can be used in the Ethiopian soap industry which now imports a large quantity of raw materials.

Bone glue can be exported to Europe (Italy alone presently imports at least 2,500 t/y of bone glue from Comecon Countries and China). NSP or normal super phosphate is an excellent fertilizer and its production can considerably increase the input of nutrients for agriculture with a consequent increase of yield and diminution of imports. The technology used is suitable and no major difficulties are anticipated in getting the plant on stream. However, it will be necessary to study and implement an efficient system for the collection of bones, apart from that carried out from the slaughterhouse of Addis Abeba (this is particularly important for the production of glue and fat, for which fresh bones are needed, while NSP may also be produced by processing dry bones).

The plant will require a fixed investment of \$ 4,900,000 (with a foreign exchange portion of \$ 2,600,000) and will have a staff of 150.

The internal rate of return is 18.71% and also the foreign exchange effect is favourable (net present value being in excess of 36 million dollars).

A detailed feasibility study is advised for the following main reasons:

- the plant will process a domestically available by-product
- the output will be used as a partial substitute for imports for extremely important products such as fertilizers and raw material for soap and a portion will also be exported
- the fixed investment requirements are relatively low
- the financial ratios are interesting

1. INTRODUCTION

The industrial exploitation of animal bones is an activity which has been established for a considerable time.

The main products usually obtained by the processing of animal bones are:

- fat,
- gelatines
- glues
- phosphatic fertilizers
- meals for animal feeding
- bone black (active carbons)

Only the first, second and fifth of these are still in current production in industrialized countries, as the others have largely been substituted by other products, such as phosphorites as raw material for the preparation of phosphatic fertilizer, synthetic adhesives as binders with a larger spectrum of applications and vegetable charcoal as a raw material for the manufacture of active carbone.

On the other hand, the usefulness of those bone-derived products for developing countries is unquestionable, and especially in the case of countries such as Ethiopia, where livestock breeding is one of the main resources.



The present study, therefore, deals with bone processing for the production of: (1)

- fat
- glue
- neatsfoot oil
- perphosphate fertilizer (NSP).

(1) The production of gelatines and, consequently, of Dicalcium Phosphate has not been taken into consideration because is the object of another opportunity study. As a matter of fact the gelatines/DCP unit can perfectly be integrated with the proposed one.

2. MARKET AND PLANT CAPACITY

2.1 Uses and forecast of demand

The main uses of fat, especially if it is of good quality, are as ingredients in the production of special lubricants, soap and candles.

The soap industry is in expansion in Ethiopia, but total production (presently around 17,700 t/a) is still lower than demand; in addition present importation of fatty acids is around 4-5000 t/y. The commercial characteristics of fat should be within the following limits.

Moisture	0.6-4%	
Free acids (as oleic acid)		18-49%
Ash	0.1-3%	
Soap index	181-194	
Iodine index	48-56	
Title (solidification point)		36-42°C

Glue is presently produced in Ethiopia by the Addis Ababa abattoir; the amount sold annually by this slaughterhouse is around 31-35 t/y; the quality is not particularly high; quality is particularly important for certain specialized activities such as the bookbinding or the construction or repairing of furniture.

In any case there are many possibilities of using animal glues: woodwork, paper manufacture, emery paper manufacture, even if this field is generally satisfied by synthetic glues.

Among the technical characteristics of glues, the most important are its appearance (which, in the best quality

products, is transparent and colourless), moisture (no more than the 20%) and ashes (less than 4% and in fine qualities, less than 1%).

Bone glue having these technical characteristics can well compete with skin and hide glues (which are considered the best for the most sophisticated applications) and the other, less expensive glues as those synthetic or derivated from maize or potatoes: for example against a total consumption of animal glues of 6000 t/y in Italy, a 35% is still covered by bone glues, the most part of which is imported from East Europe Countries and China.

Neatsfoot oil is a product obtained from certain bones only (shinbones) used in leather dressing as it gives it a particular softness. Neatsfoot oil is presently imported into Ethiopia; some samples have already been produced experimentally by the Addis Ababa slaughterhouse.

Mineral phosphate is the final substance available from the bones after the fat and collagen have been extracted; this mineral phosphate is very useful as a fertilizer, as it is one of the three fundamental elements (phosphorous, potassium and nitrogen) supplied extensively to the soil to support agricultural exploitation; for this purpose it can be used as it is, only finely ground, but it has a slow action, due to the low solubility of the tricalcium-phosphate of the bones. On the contrary, if the bones are treated with sulphuric acid, the resulting phosphate product is soluble and therefore of immediate use for the plants. This latter product is the normal method of utilization of natural

calcium-phosphate (either of mineral or organic origin) commercially known as NSP (Normal Super Phosphate) not to be confused with TSP (concentrated superphosphate) which is obtained from natural phosphate treated with phosphoric acid instead of sulphuric acid.

Ethiopia presently imports 30-40,000 tons per year of phosphate based fertilizers and therefore any amount available locally from the bones processing unit would be beneficial.

The most important feature of this product is the soluble phosphorous content that must be in the range of 14 to 20 as P2O5 soluble in water.

## 2.2 Plant capacity

As has been stated above, since the absorption by the market of bone-derived products should not be subject to significant constraints, the definition of the capacity of the bone processing plant should be based on the availability of raw bones. The first conclusion to be drawn is that the area around Addis Ababa is the most favourable for the installation of the processing plant, as this area is the most active with regard to slaughtering; the municipal slaughterhouse of Addis Ababa kills 160000 heads of cattle per year; roughly the same amount is processed by private butchers. Assuming an average value of 30 Kg per head as bone yield, a total annual quantity of 9600 tons of bones, potentially available for processing, is estimated.

Taking into account that:

- a) part of the slaughtered heads from the municipal abattoir are exported to other areas;

b) some difficulties will be encountered, at least initially, in collecting bones from private butchers; the above figure may be too high.

There is, on the other hand, a very large amount of bones piled up near the municipal abattoir. The amount in this depot is estimated between 100,000 and 170,000 t, which means that at a rate of 10,000 t/y, between ten and seventeen years will be necessary to deplete the stock. These bones, sun dried, contain only calcium, phosphorous (60-65% as tricalcium phosphate) and other minerals, with dried ossein and no fat.

A plant having a processing capacity of 20,000 t/y may therefore permit:

- a) the processing of up to 10,000 t/y of green bones for the production of fat, glue and NSP
- b) the processing of additional 10,000 t/y of dry bones for the production of NSP only (1)

The composition of the bones varies considerably, depending on the age and type of animal as well as on parts of the skeleton and the state of conservation. In any case the following composition gives an average analysis of bones (green bones) processed in large plants:

moisture 12%

organic substances 28% (with 3-4% of nitrogen)

tricalcium phosphate 44%

fat 10%

calcium carbonate, silica, etc.5%

- (1) An increase in availability of green bones may be anticipated for the time (15 years) when the deserted bones should be finished. Some modifications to the plant will be necessary at that time.

As stated above, with regard to dry bones, there is a deprivation of fat, ossein is dried and the inorganic substance amounts to 70-80% of the total.

With such quantities of bones and taking into account the following yields:

- 1750-1800 kg of NSP per 1000 kg of bones, after fat and glue has been removed.
- 100 kg of fat per 1000 kg of fresh bones
- 200 kg of glue per 2000 kg of fresh bones (not all the ossein is removed by the process)

the following productions can be expected:

NSP (14-20% P205)	30,000 t/y
Fat	1,000 t/y
Glue	2,000 t/y

### 2.3 Sale prices and total revenues

On the basis of the import prices, the NSP sale price has been estimated at 240 \$/y, and the fat at 700 \$/t. As for glue, the price has been estimated on the basis of the international price in Europe of 770 \$/t; therefore a selling price, ex works, at 600 \$/t has been estimated. Upon these assumptions, the total annual revenues are as follows:

30,000 t/y x 240 \$/t	=	7,200,000 \$/y
1000 t/y x 700 \$/t	=	700,000 \$/y
2000 t/y x 600 \$/t	=	1,200,000 \$/y
		-----
Total	=	9,100,000 \$/y

### 3. MATERIALS AND INPUTS

#### 3.1 Technology

The first step of the processing after bone crushing is the extraction of fat which is performed by means of a solvent action (1); it has been presumed that gasoline will be used as a solvent, although other substances such as light petroleum or trichloroethylene may be used.

Gasoline consumption is around 3.5-4 Kg plus 1.1 - 1.5 ton of steam per ton of raw bones.

The second step is the extraction of ossein by boiling the bones at 1.5-2 bar; consumption is around 0,67 t of steam per ton of raw bones. The third step is the transformation of the phosphatic content into NSP.

The reaction involved is the following:



As shown, only sulphuric acid 52-53 bé is required to carryout the transformation; the consumption is about 900 Kg of sulphuric acid per t of defatted and degelatinized bones.

#### 3.2 Materials and utilities: requirements and costs

In table 3.2 requirements and costs are reported subdivided among the three types of productions; the notes explain the criteria adopted.

Particular attention has been paid to the cost of Sulphuric Acid, which is one of the main inputs.

1) This system is preferable because of its higher yield

TABLE 3.2

MATERIAL AND UTILITIES: REQUIREMENTS AND COSTS

	MEASURE	CONSUMPTION FOR		UNIT COST \$	ANNUAL COST \$		
		1T (1)	1 YEAR		LC	FC	TOTAL
<b>A) Fat extraction: 1000 t/y</b>							
- green bones	t	n.a.	10,000	115	524,375 (2)	-	524,375
- gasoline	t	0.0035	35	900	-	31,500	31,500
- steam	t	1.3	13,000	17.25	-	224,250	224,250
- cooling water (3)	m3	3.25	32,500	0.02	650	-	650
- electric power	kWh	19	190,000	0.0966	18,354	-	18,354
<b>B) Glue extraction: 2000 t/y</b>							
- green bones	t	n.a.	9,000	n.a.	524,375	-	524,375
- steam	t	0.674	6,066	17.25	-	104,638	104,638
- cooling water (3)	m3	1.68	15,165	0.02	303	-	303
- electric power	kWh	8.08	72,792	0.0966	7,031	-	7,031
<b>C) NSP production: 48000 t/y</b>							
- green bones	t	n.a.	6,750	n.a.	531,709	104,638	636,347
- deserted bones	t	n.a.	10,000	15	101,250	-	101,250
- sterilizing steam	t	0.1	1,000	17.25	-	17,250	17,250
- electric power (4)	kWh	39.5	661,600	0.0966	63,913	-	63,913
- sulphuric acid 52-53 Be	t	0.9	15,075	201.2 (5)	3,033,090	-	3,033,090
<b>GRAND TOTAL</b>					<b>3,348,253</b>	<b>17,250</b>	<b>3,365,503</b>
					<b>4,423,341</b>	<b>377,638</b>	<b>4,800,979</b>

(1) referring to 1 ton of processed bones

(2) the total amount of 1,150,000 \$/y (after deducting the sum of 101,250\$ corresponding to the amount of green bones used for NSP production and valued at the same price as the deserted bones) has been equally divided between fat and glue extraction.

(3) make-up water only

(4) includes the grinding of green bones

(5) calculated on the basis of 310 \$/t for sulphuric acid 65 be (100%)



For the financial evaluation the costs of table 3.2 are grouped as follows:

Raw material (bones)	LC 1,300,000 \$
Raw material (sulfuric acid)	LC 3,033,090 \$
Energy (electricity)	LC 89,298 \$
Energy (fuel and gasoline)	FC 377,638 \$
Utilities (water)	LC 953 \$
	-----
	4,800,979 \$
Packaging (see para 5.2)	1,155,000 \$

### 3.3 Purchasing programme and storage volume of raw materials

Fuel oil, gasoline and sulphuric acid are the main raw materials required ; a stock equivalent to one month consumption at full capacity is reasonable for each of them. On this basis the following storage volumes are required:

fuel oil 152t	equivalent to	31,500 \$
gasoline 3.2t	equivalent to	2,880 \$
sulphuric acid 1,370t	equivalent to	275,735 \$
		-----
	Total	310,115 \$

For the deserted bones a stock equivalent to one week's production, that is 550t or 8400\$, is convenient. The green bones, on the other hand, as has already been stated, will be purchased daily or every two or three days; this means an average quantity of 40 - 60t or 4600-6900\$.

4. LOCATION

In any case in the area around Addis Abeba, preferably not too far from the present abattoir.

**5. PROJECT ENGINEERING**

**5.1 Description of process and main equipment**

Bone processing is carried out through the following steps:

- bone collection and crushing
- fat extraction through solvent process
- collagen extraction through boiling down process
- perphosphate production though acid treatment.

**a) Bone collection and crushing**

The green bones should be processed preferably shortly after their collection since the quality of the extracted substances is affected by a possible deterioration of the bones; for this reason the pile of collected bones should not be too high and every two or three days (depending on the atmospherical conditions) should be sprayed with a solution of carbolic acid (300 g of carbolic acid in 1000 l of water); the amount of solution should always be equal to 5-10% of the bone weight. In addition, the sheltering of the green bones under a roof is recommended.

The first step in the process is that of the bone crushing; with regard to green bones, crushing limited to the quantity daily processed in the successive phases is advisable. Upon loading of the crusher, the bone load should be washed and inspected so that extraneous materials or pieces of meat do not enter the flow.

**b) Fat extraction**

The crushed bones are loaded into extractors, each consisting of a cylindrical tank fitted with a drilled false bottom, to support the bones, and a steam pipe coil at the bottom; after bone loading the tank is closed and filled with gasoline up to the false bottom; the gasoline is then evaporated by steam and contact of the vapours with the bones dissolves the fat which gathers at the bottom; after two hours all the gasoline is left to evaporate, condensed in a water cooled exchanger and collected in a storage tank; the fat is then discharged from the bottom of the extractor in a distiller where the recovery of the solvent is completed. This operation is repeated with the same bone load three times; after the third extraction the bones are washed and dried by direct injection of steam, then unloaded; the residual moisture is around 4-6%  
The equipment is now ready for a new load.

**c) Glue extraction**

The defatted bones are now loaded into a steam jacketed autoclave together with a certain amount of softened water; then the temperature of the mass is brought to a temperature of no greater than 90°C and maintained for 3 hours.  
The resulting mass is then discharged and sent through a coarse filter to the concentration; this boiling operation is carried out twice for each batch. After the concentration (up to 40%), carried out in a multiple effect evaporator, the liquid is

clarified and decolourized with SO<sub>2</sub>; it is then left to solidify in blocks, successively cut into slices and left to dry completely, in a well ventilated room.

A similar operation could be carried out in a separate tank and at a strictly controlled temperature, on selected bones (the shin bones) to recover the neatsfoot oil. Pure neatsfoot oil fetches a very high price but the manufacturing process is rather lengthy and requires delicate handling; the main requirements are:

- raw material must be fresh and free from blood and dirt
- no bones other than those of the feet are used and overcooking must be avoided

The production of neatsfoot oil, therefore, is economically viable only where a large number of animals (the average yield is approximately 1/2 liter of oil from one head) is slaughtered. Consequently, the possibility of installing the necessary equipment should be considered only when all the other production lines are well in operation and the supply of green bones is well organized

#### d) NSP production

The defatted and degelatinized green bones are now ready to be transformed into NSP together with the deserted bones. The deserted bones are first crushed and steamed in separate tanks, similar to those utilized for the gelatine extraction, in order to assure complete sterilization. Then green and deserted bones are ground in ball mills, as the

reaction speed between calcium triphosphate and sulphuric acid depends on the fineness of the milling.

As the process is of the batch type, the ground material is conveyed from the ball mills to a surge hopper, from which it is fed through another conveyor to the manually operated weigh hopper (a scale-mounted hopper; the operator controls the flow by starting and stopping the conveyor).

The acid measure is of the volumetric type: the operator merely fills the tank to a proper level for a mixer batch, usually by observing a sight gauge.

The two measured components may now be mixed: this mixing must be accomplished in a very short times because the mix sets in a few minutes and if a thorough mixing is not obtained within this period, portions of the product will be underacidulated, while others will be overacidulated.

As a mixer, the vertical shaft pan mixer has been selected; this pan mixer is made of cast iron and consists of two main parts: the pan and plow assemblies (special steels are used for the plows); in operation both the pan and plow assemblies turn, the pan at approx. 4 RPM and the plows at approx. 40.. The discharge is controlled by a counterbalanced lever that raises the discharge plug and at the same time lower a scraper to help push the mix to the center; total time for the cycle of filling, mixing and emptying 1 ton of slurry usually ranges from 1 to 1/2 minutes.

From the mixer the slurry is discharged into a den (usually a mixer with two or more dens is used) where the curing hold for 18-24 h is situated During

this period the temperature reaches 130°C. It should be borne in mind that unlike phosphorite rocks, the bones do not contain fluorine, therefore the gas evolved during this phase and during the emptying of the den are not neither harmful nor pollutant as in the other case.

The den is made up of simple brick work with an exhausting vent and a loading opening on the top and a side door for the product discharge. The capacity of these dens is 50t approx (they must not be filled completely as provision for the expansion of the slurry during curing).

When the setting up period has expired, the side door is opened and the perphosphate is pulled out with a dragline scraper onto a conveyor system that carries it to the ageing pile in a storehouse. The perphosphate is ready to package in bags and ship after approximately three months of storing. Due to this curing period and to the seasonal nature of fertilizer sales, a large storage capacity is required.

The installation will therefore include the following main machinery and equipment.

a) bone crushing

- 1 bone washer, rotating drum type
- 2 crusher, each complete with an electromagnet for the iron scrap removal - total installed power 150 KW
- one silos, 10 m<sup>3</sup> capacity

b) fat extraction

- 4 carbon steel extractors, each with a capacity of 4000 l, fitted with false bottom and internal pipe coil, mechanical bone discharger and complete with water tube condenser, distiller and gasoline separator.
- 1 heated, carbon steel tank for fat storage (2000 l capacity)

c) glue extraction

- 4 carbon steel, steam jacketed, autoclaves, each fitted with an agitator and mechanical extractor and sized for a filling capacity of 3800 kg (gross volume 6000 l)
- 1 glue container
- 1 coarse filter
- 1 three effects evaporative unit designed for concentrating a 15-20% gelatine solution to a 20-40% solution - influx capacity 3 t/h
- 1 clarifier, carbon steel construction, 2000 l capacity, complete with reagent dosing unit.
- 1 series of plastic trays with water cooled bottom

d) NSP production

- 2 carbon steel steam jacketed autoclaves, as described above
- 1 ball mill; total installed power: 70 kW
- 1 carbon steel hopper; capacity 5000 kg
- 2 carbon steel weigh hoppers; capacity 500 kg each
- 1 carbon steel tank for sulphuric acid measure; capacity 500 l



- 1 carbon steel tank for sulphuric acid storage cap. 500 m<sup>3</sup>
- 1 cast iron pan mixer, (1 standby) capacity per charge: 1 t; installed power: 25 kW
- 1 serie of apparatus for 4 dens of 50 ton capacity each.
- 1 dragline scraper

e) auxiliary equipment

- 1 boiler sized for producing 5t/h of steam at 6 bar, burning fuel oil
- 1 Na-cation exchangers, salt regenerated, each sized for the production of 50 m<sup>3</sup> of net softened water
- 1 cooling water system with cooling tower
- 1 electric substation complete with transformer, motor control center and distribution network for a total installed power of 500 kW
- 1 effluent water treatment system
- 1 series of conveyors for the bone transfer from one process stage to another
- 1 mobile grab bucket for crusher loading

**5.2 Packaging**

The fat is sold in drums (160 lt) directly filled from the heated storage tank; cost of each drum: 35 \$/piece. The glue slabs are manually discharged in cardboard boxes (10 Kg each), wrapped in a moisture resistant envelope; cost of each pack: 2.5 \$/piece.

The NSP is sold in 50 Kg paperbag, cost of each bag: 0.7 \$/piece.

The total expenditure amounts to 1,155,000 \$/y

### 5.3 Layout and civil works

The area covered by the layout of the factory is approx 10.000 m<sup>2</sup> divided as follows:

- 2000 m<sup>2</sup> about, for the processing plants workshops, warehouse, packaging and the storage of green and deserted bones
- 1500 m<sup>2</sup> for the storage of NSP
- 200 m<sup>2</sup> for a two-storey building for the administrative offices, workshop and social facilities
- the remaining space as roads and courtyards.

The area of the processing plants is sheltered by a roof; the roof is covered by corrugated asbestos sheets and supported by steel columns and trusses. The floors, including the area for the depot of green bones, are of concrete with a hard aggregate as finishing surface. The depot of the deserted bones is outside the shelter but also on a concrete slab.

The same type of construction is used for the storage of the NSP, but with a closure of corrugated asbestos on three side walls.

The four dens are of cylindrical shape, 4.5m diameter, 4m height. The walls are of heavy brickwork; the roof of reinforced concrete; the floors of concrete or stones; the doors, very heavy, of wood.

The building has a supporting structure of reinforced concrete; external and internal wall of brickwork; the roof is covered with asbestos cement insulated with

mineral wool lagging; the floors are covered with tiles.

Roads and courtyard are covered with gravel and rolled. A fence, consisting of a wire-netting supported by small steel poles, encloses the entire factory.

**5.4 Investment costs; depreciation and maintenance**

The investment costs for the process machinery and equipment and for utility and general facility plants are as follows:

	FC	LC	TOTAL
	M\$	M\$	M\$
Process machinery and equipment			
Fob European port	1.500	-	1.500
Utility and general facility			
plant, Fob European port	0.35	-	0.35
	-----	-----	-----
	1.850	-	1.850
Transportation	0.185	0.185	0.370
Erection	0.100	0.270	0.370
site preparation	-	0.150	0.150
Civil works	-	1.500	1.500
Spare parts	0.180	-	0.180
	-----	-----	-----
	2.315	2.105	4.420
Contingencies	<u>0.285</u>	<u>0.195</u>	<u>0.480</u>
GRAND TOTAL	2.600	2.300	4.900

The life cycle of this plant may be estimated as 15 years.

Annual maintenance cost is assumed as being 4% of the machinery value, that is 74,000 \$/y.

In the financial evaluation, the investment costs (contingencies included) are so subdivided:

Machinery	FC 2.600 million dollars
Machinery	LC 0.455 million dollars
Site preparation	LC 0.150 million dollars
Civil works	LC 1.695 million dollars
	-----
	4.900 million dollars

6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit, complete with utilities and general facilities, operating under the direction of the N.C.C.

7. MANPOWER

Although the processes involved in this plant are quite simple in principle, experience plays an important role in the achievement of the proposed yield with the quality required; this experience is made up of many small details to be learned. For this reason an on-the-job training and technical assistance provided by two experts, for a period of at least 6 months, is recommended.

7.1 Management and administrative department

		birr/m	
General manager	1	1500	
Technical manager	1	1200	
Financial manager	1	1000	
Senior accountant	1	400	
Purchasing dep.head	1	400	
Sale depart.head	1	400	
Storage dep.head	1	400	
Senior clerks	4	1600	
Secretaries and clerks	9	2700	
Drivers	3	1050	
Guards	12	2400	
	--	-----	-----
	35	13050	156600
			(75,652 \$/y)

**7.2 Production and maintenance dep.**

birr/m

**a) Production dep.**

Production manager	1	1000	
Foremen	12	4800	
Operators	36	12500	
Chemist	1	700	
Analyst	3	1050	
Clerks	2	700	
Unskilled workers	30	6000	
	--	-----	-----
	85	26850	322200
			(155,652 \$/y)

**b) Maintenance dep.**

Engineer	1	1000	
Supervisors	3	1200	
Mechanics	6	2400	
Electricians	4	1600	
Assistants	6	2100	
Unskilled workers	10	2000	
	--	-----	-----
	30	10300	123600
			(59,710 \$/y)

8. IMPLEMENTATION SCHEDULING

Thirty months will be necessary for the design, equipment supply and erection of the plant, up to the commissioning and start up.



9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe1. This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
inventory raw material (bones) 1		7
inventory raw mat. (others) 180		30
inventory, utilities 1		30
work in progress 7		7

- the assistance of two foreign experts for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "utilities"

- the production programme has been assumed as follows:

1st year: 30% capacity (9000t NSP, 300t fat, 600 t glue)

2nd year: 60% capacity (18000t NSP, 600t fat, 1200t glue)

from the 3rd to the 15th year: 100% capacity (30000t NSP, 1000t fat, 2000t glue)

Glue was always considered as being equally distributed (50% + 50%) on the domestic and foreign markets.

Selling prices are:

NSP 240 \$/t

Fat 700 \$/t

Glue 600 \$/t (both for the domestic and export market)

As a result, the evaluation yields an IRR of 18.71% and a BEP of 24%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme, that is 30000 t of NSP and 1000 t of fat at 100% capacity;
- cost of imported phosphatic fertilizer equal to 210 \$/t CIF Assab;
- cost of fat 645 \$/t CIF Assab.

By discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 36,743,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, there would still be a surplus which in terms of present value would amount to 36,743,000\$

**FINANCIAL EVALUATION**



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**BONE BASED CHEMICAL INDUSTRY**  
February 85  
**SASIC PROJECT**

3 years) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency.  
accounting currency: 1000 US \$

---

**Total initial investment during construction phase**

fixed assets:	5256.00	53.672 % foreign
current assets:	0.00	0.000 % foreign
total assets:	5256.00	53.672 % foreign

---

**Source of funds during construction phase**

equity & grants:	2825.00	0.000 % foreign
foreign loans :	2210.00	
local loans :	0.00	
total funds :	5035.00	43.893 % foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	2160.01	3908.99	6320.99
depreciation :	345.52	345.52	330.52
interest :	221.00	193.38	165.75
production costs	2726.53	4447.88	6817.26
thereof foreign :	21.64 %	14.34 %	11.60 %
total sales :	2730.00	5460.00	9100.00
gross income :	3.47	1012.12	2282.74
net income :	1.74	506.06	1141.37
cash balance :	-331.15	247.04	739.92
net cashflow :	166.10	716.67	1181.92

Net Present Value at: 10.00 % = 3789.77  
Internal Rate of Return on total investment: 18.71 %  
Equity paid versus Net income flow (IRR%): 20.29 %  
Net investment versus Net Cash Return (IRR%): 19.22 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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**Total Initial Investment in 1000 US \$**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	510.00	510.00	510.00	165.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment ...	130.00	370.00	930.00	1190.00	415.00	0.00
<b>Total fixed investment costs .....</b>	<b>280.00</b>	<b>900.00</b>	<b>1440.00</b>	<b>1700.00</b>	<b>580.00</b>	<b>0.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	40.00	170.50	110.50
Net working capital .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs ...</b>	<b>285.00</b>	<b>915.00</b>	<b>1455.00</b>	<b>1740.00</b>	<b>750.50</b>	<b>110.50</b>
Of it foreign, in % .....	45.61	42.62	53.61	59.77	49.57	100.00

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**Total Current Investment in 1000 US \$**

Year .....	1990	1991	1992
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital .....	402.16	328.29	455.72
<b>Total current investment costs ...</b>	<b>402.16</b>	<b>328.29</b>	<b>455.72</b>
<b>Of it foreign, % .....</b>	<b>17.63</b>	<b>13.37</b>	<b>16.80</b>

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**Total Production Costs in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product)	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	390.00	780.00	1300.00	1300.00	1300.00	1300.00
Other raw materials .....	909.93	1819.85	3033.09	3033.09	3033.09	3033.09
Utilities .....	346.79	693.57	1155.95	1155.95	1155.95	1155.95
Energy .....	140.08	280.16	466.94	466.94	466.94	466.94
Labour, direct .....	155.65	155.65	155.65	155.65	155.65	155.65
Repair, maintenance .....	59.71	59.71	59.71	59.71	59.71	59.71
Spares .....	22.20	44.40	74.00	74.00	74.00	74.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2084.36</b>	<b>3833.34</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>
Administrative overheads .....	75.65	75.65	75.65	75.65	75.65	75.65
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	345.52	345.52	330.52	315.52	315.52	288.52
Financial costs .....	221.00	193.38	165.75	138.13	110.50	82.88
<b>Total production costs .....</b>	<b>2726.53</b>	<b>4447.88</b>	<b>6817.26</b>	<b>6774.63</b>	<b>6747.01</b>	<b>6692.38</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	21.64	14.34	11.60	11.27	10.90	10.58
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour .....</b>	<b>231.30</b>	<b>231.30</b>	<b>231.30</b>	<b>231.30</b>	<b>231.30</b>	<b>231.30</b>



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**Total Production Costs in 1000 US \$**

Year .....	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I .....	1300.00	1300.00	1300.00	1300.00	1300.00	1300.00
Other raw materials .....	3033.09	3033.09	3033.09	3033.09	3033.09	3033.09
Utilities .....	1155.95	1155.95	1155.95	1155.95	1155.95	1155.95
Energy .....	466.94	466.94	466.94	466.94	466.94	466.94
Labour, direct .....	155.65	155.65	155.65	155.65	155.65	155.65
Repair, maintenance .....	59.71	59.71	59.71	59.71	59.71	59.71
Spares .....	74.00	74.00	74.00	74.00	74.00	74.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>	<b>6245.34</b>
Administrative overheads .....	75.65	75.65	75.65	75.65	75.65	75.65
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	288.52	288.52	288.52	203.77	100.50	0.00
Financial costs .....	55.25	27.63	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>6664.76</b>	<b>6637.13</b>	<b>6609.51</b>	<b>6524.76</b>	<b>6421.49</b>	<b>6320.99</b>
Costs per unit ( single product ) .	0.00	0.00	0.00	0.00	0.00	0.00
Of it foreign, % .....	10.21	9.83	9.46	9.58	8.37	7.15
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	231.30	231.30	231.30	231.30	231.30	231.30





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**Net Working Capital in 1000 US \$**

Year .....		1990	1991	1992	1993-2004
Coverage .....	ndc coto				
<b>Current assets &amp;</b>					
Accounts receivable . . . . .	30 12.0	180.00	325.75	526.75	526.75
Inventory and materials . . . . .	25 14.7	112.31	224.62	374.36	374.36
Energy .....	24 14.7	9.52	19.03	31.72	31.72
Spares .....	360 1.0	22.20	44.40	74.00	74.00
Work in progress . . . . .	7 51.4	40.53	74.54	121.44	121.44
Finished products . . . . .	30 12.0	180.00	325.75	526.75	526.75
Cash in hand .....	15 24.0	15.55	13.98	15.21	15.21
<b>Total current assets .....</b>		<b>560.11</b>	<b>1028.06</b>	<b>1670.23</b>	<b>1670.23</b>
<b>Current liabilities and</b>					
Accounts payable .....	28 12.9	157.95	297.62	484.06	484.06
<b>Net working capital .....</b>		<b>402.16</b>	<b>730.44</b>	<b>1186.16</b>	<b>1186.16</b>
<b>Increase in working capital .....</b>		<b>402.16</b>	<b>328.29</b>	<b>455.72</b>	<b>0.00</b>
<b>Net working capital, local .....</b>		<b>331.25</b>	<b>615.63</b>	<b>994.81</b>	<b>994.81</b>
<b>Net working capital, foreign .....</b>		<b>70.91</b>	<b>114.81</b>	<b>191.35</b>	<b>191.35</b>

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US \$

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	2825.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	2210.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	2210.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	110.50
Total funds .....	5035.00	0.00	110.50



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Source of Finance, production in 1000 US \$

Year .....	1990	1991	1992	1993-97
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-276.25	-276.25	-276.25	-276.25
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-276.25	-276.25	-276.25	-276.25
Current liabilities	157.95	139.67	186.45	0.00
Bank overdraft ....	331.15	-247.04	-305.11	0.00
Total funds .....	212.85	-383.62	-394.92	-276.25

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow ..	5035.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	5035.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow ..	285.00	915.00	1455.00	1740.00	750.50	110.50
Total assets .....	285.00	915.00	1455.00	1740.00	640.00	0.00
Operating costs ...	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance ...	0.00	0.00	0.00	0.00	110.50	110.50
Repayment .....	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax ...	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	4750.00	-915.00	-1455.00	-1740.00	-750.50	-110.50
Cumulated cash balance	4750.00	3835.00	2380.00	640.00	-110.50	-221.00
Inflow, local .....	2825.00	0.00	0.00	0.00	0.00	0.00
Outflow, local .....	155.00	525.00	675.00	700.00	380.00	0.00
Surplus ( deficit ) .	2670.00	-525.00	-675.00	-700.00	-380.00	0.00
Inflow, foreign ...	2210.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign ...	130.00	390.00	780.00	1040.00	370.50	110.50
Surplus ( deficit ) .	2080.00	-390.00	-780.00	-1040.00	-370.50	-110.50
Net cashflow .....	-285.00	-915.00	-1455.00	-1740.00	-640.00	0.00
Cumulated net cashflow	-285.00	-1200.00	-2655.00	-4395.00	-5035.00	-5035.00



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Cashflow tables, production in 1000 US \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	2887.95	5599.67	9286.45	9100.00	9100.00	9100.00
Financial resources .	157.95	139.67	186.45	0.00	0.00	0.00
Sales, net of tax . .	2730.00	5460.00	9100.00	9100.00	9100.00	9100.00
Total cash outflow . .	3219.10	5352.63	8546.53	7898.05	7884.24	7883.92
Total assets . . . . .	560.11	467.95	642.17	0.00	0.00	0.00
Operating costs . . . .	2160.01	3908.99	6320.99	6320.99	6320.99	6320.99
Cost of finance . . . .	221.00	193.38	165.75	138.13	110.50	82.88
Repayment . . . . .	276.25	276.25	276.25	276.25	276.25	276.25
Corporate tax . . . . .	1.74	506.06	1141.37	1162.68	1176.50	1203.81
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	-331.15	247.04	739.92	1201.95	1215.76	1216.08
Cumulated cash balance	-552.15	-305.11	434.81	1636.76	2852.52	4068.60
Inflow, local . . . . .	2707.41	5239.46	8685.95	8500.00	8500.00	8500.00
Outflow, local . . . . .	2454.91	4567.91	7575.84	7032.03	7045.85	7073.16
Surplus ( deficit ) . .	252.49	671.55	1110.10	1467.97	1454.15	1426.84
Inflow, foreign . . . .	180.54	360.21	600.50	600.00	600.00	600.00
Outflow, foreign . . . .	764.19	784.72	970.68	866.02	838.39	810.77
Surplus ( deficit ) . .	-583.65	-424.51	-370.18	-266.02	-238.39	-210.77
Net cashflow . . . . .	166.10	716.67	1181.92	1616.33	1602.51	1575.20
Cumulated net cashflow	-4868.90	-4152.24	-2970.32	-1353.99	248.52	1823.72



Cashflow tables, production in 1000 US \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	9100.00	9100.00	9100.00	9100.00	9100.00	9100.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	9100.00	9100.00	9100.00	9100.00	9100.00	9100.00
Total cash outflow . .	7870.11	7856.30	7566.24	7566.24	7608.61	7608.61
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	6320.99	6320.99	6320.99	6320.99	6320.99	6320.99
Cost of finance . . .	55.25	27.63	0.00	0.00	0.00	0.00
Repayment . . . . .	276.25	276.25	0.00	0.00	0.00	0.00
Corporate tax . . . .	1217.62	1231.43	1245.25	1245.25	1287.62	1287.62
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1229.89	1243.70	1533.76	1533.76	1491.39	1491.39
Cumulated cash balance	5298.49	6542.19	8075.95	9609.72	11101.10	12592.49
Inflow, local . . . . .	8500.00	8500.00	8500.00	8500.00	8500.00	8500.00
Outflow, local . . . .	7086.97	7100.78	7114.60	7114.60	7156.97	7156.97
Surplus ( deficit ) .	1413.03	1399.22	1385.40	1385.40	1343.03	1343.03
Inflow, foreign . . . .	600.00	600.00	600.00	600.00	600.00	600.00
Outflow, foreign . . .	783.14	755.52	451.64	451.64	451.64	451.64
Surplus ( deficit ) .	-183.14	-155.52	148.36	148.36	148.36	148.36
Net cashflow . . . . .	1561.39	1547.58	1533.76	1533.76	1491.39	1491.39
Cumulated net cashflow	3385.11	4932.69	6466.45	8000.21	9491.60	10982.99



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Cashflow tables, production in 1000 US \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	9100.00	9100.00	9100.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	9100.00	9100.00	9100.00
Total cash outflow . .	7608.61	7660.24	7710.50
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	6320.99	6320.99	6320.99
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	1287.62	1339.25	1389.51
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	1491.39	1439.76	1389.50
Cumulated cash balance	14083.88	15523.64	16913.14
Inflow, local . . . .	8500.00	8500.00	8500.00
Outflow, local . . . .	7156.97	7208.60	7258.86
Surplus ( deficit ) .	1343.03	1291.40	1241.14
Inflow, foreign . . .	600.00	600.00	600.00
Outflow, foreign . . .	451.64	451.64	451.64
Surplus ( deficit ) .	148.36	148.36	148.36
Net cashflow . . . . .	1491.39	1439.76	1389.50
Cumulated net cashflow	12474.38	13914.14	15302.64



**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	3463.31	at 10.00 %
Internal Rate of Return (IRRE1) ..	20.29 %	
b) Net Worth versus Net cash return:		
Net present value .....	3655.60	at 10.00 %
Internal Rate of Return (IRRE2) ..	19.22 %	
c) Internal Rate of Return on total investment:		
Net present value .....	3789.77	at 10.00 %
Internal Rate of Return ( IPR ) ..	18.71 %	

Net Worth = Equity paid plus reserves





**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	2730.00	5460.00	9100.00	9100.00	9100.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2730.00	5460.00	9100.00	9100.00	9100.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	2505.53	4254.51	6651.51	6636.51	6636.51
Operational margin . . . . .	224.47	1205.49	2448.49	2463.49	2463.49
As % of total sales . . . . .	8.22	22.08	26.91	27.07	27.07
Cost of finance . . . . .	221.00	193.38	165.75	138.13	110.50
Gross profit . . . . .	3.47	1012.12	2282.74	2325.37	2352.99
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	3.47	1012.12	2282.74	2325.37	2352.99
Tax . . . . .	1.74	506.06	1141.37	1162.68	1176.50
Net profit . . . . .	1.74	506.06	1141.37	1162.68	1176.50
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1.74	506.06	1141.37	1162.68	1176.50
Accumulated undistributed profit . . . . .	1.74	507.79	1649.16	2811.85	3988.34
Gross profit, % of total sales . . . . .	0.13	18.54	25.09	25.55	25.86
Net profit, % of total sales . . . . .	0.06	9.27	12.54	12.78	12.93
ROE, Net profit, % of equity . . . . .	0.06	17.91	40.40	41.16	41.65
ROI, Net profit+interest, % of invest. . . . .	4.10	12.13	21.01	20.91	20.69



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	9100.00	9100.00	9100.00	9100.00	9100.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	9100.00	9100.00	9100.00	9100.00	9100.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	6609.51	6609.51	6609.51	6609.51	6609.51
Operational margin . . . . .	2490.49	2490.49	2490.49	2490.49	2490.49
As % of total sales . . . . .	27.37	27.37	27.37	27.37	27.37
Cost of finance . . . . .	82.88	55.25	27.63	0.00	0.00
Gross profit . . . . .	2407.62	2435.24	2462.87	2490.49	2490.49
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	2407.62	2435.24	2462.87	2490.49	2490.49
Tax . . . . .	1203.81	1217.62	1231.43	1245.25	1245.25
Net profit . . . . .	1203.81	1217.62	1231.43	1245.25	1245.25
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1203.81	1217.62	1231.43	1245.25	1245.25
Accumulated undistributed profit . . . . .	5192.15	6409.77	7641.21	8886.45	10131.70
Gross profit, % of total sales . . . . .	26.46	26.76	27.06	27.37	27.37
Net profit, % of total sales . . . . .	13.23	13.38	13.53	13.68	13.68
ROE, Net profit, % of equity . . . . .	42.61	43.10	43.59	44.08	44.08
ROI, Net profit+interest, % of invest. . . . .	20.68	20.46	20.24	20.02	20.02



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	9100.00	9100.00	9100.00	9100.00	9100.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	9100.00	9100.00	9100.00	9100.00	9100.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	6524.76	6524.76	6524.76	6421.49	6320.99
Operational margin . . . . .	2575.24	2575.24	2575.24	2678.51	2779.01
As % of total sales . . . . .	28.30	28.30	28.30	29.43	30.54
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	2575.24	2575.24	2575.24	2678.51	2779.01
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2575.24	2575.24	2575.24	2678.51	2779.01
Tax . . . . .	1287.62	1287.62	1287.62	1339.25	1389.51
Net profit . . . . .	1287.62	1287.62	1287.62	1339.25	1389.51
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1287.62	1287.62	1287.62	1339.25	1389.51
Accumulated undistributed profit . . . . .	11419.32	12706.94	13994.56	15333.82	16723.32
Gross profit, % of total sales . . . . .	28.30	28.30	28.30	29.43	30.54
Net profit, % of total sales . . . . .	14.15	14.15	14.15	14.72	15.27
ROE, Net profit, % of equity . . . . .	45.58	45.58	45.58	47.41	49.19
ROI, Net profit+interest, % of invest. . . . .	20.70	20.70	20.70	21.53	22.34



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Total assets .....</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5145.50</b>	<b>5256.00</b>
Fixed assets, net of depreciation	0.00	285.00	1200.00	2655.00	4395.00	5145.50
Construction in progress .....	285.00	915.00	1465.00	1740.00	750.50	110.50
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	4750.00	3835.00	2380.00	640.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5035.00</b>	<b>5145.50</b>	<b>5256.00</b>
Equity capital .....	2825.00	2825.00	2825.00	2825.00	2825.00	2825.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	2210.00	2210.00	2210.00	2210.00	2210.00	2210.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	110.50	221.00
<b>Total debt .....</b>	<b>2210.00</b>	<b>2210.00</b>	<b>2210.00</b>	<b>2210.00</b>	<b>2320.50</b>	<b>2431.00</b>
<b>Equity, % of liabilities .....</b>	<b>56.11</b>	<b>56.11</b>	<b>56.11</b>	<b>56.11</b>	<b>54.90</b>	<b>53.75</b>



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>5470.59</b>	<b>5593.02</b>	<b>6339.48</b>	<b>7225.91</b>	<b>8126.16</b>	<b>9053.71</b>
Fixed assets, net of depreciation	4910.48	4564.96	4234.44	3918.92	3603.40	3314.89
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Current assets .....</b>	<b>544.56</b>	<b>1014.08</b>	<b>1655.02</b>	<b>1655.02</b>	<b>1655.02</b>	<b>1655.02</b>
Cash, bank .....	15.55	13.98	15.21	15.21	15.21	15.21
Cash surplus, finance available .	0.00	0.00	434.81	1636.76	2852.53	4068.60
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>5470.59</b>	<b>5593.02</b>	<b>6339.48</b>	<b>7225.91</b>	<b>8126.16</b>	<b>9053.71</b>
Equity capital .....	2825.00	2825.00	2825.00	2825.00	2825.00	2825.00
Reserves, retained profit .....	0.00	1.74	507.79	1649.16	2811.85	3988.34
Profit .....	1.74	506.06	1141.37	1162.68	1176.50	1203.81
Long and medium term debt .....	1933.75	1657.50	1381.25	1105.00	828.75	552.50
Current liabilities .....	157.95	297.62	484.06	484.06	484.06	484.06
Bank overdraft, finance required.	552.15	305.11	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>2643.85</b>	<b>2260.23</b>	<b>1865.31</b>	<b>1589.06</b>	<b>1312.81</b>	<b>1036.56</b>
<b>Equity, % of liabilities .....</b>	<b>51.64</b>	<b>50.51</b>	<b>44.56</b>	<b>39.10</b>	<b>34.76</b>	<b>31.20</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	9995.08	10950.27	12195.51	13440.76	14728.38	16016.00
Fixed assets, net of depreciation	3028.37	2737.85	2449.33	2160.81	1957.04	1753.27
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1655.02	1655.02	1655.02	1655.02	1655.02	1655.02
Cash, bank .....	15.21	15.21	15.21	15.21	15.21	15.21
Cash surplus, finance available .	5298.49	6542.19	8075.96	9609.72	11101.11	12592.50
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	9995.08	10950.27	12195.51	13440.76	14728.38	16016.00
Equity capital .....	2825.00	2825.00	2825.00	2825.00	2825.00	2825.00
Reserves, retained profit .....	5192.15	6409.77	7641.21	8886.45	10131.70	11419.32
Profit .....	1217.62	1231.43	1245.25	1245.25	1287.62	1287.62
Long and medium term debt .....	276.25	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	484.06	484.06	484.06	484.06	484.06	484.06
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt .....	760.31	484.06	484.06	484.06	484.06	484.06
Equity, % of liabilities .....	28.26	25.80	23.16	21.02	19.18	17.64



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>17303.62</b>	<b>18642.88</b>	<b>20032.38</b>
Fixed assets, net of depreciation	1549.50	1449.00	1449.00
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1655.02	1655.02	1655.02
Cash, bank .....	15.21	15.21	15.21
Cash surplus, finance available .	14083.89	15523.65	16913.16
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>17303.62</b>	<b>18642.88</b>	<b>20032.38</b>
Equity capital .....	2825.00	2825.00	2825.00
Reserves, retained profit .....	12706.94	13794.56	15333.82
Profit .....	1287.62	1339.25	1389.51
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	484.06	484.06	484.06
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>484.06</b>	<b>484.06</b>	<b>484.06</b>
<b>Equity, % of liabilities .....</b>	<b>16.33</b>	<b>15.15</b>	<b>14.10</b>

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>9100</u>
2) VARIABLE COSTS:	<u>6111.63</u>
. RAW MATERIALS	4333.09
. UTILITIES	1155.95
. ENERGY	466.94
. LABOUR	155.65
3) FIXED COSTS	<u>705.63</u>
. REPAIR-MAINTENANCE	59.71
. SPARES	74
. ADMINISTRATION	75.65
. DEPRECIATION	330.52
. FINANCIAL COSTS	165.75
4) TOTAL PRODUCTION COSTS	<u>6817.26</u>

$$\text{BEP} = \frac{705.63}{9100 - 6111.63} \times 100 = 23.6\%$$

**Bone based chemicals**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALDO & CIA. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	10651.25	2210.00	8341.25	2210.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	2211.25	2210.00	1.25	2210.00	0.00	0.00	0.00
exports . . . . .	8340.00	0.00	8340.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	11883.54	2821.00	9062.54	130.00	390.00	780.00	1040.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	2119.00	2600.00	-481.00	130.00	390.00	780.00	1040.00
imported materials . . .	6337.79	0.00	6337.79	0.00	0.00	0.00	0.00
repayment loans & overd.	2211.25	0.00	2211.25	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	1215.56	221.00	994.50	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1332.29	-611.00	-721.29	2080.00	-390.00	-780.00	-1040.00
import substit'n effect	9635.50	0.00	9635.50	0.00	0.00	0.00	0.00
net foreign exchange effect	95203.20	-611.00	95814.20	2080.00	-390.00	-780.00	-1040.00
present values at	10.00 %						
foreign exchange flow .	-1363.01						
net foreign exchange effect	36743.43						



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BRL00 & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		1992	1993	production		
	1988.1	1989.2			1994	1995	1996
total foreign inflow ..	0.00	0.00	180.54	360.21	600.50	600.00	600.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.54	0.21	0.50	0.00	0.00
exports . . . . .	0.00	0.00	180.00	360.00	600.00	600.00	600.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	370.50	110.50	784.19	784.72	970.68	866.02	838.39
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	260.00	0.00	71.45	44.12	77.04	0.00	0.00
imported materials . . .	0.00	0.00	195.49	270.98	451.64	451.64	451.64
repayment loans & overd.	0.00	0.00	276.25	276.25	276.25	276.25	276.25
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	110.50	110.50	221.00	193.38	165.75	138.13	110.50
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-370.50	-110.50	-583.65	-424.51	-370.18	-266.02	-238.39
import substit'n effect	0.00	0.00	2083.50	4167.00	6945.00	6945.00	6945.00
net foreign exchange effect	-370.50	-110.50	1499.85	3742.49	6574.82	6678.98	6706.61
present values at 10.00 %							
foreign exchange flow .	-1363.01						
net foreign exchange effect	36743.43						



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALLO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	600.00	600.00	600.00	600.00	600.00	600.00	600.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	600.00	600.00	600.00	600.00	600.00	600.00	600.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	810.77	783.14	755.52	451.64	451.64	451.64	451.64
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	451.64	451.64	451.64	451.64	451.64	451.64	451.64
repayment loans & overd.	276.25	276.25	276.25	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	82.88	55.25	27.63	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-210.77	-183.14	-155.52	148.36	148.36	148.36	148.36
import substit'n effect	695.00	695.00	695.00	695.00	695.00	695.00	695.00
net foreign exchange effect	674.23	671.86	6789.48	7093.36	7093.36	7093.36	7093.36
present values at 10.00 %							
foreign exchange flow .	-1363.01						
net foreign exchange effect	36743.43						



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21 UNIOO

COMFAR 2.1 - BALOO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

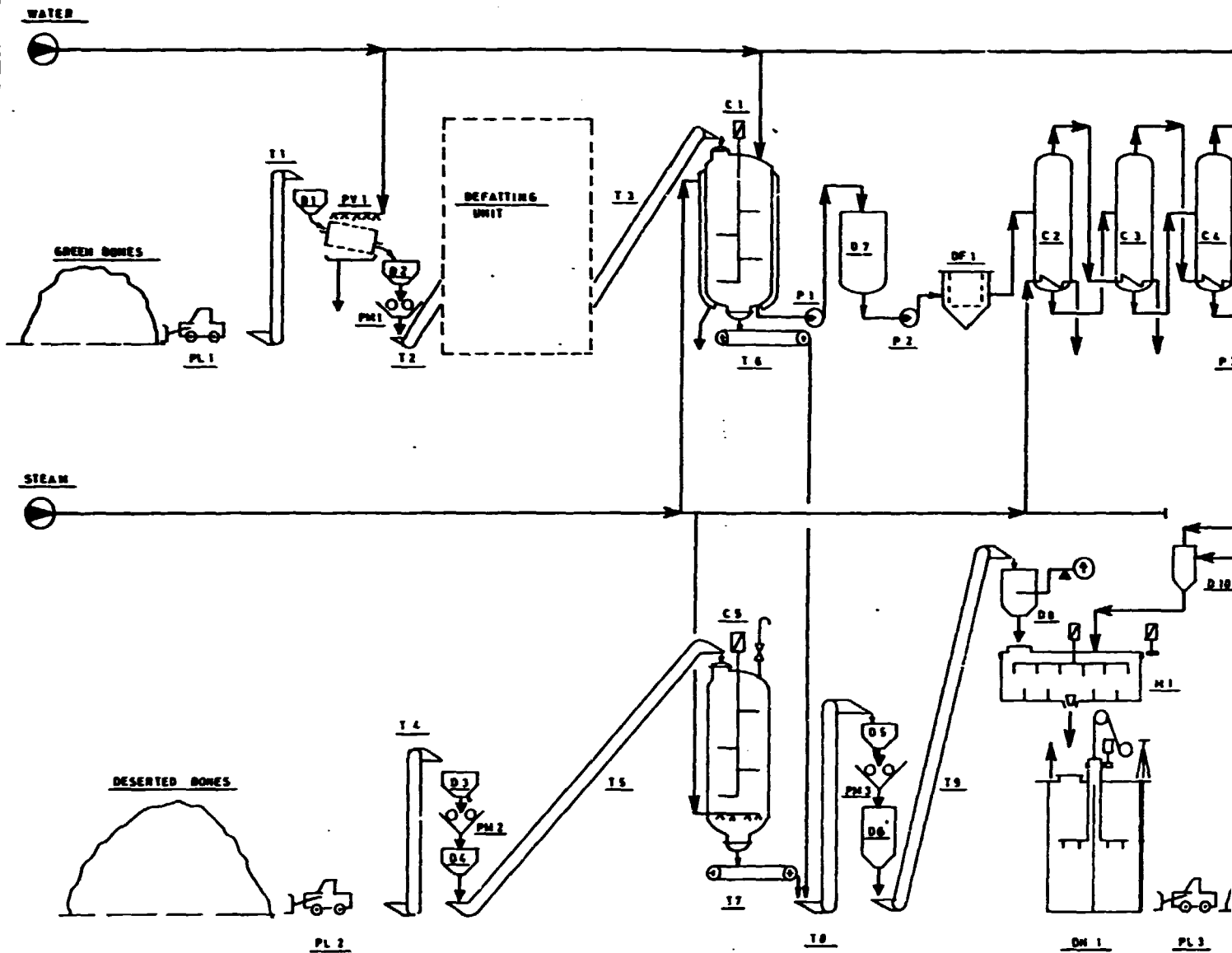
	2004	production 2005	2006	2007
total foreign inflow ..	600.00	600.00	600.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	600.00	600.00	600.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	451.64	451.64	451.64	-672.35
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-673.61
imported materials . . .	451.64	451.64	451.64	0.00
repayment loans & overd.	0.00	0.00	0.00	1.25
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	148.36	148.36	148.36	672.35
import substit'n effect	6945.00	6945.00	6945.00	0.00
net foreign exchange effect	7093.36	7093.36	7093.36	672.35
present values at 10.00 %				
foreign exchange flow .	-1363.01			
net foreign exchange effect	36743.43			

**Bone based chemicals**

**ANNEXE 4**

DRW. B162 - 13 - 1  
PROCESS SCHEME

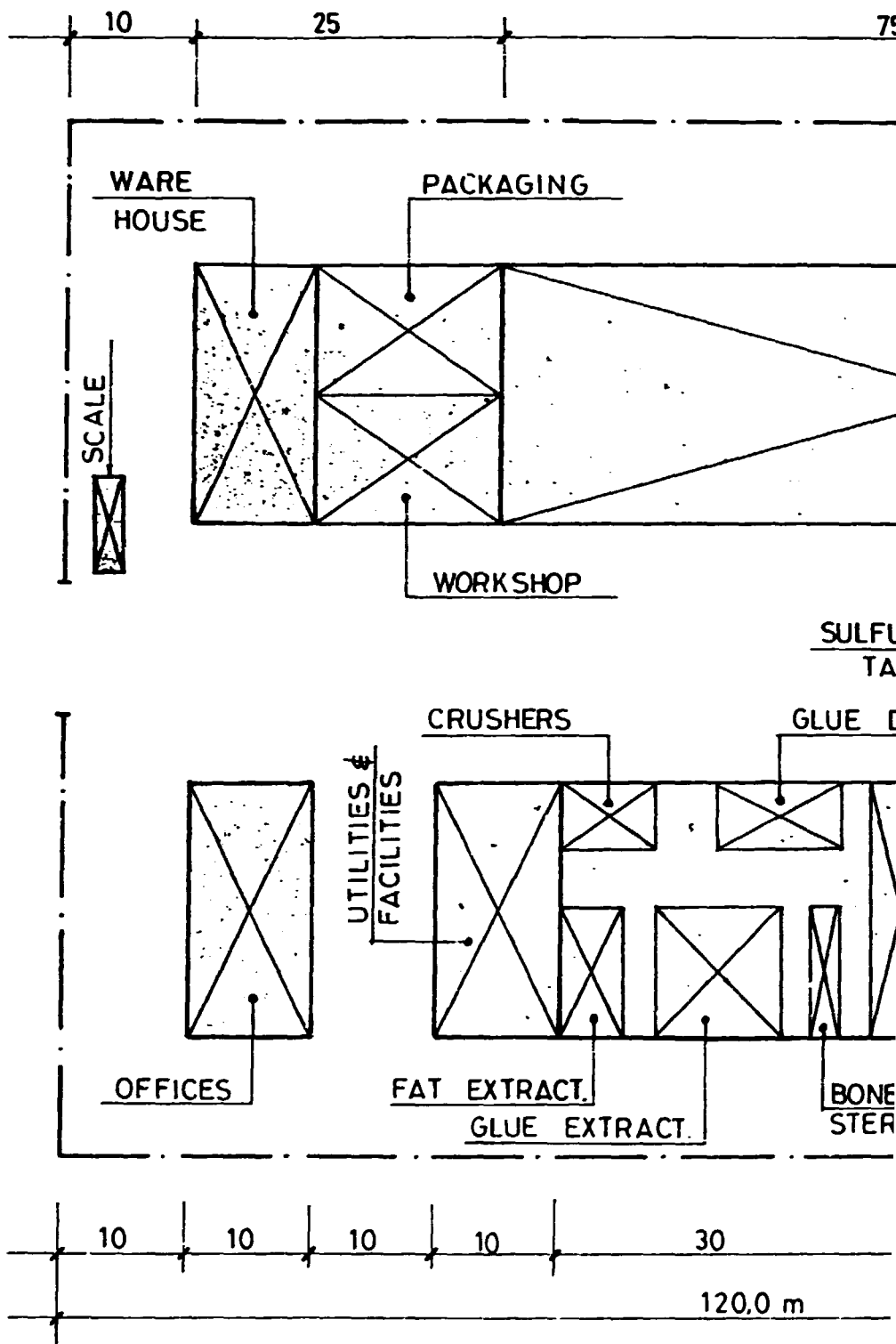
DRW. B162 - 13 - 2  
LAY OUT



SECTION 1







SECTION 1

75

10

NSP STORAGE

10

20

20

80,0 m

20

10

SULFURIC ACID TANK

GREEN BONES

GLUE DRYING

DENS

DESERTED BONES

BONE STERILIZING

ACT.

30

5

35

10

120,0 m

# SECTION .2

CLIENTE  
CUSTOMER

COMMESSA N°  
JOB N° B-162

BONE BASED CHEMICALS  
LAY-OUT

CONTROLLATO  
APPROVED

DATA  
DATE

DISEGNATO  
DRAWN *A. Lino*

DATA  
DATE *Feb. 88*

SCALA  
SCALE *//*

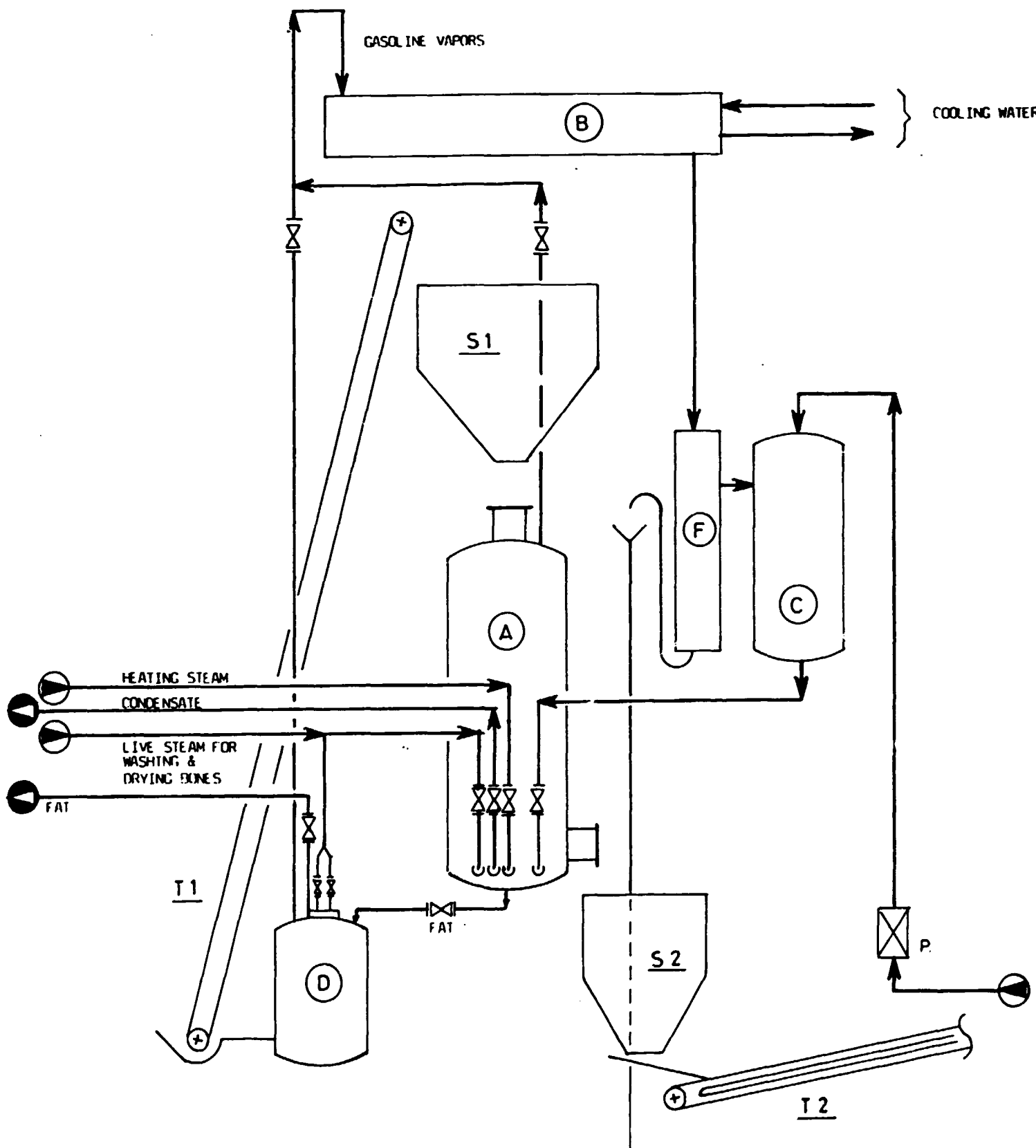
DIS. N°  
DWG N°

B.162-13-2

**baldo & c.**  
CONSULTING ENGINEERS

Via Stillicone 39, 20154 MILANO  
Ph. N. 3102 Tlx N. 330229

REV.



**SECTION 1**



U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF SULPHONATION CHEMICALS  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION FOR THE AUTONOMOUS FACTORY**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 4 - FINANCIAL AND FOREIGN EXCHANGE EVALUATIONS FOR THE  
INTEGRATED FACTORY**

**ANNEXE 5 - DRW. B162-17-1 - PROCESS FLOW DIAGRAM  
DRW. B162-17-2 - EQUIPMENT LAYOUT**



0. SUMMARY AND CONCLUSIONS

The sulphonation process is used in several different fields. In particular the sulphonation of aromatic compounds has a relevant position because their sulphonated derivatives include detergents, tanning agents, intermediates for preparing dyes, pharmaceuticals, auxiliary products for textile and leather industry, etc:

In the proposed plant the sulphonation of linear dodecylbenzene (DDB) will mainly be carried out to produce linear dodecylbenzene sulphonic acid (DDBSA) because this product is presently imported in large quantities as basic raw material for the production of detergents.

Once this plant is successfully in operation and personnel are adequately trained, other sections can be added to process other products, such as castor oil, etc, according to market (domestic and export) requirements.

The plant, as proposed in the study, will produce 2,000 tons/year DDBSA to be used domestically and also exported as this unit is the only one in the Region and DDBSA produced in Europe is imported by other countries in the area. The financial analysis has been developed in two alternatives, as an autonomous factory or as an expansion of an existent detergent factory. For the first alternative the fixed investment has been evaluated at 1,185,000 \$ (820,000 \$ being the foreign exchange portion), the personnel requirement is 56 and the Internal Rate of Return on total investment is 13.36. In the second alternative the total investment is 950,000 \$ and the personnel requirement 33 units; the

Internal Rate of Return results 16.61%. Since the Foreign exchange effect evaluation is also favourable, the preparation of a detailed feasibility study is recommended.

1. INTRODUCTION

The term "sulphonation" designates any procedure by which the sulfonic acid group  $-SO_2 OH$  is attached to an atom of carbon.

The introduction of a  $-SO_2 OH$  group into an organic compound can be carried out in different ways: in the past oleum or liquid  $SO_3$  had been utilized but nowadays the most widely used procedure by far the cheapest and the simplest involves the utilization of direct  $SO_3$  gas. This method is known as "direct sulphonation".

In the modern processes dried air is conveyed to a sulfur combustion furnace where it meets the liquid sulfur in counterflow and converts it into  $SO_2$  by burning. The  $SO_2$  enters in a catalysis tower for the conversion into  $SO_3$ .

The following reaction between  $SO_3$  and the compound to be sulfonated is instantaneous, complete and strongly exothermic.

A typical analysis of a normal dodecylbenzensulfonic acid is:

Physical state = viscous liquid  
Colour = brownish  
Active matter = 95-96%  
Non sulfonated matter = 2-2.5%  
Free sulfuric acid = 2%

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The sulphonation process is used in many different fields.

From the industrial point of view the sulphonation of the aromatic compounds is relevant because their sulfonated derivatives include detergents, tanning agents, ion-exchange resins, intermediates for preparing dyes, pharmaceuticals, phenolic compounds, auxiliary products for textile and leather industries, emulsifiers for polymerisation, etc.

Among the sulfonated aromatic compounds the class of sulfonated hydrocarbons is the outstanding category and the direct sulphonation is by far the most useful procedure for manufacturing these compounds.

In this study the sulphonation of the linear dodecylbenzene (DDB) will mainly be taken into consideration to obtain linear dodecylbenzene sulfonic acid (DDBSA); this is due, apart from the industrial importance of the latter product, to the lower investment costs required for its production.

As will be explained below, DDBSA is, in fact, the only sulfonated product that is stable in acid form; so the production plant does not require a neutralization section, necessary for the sulphonation of other products.

DDB is easily sulfonated to yield detergents of good colour, odour, performances and biodegradability, either for the manufacture of products for the house-keeping or for the industrial applications.

As stated above the sulphonation process for

manufacturing detergents is also applicable, with the same equipment, to other raw materials such as natural or synthetic lauryl alcohol, 3-oxy-ethylated lauryl ethers, 2-oxy-ethylated lauryl ethers, natural synthetic C16-C18 alcohols, C12-C16 alpha olefins, etc. But while DDBSA is a stable product, the sulfonic acids of the other products are unstable and must be immediately neutralized; as a consequence, as stated above, the plant must be completed by a neutralization section. Castor oil could also be processed in the same unit, but it is suggested that a separate sulphonation section be used, working in parallel with the other and having the SO3 generator in common with it; this is due to the sticking character of some of the castor oil derivatives (with the consequent risk of pollution of the other products that may be processed in the same equipment) and to the very low consumption of SO3 required for the sulphonation of the castor oil.

## 2.2 Forecast demand and plant capacity

Consumption of DDBSA (Dodecyl Benzene Sulphonated Acid) is related to production of detergents. The following table presents the information made available by NCC on production of detergents and DDBSA consumption for the last few years in the three existing factories (Reppi, Asmara, Red Sea).

Table: Production of detergents and consumption of DDBSA in Ethiopia

YEAR (G.C.)	APPARENT CONSUMPTION OF ALL SOAPS (tonnes) (a)	DETERGENTS (tonnes) b	$\frac{b \times 100}{a}$ (c)	DDBSA tonnes (d)	UNIT PRICE (1) OF DDBSA birr/kg (e)	$\frac{d \times 100}{b}$ (f)
1978/79	18598	2013	10.8	134	1.8	7
1979/80	20771	1971	9.5	345	2.5	18
1980/81	22045	2129	10.6	180	2.2	8
1981/82	27438	2505	9.1	716	3.0	29
1982/83	29771	2551	8.6	701	3.3	27
1983/84	19572	2782	14.2	762	2.6	27
1984/85		2276		636	2.6	28
1985/86		1853		617	3.2	33
Three-year plan					2.9	
1986/87				820	2.6	
1987/88				913	2.9	
1988/89				968		

(1) CIF Assab plus 40% custom duties

Source: N.C.C. For apparent consumption: Customs and Excise Tax Administration and CSO Survey of Manufacturing Industry

Comparisons of apparent consumption of all types of soap and production (taken to be equal to consumption) of detergents shows a slight increase in the relative importance of the latter, from a little over 20 percent on average for the two years 1978/79 - 1979/80 to almost 23 percent in 1982/83-1983/84. In the following two years considered together, however, a fall in detergent production of about 23 per cent is recorded against the average of the two previous years, while DDBSA consumption is stated as having been only 14 percent lower. The apparent percentage content of DDBSA in the detergents appears therefore to have risen. No explanation for this fact is known.

Following the pattern of other countries all over the world, it can be expected that also in Ethiopia the use of detergents will grow in the near future, and that DDBSA requirements will follow. This seems to be already reflected in NCC projections for the current three-year plan. For the present year consumption of DDBSA is expected to jump by 33 per cent to 820 tonnes. For the next two years, growth rates are projected as 11 per cent and 6 per cent approximately.

If further maintained, a 6 per cent rate of growth would double demand in 12 years: by the end of the century, requirements would be close to 2,000 tonnes and not far from 1400 tonnes in 1994/95.

This quantity justifies local processing of imported raw material.

Consequently, with regard to plant size, a capacity of 2000 t/y (on three shifts) has been selected; this capacity also corresponds to the minimum economic size suggested for this type of plant.

2.3 Sale prices and total revenues

At present, as already stated, the DDBSA is wholly imported into Ethiopia. The average price paid in the last five years by the factories under the control of the National Chemical Corp. has been 2941 birr/t, (1421 \$/t delivered at plant).

The plant has a capacity of 2,000 tons/year and it is assumed that it can supply both the domestic and foreign markets, taking into consideration that it would be the only plant in the region, at least until the domestic market requirements reach 100% of the capacity of the proposed unit.

The domestic selling price may be the same as the imported DDBS, i.e. 1.420 \$/ton while the export price should be lower of approx. 30% (1,130\$) to take into account additional inland transportation, international competition etc. The average selling price can be assumed as 1,300 \$/ton ex works.

Total revenues are therefore as follows:

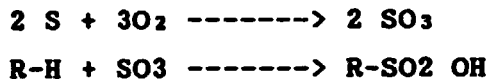
1st year: production 1,000 tons x 1,300 \$ = 1,300,000 \$  
2nd year: production 1,500 tons x 1,300 \$ = 1,950,000 \$  
3rd year: production 2,000 tons x 1,300 \$ = 2,600,000 \$



### 3. MATERIALS AND INPUTS

#### 3.1 Chemistry

The hydrocarbon sulphonation process takes place according to the following simplified equation:



where R-H means linear dodecylbenzene.

It follows that the main raw materials are sulphur and linear dodecylbenzene. These products are presently not available in Ethiopia and therefore must be imported; both of them, however, are readily available on the international market at low prices. (1)

#### 3.2 Material and utility requirements and costs

The complete list of raw material and utilities (amounts and costs) to be supplied annually to the plant at full capacity (2000 t/y) is as follows: (2)

- (1) Sulphur also has to be imported to feed the planned sulphuric acid plant in the final planning stage with NCC. The NCC centralized purchasing department can therefore buy sulphur for both plants with consequent relevant savings.
- (2) Costs of linear DDB and sulphur have been estimated on the basis of the current prices in Europe.

a) Raw materials

- Linear DDB

(in drums): 1536t x 2320 birr/t = 3.564 Mbirr/y

- Sulphur (in bags): 216t x 340 birr/t = 0.073 Mbirr/y

- Caustic soda 100%: 18t x 818 birr/t = 0.015 Mbirr/y  
(for scrubbing) -----

TOTAL = 3,652 Mbirr/y

b) Utilities

MBirr/y

- Electric power: 328,000 kWh/y x 0.2 birr/kWh = 0.066

- Steam : 428 t/y x 35.7 birr/t = 0.015

- Cooling water

(25°C temp.

range) : 90,000 m3/yx 0.029 birr/m3 = 0.003  
-----

Total = 0.084

For the financial evaluation these costs are grouped as follows:

- raw material (FC)	3.637 Mbirr/y = 1.757 M\$/y
- raw material (LC)	0.015 Mbirr/y = 0.00725 M\$/y
- energy (fuel-FC)	0.015 Mbirr/y = 0.00725 M\$/y
- energy (electricity-LC)	0.066 Mbirr/y = 0.03186 M\$/y
- utilities (LC)	0.003 Mbirr/y = 0.00145 M\$/y
	-----
	3.736                      1,80481

3.3 Raw materials purchasing programme and storage volumes

The main raw materials, sulphur and linear DDB, are imported items; as a consequence a storage volume equivalent to the consumption at full capacity for 6 months, seems advisable.

For caustic soda, a 30 days storage volume seems to be sufficient.

As a result, the following amounts of raw materials must be considered as a minimum storage:

- linear DDB		
768t equivalent to	860,753	\$
- sulfur		
108t equivalent to	17,739	\$
- caustic soda		
6t equivalent to	790	\$
	-----	
Total	879,282	\$

4. LOCATION

The plant could be located in Nazareth where detergent plants operated by NCC already exist. This would decrease transportation costs. Other synergisms between detergent plants and sulphonation unit suggesting this location are highlighted in paragraph 5.1.4.

5. PROJECT ENGINEERING

5.1 Process Description

Between the two available processes, continuous or batch process, the continuous technology has been selected as the more flexible, that is the more suitable to treat various raw materials, if required.

The process can be divided into the following steps:

Air drying

SO<sub>2</sub> - SO<sub>3</sub> production

Film sulphonation

Gas-scrubbing

Please refer to the attached flow diagramme B162-17-2

5.1.1 Air Drying

The air required for sulfur combustion and the production of SO<sub>3</sub> is filtered and dehumidified to a dew point below -60°C.

The air, which is filtered to eliminate dust, flows to the process air compressor, which conveys it to the cooling unit where it is cooled to + 3°C.

The process air compressor operates at a very low pressure (0.6 Atm approx.).

This low pressure, however, is sufficient for conveying the air both through the SO<sub>3</sub> production unit and the sulphonation unit.

The process air-cooling unit consists of a refrigerating group and heat exchangers carrying circulating ethylene glycole at a temperature below 0°C

This unit is designed to provide constant condensation of the humidity in the process air, regardless of the

existing climatic conditions. At this stage the air is cooled and partially dehydrated.

The air goes from the cooling unit to the final silicagel dehumidifier, which consists of an absorption drying unit and a regenerating drying unit connected in parallel.

The switching-over from the absorption phase to the regeneration phase is controlled manually (although it can be carried out automatically), according to a prefixed programme. Part of the heat generated by the sulfur combustion and by the conversion from  $\text{SO}_2$  to  $\text{SO}_3$  is utilized for regeneration.

#### 5.1.2 $\text{SO}_2$ / $\text{SO}_3$ Production

The dried air is conveyed to the sulfur combustion furnace where it meets the liquid sulfur, in counterflow, and converts it into  $\text{SO}_2$  by burning.

The unit for melting and burning the sulfur has a melter, which is completed by a set of filters for the molten sulfur, and special proportioning pumps.

The proportioning of the sulfur is carried out at a controlled temperature, so as to maintain the viscosity at optimum and constant values.

The combustion of the sulfur takes place in a special, refractory-lined, vertical furnace. The sulfur is uniformly distributed over a bundle of refractory balls (after start-up ignition with pilot lighter) and the combustion air counterflows over it. The diluted sulfur dioxide leaves the sulfur combustion furnace at a temperature of about  $650^\circ\text{C}$ ; it is then cooled to about  $430^\circ\text{C}$  by means of an  $\text{SO}_2$  cooler.

This cooler is operated as a preheater during the start-up phase.

The SO<sub>2</sub> at this temperature, enters the catalysis tower for conversion into SO<sub>3</sub>. The catalysis tower contains different layers of vanadium pentoxide catalyst interspaced with air-cooled heat exchangers which carry off the conversion heat.

The SO<sub>3</sub> leaving the catalysis tower is cooled to about 50 °C by one or more SO<sub>3</sub> cooling units. The exhaust cooling air, which is at a temperature above 200°C, is recovered and used for silicagel regeneration. Catalysis tower conversion efficiency of SO<sub>2</sub> to SO<sub>3</sub> is higher than 98%. The plant can be operated within a production range from 60% to 110%.

Whenever the plant is started up, the SO<sub>2</sub> heat exchanger is used as a preheater of the process air and brings the catalyst to the correct conversion temperature in a very short time (less than two hours). (1)

No pre-heating of the sulfur burner itself is needed for the starting-up operations.

In the process line, from the air-sulfur feed to the delivery of SO<sub>3</sub> gas, there are no diversion or by-pass valves. This is a great advantage in a plant section where corrosive gas is produced at relatively high process temperatures.

- (1) Due to the necessity of pre-heating the system, it is recommended that the plant be made to work as continuously as possible; when it is necessary to reduce production to below the minimum indicated above, it would be better to let the plant work for some days a week (or for some weeks a month) instead of working one or two shifts a day.

### 5.1.3 Film sulphonation

The reactor consists of a vertical bundle of long, small-diameter tubes.

The liquid film which forms inside the tubes comes into contact with the gaseous reactant.

The length and diameter of each tube is so dimensioned in such a way as to provide the optimum product quality performance.

The most interesting feature of the reactor is the simple way in which the exact reactant ratio is maintained in all the tubes.

The automatic adjustment of the reactants in each of the tubes is a result of the geometric design of the reactor itself and is completely independent of the actual number of tubes.

It is a simple matter, therefore, to scale-up the reactor to meet any production capacity requirement. All that is required is an increase in the number of reaction tubes.

The attached flow-sheet illustrates the principle of the reactor. The SO<sub>2</sub> gas enters at the top of the reactor and then flows, without restriction, into each of the parallel mounted reactor tubes. The fed liquid is uniformly distributed, by means of a simple concentric slot, over the inner wall surfaces of each tube.

The concentric slot permits the same amount of liquid to be fed to each tube. A difference of about  $\pm 20\%$  between tubes is allowable, and the correct amount of gas is automatically fed to each tube, due to the aforementioned geometric design of the reactor.

The special feature of the reactor is that the required molar ratio between the reactants in each tube is self-adjusting and, in addition, is close to the preset



ratio of the total liquid to the total gas flow rates in each of the tubes.

The total gaseous reactant is fed to the reactor at the appropriate rate and concentration. The total liquid reactant is pumped to the reactor by means of the proportioning pump.

The flow of gas and liquid inside the reactor is parallel, with the liquid phase forming the film on the inner surface of each tube and the gas flowing through the tubes at very high speed. The outside of the tubes (the shell side) is cooled with water to control the correct reaction temperature.

The reaction takes place at a very high rate, with about 70 to 80% of conversion occurring in the first third of the reactor. Each individual tube, fed at a particular average rate of liquid flow which is different from the next, has a correspondingly different film-thickness and viscosity profile. This contributes to the self-adjustment of the gas-to-liquid mole ratios to the optimum average values, since the flow of gas in each tube is then directly proportional to the flow of liquid itself.

The sulfonated liquid and exhaust gas leaving the reactor enter the separator vessel. The separated exhaust gas is sent to the cleaning and scrubbing section and then released to the atmosphere.

The liquid remaining in the separation vessel is sent, by way of the transfer pump, to the neutralization section or, if the plant is next to the detergents plant, to the spray drying and dry neutralization of powdered detergents.

Should the flow of liquid to the reactor be interrupted, for any reason, an independently-powered stand-by

emergency system takes over and purges the reactor with fresh raw material. In this way, charring of sections of the reactor, due to stagnant liquid in the presence of  $SO_3$ , is avoided.

#### 5.1.4 Gas Scrubbing

The stream of exhaust gas leaving sulphonation is treated to eliminate any traces of nonconverted  $SO_2$ ,  $SO_3$  and organic matter before being discharged to the atmosphere. Traces of any organic matter or  $SO_3$ , in a finely-divided state, are separated out and eliminated by means of an electrostatic precipitator.

The electrostatic precipitator contains electrodes which produce a difference of electrical potential between the electrodes and the exhaust-gas discharge pipes. The impurities in the exhaust gas are consequently given an electrically charged as they pass through.

The charge of the particles of impurities, which are opposite in sign to that on the pipes, causes the impurities to be attracted to the walls of the pipes. After striking the walls of the pipes, the impurities fall to the bottom of the precipitator unit.

The gaseous stream containing non-converted  $SO_2$ , is then absorbed in a special scrubbing column in which a solution of water and soda is continually recycled.

The residual unabsorbed  $SO_2$  in this column amounts to less than 5 ppm, and the discharge gas is saturated with water before being expelled to the atmosphere. The liquid solution is continually discharged from the column.

The re-use of this liquid effluent has become important today, both for economical and ecological reasons.

It is usually recovered and used as dilution water in the neutralization of slurry-preparation units in synthetic detergent plants. (1)

When factory waste water containing sodium sulphite cannot be re-used, as such, a sulfites oxidation unit can be installed as an optional, by means of which atmospheric air is blown through a packed column, into which the solution is recycled and the sulfite contained therein are oxidized to sulfates. (2)

## 5.2 Packaging

The same drums as those with which the DDB has been supplied, can be conveniently re-used, without any further treatment, as packaging of the product, if it cannot be fed directly to the user plant.

## 5.3 Layout and civil works

The lay-out of the plant is shown on the attached drawing B162-17-1.

The process plant together with the utilities requires an area of about 380 sq.mt. All equipment is installed under a shelter; only the transformers and the air cooling unit are installed in a separate building. Another covered area is reserved for the storage of sulphur bags, DDB drums and DBSA drums.

- (1) For this reason it is recommended that the plant be located next to a detergent plant
- (2) The investment cost of this alternate solution is more or less the same as the other one.

Administrative offices, laboratory, workshop and social services will be accommodated in a two-storey building, covering an area of 200 sq.mt. The roof of the shelters is supported by steel structure and is insulated with mineral wool lagging covered with corrugated asbestos-cement sheets. The entire area under the shelter is made-up of reinforced concrete with a hard aggregate as finishing surface. The compartments for the electrical section and air cooling unit are in reinforced concrete with windows, doors and ventilation openings in standard steels. The building for administrative offices and other services has structure in reinforced concrete and partition and external walls in brickwork.

5.4 Investment costs, depreciation and maintenance.

	LC	FC	Total
	M\$	M\$	M\$
- machinery & equipment			
FOB European port		0.600	0.600
- Transportation	0.060	0.060	0.120
- Erection	0.040	0.080	0.120
- Civil work	0.215	-	0.215
- Site preparation	0.020	-	0.020
	-----	-----	-----
	0.335	0.740	1.075 (1)
Contingencies	0.030	0.080	0.110
Grand Total	0.365	0.820	1,185

(1) The additional investment cost of the neutralizing section, if required, is estimated as 20% of the figure indicated as total amount.

The life cycle of the plant can be considered as fifteen years.

Annual maintenance costs have been assumed as being in the range of 4% of the machinery and equipment costs.

In the financial evaluation, the investment costs (contingencies included) are so subdivided:

Machinery	FC 0.820 million dollars
Machinery	LC 0.100 million dollars
Site preparation	LC 0.020 million dollars
Civil works	LC 0.245 million dollars
	-----
TOTAL	1.185 million dollars

6. PLANT ORGANIZATION

Although the best solution is to install the plant adjacent to a detergent manufacture, the financial evaluation is developed in duplicate, one as an independent unit, with their own utilities and social services, operating within the framework of the National Chemical Corporation, and one as extension of a detergent factory that is with common services.



**7.3 Production Dept.**

- Production Manager	1	1,000	
- Shift foremen	6	2,400	
- Shift operators	6	2,400	
- Semiskilled workers	6	1,800	
- Chemist	1	700	
- Analysts	3	1,050	
- Clerks	1	350	
	-----	-----	-----
	24	9,700	116,400
			(56,232 \$/y)

**7.4 Maintenance Dep.**

	n°	birr/m	birr/y
- Engineer	1	1,000	
- Foremen	2	800	
- Electricians	2	800	
- Mechanical fitters	4	1,600	
- Semi-skilled worker	2	700	
- Unskilled workers	2	400	
	-----	-----	-----
	13	5,300	63,600
			(30,724 \$/y)



8. IMPLEMENTATION SCHEDULING

The time needed to design, build and start-up the plant is in the range of 24 months.

9. FINANCIAL EVALUATIONS

The Comfar financial evaluation for the autonomous factory is attached as Annexe 1.

This evaluation has been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operating period (one year) has been taken into account and indicated as "foreign factory overheads".

- the production program has been assumed as follows:

1st year 1000 t (50% capacity)

2nd year 1500 t (75% capacity)

from 3rd to 15th year 2000 t (100% capacity)

selling price 1300 \$/t average

This first evaluation yields an IRR equal to 13.36 and a BEP equal to 33%.

The financial evaluation of the sulfonation plant as an expansion of a detergent factory is attached as Annexe 4.

This last evaluation is based on the same assumption as above, but taking into account also the following reduction in the investment and personnel costs:

a) Investment cost

Assuming that all the utilities and social services are supplied by the soap factory the investment costs can be reduced (contingencies included) from 1.185 M \$ to:

Machinery	FC 0.690 million dollars
Machinery	LC 0.090 million dollars
Civil works	LC 0.150 million dollars
Site preparation	LC 0.020 million dollars
	-----
	0.950 million dollars

b) Personnel cost

Considering only the addition of new personnel to the existing manpower of the soap factory, such as to satisfy the needs of the sulfonation plant, the personnel expenditure can be reduced as follows:

Management and Administrative dept.	from 47.8 to 5 million dollars
Maintenance	from 30.7 to 21.5
Production	from 56.2 to 50

This second evaluation yields an IRR equal to 16.61.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "outflows, loan and production programme" correspond to the inputs given to the COMFAR for the same items, while the values of export and import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly domestic consumptions increasing gradually from 820 t (1st year) to 1950 t (15th year);
- yearly exported quantity: the balance to 1000 t for the 1st year (50% capacity), to 1500 t for the 2nd year (75% capacity) and to 2000 t (100% capacity) from the 3rd to the 15th year.
- cost of import : 1000 \$/t CIF Assab
- price of export: 1130 \$/t, ex works

While the net foreign exchange flow results negative, the net foreign exchange effect is favourable; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 427,000 \$ (Basic solution) or 553,000 \$ (Alternative scenario).

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 427,000 \$

**baldo & c.**  
CONSULTING ENGINEERS

**Sulphonation Chemicals**

**ANNEXE 1**

**FINANCIAL EVALUATIONS**  
**FOR THE AUTONOMOUS FACTORY**



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**SULPHONATION CHEMICALS IN ETHIOPIA**  
February 88  
BASIC PROJECT

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	1326.70	67.061 % foreign
current assets:	0.00	0.000 % foreign
total assets:	1326.70	67.061 % foreign

**Source of funds during construction phase**

equity & grants:	560.00	0.000 % foreign
foreign loans :	697.00	
local loans :	0.00	
total funds :	1257.00	55.449 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1109.20	1506.40	1963.59
depreciation :	92.01	92.01	90.01
interest :	69.70	60.99	52.28
production costs	1270.91	1659.40	2105.88
thereof foreign	84.86 %	87.79 %	90.00 %
total sales :	1300.00	1950.00	2600.00
gross income :	29.09	290.60	494.12
net income :	14.54	145.30	247.06
cash balance :	-617.31	-138.89	-51.63
net cashflow :	-460.49	9.22	87.77

Net Present Value at: 10.00 % = 476.79  
Internal Rate of Return: 13.36 %  
Return on equity<sup>1</sup>: 26.17 %  
Return on equity<sup>2</sup>: 13.76 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



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**Total Initial Investment in 1000 US \$**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	20.00	0.00
Buildings and civil works .....	178.00	67.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	136.00	784.00
<b>Total fixed investment costs .....</b>	<b>334.00</b>	<b>851.00</b>
Pre-production capital expenditures.	20.00	121.70
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>354.00</b>	<b>972.70</b>
<b>Of it foreign, in % .....</b>	<b>38.42</b>	<b>77.49</b>

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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**Total Current Investment in 1000 US \$**

Year .....	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Working capital .....</b>	<b>636.75</b>	<b>289.08</b>	<b>301.58</b>
<b>Total current investment costs ...</b>	<b>636.75</b>	<b>289.08</b>	<b>301.58</b>
<b>Of it foreign, % .....</b>	<b>96.36</b>	<b>99.64</b>	<b>99.65</b>

SULPHONATION CHEMICALS IN ETHIOPIA — February 88





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**Total Production Costs in 1900 US \$**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	50.00	75.00	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	882.13	1323.19	1764.25	1764.25	1764.25	1764.25
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	0.73	1.09	1.45	1.45	1.45	1.45
Energy . . . . .	19.56	29.34	39.11	39.11	39.11	39.11
Labour, direct . . . . .	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance . . . . .	30.72	30.72	30.72	30.72	30.72	30.72
Spares . . . . .	12.00	18.00	24.00	24.00	24.00	24.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1061.37</b>	<b>1458.57</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>
Administrative overheads . . . . .	47.83	47.83	47.83	47.83	47.83	47.83
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	92.01	92.01	90.01	88.01	88.01	73.61
Financial costs . . . . .	69.70	60.99	52.28	43.56	34.85	26.14
<b>Total production costs . . . . .</b>	<b>1270.91</b>	<b>1659.40</b>	<b>2105.88</b>	<b>2095.17</b>	<b>2086.45</b>	<b>2063.34</b>
<b>Costs per unit (single product) . . . . .</b>	<b>1.27</b>	<b>1.11</b>	<b>1.05</b>	<b>1.05</b>	<b>1.04</b>	<b>1.03</b>
Of it foreign, % . . . . .	84.86	87.79	90.00	90.04	90.00	90.59
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	104.06	104.06	104.06	104.06	104.06	104.06

**Total Production Costs in 1000 US \$**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product)	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	1764.25	1764.25	1764.25	1764.25	1764.25	1764.25
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	1.45	1.45	1.45	1.45	1.45	1.45
Energy .....	39.11	39.11	39.11	39.11	39.11	39.11
Labour, direct .....	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance .....	30.72	30.72	30.72	30.72	30.72	30.72
Spares .....	24.00	24.00	24.00	24.00	24.00	24.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>	<b>1915.76</b>
Administrative overheads .....	47.83	47.83	47.83	47.83	47.83	47.83
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	73.61	73.61	73.61	61.36	30.27	0.00
Financial costs .....	17.42	8.71	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>2094.63</b>	<b>2045.92</b>	<b>2037.20</b>	<b>2024.95</b>	<b>1993.86</b>	<b>1963.59</b>
<b>Costs per unit (single product) .</b>	<b>1.03</b>	<b>1.02</b>	<b>1.02</b>	<b>1.01</b>	<b>1.00</b>	<b>0.98</b>
Of it foreign, % .....	90.55	90.50	90.46	91.01	91.04	91.07
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	104.06	104.06	104.06	104.06	104.06	104.06



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**Net Working Capital in 1000 US \$**

Year .....	1989	1990	1991	1992-2003
Coverage .....	ndc	coto		
<b>Current assets &amp;</b>				
Accounts receivable . . . . . 30 12.0	92.43	125.53	163.63	163.63
Inventory and materials . 179 2.0	439.55	659.33	879.11	879.11
Energy . . . . . 6 56.5	0.35	0.52	0.69	0.69
Spares . . . . . 360 1.0	12.00	18.00	24.00	24.00
Work in progress . . . . . 1 360.0	2.95	4.05	5.32	5.32
Finished products . . . . . 30 12.0	92.43	125.53	163.63	163.63
Cash in hand . . . . . 15 24.0	8.62	6.37	6.62	6.62
<b>Total current assets . . . . .</b>	<b>648.33</b>	<b>939.34</b>	<b>1243.00</b>	<b>1243.00</b>
<b>Current liabilities and</b>				
Accounts payable . . . . . 3 120.4	11.59	13.51	15.59	15.59
<b>Net working capital . . . . .</b>	<b>636.74</b>	<b>925.83</b>	<b>1227.41</b>	<b>1227.41</b>
<b>Increase in working capital . . . . .</b>	<b>636.74</b>	<b>289.08</b>	<b>301.58</b>	<b>0.00</b>
<b>Net working capital, local . . . . .</b>	<b>23.17</b>	<b>24.22</b>	<b>25.26</b>	<b>25.26</b>
<b>Net working capital, foreign . . . . .</b>	<b>613.57</b>	<b>901.61</b>	<b>1202.15</b>	<b>1202.15</b>

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	560.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	697.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	697.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	69.70
Total funds .....	1257.00	69.70

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994	1995
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-87.13	-87.13	-87.13	-87.13	-87.13	-87.13	-87.13
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-87.13	-87.13	-87.13	-87.13	-87.13	-87.13	-87.13
Current liabilities	11.59	1.92	2.09	0.00	0.00	0.00	0.00
Bank overdraft ....	617.31	138.89	51.63	-253.31	-257.66	-254.82	-111.75
Total funds .....	541.78	53.69	-33.41	-340.43	-344.79	-341.94	-198.88

SULPHONATION CHEMICALS IN ETHIOPIA — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1996
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-87.13
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	-87.13
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	-87.13

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	1257.00	0.00
Financial resources .	1257.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	354.00	972.70
Total assets . . . .	354.00	903.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	69.70
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	903.00	-972.70
Cumulated cash balance	903.00	-69.70
Inflow, local . . . . .	560.00	0.00
Outflow, local . . . . .	218.00	219.00
Surplus ( deficit ) .	342.00	-219.00
Inflow, foreign . . . .	697.00	0.00
Outflow, foreign . . . .	136.00	753.70
Surplus ( deficit ) .	561.00	-753.70
Net cashflow . . . . .	-354.00	-903.00
Cumulated net cashflow	-354.00	-1257.00

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	1311.59	1951.92	2602.09	2600.00	2600.00	2600.00
Financial resources .	11.59	1.92	2.09	0.00	0.00	0.00
Sales, net of tax . .	1300.00	1950.00	2600.00	2600.00	2600.00	2600.00
Total cash outflow . .	1928.90	2090.81	2653.72	2346.69	2342.34	2345.18
Total assets . . . .	648.33	291.00	303.67	0.00	0.00	0.00
Operating costs . . .	1109.20	1506.40	1963.59	1963.59	1963.59	1963.59
Cost of finance . . .	69.70	60.99	52.28	43.56	34.85	26.14
Repayment . . . . .	87.13	87.13	87.13	87.13	87.13	87.13
Corporate tax . . . .	14.54	145.30	247.06	252.42	256.77	268.33
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-617.31	-138.89	-51.63	253.31	257.66	254.82
Cumulated cash balance	-687.01	-825.91	-877.54	-624.23	-366.57	-111.75
Inflow, local . . . . .	1308.94	1950.84	2600.84	2600.00	2600.00	2600.00
Outflow, local . . . .	201.72	312.40	424.29	427.76	432.11	443.67
Surplus ( deficit ) .	1107.22	1638.44	2176.55	2172.24	2167.89	2156.33
Inflow, foreign . . . .	2.65	1.08	1.24	0.00	0.00	0.00
Outflow, foreign . . .	1727.18	1778.41	2229.43	1918.94	1910.22	1901.51
Surplus ( deficit ) .	-1724.53	-1777.34	-2228.19	-1918.94	-1910.22	-1901.51
Net cashflow . . . . .	-460.49	9.22	87.77	383.99	379.64	368.08
Cumulated net cashflow	-1717.49	-1708.27	-1620.50	-1236.51	-856.87	-488.79



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Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Total cash outflow . .	2340.83	2336.47	2244.99	2244.99	2251.11	2251.11
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1963.59	1963.59	1963.59	1963.59	1963.59	1963.59
Cost of finance . . .	17.42	8.71	0.00	0.00	0.00	0.00
Repayment . . . . .	87.13	87.13	0.00	0.00	0.00	0.00
Corporate tax . . . .	272.69	277.04	281.40	281.40	287.52	287.52
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	259.17	263.53	355.01	355.01	348.89	348.89
Cumulated cash balance	147.42	410.95	765.96	1120.98	1469.86	1818.75
Inflow, local . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Outflow, local . . . .	448.03	452.38	456.74	456.74	462.86	462.86
Surplus ( deficit ) .	2151.77	2147.62	2143.26	2143.26	2137.14	2137.14
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	1892.80	1884.09	1788.25	1788.25	1788.25	1788.25
Surplus ( deficit ) .	-1892.80	-1884.09	-1788.25	-1788.25	-1788.25	-1788.25
Net cashflow . . . . .	363.72	359.37	355.01	355.01	348.89	348.89
Cumulated net cashflow	-125.07	234.30	589.31	944.33	1293.21	1642.10





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Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	2600.00	2600.00	2600.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	2600.00	2600.00	2600.00
Total cash outflow . .	2251.11	2266.66	2281.79
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1963.59	1963.59	1963.59
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	287.52	303.07	318.21
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	348.89	333.34	318.21
Cumulated cash balance	2167.64	2500.98	2819.18
Inflow, local . . . .	2600.00	2600.00	2600.00
Outflow, local . . . .	462.86	478.41	493.54
Surplus ( deficit ) .	2137.14	2121.59	2106.46
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	1788.25	1788.25	1788.25
Surplus ( deficit ) .	-1788.25	-1788.25	-1788.25
Net cashflow . . . . .	348.89	333.34	318.21
Cumulated net cashflow	1990.99	2324.33	2642.53



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	1013.54 at	10.00 %
Internal Rate of Return (IRRE1) ..	26.17 %	
b) Net Worth versus Net cash return:		
Net present value .....	458.07 at	10.00 %
Internal Rate of Return (IRRE2) ..	13.76 %	
c) Internal Rate of Return on total investment:		
Net present value .....	476.79 at	10.00 %
Internal Rate of Return ( IRR ) ..	13.36 %	
Net Worth = Equity paid plus reserves		

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



**COMFAR**  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year .....	1989	1990	1991	1992	1993
Total sales, incl. sales tax .....	1300.00	1950.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	1300.00	1950.00	2600.00	2600.00	2600.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	1201.21	1598.41	2053.60	2051.60	2051.60
Operational margin .....	98.79	351.59	546.40	548.40	548.40
As % of total sales .....	7.60	18.03	21.02	21.09	21.09
Cost of finance .....	69.70	60.99	52.28	43.56	34.85
Gross profit .....	29.09	290.60	494.12	504.83	513.55
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	29.09	290.60	494.12	504.83	513.55
Tax .....	14.54	145.30	247.06	252.42	256.77
Net profit .....	14.54	145.30	247.06	252.42	256.77
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	14.54	145.30	247.06	252.42	256.77
Accumulated undistributed profit .....	14.54	159.84	406.90	659.32	916.09
Gross profit, % of total sales .....	2.24	14.90	19.00	19.42	19.75
Net profit, % of total sales .....	1.12	7.45	9.50	9.71	9.88
ROE, Net profit, % of equity .....	2.60	25.95	44.12	45.07	45.85
ROI, Net profit+interest, % of invest. ....	4.45	9.45	12.05	11.91	11.74



COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1994	1995	1996	1997	1998
Total sales, incl. sales tax	2600.00	2600.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax	0.00	0.00	0.00	0.00	0.00
Variable margin	2600.00	2600.00	2600.00	2600.00	2600.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2037.20	2037.20	2037.20	2037.20	2037.20
Operational margin	562.80	562.80	562.80	562.80	562.80
As % of total sales	21.65	21.65	21.65	21.65	21.65
Cost of finance	26.14	17.42	8.71	0.00	0.00
Gross profit	536.66	545.37	554.08	562.80	562.80
Allowances	0.00	0.00	0.00	0.00	0.00
Tangible profit	536.66	545.37	554.08	562.80	562.80
Tax	268.33	272.69	277.04	281.40	281.40
Net profit	268.33	272.69	277.04	281.40	281.40
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	268.33	272.69	277.04	281.40	281.40
Accumulated undistributed profit	1184.42	1457.11	1734.15	2015.55	2296.95
Gross profit, % of total sales	20.64	20.98	21.31	21.65	21.65
Net profit, % of total sales	10.32	10.49	10.66	10.82	10.82
RCE, Net profit, % of equity	47.92	48.69	49.47	50.25	50.25
ROI, Net profit+interest, % of invest.	11.85	11.68	11.50	11.33	11.33



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	2024.95	2024.95	2024.95	1993.86	1963.59
Operational margin . . . . .	575.05	575.05	575.05	606.14	636.41
As % of total sales . . . . .	22.12	22.12	22.12	23.31	24.48
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	575.05	575.05	575.05	606.14	636.41
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	575.05	575.05	575.05	606.14	636.41
Tax . . . . .	287.52	287.52	287.52	303.07	318.21
Net profit . . . . .	287.52	287.52	287.52	303.07	318.21
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	287.52	287.52	287.52	303.07	318.21
Accumulated undistributed profit . . . . .	2584.47	2871.99	3159.51	3462.58	3780.79
Gross profit, % of total sales . . . . .	22.12	22.12	22.12	23.31	24.48
Net profit, % of total sales . . . . .	11.06	11.06	11.06	11.66	12.24
ROE, Net profit, % of equity . . . . .	51.34	51.34	51.34	54.12	56.82
ROI, Net profit+interest, % of invest. . . . .	11.57	11.57	11.57	12.20	12.81



**COMFAR**<sup>2.1</sup>  
UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
Total assets .....	1257.00	1326.70
Fixed assets, net of depreciation	0.00	354.00
Construction in progress .....	354.00	972.70
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available	903.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	1257.00	1326.70
Equity capital .....	560.00	560.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	697.00	697.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required	0.00	69.70
Total debt .....	697.00	766.70
Equity, % of liabilities .....	44.55	42.21



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>1883.02</b>	<b>2082.01</b>	<b>2295.66</b>	<b>2207.65</b>	<b>2119.63</b>	<b>2046.02</b>
Fixed assets, net of depreciation	1234.69	1142.67	1052.66	964.64	876.63	803.02
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	639.72	932.97	1236.39	1236.39	1236.39	1236.39
Cash, bank .....	6.62	6.37	6.62	6.62	6.62	6.62
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>1883.02</b>	<b>2082.01</b>	<b>2295.66</b>	<b>2207.65</b>	<b>2119.63</b>	<b>2046.02</b>
Equity capital .....	560.00	560.00	560.00	560.00	560.00	560.00
Reserves, retained profit .....	0.00	14.54	159.84	406.90	659.32	916.09
Profit .....	14.54	145.30	247.06	252.42	256.77	268.33
Long and medium term debt .....	609.88	522.75	435.63	348.50	261.38	174.25
Current liabilities .....	11.59	13.51	15.59	15.59	15.59	15.59
Bank overdraft, finance required.	687.01	825.91	877.54	624.23	366.57	111.75
<b>Total debt .....</b>	<b>1308.47</b>	<b>1362.16</b>	<b>1328.76</b>	<b>988.33</b>	<b>643.54</b>	<b>301.60</b>
<b>Equity, % of liabilities .....</b>	<b>29.74</b>	<b>26.90</b>	<b>24.39</b>	<b>25.37</b>	<b>26.42</b>	<b>27.37</b>

SULPHONATION CHEMICALS IN ETHIOPIA — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>2119.83</b>	<b>2309.74</b>	<b>2591.14</b>	<b>2872.54</b>	<b>3160.06</b>	<b>3447.58</b>
Fixed assets, net of depreciation	729.40	655.79	582.17	508.56	447.20	385.83
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1236.39	1236.39	1236.39	1236.39	1236.39	1236.39
Cash, bank .....	6.62	6.62	6.62	6.62	6.62	6.62
Cash surplus, finance available .	147.42	410.95	765.96	1129.98	1469.86	1818.75
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2119.83</b>	<b>2309.74</b>	<b>2591.14</b>	<b>2872.54</b>	<b>3160.06</b>	<b>3447.58</b>
Equity capital .....	560.00	560.00	560.00	560.00	560.00	560.00
Reserves, retained profit .....	1184.42	1457.11	1734.15	2015.55	2276.95	2584.47
Profit .....	272.69	277.04	281.40	281.40	287.52	287.52
Long and medium term debt .....	87.13	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	15.59	15.59	15.59	15.59	15.59	15.59
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>102.72</b>	<b>15.59</b>	<b>15.59</b>	<b>15.59</b>	<b>15.59</b>	<b>15.59</b>
<b>Equity, % of liabilities .....</b>	<b>26.42</b>	<b>24.25</b>	<b>21.61</b>	<b>19.49</b>	<b>17.72</b>	<b>16.24</b>

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
Total assets .....	3735.11	4038.18	4356.38
Fixed assets, net of depreciation	324.47	294.20	294.20
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1236.39	1236.39	1236.39
Cash, bank .....	6.62	6.62	6.62
Cash surplus, finance available .	2167.64	2500.98	2819.18
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	3735.11	4038.18	4356.38
Equity capital .....	560.00	560.00	560.00
Reserves, retained profit .....	2871.99	3159.51	3462.58
Profit .....	287.52	303.07	318.21
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	15.59	15.59	15.59
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	15.59	15.59	15.59
Equity, % of liabilities .....	14.99	13.87	12.85



**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL LOAD (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	BASIC PROJECT	EXPANSION OF DETERGENT FACTORY
1) TOTAL REVENUES	<u>2600</u>	<u>2600</u>
2) VARIABLE COSTS:	<u>1861.04</u>	<u>1854.81</u>
. RAW MATERIALS	1764.25	1764.25
. UTILITIES	1.45	1.45
. ENERGY	39.11	39.11
. LABOUR	56.23	50.00
3) FIXED COSTS	<u>244.84</u>	<u>168.02</u>
. REPAIR-MAINTENANCE	30.72	21.50
. SPARES	24.00	24.00
. ADMINISTRATION	47.83	5.00
. DEPRECIATION	90.01	73.53
. FINANCIAL COSTS	52.28	43.99
4) TOTAL PRODUCTION COSTS	<u>2105.88</u>	<u>2022.83</u>

$$\text{BEP} \frac{244.84}{2600 - 1861.04} \times 100 = 33\%$$

$$\text{BEP} \frac{168.02}{2600 - 1854.81} \times 100 = 22\%$$

**baldo & c.**  
CONSULTING ENGINEERS

**Sulphonation Chemicals**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



**COMFAR**<sup>©</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow . .	10239.17	697.00	9542.17	697.00	0.00	206.05	656.48
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	701.97	697.00	4.97	697.00	0.00	2.65	1.08
exports . . . . .	9537.20	0.00	9537.20	0.00	0.00	203.40	655.40
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	27256.19	889.70	26406.49	136.00	753.70	1727.18	1778.41
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	668.30	820.00	-151.70	136.00	684.00	616.22	289.11
imported materials . . .	25942.57	0.00	25942.57	0.00	0.00	954.13	1341.19
repayment loans & overd.	701.97	0.00	701.97	0.00	0.00	87.13	87.13
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	383.35	69.70	313.65	0.00	69.70	69.70	60.99
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-17057.02	-192.70	-16864.32	561.00	-753.70	-1521.13	-1121.94
import substit'n effect	20060.00	0.00	20060.00	0.00	0.00	820.00	920.00
net foreign exchge effect	3002.98	-192.70	3195.68	561.00	-753.70	-701.13	-201.94
present values at 10.00 %							
foreign exchange flow .	-7901.42						
net foreign exchge effect	427.36						



**COMFAR**<sup>®</sup>  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	1165.14	1107.40	1028.30	960.50	881.40	791.00	700.60
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1.24	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1163.90	1107.40	1028.30	960.50	881.40	791.00	700.60
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	2229.43	1918.94	1910.22	1901.51	1892.80	1884.09	1788.25
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	301.78	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25
repayment loans & overd.	87.13	87.13	87.13	87.13	87.13	87.13	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	52.28	43.56	34.85	26.14	17.42	8.71	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1064.29	-811.54	-881.92	-941.01	-1011.40	-1093.09	-1087.65
import substit'n effect	970.00	1020.00	1090.00	1150.00	1220.00	1300.00	1380.00
net foreign exchange effect	-94.29	208.46	208.08	208.99	208.60	206.91	292.35
present values at foreign exchange flow .	10.00 %	-7901.42					
net foreign exchange effect		427.36					



**COMFAR**<sup>®</sup>  
2.1 UNICO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	-1353.85
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-1358.81
imported materials . . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	4.97
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1178.05	-1279.75	-1381.45	-1494.45	-1618.75	-1731.75	1353.85
import substit'n effect	1460.00	1550.00	1640.00	1740.00	1850.00	1950.00	0.00
net foreign exchange effect	281.95	270.25	258.55	245.55	231.25	218.25	1353.85
present values at 10.00 %							
foreign exchange flow . . .	-7901.42						
net foreign exchange effect	427.36						



COMFAR<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

### Foreign Exchange Effect in 1000 US \$

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	10128.67	586.50	9942.17	586.50	0.00	206.05	656.48
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	591.47	586.50	4.97	586.50	0.00	2.65	1.08
exports . . . . .	9537.20	0.00	9537.20	0.00	0.00	203.40	655.40
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	27018.96	748.65	26270.31	138.00	610.65	1702.32	1754.93
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	562.35	690.00	-127.65	138.00	552.00	616.22	289.11
imported materials . . . .	25542.57	0.00	25542.57	0.00	0.00	954.13	1341.19
repayment loans & overd.	591.47	0.00	591.47	0.00	0.00	73.31	73.31
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	322.57	58.65	263.92	0.00	58.65	58.65	51.32
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-16890.29	-162.15	-16728.14	448.50	-610.65	-1496.27	-1098.46
import substit'n effect	20090.00	0.00	20090.00	0.00	0.00	820.00	920.00
net forgn exchge effect	3199.71	-162.15	3361.86	448.50	-610.65	-676.27	-178.46
present values at 10.00 %							
foreign exchange flow . .	-7788.17						
net forgn exchge effect	553.33						



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**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	1165.14	1107.40	1028.30	960.50	881.40	791.00	700.60
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1.24	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1163.90	1107.40	1028.30	960.50	881.40	791.00	700.60
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	2207.33	1898.22	1890.89	1883.56	1876.22	1868.89	1788.25
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	301.78	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25
repayment loans & overd.	73.31	73.31	73.31	73.31	73.31	73.31	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	43.99	36.66	29.33	21.99	14.66	7.33	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1042.19	-790.82	-862.59	-923.06	-994.82	-1077.89	-1087.65
import substit'n effect	970.00	1020.00	1090.00	1150.00	1220.00	1330.00	1380.00
net foreign exchange effect	-72.19	229.18	227.41	226.94	225.18	252.11	292.35
present values at 10.00 %							
foreign exchange flow .	-7788.17						
net foreign exchange effect	553.33						





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**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	-1329.80
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-1334.76
imported materials . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	4.97
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	3.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1178.05	-1279.75	-1381.45	-1494.45	-1618.75	-1731.75	1329.80
import substit'n effect	1460.00	1550.00	1640.00	1740.00	1850.00	1950.00	0.00
net foreign exchange effect	281.95	270.25	258.55	245.55	231.25	218.25	1329.80
present values at 10.00 %							
foreign exchange flow .	-7788.17						
net foreign exchange effect	553.33						

**baldo & c.**  
CONSULTING ENGINEERS

**Sulphonation Chemicals**

**ANNEXE 4**

**FINANCIAL AND FOREIGN EXCHANGE EVALUATIONS**  
**FOR THE INTEGRATED FACTORY**



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**SULPHONATION CHEMICALS IN ETHIOPIA**

February 88

Expansion of a detergent factory

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	1048.65	70.05% foreign
current assets:	0.00	0.00% foreign
total assets:	1048.65	70.05% foreign

**Source of funds during construction phase**

equity & grants:	423.50	0.00% foreign
foreign loans:	586.50	
local loans:	0.00	
total funds:	1010.00	58.06% foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1050.92	1448.12	1905.31
depreciation :	75.53	75.53	73.53
interest :	58.65	51.32	43.99
production costs	1185.10	1574.96	2022.82
thereof foreign	89.34 %	91.34 %	92.85 %
total sales :	1300.00	1950.00	2600.00
gross income :	114.90	375.04	577.18
net income :	57.45	187.52	288.59
cash balance :	-566.18	-99.35	-12.78
net cashflow :	-434.22	25.28	104.52

Net Present Value at: 10.00 % = 837.77

Internal Rate of Return on total investment: 16.61 %

Equity paid versus Net income flow (IRR): 36.44 %

Net Worth versus Net Cash Return (IRR): 17.69 %

**Index of Schedules produced by CONFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US \$**

Year . . . . .	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	20.00	0.00
Buildings and civil works . . . . .	120.00	30.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00
Plant machinery and equipment . . .	138.00	642.00
<b>Total fixed investment costs . . . . .</b>	<b>278.00</b>	<b>672.00</b>
Pre-production capital expenditures.	20.00	98.65
Net working capital . . . . .	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>298.00</b>	<b>770.65</b>
Of it foreign, in % . . . . .	46.31	79.24

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SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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Total Current Investment in 1000 US \$

Year . . . . .	1989	1990	1991
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . . . . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . . . . .	0.00	0.00	0.00
Total fixed investment costs . . . . .	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	625.85	289.08	301.58
Total current investment costs . . . . .	625.85	289.08	301.58
Of it foreign, % . . . . .	98.84	99.64	99.65

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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**Total Production Costs in 1000 US \$**

Year	1989	1990	1991	1992	1993	1994
I of non. capacity (single product).	50.00	75.00	100.00	100.00	100.00	100.00
Raw material I	882.13	1323.19	1764.25	1764.25	1764.25	1764.25
Other raw materials	0.00	0.00	0.00	0.00	0.00	0.00
Utilities	0.73	1.09	1.45	1.45	1.45	1.45
Energy	19.56	29.34	39.11	39.11	39.11	39.11
Labour, direct	50.00	50.00	50.00	50.00	50.00	50.00
Repair, maintenance	21.50	21.50	21.50	21.50	21.50	21.50
Spares	12.00	18.00	24.00	24.00	24.00	24.00
Factory overheads	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs</b>	<b>1045.92</b>	<b>1443.12</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>
Administrative overheads	5.00	5.00	5.00	5.00	5.00	5.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	75.53	75.53	73.53	71.53	71.53	59.53
Financial costs	58.65	51.32	43.99	36.66	29.33	21.99
<b>Total production costs</b>	<b>1185.10</b>	<b>1574.96</b>	<b>2022.82</b>	<b>2013.49</b>	<b>2006.16</b>	<b>1986.83</b>
<b>Costs per unit (single product)</b>	<b>1.19</b>	<b>1.05</b>	<b>1.01</b>	<b>1.01</b>	<b>1.00</b>	<b>0.99</b>
Of it foreign, I	89.34	91.34	92.85	92.92	92.89	93.43
Of it variable, I	0.00	0.00	0.00	0.00	0.00	0.00
Total labour	55.00	55.00	55.00	55.00	55.00	55.00



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**Total Production Costs in 1000 US \$**

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I . . . . .	1764.25	1764.25	1764.25	1764.25	1764.25	1764.25
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	1.45	1.45	1.45	1.45	1.45	1.45
Energy . . . . .	39.11	39.11	39.11	39.11	39.11	39.11
Labour, direct . . . . .	50.00	50.00	50.00	50.00	50.00	50.00
Repair, maintenance . . . . .	21.50	21.50	21.50	21.50	21.50	21.50
Spares . . . . .	24.00	24.00	24.00	24.00	24.00	24.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>	<b>1900.31</b>
Administrative overheads . . . . .	5.00	5.00	5.00	5.00	5.00	5.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	59.53	59.53	59.53	52.03	25.66	0.00
Financial costs . . . . .	14.66	7.33	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>1979.50</b>	<b>1972.17</b>	<b>1964.84</b>	<b>1957.34</b>	<b>1930.97</b>	<b>1905.31</b>
<b>Costs per unit ( single product ) .</b>	<b>0.99</b>	<b>0.99</b>	<b>0.98</b>	<b>0.98</b>	<b>0.97</b>	<b>0.95</b>
Of it foreign, % . . . . .	93.40	93.38	93.36	93.71	93.78	93.86
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	55.00	55.00	55.00	55.00	55.00	55.00



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year	1989	1990	1991	1992-2003
Coverage . . . . . ndc coto				
<b>Current assets &amp;</b>				
Accounts receivable . . . 30 12.0	87.58	120.68	158.78	158.78
Inventory and materials . 179 2.0	439.55	659.33	879.11	879.11
Energy . . . . . 6 56.5	0.35	0.52	0.69	0.69
Spares . . . . . 360 1.0	12.00	18.00	24.00	24.00
Work in progress . . . . 1 360.0	2.91	4.01	5.28	5.28
Finished products . . . . 30 12.0	87.58	120.68	158.78	158.78
Cash in hand . . . . . 15 24.0	6.19	3.94	4.19	4.19
Total current assets . . . . .	636.15	927.15	1230.82	1230.82
<b>Current liabilities and</b>				
Accounts payable . . . . . 3 130.4	10.30	12.22	14.31	14.31
<b>Net working capital . . . . .</b>	<b>625.85</b>	<b>914.93</b>	<b>1216.51</b>	<b>1216.51</b>
<b>Increase in working capital . . . . .</b>	<b>625.85</b>	<b>289.08</b>	<b>301.58</b>	<b>0.00</b>
<b>Net working capital, local . . . . .</b>	<b>12.27</b>	<b>13.32</b>	<b>14.37</b>	<b>14.37</b>
<b>Net working capital, foreign . . . . .</b>	<b>613.57</b>	<b>901.61</b>	<b>1202.15</b>	<b>1202.15</b>

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .





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Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	423.50	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	586.50	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	586.50	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	58.65
Total funds .....	1010.00	58.65

SULPHONATION CHEMICALS IN ETHIOPIA --- February 89



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994	1995-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-73.31	-73.31	-73.31	-73.31	-73.31	-73.31	-73.31
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-73.31	-73.31	-73.31	-73.31	-73.31	-73.31	-73.31
Current liabilities	10.30	1.92	2.09	0.00	0.00	0.00	0.00
Bank overdraft ....	566.18	99.35	12.78	-291.47	-295.13	-150.36	0.00
Total funds .....	503.17	27.96	-58.45	-364.78	-368.45	-223.68	-73.31

SULPHONATION CHEMICALS IN ETHIOPIA --- February 88



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Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	1010.00	0.00
Financial resources .	1010.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	298.00	770.65
Total assets . . . .	298.00	712.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	58.65
Repayment . . . . .	0.00	0.00
Corporate tax . . .	0.00	0.00
Dividends paid . . .	0.00	0.00
Surplus ( deficit ) .	712.00	-770.65
Accumulated cash balance	712.00	-58.65
Inflow, local . . . .	423.50	0.00
Outflow, local . . . .	160.00	160.00
Surplus ( deficit ) .	263.50	-160.00
Inflow, foreign . . .	586.50	0.00
Outflow, foreign . . .	138.00	610.65
Surplus ( deficit ) .	448.50	-610.65
Net cashflow . . . . .	-298.00	-712.00
Accumulated net cashflow	-298.00	-1010.00

SULPHONATION CHEMICALS IN ETHIOPIA --- February 88



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Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	1310.30	1951.92	2602.09	2600.00	2600.00	2600.00
Financial resources .	10.30	1.92	2.09	0.00	0.00	0.00
Sales, net of tax . .	1300.00	1950.00	2600.00	2600.00	2500.00	2600.00
Total cash outflow . .	1876.48	2051.27	2614.87	2308.53	2304.87	2307.20
Total assets . . . .	636.15	291.00	303.67	0.00	0.00	0.00
Operating costs . . .	1050.92	1448.12	1905.31	1905.31	1905.31	1905.31
Cost of finance . . .	58.65	51.32	43.99	36.66	29.33	21.99
Repayment . . . . .	73.31	73.31	73.31	73.31	73.31	73.31
Corporate tax . . . .	57.45	187.52	288.59	293.25	296.92	306.59
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-566.18	-99.35	-12.78	291.47	295.13	292.80
Cumulated cash balance	-624.83	-724.18	-736.96	-445.50	-150.36	142.43
Inflow, local . . . .	1307.65	1950.84	2600.84	2600.00	2600.00	2600.00
Outflow, local . . . .	174.16	296.34	407.54	410.31	413.98	423.65
Surplus ( deficit ) .	1133.48	1654.51	2193.31	2189.69	2186.02	2176.35
Inflow, foreign . . .	2.65	1.08	1.24	0.00	0.00	0.00
Outflow, foreign . . .	1702.32	1754.93	2207.33	1898.22	1890.89	1883.56
Surplus ( deficit ) .	-1699.67	-1753.86	-2206.09	-1898.22	-1890.89	-1883.56
Net cashflow . . . . .	-434.22	25.28	104.52	401.44	397.77	388.10
Cumulated net cashflow	-1444.22	-1418.94	-1314.42	-912.98	-515.21	-127.11

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Total cash outflow . .	2303.54	2299.87	2222.89	2222.89	2226.64	2226.64
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1905.31	1905.31	1905.31	1905.31	1905.31	1905.31
Cost of finance . . .	14.66	7.33	0.00	0.00	0.00	0.00
Repayment . . . . .	73.31	73.31	0.00	0.00	0.00	0.00
Corporate tax . . . .	310.25	313.92	317.58	317.58	321.33	321.33
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	296.46	300.13	377.11	377.11	373.36	373.36
Cumulated cash balance	438.90	739.03	1116.14	1493.24	1866.60	2239.96
Inflow, local . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00	2600.00
Outflow, local . . . .	427.31	430.98	434.64	434.64	438.39	438.39
Surplus ( deficit ) .	2172.69	2169.02	2165.36	2165.36	2161.61	2161.61
Inflow, foreign . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	1876.22	1868.89	1788.25	1788.25	1788.25	1788.25
Surplus ( deficit ) .	-1876.22	-1868.89	-1788.25	-1788.25	-1788.25	-1788.25
Net cashflow . . . . .	384.44	380.77	377.11	377.11	373.36	373.36
Cumulated net cashflow	257.33	638.10	1015.21	1392.32	1765.68	2139.03



COMFAR 2.0 - BALDO & CO. S.R.L., NILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	2600.00	2600.00	2600.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	2600.00	2600.00	2600.00
Total cash outflow . .	2226.64	2239.82	2252.66
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1905.31	1905.31	1905.31
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	321.33	334.51	347.34
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	373.36	360.18	347.34
Cumulated cash balance	2613.32	2973.49	3320.84
Inflow, local . . . . .	2600.00	2600.00	2600.00
Outflow, local . . . . .	438.39	451.57	464.41
Surplus ( deficit ) .	2161.61	2148.43	2135.59
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . . .	1788.25	1788.25	1788.25
Surplus ( deficit ) .	-1788.25	-1788.25	-1788.25
Net cashflow . . . . .	373.36	360.18	347.34
Cumulated net cashflow	2512.39	2872.57	3219.91



**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	1416.36	at 10.00 %
Internal Rate of Return (IRRE1) ..	36.44	%
b) Net Worth versus Net cash return:		
Net present value .....	826.36	at 10.00 %
Internal Rate of Return (IRRE2) ..	17.69	%
c) Internal Rate of Return on total investment:		
Net present value .....	837.77	at 10.00 %
Internal Rate of Return (IRR) ..	16.61	%
Net Worth = Equity paid plus reserves		



COMFAR 2.0 - BALNO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1989	1990	1991	1992	1993
Total sales, incl. sales tax	1300.00	1950.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	1300.00	1950.00	2600.00	2600.00	2600.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1126.45	1523.65	1970.04	1976.04	1976.64
Operational margin	173.55	426.35	621.16	623.16	623.16
As % of total sales	13.35	21.86	23.89	23.97	23.97
Cost of finance	58.65	51.32	43.99	36.66	29.33
Gross profit	114.90	375.04	577.18	586.51	593.84
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	114.90	375.04	577.18	586.51	593.84
Tax	57.45	187.52	288.59	293.25	296.92
Net profit	57.45	187.52	288.59	293.25	296.92
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	57.45	187.52	288.59	293.25	296.92
Accumulated undistributed profit	57.45	244.97	533.56	826.81	1123.73
Gross profit, % of total sales	8.84	19.23	22.20	22.56	22.84
Net profit, % of total sales	4.42	9.62	11.10	11.28	11.42
RDE, Net profit, % of equity	13.57	44.28	68.14	69.25	70.11
ROI, Net profit+interest, % of invest.	7.10	12.41	14.94	14.82	14.65





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COMFAR 2.0 - DALSO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year	1994	1995	1996	1997	1998
Total sales, incl. sales tax	2600.00	2600.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin	2600.00	2600.00	2600.00	2600.00	2600.00
As % of total sales	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1964.84	1964.84	1964.84	1964.84	1964.84
Operational margin	635.16	635.16	635.16	635.16	635.16
As % of total sales	24.43	24.43	24.43	24.43	24.43
Cost of finance	21.99	14.66	7.33	0.00	0.00
Gross profit	613.17	620.50	627.83	635.16	635.16
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	613.17	620.50	627.83	635.16	635.16
Tax	306.59	310.25	313.92	317.58	317.58
Net profit	306.59	310.25	313.92	317.58	317.58
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	306.59	310.25	313.92	317.58	317.58
Accumulated undistributed profit	1430.32	1740.57	2054.49	2372.07	2689.65
Gross profit, % of total sales	23.58	23.87	24.15	24.43	24.43
Net profit, % of total sales	11.79	11.93	12.07	12.21	12.21
ROE, Net profit, % of equity	72.39	73.26	74.12	74.99	74.99
ROI, Net profit+interest, % of invest.	14.76	14.59	14.43	14.26	14.26

SULPHONATION CHEMICALS IN ETHIOPIA -- February 89



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2600.00	2600.00	2600.00	2600.00	2600.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1957.34	1957.34	1957.34	1930.97	1905.31
Operational margin . . . . .	642.66	642.66	642.66	669.03	694.69
As % of total sales . . . . .	24.72	24.72	24.72	25.73	26.72
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	642.66	642.66	642.66	669.03	694.69
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	642.66	642.66	642.66	669.03	694.69
Tax . . . . .	321.33	321.33	321.33	334.51	347.34
Net profit . . . . .	321.33	321.33	321.33	334.51	347.34
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	321.33	321.33	321.33	334.51	347.34
Accumulated undistributed profit . . .	3010.98	3332.31	3653.64	3988.16	4335.50
Gross profit, % of total sales . . . .	24.72	24.72	24.72	25.73	26.72
Net profit, % of total sales . . . .	12.36	12.36	12.36	12.87	13.36
ROE, Net profit, % of equity . . . .	75.88	75.88	75.88	78.99	82.02
ROI, Net profit/interest, % of invest.	14.43	14.43	14.43	15.02	15.60



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
<b>Total assets .....</b>	<b>1010.00</b>	<b>1068.65</b>
Fixed assets, net of depreciation	0.00	298.00
Construction in progress . . . .	298.00	770.65
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	712.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>1010.00</b>	<b>1068.65</b>
Equity capital .....	423.50	423.50
Reserves, retained profit . . . .	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt . . . .	586.50	586.50
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	58.65
<b>Total debt .....</b>	<b>586.50</b>	<b>645.15</b>
<b>Equity, % of liabilities . . . .</b>	<b>41.93</b>	<b>39.63</b>



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year	1989	1990	1991	1992	1993	1994
Total assets	1629.27	1844.75	2074.89	2003.36	1931.84	2014.75
Fixed assets, net of depreciation	993.12	917.60	844.87	772.55	701.02	641.49
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	629.96	923.21	1226.63	1226.63	1226.63	1226.63
Cash, bank	6.19	3.94	4.19	4.19	4.19	4.19
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	142.43
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	1629.27	1844.75	2074.89	2003.36	1931.84	2014.75
Equity capital	423.50	423.50	423.50	423.50	423.50	423.50
Reserves, retained profit	0.00	57.45	244.97	533.56	826.81	1123.73
Profit	57.45	187.52	288.59	293.25	296.92	306.59
Long and medium term debt	513.19	439.88	366.56	293.25	219.94	146.63
Current liabilities	10.30	12.22	14.31	14.31	14.31	14.31
Bank overdraft, finance required	624.83	724.18	736.96	445.50	150.36	0.00
Total debt	1148.32	1176.28	1117.83	753.05	384.61	160.93
Equity, % of liabilities	25.99	22.96	20.41	21.14	21.92	21.02



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COMFAR 2.0 - BALBO & CO. S. R. L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>2251.69</b>	<b>2492.29</b>	<b>2809.87</b>	<b>3127.45</b>	<b>3446.79</b>	<b>3770.12</b>
Fixed assets, net of depreciation	581.97	522.44	462.92	403.39	351.36	299.34
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1226.63	1226.63	1226.63	1226.63	1226.63	1226.63
Cash, bank .....	4.19	4.19	4.19	4.19	4.19	4.19
Cash surplus, finance available	438.90	739.03	1116.14	1493.24	1866.60	2239.96
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2251.69</b>	<b>2492.29</b>	<b>2809.87</b>	<b>3127.45</b>	<b>3446.79</b>	<b>3770.12</b>
Equity capital .....	423.50	423.50	423.50	423.50	423.50	423.50
Reserves, retained profit .....	1470.32	1740.57	2054.48	2372.07	2689.65	3010.98
Profit .....	310.25	313.92	317.58	317.58	321.33	321.33
Long and medium term debt .....	73.31	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	15.31	14.31	14.31	14.31	14.31	14.31
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>87.62</b>	<b>14.31</b>	<b>14.31</b>	<b>14.31</b>	<b>14.31</b>	<b>14.31</b>
<b>Equity, % of liabilities .....</b>	<b>18.81</b>	<b>16.99</b>	<b>15.07</b>	<b>13.54</b>	<b>12.28</b>	<b>11.23</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	2001	2002	2003
Total assets .....	4091.45	4425.96	4773.31
Fixed assets, net of depreciation	247.31	221.65	221.65
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1226.63	1226.63	1226.63
Cash, bank .....	4.19	4.19	4.19
Cash surplus, finance available .	2613.32	2973.50	3320.84
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	4091.45	4425.96	4773.31
Equity capital .....	423.50	423.50	423.50
Reserves, retained profit .....	3332.31	3653.64	3988.16
Profit .....	321.33	334.51	347.34
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	14.31	14.31	14.31
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	14.31	14.31	14.31
Equity, % of liabilities .....	10.35	9.57	8.87

SULPHONATION CHEMICALS IN ETHIOPIA — February 88



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COMFAR 2.1 - BALDO & CO. S.P.A., MILANO

### Foreign Exchange Effect in 1000 US \$

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	10128.67	586.50	9542.17	586.50	0.00	206.05	656.48
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft .....	591.47	586.50	4.97	586.50	0.00	2.65	1.08
exports .....	9537.20	0.00	9537.20	0.00	0.00	203.40	655.40
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow ..	27018.94	748.65	26270.31	138.00	610.65	1702.32	1754.93
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	562.35	690.00	-127.65	138.00	552.00	616.22	289.11
imported materials .....	25542.57	0.00	25542.57	0.00	0.00	954.13	1341.19
repayment loans & overd.	591.47	0.00	591.47	0.00	0.00	73.31	73.31
other repayments .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	322.57	58.65	263.92	0.00	58.65	58.65	51.32
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-16890.29	-162.15	-16728.14	448.50	-610.65	-1496.27	-1098.46
import substit'n effect	20090.00	0.00	20090.00	0.00	0.00	820.00	920.00
net foreign exchnge effect	3199.71	-162.15	3361.86	448.50	-610.65	-676.27	-178.46
present values at 10.00 %							
foreign exchange flow ..	-7788.17						
net foreign exchnge effect	553.33						



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COMFAR 2.1 - BALZO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	1165.14	1107.40	1028.30	960.50	881.40	791.00	700.60
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1.24	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1163.90	1107.40	1028.30	960.50	881.40	791.00	700.60
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	2207.33	1898.22	1890.89	1883.56	1876.22	1868.89	1788.25
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	301.78	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25
repayment loans & overd.	73.31	73.31	73.31	73.31	73.31	73.31	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	43.99	36.66	29.33	21.99	14.66	7.33	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-1042.19	-790.82	-862.59	-923.06	-994.82	-1077.89	-1087.65
import substit'n effect	970.00	1020.00	1090.00	1150.00	1220.00	1330.00	1380.00
net foreign exchge effect	-72.19	229.18	227.41	226.94	225.18	252.11	292.35
present values at 10.00 %							
foreign exchange flow .	-7788.17						
net foreign exchge effect	553.33						





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overcraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	610.20	508.50	406.80	293.80	169.50	56.50	0.00
indirect effects . . . . .							
total foreign outflow .	1788.25	1788.25	1786.25	1788.25	1788.25	1788.25	-1329.80
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-1334.76
imported materials . . .	1788.25	1788.25	1788.25	1788.25	1788.25	1788.25	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	4.97
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .							
net foreign exchnge flow	-1178.05	-1279.75	-1381.45	-1494.45	-1618.75	-1731.75	1329.80
import substit'n effect	1460.00	1550.00	1640.00	1740.00	1850.00	1950.00	0.00
net forgn exchnge effect	281.95	270.25	258.55	245.55	231.25	218.25	1329.80
present values at 10.00 %							
foreign exchange flow .	-7788.17						
net forgn exchnge effect	553.33						

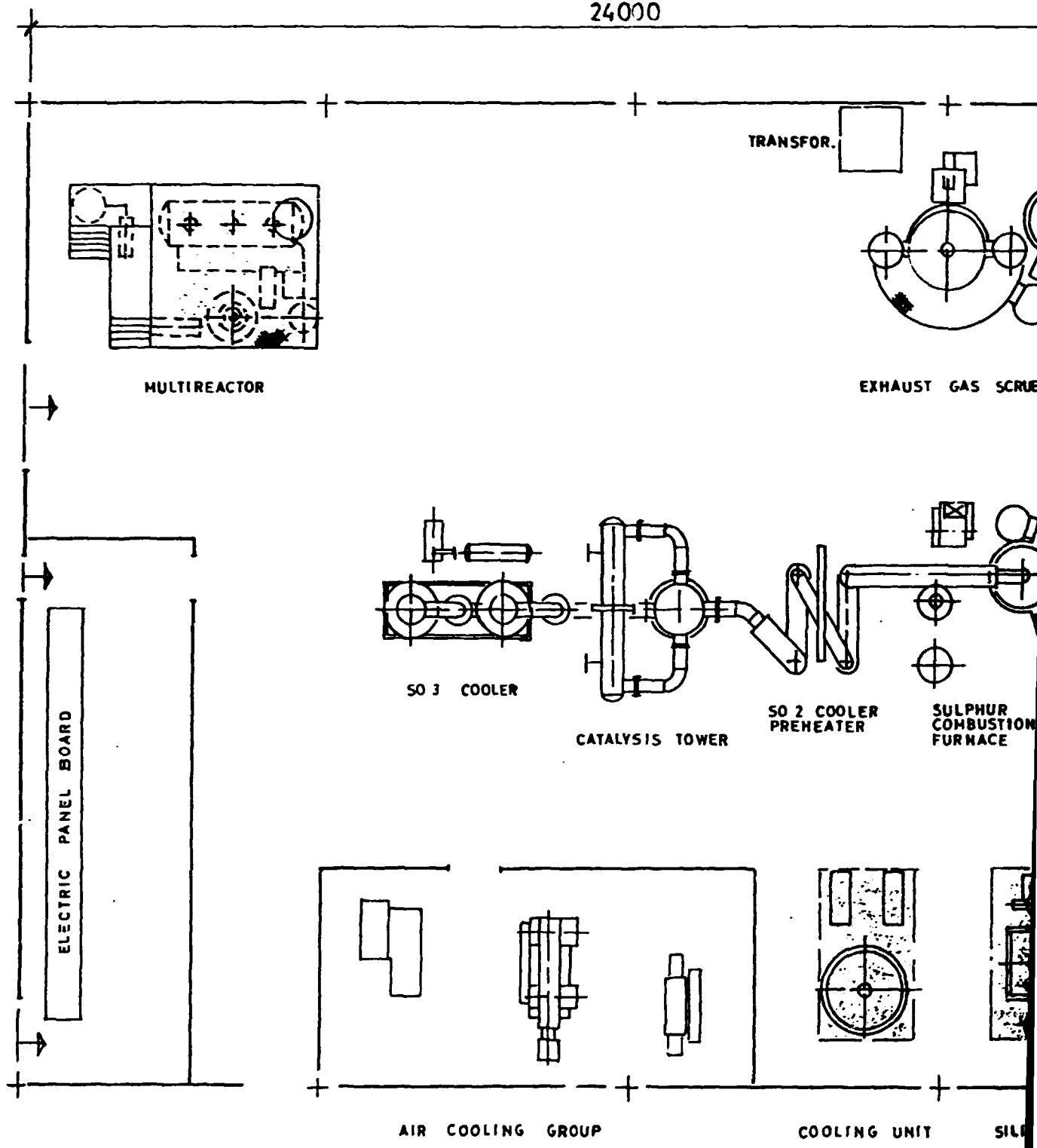
**Sulphonation Chemicals**

**ANNEXE 5**

DRW. B162 - 17 - 1  
PROCESS FLOW DIAGRAM

DRW. B162 - 17 - 2  
EQUIPMENT LAY OUT

24000

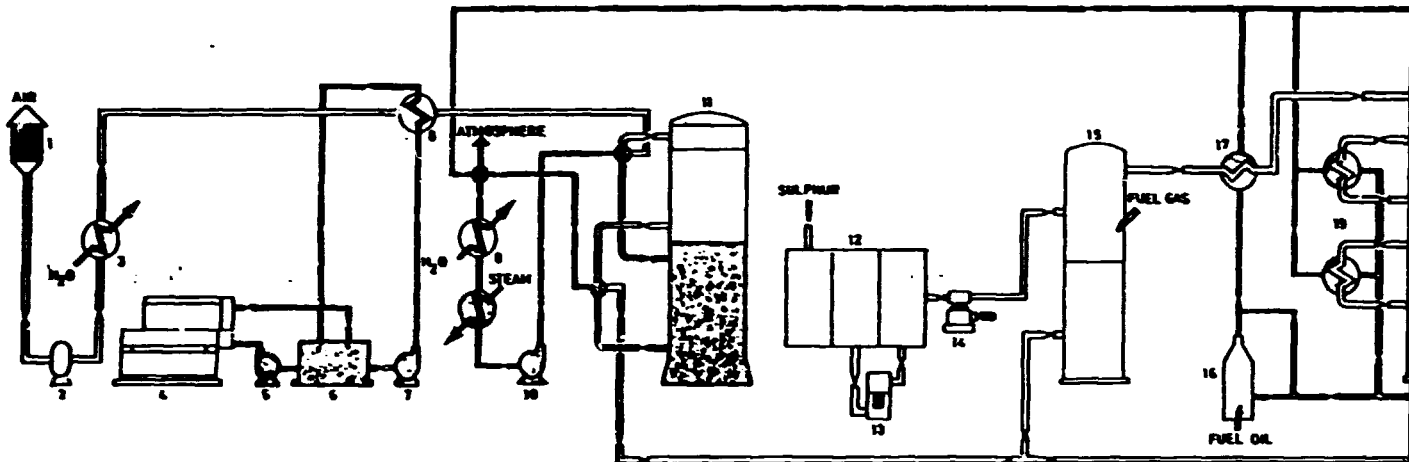


SECTION 1



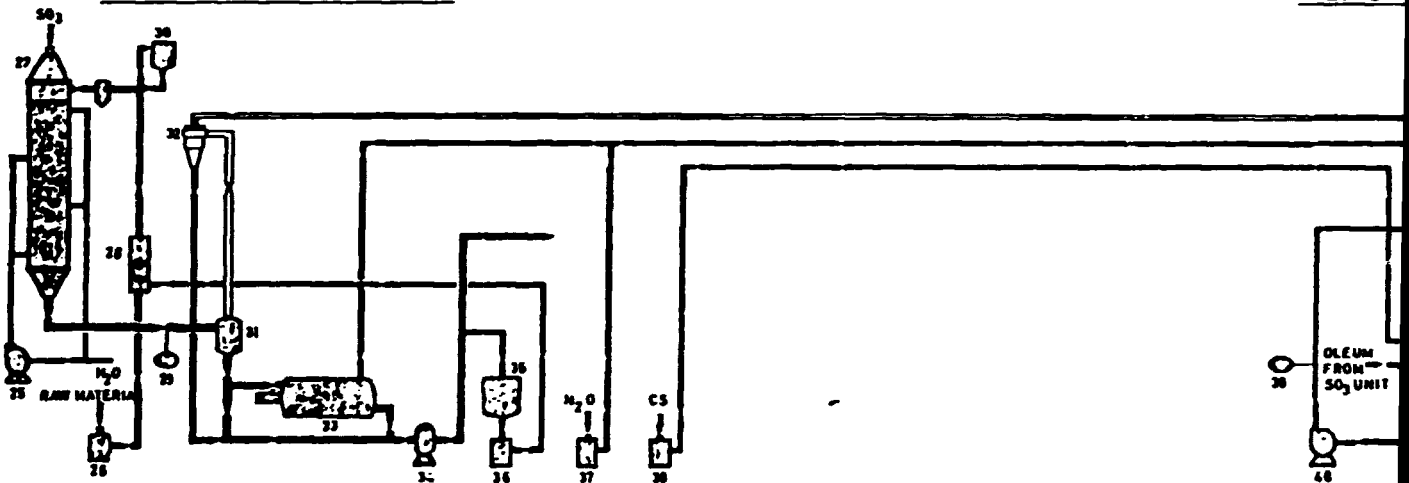
## AIR DRYING

## SO<sub>2</sub>/SO<sub>3</sub> PROD



## FILM SULPHONATION

## GAS



### FILM SULPHONATION & SULPHATION (SULPHUREX F)

### DOUBLE STEP NEUTRALIZATION (NEUTREX)

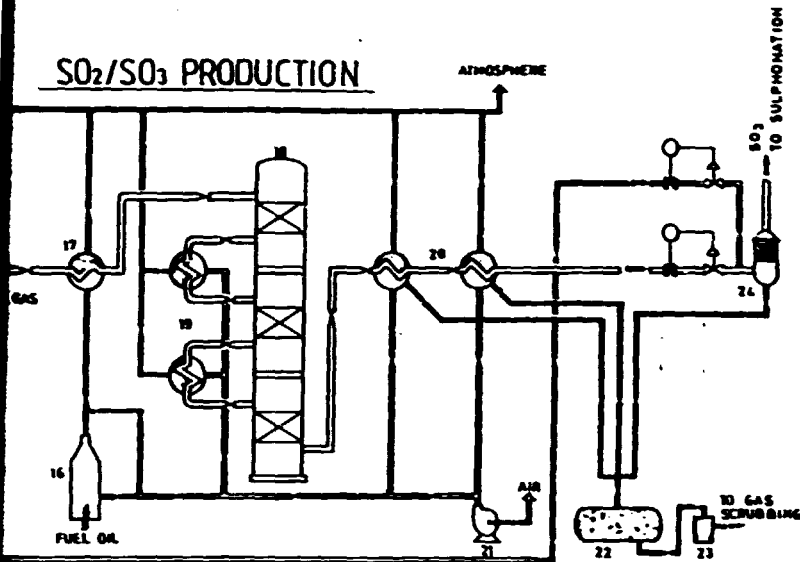
### EXHAUST GAS S

- 24- GAS-ACID CONDENSATES FILTER
- 25- COOLING WATER RECIRCULATION PUMP
- 26- RAW MATERIAL DOSING UNIT
- 27- MULTIPHASE REACTOR
- 28- STATIC MIXER
- 29- SULPHONATION DEGREE CONTROLLER
- 30- EMERGENCY RAW MATERIAL FEEDING VESSEL
- 31- GAS-LIQUID SEPARATOR
- 32- EXHAUST GAS SEPARATOR CYCLONE
- 33- ACIDING-STABILIZING UNIT
- 34- ACID TRANSFER PUMP
- 35- ACID COLLECTING VESSEL
- 36- ACID DOSING UNIT

- 37- WATER DOSING UNIT
- 38- CAUSTIC SODA DOSING UNIT
- 39- PH CONTROL UNIT

- 40- SCRUBBING UNIT
- 41- GAS SCRUBBER
- 42- ELECTRIC HEATER
- 43- AIR HEATER
- 44- AIR FAN

### SO<sub>2</sub>/SO<sub>3</sub> PRODUCTION



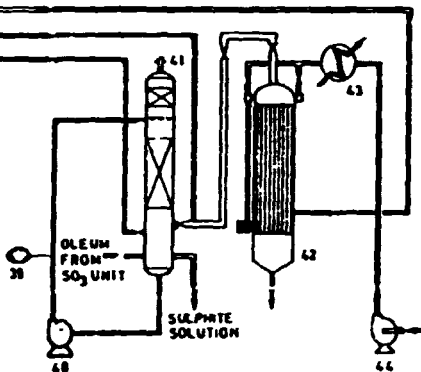
### AIR DRYING

- 1- PROCESS AIR FILTER
- 2- PROCESS AIR CYCLONE SEPAR
- 3- CYCLONE UNIT
- 4- AIR COOLING COOLER
- 5- CYCLONE UNIT
- 6- 12 YEAR RECYCLE VESSEL
- 7- CYCLONE UNIT
- 8- MUST CYCLONE UNIT
- 9- SILICATE REGENERATION UNIT
- 10- REGENERATION AIR FAN
- 11- SILICATE AIR DEHUMIDIFIER

### SULPHUR COMBUSTION AND SO<sub>2</sub>/SO<sub>3</sub> PRODUCTION

- 12- SULPHUR MELTING VESSEL
- 13- MIXED SULPHUR FILTER
- 14- MIXED SULPHUR PROPORTIONING PUMP
- 15- SULPHUR COMBUSTION FURNACE
- 16- PRE-HEATING AIR HEATER
- 17- SO<sub>2</sub> CYCLONE - PREHEATER
- 18- CATALYSIS TOWER
- 19- INTERMEDIATE HEAT EXCHANGER
- 20- SO<sub>3</sub> CYCLONE
- 21- CYCLONE FAN
- 22- ACID CONCENTRATES COLLECTING TANK
- 23- CONCENTRATES PREHEATING PUMP


### GAS SCRUBBING



### EXHAUST GAS SCRUBBING

- 40- SCRUBBING SOLUTION CIRCULATION PUMP
- 41- GAS SCRUBBING COLUMN
- 42- ELECTROSTATIC PRECIPITATOR
- 43- AIR WATER
- 44- AIR FAN

## SECTION .2

CLIENTE CUSTOMER	COMMESSA N. JOB N.	
PLANT FOR CONTINUOUS SO <sub>3</sub> - FILM SULPHONATION	CONTROLATO APPROVED	DATA DATE
	DISEGNATO DRAWN	DATA DATE
	SCALA SCALE	
 CONSULTING ENGINEERS	Dis. N. Dwg. N. B. 162-17-2	
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	REV.	

**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF INDUSTRIAL ADHESIVE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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0. SUMMARY AND CONCLUSIONS

Industrial adhesives are widely used in Ethiopia for a number of application ranging from wood processing to cardboard, shoe production etc., and are mainly imported.

The present opportunity study has analysed the possibility of importing the raw materials and mixing them in a formulating plant in order to produce the adhesives mostly used in the Ethiopian Industry.

The present consumption is estimated in the range of 1,000 tons and, according to the development plans of the various corporations using this kind of product, should increase to 1,300 tons by the end of the decade and to 1,700 tons by 1994/5.

This amount justifies the local formulation, a practice commonly followed in industrialized countries too, where adhesives industries usually simply formulate them according to application specifications.

The fixed investment foreseen is 3,040,000 \$ (1,630,000 \$ the foreign exchange portion) and will generate employment for 43 persons).

The internal rate of return is 10.69 %.

Since the foreign exchange effect is also favourable the preparation of a feasibility study is recommended.

1. INTRODUCTION

Adhesives are substances capable of holding materials together by surface attachment. Although other terms (such as cement, glue, paste and mucilage) are loosely used interchangeably, adhesive is considered as the most acceptable general term for all such bonding agents.

At the present time there are no all purpose adhesives that combine all of the desired properties for a wide variety of bonding applications and it is unlikely that such an adhesive will ever be formulated.

The actual formulation of modern adhesives is the result of a complex process where several different components, all important to the adhesive system, are combined.

The compositions of many adhesives are not revealed publicly or are covered by patents. As with other proprietary products consisting of a number of components the success of the adhesive composition may often depend on special techniques in mixing that are not divulged by the adhesive formulator; it is not a simple matter of following a prescribed formula.

Most of the raw materials are intermediates produced by different branches of the petrochemical industry. For all these reasons the industry of adhesives has developed, even in the industrialized countries, as an autonomous industry, separated by the industries producing the raw materials. At present in Ethiopia, the majority of the required adhesives are imported as finished products.

Although the raw materials have to be imported, the advantage in installing such an industry in the country, should be found in the savings deriving from the possibility of buying raw materials in bulk and with

higher concentration, as well as the achievement of the more general goal of contributing to the development of the local chemical industry.

Since certain characteristics of adhesives are selected according to their final use (industrial or household field), our study will be addressed to the production of industrial adhesives only.

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

The adhesives proposed for the new plant should have the following main uses.

2.1.1 Water based adhesives consisting in dispersions in water of the omo and co-polymers of the vinylacetate; these adhesives are particularly suitable for the wood sector (furnitures, window and door frames) and the cardboard sector.

In particular the following compounds have been considered:

#### a) wood processing

- a base compound to be used for the bonding of laminated plastics on chipboards and other similar woodworks
- a base compound to be used for the production of window and door frames and casings to be exposed to atmospheric agents
- a base compound to be used with clamps for the manufacture and assembling of furniture
- a base compound for the cold nobilitation of chipboards with paper sheets impregnated with thermosetting resins or plastic materials, in particular PVC
- a base compound for the assembly and bounding of wood structures, particularly for the production of chairs

b) cardboard processing

- a base compound for the preparation and closing-up of boxes and cases
- a base compound for the binding of spines
- a base compound for the book encasing

2.1.2 Hot-melting adhesives based on the copolymers of vinyl-ethylene acetate suitable for the wood and cardboard sectors. In particular the following compounds have been considered:

a) wood processing

- a base compound for the binding of borders made-up of laminate plastic, wood, PVC and melamine

b) cardboard processing

- a base compound for the manufacture of boxes and cases
- a base compound for the binding of book spines

2.1.3 Adhesive with solvents prepared with a poly-chloroprenic or polyurethanic base, suitable for the wood sector and the shoe sector.

In particular the following compounds have been considered:

a) wood processing

- a base compound for the bonding of laminated plastic on chipboards

b) shoe processing

- a base compound for the bonding of soles to the uppers

- a base compound for the bonding of synthetic articles

2.1.4 The following applications have not been taken into consideration:

- paper manufacture, as the preparation of casein glue (a typical product for this use) differs in conception and raw material from the other products
- chipboards and plywood manufacture, as the required adhesives, which consist essentially of urea and formaldehyde, can be produced economically only in very large quantities (not less than 30,000 ton/y).

These uses therefore will still be covered by the direct import of the finished products, while all the other utilizations will be satisfied by the proposed production.

## 2.2 Forecast demand and plant capacity

Current consumption of adhesives can be put at 650 tonnes per year, an approximate breakdown being as follows:

- Ministry of construction	430 tonnes
(wood processing)(1)	(average 1984/5-1985/6)
- Metals Corporation (wood processing) (1)	30 tonnes
- National Printing Corporation	75 tonnes
- National Textiles Corporation	40 tonnes
- National Leather and Shoe Corp.	75 tonnes
- AMCE	5 tonnes

-----  
TOTAL 655 tonnes

(1) plywood and particle board production plus furniture making  
Source: Direct interviews by Baldo & C.

There is an additional consumption of at least 150 tonnes for the private furniture manufacturing industry ( 35 per cent roughly of that of the public sector), and some 50 tonnes on account of small private producer of leather shoes (estimated as making one million pairs per year to NLSC's 1.5 million).

As for future demand, the statistics on past production of plywood and particle board do not show a clear trend. It can be assumed, however, that in the next few years a more steady development trend will prevail in those two subsectors also. For 1986/7 the Ministry of Construction projects a consumption of adhesive of 567 tonnes (+33 per cent over the average of the previous two years). Based on foreseeable developments by other main consumers, total demand can be forecast as in table 1.



Table 1

	1986/7	1990/1	1994/5
- Ministry of construction (a)	567	716	904
- Metals Corporation (a)	31	39	49
- National Printing Corp.(b)	75	110	210
- National Textile Corp. (c)	45	57	73
- National Leather and Shoes Corp.(d)	75	98	132
- Iveco (e)	5	7	9
- Private furniture and leather shoes makers (a)	200	252	319
	----	----	----
TOTAL	998	1279	1696
rounded off	1000	1300	1700

(a) projected to grow at assumed GDP rate (6% p.a.)

(b) interview with NPC; projected pulp factory assumed to become fully operational by 1994/5 rather than 1990/1

(c) growth proportional to projected cotton fabrics production ( $y = -12205 + 12.64 \text{ GDP f.c.}; r = 0.88$ )

(d) same criterium as (c), production of leather shoes ( $y = -301755 + 451.3 \text{ non-agricultural GDP f.c.}; r = 0.94$ )

(e) assumed growth: +8 per cent per year approx.

Current prices vary considerably, at least partly following the characteristics of the products. Average import prices in the last four years for "adhesives, not elsewhere specified" have fluctuated around 2.6 birr/Kg. The Metals Corporation quotes prices between 5 and 8 birr/Kg (at the factory). The Ministry of Construction

factories making plywood and particle board give an average price of 3.5 birr/Kg. The National Printing Corporation states prices of 2.24 birr/Kg (at Addis Ababa airport) for cold glue in 120 Kg drums and of 4.44 birr/Kg for hot-melt glue in 20-30 Kg packages. Information for one NLSC factory shows prices varying between 6.0 and 15 birr/kg (7.5 birr/Kg on average).

Without taking into consideration, for reasons previously explained, the consumption of adhesives for the production of plywood, chipwood and paper, the forecast of 1700 ton in the mid-nineties should be reduced to about 1000-1100 ton/y, approximately equally subdivided into three sectors, namely the wood sector, the cardboard sector and the shoe sector.

These quantities are very small, especially considering, as pointed out in para 2.1, that more than one type of adhesive is normally required for each sector.

So the criteria followed for establishing the capacity of the plant are the following:

- production of four of the main base types of adhesives for the selected three sectors;
- minimum economical capacity for each of the four types;

These capacities are:

- 660 t/y of adhesives dispersed in water (see para 2.2.1.1) suitable for the wood and the cardboard sectors
- 660 t/y of adhesive dissolved in solvents (see para 2.2.1.3) suitable for the wood and the shoe sectors
- 265 t/y of hot-melting adhesives (see para 2.2.1.2) for the wood sector

- 110 t/y of hot-melting adhesives for the cardboard sector.

As a whole 1695 t/y.

The characteristics of the selected products are shown in the specifications annexed to the present study. (Annexe 5).

On the basis of the present situation of the market and on the prices above indicated the following average selling prices, ex-works, can be assumed:

- 1212 \$/t for adhesives dispersed in water
- 2402 \$/t for hot melting adhesives for cardboard sector
- 1320 \$/t for hot melting adhesives for wood sector
- 3792 \$/t for adhesives dissolved in solvents.

On this assumption, the total annual theoretical revenues at full capacity (1695 t/y) would be as follows:

- adhesive dispersed in water	
660 t/y x 1212 \$/t =	799,920 \$/y
- hot melting adhesives for wood sector	
265 t/y x 1320 \$/y =	349,800 \$/y
- hot melting adhesives for cardboard sector	
110 t/y x 2402 \$/y =	264,220 \$/y
- adhesives dissolved in solvents	
660 t/y x 3792 \$/y =	2,502,720 \$/y
	-----
Total annual revenues	3,916,660 \$/y

Taking into consideration that, at least for the first years of operation the actual sales should not be more than 1,100 tons/year approximately, the total actual revenues should be in the range of 2.5 Million Dollars. As far as the financial evaluation is concerned, the total amount at an average weighted price of 2310 \$/t only has been considered.

3. MATERIAL AND INPUTS

3.1 Formulation

Each type of adhesive, depending on the field of application and on the adherends quality, includes a large number of components. A complete list of the inputs required for the planned production is reported in table 3.1; this list includes the commercial name of the 60 base materials taken into consideration, together with the name of major manufacturers and an estimated price for the supply free site.

3.2 Materials and utilities; requirements and costs

On the basis of typical formulations presently used in Europe and the prices in table 3.1 the cost of the raw materials at full capacity (1650 t/y) are as follows:

Table 3.1

Selected raw materials for adhesives formulations

<u>Raw materials</u>	<u>\$/Kg</u>	<u>Supplier</u>
. Polyvinyl acetate 50% sol.	0.815	Vinavil - Italy
. Polyninyl acetate 60% sol.	0.884	Vinavil - Italy
. Vinylethylene acetate co-polimers in 65% water dispersion	1.346	Wacker-W.Germany
. Vinnipas DPN 15	1.346	Wacker-W.Germany
. Ravemul M 18	0.884	Enichem Sintesi-I
. Vinavil Eva 09	1.230	Montedipe-Italy
. Neozapon red 355	64.885	Basf-W.Germany
. Baypren 233 grains	4.385	Bayer-W.Germany
. Neoprene (low crystallization)	4.038	Chemverga-Italy
. Neoprene (high crystallization)	5.5	Bayer-W.Germany
. Neoprene GNA	4.692	Dupont-France
. Polyos K8N	6.003	Kaso
. Estane 5712	4.846	Ichemco
. Vynilethilene acetate co-polymers	1.808	Dupont-France
. 7522 Rousselot resin	3.077	Ceca
. Schenectady SP 134	2.915	Basf-W.Germany
. Schenectady SP 154	4.073	Basf-W.Germany
. Schenectady SP 560	2.750	Basf-W.Germany
. Hercures A 130	2.062	Eigenmann & Veronelli - Italy
. Coumarone resin B 1/95	1.73	V.F.T.
. Coumarone resin B 1/2 105	1.808	V.F.T.
. Rokrasin 1887	2.738	Kramer-Inalco
. Norsolene 1090	1.885	Soconomar
. Escorez 2203	2.5	Exxon Chemical M.

. Uratak 68520	3.	D.S.M.
. Uratak 68525	3.308	D.S.M.
. Escorez 5300	3.577	Exxon Chemical M.
. Alresen 565 PA	3.846	Hoechst-W.Germany
. Micronized calcium carbonate	0.315	Cominder-Ros
. Maglite D	2.769	Eigenmann & Veronelli - Italy.
. Calsil	2.154	Eigenmann & Veronelli - Italy
. Elastomag 170	2.923	Garzanti Chimica - Italy
. Ducal 401	0,462	Hulss & Capelli - Italy
. Nivea barite	0,692	Cominder
. Pure ethinyl trichloride	1.00	Cambiaghi - Italy
. Labelled toluene	0,692	Total
. Denaturated hexane	0,615	Salgoil
. Ethyl methylketone	1.038	Iempsa
. Ethyl acetate	1.038	Wacker-W.Germany
. Labelled cyclohexane	0.884	Carburanti & Suc.-Italy
. Pure acetone	0,846	Carmagnani-Italy
. Cyclohexanone	1.885	Iempsa
. Isobutyl phtalate	1.230	Sisas-Italy
. Sicol 160	1.962	Riveda e/o Enichem - Italy
. Antifoaming Nopco NDW	1.962	Diamond
. Parmentol A 23	3.885	Maggioni Wintrop
. Maize starch	1.077	C.P.C.
. Dowicil 75	4.385	U.C.E.
. Lutensint AF-K	6.269	Basf-W.Germany
. Aquatint yellow 3211	12.961	Di.Pi.A-Italy
. Pigmosol brown 2915	15.5	Basf-W.Germany

. Zapon yellow 157	51.423	Basf-W.Germany
. Antioxidant BHT	4.385	Amik Italia-Italy
. Zinc oxide	2.385	Garzanti Chimica - Italy
. Salsolvaks H1	2.346	Spica
. Polarwachs A 75	2.399	Tromm
. Pergut S 90	5.730	Bayer-W.Germany
. Europox 720	4.462	Schering-Italy
. Wing stay L	7.385	Sides
. Vinilite VROH	8.038	Chemplast



- adhesive dispersed in water		
660 t/y x 1,011 \$/t =		667,260 \$/y
- hot-melting adhesives for wood sector		
265 t/y x 1,320 \$/t =		349,800 \$/y
- hot-melting adhesives for cardboard sector		
110 t/y x 2,288 =		251,680 \$/y
- adhesives dissolved in solvents		
660 t/y x 1,653 \$/t =		1,090,980 \$/y

-----  
Total annual expenses for raw materials

at full capacity 2,359,720 \$/y  
of which 80% (1,887,776) in foreign currency and 20% as local currency (471,944)(1). The annual consumption of utilities on the whole (the difference among the utility requirements of each type of adhesive being small) is as follows:

- electric energy 43,329 Kwh/y x 0.20		
birr/KWh	=	8,666 birr/y
- industrial water (make-up) 1440 m3/y		
x 0.5 birr/KWh	=	720 birr/y
- nitrogen (liquified, in bottle)		
1080 Kg/y x 5 birr/Kg	=	5,400 birr/y
- fuel oil 20,250 Kg/y x 0,466		
birr/Kg	=	9,436 birr/y
		-----
		24,222 birr/y

or expressed in dollars 11,701 \$/y

(1) Taking into account part of the import charges (inland transportation and other charges) which are paid in local currency.

Thus, the total annual expenses for material inputs and utilities amount to:

- 1,887,776 \$/y as foreign currency
- 483,645 \$/y as local currency
- 
- 2,371,421 \$/y as total annual expenses

### 3.3 Raw material purchasing programme and storage volume

It has been indicated that practically all raw materials are imported. It is therefore recommended that, in order to gain more favourable commercial terms, the raw materials be imported in bulk, for at least 6 months consumption requirements, i.e. 750 tons at a time, equivalent approximately to 1,044,000 \$ (80% in foreign currency, as above stated).

A storehouse of approximately 2,000 cu.mt. is therefore required.

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4. LOCATION

The factory should be installed in the vicinity of the main State factories of the wood or cardboard or shoe sector in order to minimize the transportation of the final product to the main users, other considerations (pollution, utilities, etc) being of minor importance.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

5.1.1 Process description

a) Adhesives dispersed in water

As already stated, these adhesives use, as base materials, omo and co-polymers of vinyl acetate mixed with various additives such as (depending on the general requirements of the user) mineral fillers, polyvinyl alcohol, plasticisers, resins, solvents and other substances in small amounts as it is indicated in the annexed data sheets.

For the production of adhesives of this type a simple blending of the various components according to a prefixed sequence will be sufficient, using blenders with multirod or rotating disc stirrers.

b) Hot melting adhesives

These adhesives use co-polymers of vinyl-ethylene acetate, mixed with resins, mineral fillers and some types of wax, as base materials.

Production for the wood sector is carried out in blenders with strong sigmalike stirrers; the product, well homogenized is afterwards extruded by a screw feeder through a die drawplate; with water flowing in a channel the product is cooled down so that the cutting by means of a cutter or a granulator is possible.

The production of the same type of adhesives but addressed to the cardboard sector will be carried out in separate blenders in order to avoid the pollution of these adhesives with the fillers normally used in the adhesives for the wood sector.

Vertical blenders are utilized for their preparation and the cooling of the product is carried out on a properly cooled steel belt; in the same way, as far the adhesives of the wood sector, a cutter, cooled as necessary with a liquid nitrogen jet, reduces the extruded product size to granules.

The heating of the blender is carried out with dowtherm oil at temperatures ranging from 160 to 230°C, depending on the type of adhesive produced.

c) Adhesives with solvent

This type of adhesive uses polychloroprene and polyurethane dissolved in organic, aromatic, alifatic and chlorinated solvents as base material.

Together with the main raw materials, various other substances such as resins, antioxidants, magnesium and zinc oxides and mineral fillers are added.

The neoprenic bases before their solution in the solvent mixtures will be masticated in a roller press-mill (calender); afterwards the masticated product is charged into the mixers and dissolved with the selected solvents; this operation requires from four to twentyfour hours, depending on the type of mixer available and the type of adhesive.

The polyurethanic adhesives are normally dissolved in the selected solvents without any mastication.

5.1.2 Machinery and equipment

The process machinery and equipment include:

- a) for the adhesive dispersed in water
- 4 raw materials storage tanks complete with pumps and pipes for the transfer of the products
  - 2x500 liter blenders complete with stirrer
  - steel supporting structure
  - 1 pneumatic double head packaging machine
  - discharge pipe feeders for packaging
  - 1 underground scale for a max load of 1500 Kg
  - shelving for raw materials and finished products
  - washing plant for vessels, transfer pipes, etc
  - washing waters treating plant
- b) for the adhesives with solvent
- 5x10m<sup>3</sup> underground tanks with partition walls
  - solvent transfer pumps from the tanks to the blenders
  - dosing transfer pipes complete with stop valves, vents, etc
  - steel supporting structure
  - 1x1000 liter vertical blender complete with turbo-mixer, 1x1000 liter horizontal blender with a slow speed agitator complete with solvent vapor trap
  - discharging pipes for finished products complete with pumps and filters
  - packaging machine with double head
  - shelvings for raw material and finished product storage
  - washing plant for filtering medium
- In addition to this equipment a press roller mill for

neoprene mastication is included, namely:

- one press-roller mill (300x1000mm) complete with main motor, auxiliary and safety systems
- one granulator
- one scale for dosing raw materials
- shelvings for raw material storage

c) for the hot melting adhesives for the wood sector

- 1x300 liter sigmamate-mixer with extrusion screw feeder, complete with heating jacket and extrusion head
- steel supporting structure
- channel for extruded product cooling
- cutter for product granulation
- pneumatic transfer and packaging line
- manual sewing machine
- shelvings for raw material and finished product storage

d) for the hot melting adhesives for the cardboard sector:

- 1x500 liter mixer complete with heating jacket and extrusion head
- steel supporting structure
- steel cooling belt
- cutter for product granulation
- pneumatic transfer and packaging line

As auxiliary plant common to both hot melting adhesive productions, a dowtherm boiler of 150,000 Kcal/h capacity is supplied complete with 1x15m<sup>3</sup> underground fuel oil storage tank, dowtherm oil circulation pumps and lines, control valves, etc.

e) for general facilities and utilities plants:

- one 180 KW electric transformer, main breaker and motor control center, power distribution network, grounding network, re-phasing equipment; all the electrical components outside the electric compartment are of the explosion proof type
- two air-compressors with surge tank and distribution pipes
- refrigerating units and distribution pipes
- potable water distribution
- ventilation systems for hot melting and vinylic adhesives areas
- vapor exhaust system complete with filter for the press-roller masticator area
- antifire system including an automatic sprinkler installation and some mobile equipment (portable and trailer-mounted extinguishers)
- special laboratory equipment
- air conditioning system for offices and laboratories
- underground sewer system
- internal electric means of transport battery powered, of the explosion-proof type, including:
  - . one trailer
  - . two fork lift trucks

## 5.2 Packaging

The water dispersed adhesives are generally sold in drums (30,50 - 100 Kg each) or in pails (10 Kg each) the adhesives with solvent in cans (1.5 and 15 Kg each) or in drums (50 and 250 Kg each); the hot melting adhesives in bags (25 Kg polyethylene bags).



The packaging machines are already listed in the equipment description.

The average cost of packaging materials is estimated as 10% of the production cost.

### 5.3 Layout and civil works

The layout of the production plant is represented on the annexed drawing B162 - 6 -1. Due to the hazard of fire it is recommended to leave the production building isolated from other plants or buildings; thus a total area of about 5000 ÷ 6000sq.mt is required, of which the area covered by the production building is about 2500sq.mt.

In the drawing the possible arrangement of the various production equipment as well as utilities, laboratory and storage rooms are shown.

The construction characteristics of the production building are as follows:

- the supporting structures (footings, columns, beams and double-T beams for the roof) are of reinforced concrete;
- the partition walls are made of brick or, when fire cut-off walls are required, of reinforced concrete
- the compartments for the electric transformer and the motor control center boiler, for the refrigerating units and laboratory, are constructed in reinforced concrete
- the floor is made of reinforced concrete with a hard aggregate as surface finishing. Underground passages covered with grating are inserted in the floor for the installation of pipes and cables

- the external walls are made of brickwork
- the roof is insulated with mineral wool lagging covered with asbestos cement sheets
- windows, aeration openings and doors are made of steel
- as protection against the lightning hazard, an air terminator is installed above the roof, with down conductors for the connection to the earthing system
- the fence, which encloses the entire factory, is made of reinforced concrete with two steel gates for the movement, in and out, of the trucks. Between the two gates a weighing bridge is installed
- all the space inside the fence, courtyards and roads, is asphalted.

5.4 Investment costs: depreciation and maintenance

The investment costs for the installation described in the previous para 2.5.1 and 2.5.3 are estimated as follows:

	FC	LC	TOTAL
	M\$	M\$	M\$
machinery and equipment for water dispersed adhesives FOB European port	0.138	-	0.138
m & e. for adhesive with solvent FOB European port	0.315	-	0.315
m & e. for hot melting adhesive FOB European port	0.215	-	0.215
m & e. for general facilities and utilities FOB Eur.port	0.423	-	0.423
	-----	-----	-----
	1.091	-	1.091
transportation	0.109	0.109	0.218
licence and technical assistance	0.201	-	0.201
erection	0.075	0.075	0.150
Site preparation	-	0.100	0.100
civil works	-	1.000	1.000
	-----	-----	-----
Total	1.476	1.284	2.760
Contingencies	0.154	0.126	0.280
	-----	-----	-----
GRAND TOTAL	1.630	1.410	3.040

Note: in the cost of machinery and equipment all the charges for plant commissioning are included.

The life cycle of the plant can be considered 15 years. The maintenance annual cost has been assumed to be 4% of the cost of equipment and machinery, that is 45,000.

In the financial evaluation, the investment costs (contingencies included) are so subdivided:

Machinery	FC 1.630 million dollars
Machinery	LC 0.184 " "
Site preparation	LC 0.100 " "
Civil Works	LC 1.126
	-----
	3.040 million dollars

6. PLANT ORGANIZATION

For the financial evaluation the plant has been considered as an autonomous unit, operating under the direction of the National Chemical Corporation.

7. MANPOWER

7.1 Management

		birr/m	birr/y
General manager	n.1	1500	
Technical manager	n.1	1200	
		-----	-----
		2700	32,400

7.2 Administrative Dep.

Senior accountant	n.1	800	
Accountant	n.1	400	
Purchase officer	n.1	400	
Store head	n.1	400	
Store assist.	n.1	350	
Sales officer	n.1	400	
Drivers	n.3	1050	
Clerks and secretaries	n.4	1200	
Guards	n.6	1200	
		-----	-----
		6200	74,400

Total Manag. + Administr: Dep. 106,800 birr/y  
(51594 \$/y)

7.3 Production and maintenance dep.

		birr/m	birr/y
a) product dep.			
Production head	n.1	1,000	
Operators	n.5	2,000	
Semi-skilled workers	n.5	1,500	
Chemist	n.1	800	
Labourers	n.3	600	
	-----	-----	-----
	n.15	5,900	70,800
			(34203 \$/y)
b) Engineering dep.			
Engineer	n.1	800	
Electrician	n.1	400	
Mechanic	n.1	400	
Welder	n.1	400	
Unskilled workers	n.3	600	
	---	-----	-----
	n.7	2,600	31,200
			(15072 \$/y)

8. IMPLEMENTATION SCHEDULING

A total of 24 months are needed from the moment the project implementation is decided to the commissioning of the plant.



9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	LC	FC
inventory utilities	1	1
work in progress	7	7

- the assistance of one foreign expert for the first operating period (one year) has been taken into account and indicated as "foreign factory overheads".

- packaging costs have been included as "other raw materials"

- the production program has been assumed as follows:

1st year : 700 t as a whole (about 41% capacity)  
from 2nd to 6th year : 1100 t (about 65% capacity)  
from 7th to 11th year: 1500 t (about 88.5% capacity)  
from 12th to 15th year: 1695 t (100% capacity)

selling price (w. average) 2310 \$/t

As a result, the evaluation yields an IRR equal to 10.69% and a BEP equal to 27%

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 4.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantities equal to the production programme;
- cost of import equal to 1617 \$/t CIF Assab (average price).

While the net foreign exchange flow results negative (no export is foreseen), the net foreign exchange effect is favourable; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 1,997,000\$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 1,997,000 \$

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CONSULTING ENGINEERS

**Industrial Adhesive**

**ANNEXE 1**

**FINANCIAL EVALUATION**



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**INDUSTRIAL ADHESIVES**  
February 88  
BASIC PROJECT

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US DOLLARS

---

**Total initial investment during construction phase**

fixed assets:	3248.50	54.441 % foreign
current assets:	3.00	0.000 % foreign
total assets:	3248.50	54.441 % foreign

---

**Source of funds during construction phase**

equity & grants:	175.00	0.000 % foreign
foreign loans :	1385.00	
local loans :	0.00	
total funds :	3110.00	44.534 % foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	1258.20	1823.84	1823.84
depreciation :	211.29	211.29	201.29
interest :	138.50	121.19	103.88
production costs	1607.99	2156.32	2129.01
thereof foreign	68.83 %	68.87 %	68.94 %
total sales :	1617.00	2541.00	2541.00
gross income :	9.01	384.68	411.99
net income :	4.50	192.34	206.00
cash balance :	-600.95	-104.11	234.16
net cashflow :	-289.32	190.20	511.16

Net Present Value at: 10.00 % = 182.99

Internal Rate of Return on total investment: 10.69 %

Equity paid versus Net income flow (IRR): 11.99 %

Net Worth versus Net Cash Return (IRR): 10.55 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	100.00	0.00
Buildings and civil works .....	675.00	451.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	326.00	1428.00
<b>Total fixed investment costs . . . .</b>	<b>1101.00</b>	<b>1939.00</b>
Pre-production capital expenditures.	20.00	188.50
Net working capital .....	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>1121.00</b>	<b>2127.50</b>
<b>Of it foreign, in % .....</b>	<b>29.08</b>	<b>67.80</b>

INDUSTRIAL ADHESIVES — February 88



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**Total Current Investment in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991-94	1995	1996-99	2000
<b>Fixed investment costs</b>						
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00	0.00
Working capital . . . . .	643.62	334.62	0.00	348.11	0.00	169.80
<b>Total current investment costs . . .</b>	<b>643.62</b>	<b>334.62</b>	<b>0.00</b>	<b>348.11</b>	<b>0.00</b>	<b>169.80</b>
<b>Of it foreign, % . . . . .</b>	<b>88.68</b>	<b>90.60</b>	<b>0.00</b>	<b>90.97</b>	<b>0.00</b>	<b>91.61</b>

INDUSTRIAL ADHESIVES — February 88



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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product)	41.30	64.90	64.90	64.90	64.90	64.90
Raw material I . . . . .	974.51	1531.39	1531.39	1531.39	1531.39	1531.39
Other raw materials . . . . .	98.00	154.00	154.00	154.00	154.00	154.00
Utilities . . . . .	4.83	7.59	7.59	7.59	7.59	7.59
Energy . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Labour, direct . . . . .	34.20	34.20	34.20	34.20	34.20	34.20
Repair, maintenance . . . . .	15.07	15.07	15.07	15.07	15.07	15.07
Spares . . . . .	20.00	36.00	30.00	30.00	30.00	30.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1206.61</b>	<b>1772.25</b>	<b>1772.25</b>	<b>1772.25</b>	<b>1772.25</b>	<b>1772.25</b>
Administrative overheads . . . . .	51.59	51.59	51.59	51.59	51.59	51.59
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	211.29	211.29	201.29	191.29	191.29	177.29
Financial costs . . . . .	138.50	121.19	103.88	86.56	69.25	51.94
<b>Total production costs . . . . .</b>	<b>1607.99</b>	<b>2156.32</b>	<b>2129.01</b>	<b>2101.70</b>	<b>2084.38</b>	<b>2053.07</b>
<b>Costs per unit ( single product ) .</b>	<b>2.30</b>	<b>1.96</b>	<b>1.94</b>	<b>1.91</b>	<b>1.89</b>	<b>1.87</b>
Of it foreign, % . . . . .	68.83	68.87	68.94	69.01	68.75	68.96
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	85.79	85.79	85.79	85.79	85.79	85.79



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**Total Production Costs in 1000 US DOLLARS**

Year .....	1995	1996	1997-98	1999	2000-1	2002
% of nom. capacity (single product).	88.50	88.50	88.50	88.50	100.00	100.00
Raw material 1 .....	2088.25	2088.25	2088.25	2088.25	2359.72	2359.72
Other raw materials .....	210.00	210.00	210.00	210.00	237.00	237.00
Utilities .....	10.35	10.35	10.35	10.35	11.70	11.70
Energy .....	0.00	0.00	0.00	0.00	0.00	0.00
Labour, direct .....	34.20	34.20	34.20	34.20	34.20	34.20
Repair, maintenance .....	15.07	15.07	15.07	15.07	15.07	15.07
Spares .....	40.00	40.00	40.00	40.00	45.00	45.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>2397.87</b>	<b>2397.87</b>	<b>2397.87</b>	<b>2397.87</b>	<b>2702.69</b>	<b>2702.69</b>
Administrative overheads .....	51.59	51.59	51.59	51.59	51.59	51.59
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	177.29	177.29	177.29	120.99	120.99	59.68
Financial costs .....	34.63	17.31	0.00	0.00	0.00	0.00
<b>Total production costs ..</b>	<b>2661.38</b>	<b>2644.07</b>	<b>2621.75</b>	<b>2570.45</b>	<b>2875.27</b>	<b>2813.96</b>
<b>Costs per unit ( single product ) .</b>	<b>1.77</b>	<b>1.76</b>	<b>1.75</b>	<b>1.71</b>	<b>1.70</b>	<b>1.66</b>
Of it foreign, % .....	69.66	69.46	69.26	70.78	71.00	70.59
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	85.79	85.79	85.79	85.79	85.79	85.79





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**Total Production Costs in 1000 US DOLLARS**

Year .....	2003
% of nom. capacity (single product) .	100.00
Raw material 1 .....	2359.72
Other raw materials .....	237.00
Utilities .....	11.70
Energy .....	0.00
Labour, direct .....	34.20
Repair, maintenance .....	15.07
Spares .....	45.00
Factory overheads .....	0.00
<hr/>	<hr/>
Factory costs .....	2702.69
Administrative overheads .....	51.59
Indir. costs, sales and distribution	0.00
Direct costs, sales and distribution	0.00
Depreciation .....	0.00
Financial costs .....	0.00
<hr/>	<hr/>
Total production costs .....	2794.28
<hr/>	<hr/>
Costs per unit ( single product ) .	1.62
Of it foreign, % .....	70.17
Of it variable, % .....	0.00
Total labour .....	65.79

INDUSTRIAL ADHESIVES — February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US DOLLARS**

Year .....		1989	1990	1991-94	1995	1996-99
Coverage .....	ndc coto					
<b>Current assets &amp;</b>						
Accounts receivable . . .	30 12.0	104.85	151.99	151.99	204.12	204.12
Inventory and materials .	138 2.6	414.23	650.93	650.93	887.63	887.63
Energy .....	0 —	0.00	0.00	0.00	0.00	0.00
Spares .....	360 1.0	20.00	30.00	30.00	40.00	40.00
Work in progress . . . . .	7 51.4	23.46	34.46	34.46	46.63	46.63
Finished products . . . . .	30 12.0	104.85	151.99	151.99	204.12	204.12
Cash in hand .....	15 24.0	7.54	5.45	5.45	5.87	5.87
Total current assets .....		674.92	1024.82	1024.82	1388.37	1388.37
<b>Current liabilities and</b>						
Accounts payable .....	9 38.6	31.30	46.58	46.58	62.02	62.02
Net working capital .....		643.62	978.24	978.24	1326.35	1326.35
Increase in working capital .....		643.62	334.62	0.00	348.11	0.00
Net working capital, local .....		72.89	104.33	104.33	135.77	135.77
Net working capital, foreign .....		570.73	873.91	873.91	1190.58	1190.58

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Net Working Capital in 1000 US DOLLARS

Year .....		2000	2001- 3
Coverage .....	ndc coto		
Current assets &			
Accounts receivable . . .	30 12.0	229.52	229.52
Inventory and materials .	138 2.6	1003.00	1003.00
Energy .....	0 —	0.00	0.00
Spares .....	360 1.0	45.00	45.00
Work in progress . . . .	7 51.4	52.55	52.55
Finished products . . .	30 12.0	229.52	229.52
Cash in hand .....	15 24.0	6.08	6.08
Total current assets .....		1565.68	1565.68
Current liabilities and			
Accounts payable .....	9 38.6	69.53	69.53
Net working capital .....		1496.15	1496.15
Increase in working capital .....		169.80	0.00
Net working capital, local .....		151.04	151.04
Net working capital, foreign .....		1345.11	1345.11

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US DOLLARS

Year .....	1987	1988
Equity, ordinary ..	1725.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1385.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1385.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	138.50
Total funds .....	3110.00	138.50



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993	1994	1995
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-173.13	-173.13	-173.13	-173.13	-173.13	-173.13	-173.13
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-173.13	-173.13	-173.13	-173.13	-173.13	-173.13	-173.13
Current liabilities	31.30	15.28	0.00	0.00	0.00	0.00	15.44
Bank overdraft ....	600.95	104.11	-234.16	-237.82	-246.48	-125.10	0.00
Total funds .....	459.13	-53.74	-407.29	-410.95	-419.60	-298.22	-157.68

INDUSTRIAL ADHESIVES — February 88

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1996	1997-99	2000
Equity, ordinary ..	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	-173.13	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	-173.13	0.00	0.00
Current liabilities	0.00	0.00	7.50
Bank overdraft ....	0.00	0.00	0.00
Total funds .....	-173.13	0.00	7.50

INDUSTRIAL ADHESIVES — February 88



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Cashflow Tables, construction in 1000 US DOLLARS

Year .....	1987	1988
Total cash inflow ..	3110.00	0.00
Financial resources .	3110.00	0.00
Sales, net of tax ..	0.00	0.00
Total cash outflow ..	1121.00	2127.50
Total assets .....	1121.00	1989.00
Operating costs ...	0.00	0.00
Cost of finance ...	0.00	138.50
Repayment .....	0.00	0.00
Corporate tax ...	0.00	0.00
Dividends paid ...	0.00	0.00
Surplus ( deficit ) .	1989.00	-2127.50
Cumulated cash balance	1989.00	-138.50
Inflow, local .....	1725.00	0.00
Outflow, local .....	795.00	685.00
Surplus ( deficit ) .	930.00	-685.00
Inflow, foreign ...	1385.00	0.00
Outflow, foreign ...	326.00	1442.50
Surplus ( deficit ) .	1059.00	-1442.50
Net cashflow .....	-1121.00	-1989.00
Cumulated net cashflow	-1121.00	-3110.00

INDUSTRIAL ADHESIVES — February 1989



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	1648.30	2556.28	2541.00	2541.00	2541.00	2541.00
Financial resources .	31.30	15.28	0.00	0.00	0.00	0.00
Sales, net of tax . .	1617.00	2541.00	2541.00	2541.00	2541.00	2541.00
Total cash outflow . .	2249.25	2660.39	2306.84	2303.18	2294.52	2292.87
Total assets . . . .	674.92	349.89	0.00	0.00	0.00	0.00
Operating costs . . .	1258.20	1823.84	1823.84	1823.84	1823.84	1823.84
Cost of finance . . .	138.50	121.19	103.88	86.56	69.25	51.94
Repayment . . . . .	173.13	173.13	173.13	173.13	173.13	173.13
Corporate tax . . . .	4.50	192.34	206.00	219.65	228.31	243.96
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-600.95	-104.11	234.16	237.82	246.48	248.13
Cumulated cash balance	-739.45	-843.56	-609.39	-371.57	-125.09	123.04
Inflow, local . . . . .	1646.92	2555.18	2541.00	2541.00	2541.00	2541.00
Outflow, local . . . .	504.90	806.69	774.73	788.38	797.04	812.69
Surplus ( deficit ) .	1141.02	1748.49	1766.27	1752.62	1743.96	1728.31
Inflow, foreign . . . .	2.39	1.10	0.00	0.00	0.00	0.00
Outflow, foreign . . .	1744.36	1853.70	1532.11	1514.80	1497.48	1480.17
Surplus ( deficit ) .	-1741.97	-1852.60	-1532.11	-1514.80	-1497.48	-1480.17
Net cashflow . . . . .	-289.32	190.20	511.16	497.51	482.85	473.20
Cumulated net cashflow	-3399.32	-3209.12	-2697.96	-2200.45	-1711.59	-1238.40



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Cashflow tables, production in 1000 US DOLLARS

Year .....	1995	1996	1997	1998	1999	2000
Total cash inflow ..	3480.44	3465.00	3465.00	3465.00	3465.00	3922.95
Financial resources .	15.44	0.00	0.00	0.00	0.00	7.50
Sales, net of tax ..	3465.00	3465.00	3465.00	3465.00	3465.00	3915.45
Total cash outflow ..	3422.57	3050.36	2868.58	2868.58	2896.73	3451.67
Total assets .....	363.55	0.00	0.00	0.00	0.00	177.31
Operating costs .....	2449.46	2449.46	2449.46	2449.46	2449.46	2754.28
Cost of finance .....	34.63	17.31	0.00	0.00	0.00	0.00
Repayment .....	173.13	173.13	0.00	0.00	0.00	0.00
Corporate tax .....	401.81	410.47	419.12	419.12	447.27	520.09
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	57.87	414.64	596.42	596.42	568.27	471.28
Cumulated cash balance	180.91	595.55	1191.96	1788.38	2356.65	2827.93
Inflow, local .....	3479.18	3465.00	3465.00	3465.00	3465.00	3922.34
Outflow, local .....	1186.29	1149.33	1157.98	1157.98	1186.13	1363.75
Surplus ( deficit ) .	2292.89	2315.67	2307.02	2307.02	2278.87	2558.59
Inflow, foreign .....	1.27	0.00	0.00	0.00	0.00	0.62
Outflow, foreign .....	2236.28	1901.04	1710.60	1710.60	1710.60	2087.93
Surplus ( deficit ) .	-2235.02	-1901.04	-1710.60	-1710.60	-1710.60	-2087.31
Net cashflow .....	265.62	605.07	596.42	596.42	568.27	471.28
Cumulated net cashflow	-972.78	-367.70	228.71	825.13	1393.40	1864.68





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Cashflow tables, production in 1000 US DOLLARS

Year .....	2001	2002	2003
Total cash inflow ..	3915.45	3915.45	3915.45
Financial resources .	0.00	0.00	0.00
Sales, net of tax ..	3915.45	3915.45	3915.45
Total cash outflow ..	3274.37	3305.03	3334.87
Total assets .....	0.00	0.00	0.00
Operating costs ...	2754.28	2754.28	2754.28
Cost of finance ...	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00
Corporate tax ...	520.09	550.75	580.58
Dividends paid ...	0.00	0.00	0.00
Surplus ( deficit ) .	641.08	610.42	580.58
Cumulated cash balance	3469.01	4079.43	4660.02
Inflow, local .....	3915.45	3915.45	3915.45
Outflow, local .....	1341.59	1372.25	1402.09
Surplus ( deficit ) .	2573.86	2543.20	2513.36
Inflow, foreign ...	0.00	0.00	0.00
Outflow, foreign ...	1932.78	1932.78	1932.78
Surplus ( deficit ) .	-1932.78	-1932.78	-1932.78
Net cashflow .....	641.08	610.42	580.58
Cumulated net cashflow	2505.76	3116.18	3696.77

INDUSTRIAL ADHESIVES — February 88



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### Cashflow Discounting:

a) Equity paid versus Net income flow:		
Net present value .....	312.71	at 10.00 %
Internal Rate of Return (IRR1) ..	11.99 %	
b) Net Worth versus Net cash returns:		
Net present value .....	128.08	at 10.00 %
Internal Rate of Return (IRR2) ..	10.55 %	
c) Internal Rate of Return on total investment:		
net present value .....	182.99	at 10.00 %
Internal Rate of Return (IRR) ..	10.69 %	

Net Worth = Equity paid plus reserves

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INDUSTRIAL ADHESIVES — February 88



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**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	1617.00	2541.00	2541.00	2541.00	2541.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1617.00	2541.00	2541.00	2541.00	2541.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	1469.49	2035.13	2025.13	2015.13	2015.13
Operational margin . . . . .	147.51	505.87	515.87	525.87	525.87
As % of total sales . . . . .	9.12	19.91	20.30	20.70	20.70
Cost of finance . . . . .	138.50	121.19	103.88	86.56	69.25
Gross profit . . . . .	9.01	384.68	411.99	439.30	456.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	9.01	384.68	411.99	439.30	456.62
Tax . . . . .	4.50	192.34	206.00	219.65	228.31
Net profit . . . . .	4.50	192.34	206.00	219.65	228.31
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	4.50	192.34	206.00	219.65	228.31
Accumulated undistributed profit . . . . .	4.50	196.84	402.84	622.49	850.80
Gross profit, % of total sales . . . . .	0.56	15.14	16.21	17.29	17.97
Net profit, % of total sales . . . . .	0.28	7.57	8.11	8.64	8.98
ROE, Net profit, % of equity . . . . .	0.26	11.15	11.94	12.73	13.24
ROI, Net profit+interest, % of invest. . . . .	3.81	7.67	7.58	7.49	7.28



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**Net Income Statement in 1000 US DOLLARS**

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	2541.00	3465.00	3465.00	3465.00	3465.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
<b>Variable margin .....</b>	<b>2541.00</b>	<b>3465.00</b>	<b>3465.00</b>	<b>3465.00</b>	<b>3465.00</b>
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	2001.13	2626.75	2626.75	2626.75	2626.75
<b>Operational margin .....</b>	<b>539.87</b>	<b>838.25</b>	<b>838.25</b>	<b>838.25</b>	<b>838.25</b>
As % of total sales .....	21.25	24.19	24.19	24.19	24.19
Cost of finance .....	51.94	34.63	17.31	0.00	0.00
<b>Gross profit .....</b>	<b>487.93</b>	<b>803.62</b>	<b>820.93</b>	<b>838.25</b>	<b>838.25</b>
Allowances .....	0.00	0.00	0.00	0.00	0.00
<b>Tangible profit .....</b>	<b>487.93</b>	<b>803.62</b>	<b>820.93</b>	<b>838.25</b>	<b>838.25</b>
Tax .....	243.96	401.81	410.47	419.12	419.12
<b>Net profit .....</b>	<b>243.96</b>	<b>401.81</b>	<b>410.47</b>	<b>419.12</b>	<b>419.12</b>
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	243.96	401.81	410.47	419.12	419.12
Accumulated undistributed profit .....	1074.76	1496.57	1907.04	2326.16	2745.28
Gross profit, % of total sales .....	19.20	23.19	23.69	24.19	24.19
Net profit, % of total sales .....	9.60	11.60	11.85	12.10	12.10
ROE, Net profit, % of equity .....	14.14	23.29	23.80	24.30	24.30
ROI, Net profit+interest, % of invest. ....	7.24	9.84	9.84	9.45	9.45



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**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	3465.00	3915.46	3915.46	3915.46	3915.46
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3465.00	3915.46	3915.46	3915.46	3915.46
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2570.46	2875.27	2875.27	2813.96	2754.28
Operational margin . . . . .	894.55	1040.18	1040.18	1101.49	1161.17
As % of total sales . . . . .	25.82	26.57	26.57	28.13	29.66
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	894.55	1040.18	1040.18	1101.49	1161.17
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	894.55	1040.18	1040.18	1101.49	1161.17
Tax . . . . .	447.27	520.09	520.09	550.75	580.58
Net profit . . . . .	447.27	520.09	520.09	550.75	580.58
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	447.27	520.09	520.09	550.75	580.58
Accumulated undistributed profit . . .	3192.56	3712.65	4232.73	4783.48	5364.06
Gross profit, % of total sales . . . . .	25.82	26.57	26.57	28.13	29.66
Net profit, % of total sales . . . . .	12.91	13.28	13.28	14.07	14.83
ROE, Net profit, % of equity . . . . .	25.93	30.15	30.15	31.93	33.66
ROI, Net profit+interest, % of invest.	10.08	11.29	11.29	11.96	12.60



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987	1988
<b>Total assets .....</b>	<b>3110.00</b>	<b>3248.50</b>
Fixed assets, net of depreciation	0.00	1121.00
Construction in progress .....	1121.00	2127.50
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	1989.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>3110.00</b>	<b>3248.50</b>
Equity capital .....	1725.00	1725.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1385.00	1385.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	138.50
<b>Total debt .....</b>	<b>1385.00</b>	<b>1523.50</b>
<b>Equity, % of liabilities .....</b>	<b>55.47</b>	<b>53.10</b>

INDUSTRIAL ADHESIVES — February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>3712.13</b>	<b>3850.73</b>	<b>3849.44</b>	<b>3458.14</b>	<b>3266.85</b>	<b>3212.59</b>
Fixed assets, net of depreciation	3037.21	2825.91	2624.62	2433.32	2242.03	2084.74
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	667.39	1019.37	1019.37	1019.37	1019.37	1019.37
Cash, bank .....	7.54	5.45	5.45	5.45	5.45	5.45
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	123.04
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>3712.13</b>	<b>3850.73</b>	<b>3849.44</b>	<b>3458.14</b>	<b>3266.85</b>	<b>3212.59</b>
Equity capital .....	1725.00	1725.00	1725.00	1725.00	1725.00	1725.00
Reserves, retained profit .....	0.00	4.50	196.84	402.84	622.49	850.80
Profit .....	4.50	192.34	206.00	219.65	228.31	243.96
Long and medium term debt .....	1211.88	1038.75	865.63	692.50	519.38	346.25
Current liabilities .....	31.30	46.58	46.58	46.58	46.58	46.58
Bank overdraft, finance required ..	737.45	843.56	609.39	371.57	125.10	0.00
<b>Total debt .....</b>	<b>1982.63</b>	<b>1928.89</b>	<b>1521.60</b>	<b>1110.65</b>	<b>691.05</b>	<b>392.83</b>
<b>Equity, % of liabilities .....</b>	<b>46.47</b>	<b>44.80</b>	<b>47.27</b>	<b>49.88</b>	<b>52.80</b>	<b>53.69</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>356.72</b>	<b>369.06</b>	<b>4113.19</b>	<b>4532.31</b>	<b>4979.58</b>	<b>5507.17</b>
Fixed assets, net of depreciation	1887.44	1710.15	1532.85	1355.56	1234.57	1113.57
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1382.50	1382.50	1382.50	1382.50	1382.50	1559.60
Cash, bank .....	5.87	5.87	5.87	5.87	5.87	6.08
Cash surplus, finance available .	180.91	595.54	1191.96	1788.38	2356.64	2827.92
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>356.72</b>	<b>369.06</b>	<b>4113.19</b>	<b>4532.31</b>	<b>4979.58</b>	<b>5507.17</b>
Equity capital .....	1725.00	1725.00	1725.00	1725.00	1725.00	1725.00
Reserves, retained profit .....	1094.76	1496.57	1907.04	2326.16	2745.28	3192.56
Profit .....	401.81	410.47	419.12	419.12	447.27	520.09
Long and medium term debt .....	173.13	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	62.02	62.02	62.02	62.02	62.02	69.53
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>235.15</b>	<b>62.02</b>	<b>62.02</b>	<b>62.02</b>	<b>62.02</b>	<b>69.53</b>
<b>Equity, % of liabilities .....</b>	<b>49.90</b>	<b>46.70</b>	<b>41.94</b>	<b>38.06</b>	<b>34.64</b>	<b>31.32</b>





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**Projected Balance Sheets, Production in 1000 UE DOLLARS**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>6027.26</b>	<b>6578.01</b>	<b>7158.59</b>
Fixed assets, net of depreciation	992.58	932.90	932.90
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1559.60	1559.60	1559.60
Cash, bank .....	6.08	6.08	6.08
Cash surplus, finance available .	3469.01	4079.43	4660.01
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>6027.26</b>	<b>6578.01</b>	<b>7158.59</b>
Equity capital .....	1725.00	1725.00	1725.00
Reserves, retained profit .....	3712.65	4232.73	4783.48
Profit .....	520.09	550.75	580.58
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	69.53	69.53	69.53
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>69.53</b>	<b>69.53</b>	<b>69.53</b>
<b>Equity, % of liabilities .....</b>	<b>28.62</b>	<b>26.22</b>	<b>24.10</b>

**Industrial Adhesive**

**ANNEXE 2**

**BEP EVALUATION**

BEP EVALUATION

THE VARIABLE COSTS AND THE REVENUES ARE RELEVANT TO THE PRODUCTION AT FULL CAPACITY, WHILE THE FIXED COSTS ARE RELEVANT TO THE 3RD YEAR OF PRODUCTION (65 % OF NOMINAL CAPACITY). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>3915.45</u>
2) VARIABLE COSTS:	<u>2405.62</u>
. RAW MATERIALS	2359.72
. UTILITIES	11.70
. ENERGY	-
. LABOUR	34.20
3) FIXED COSTS	<u>416.83</u>
. REPAIR-MAINTENANCE	15.07
. SPARES	45
. ADMINISTRATION	51.59
. DEPRECIATION	201.29
. FINANCIAL COSTS	103.88
4) TOTAL PRODUCTION COSTS	<u>2822.45</u>

$$\text{BEP} = \frac{416.83}{3915.45 - 2405.62} \times 100 = 27.6 \%$$

**Industrial Adhesive**

**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	1390.37	1385.00	5.37	1385.00	0.00	2.39	1.10
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1390.37	1385.00	5.37	1385.00	0.00	2.39	1.10
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow ..	26899.89	1768.50	25131.39	326.00	1442.50	1744.36	1853.70
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1328.50	1630.00	-301.50	326.00	1304.00	573.12	304.27
imported materials . . .	23419.28	0.00	23419.28	0.00	0.00	859.61	1255.11
repayment loans & overd.	1390.37	0.00	1390.37	0.00	0.00	173.13	173.13
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	761.75	138.50	623.25	0.00	138.50	138.50	121.19
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-2509.53	-383.50	-25126.03	1059.00	-1442.50	-1741.97	-1852.60
import substit'n effect	33122.40	0.00	33122.40	0.00	0.00	1123.70	1781.50
net forgn exchge effect	7612.87	-383.50	7996.37	1059.00	-1442.50	-618.27	-71.10
present values at 10.00 %							
foreign exchange flow .	-11999.89						
net forgn exchge effect	19% .72						



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### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	0.00	0.00	0.00	0.00	1.27	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	1.27	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1532.11	1514.80	1497.48	1480.17	2236.28	1901.04	1710.60
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	317.93	0.00	0.00
imported materials . . .	1255.11	1255.11	1255.11	1255.11	1710.60	1710.60	1710.60
repayment loans & overd.	173.13	173.13	173.13	173.13	173.13	173.13	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	103.88	86.56	69.25	51.94	34.63	17.31	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	-1532.11	-1514.80	-1497.48	-1480.17	-2235.02	-1901.04	-1710.60
import substit'n effect	1781.50	1781.50	1781.50	1781.50	2425.60	2425.60	2425.60
net forgn exchge effect	249.39	266.70	284.02	301.33	190.58	524.56	715.00
present values at 10.00 %							
foreign exchange flow .	-11999.89						
net forgn exchge effect	1996.72						



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2.1 UNIDO

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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign DJ = 100.00 units local DJ

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	0.00	0.00	0.62	0.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.62	0.00	0.00	0.00	0.00
exports . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect effects . . . . .							
total foreign outflow .	1710.60	1710.60	2087.93	1932.78	1932.78	1932.78	-1646.61
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	155.15	0.00	0.00	0.00	-1651.98
imported materials . . .	1710.60	1710.60	1932.78	1932.78	1932.78	1932.78	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	5.37
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .							
net foreign exchge flow	-1710.60	-1710.60	-2087.31	-1932.78	-1932.78	-1932.78	1646.61
import substit'n effect	2425.60	2425.60	2740.80	2740.80	2740.80	2740.80	0.00
net forgn exchge effect	715.00	715.00	653.49	808.02	808.02	808.02	1646.61
present values at foreign exchange flow .	10.00 %	-11999.89					
net forgn exchge effect		1996.72					

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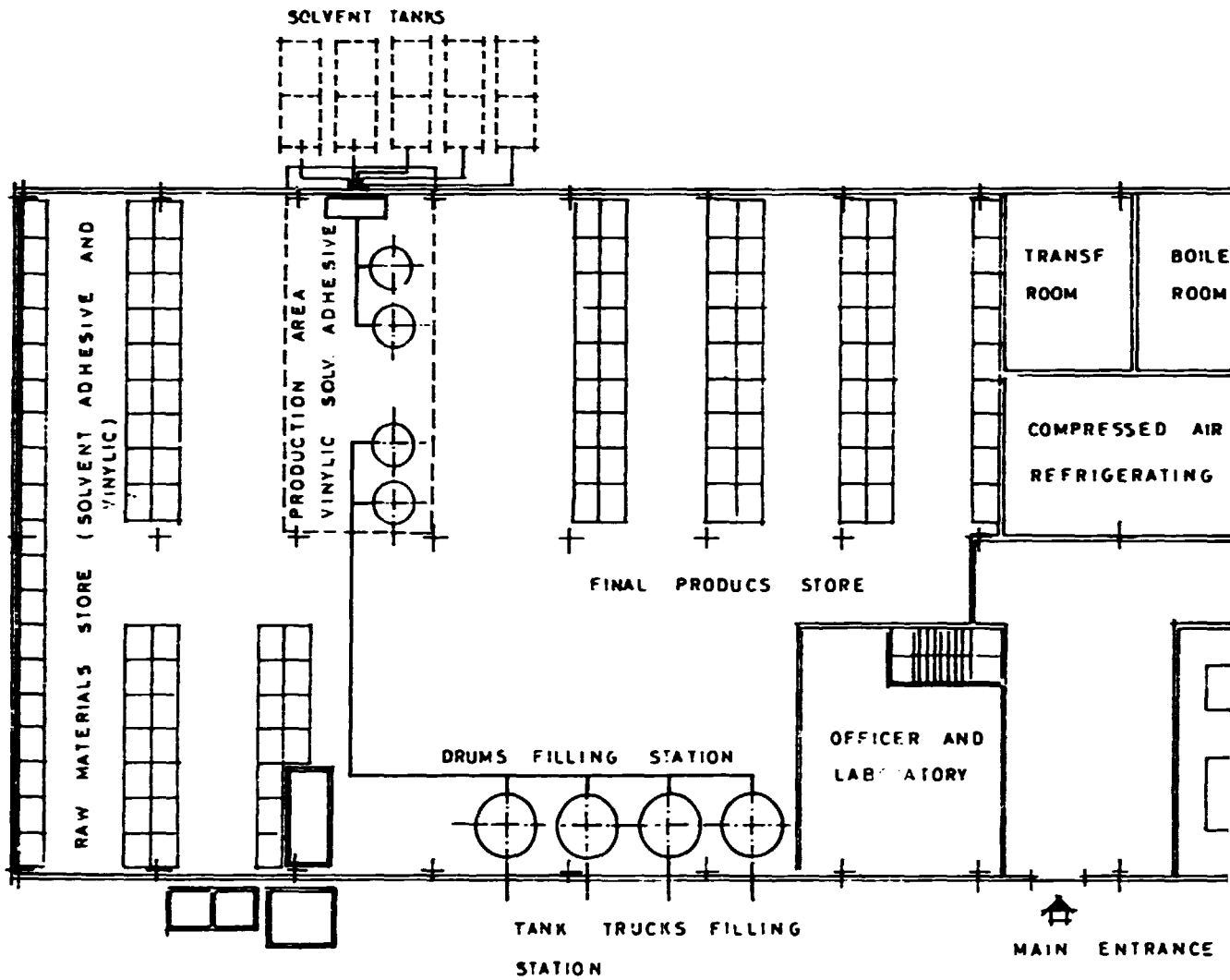
**Industrial Adhesive**

**ANNEXE 4**

DRW. B162 - 6 -1

LAY OUT





BUILDING 2,500 sq. ft.

SECTION 1



**Industrial Adhesive**

**ANNEXE 5**

**SPECIFICATIONS OF THE PROPOSED ADHESIVES**

**SPECIFICATIONS OF THE PROPOSED ADHESIVES**

**1) FOR THE WOOD SECTOR**

Spec.	2.2.2.1	-	Adhesive type A
"	" 2	-	" type B
"	" 3	-	" type C
"	" 4	-	" type D
"	" 5	-	" type E
"	" 6	-	" type F
"	" 7	-	" type G
"	" 8	-	" type H
"	" 9	-	" type L
"	" 10	-	" type M

**2) FOR CARDBOARD AND BOOKBINDING SECTOR**

Spec.	2.2.2.11	-	Adhesive type N
"	" 12	-	" type P
"	" 13	-	" type R
"	" 14	-	" type S
"	" 15	-	" type T
"	" 16	-	" type W

**3) FOR SHOE SECTOR**

Spec.	2.2.2.17	-	Adhesive type Y
"	" 18	-	Adhesive type Z

Specification 2.2.2.1

TYPE A

Ready-to-use liquid PVAC adhesive, suitable for a variety of uses in the woodworking industry. Especially recommended for working at Winter temperatures.

Characteristics

Aqueous dispersion of polyvinyl acetate.

Colour

Milk-white

Viscosity at 20°C (Epprecht  
viscosimeter 200 rpm)

8,000 +/- 500 cPs

Minimum film forming temperature

-2/0°C

Field of use

TYPE A is used hot or cold with platen presses, for bonding of wood, veneer, plywood, laminated plastic and chipboard. It is also recommended for assembly work with cramps and screw-presses.

Conditions of use

The following are the optimal conditions of use for TYPE A;

Temperature of wood, environment and adhesive	18-20°C
Humidity of wood	8-12%
Relative humidity of air	65-75%
Coating	140-180 gr/m <sup>2</sup>
Open time	15 min. approx.
Pressure	2-3 Kg/cm <sup>2</sup>

**Pressing time at ambient temperature:**

- for panels and solid timber	10-15 min.
- for laminate to chipboard	20-30 min.

**Pressing time for bonding timber or  
laminate to chipboard at the  
following temperatures:**

60°C	9-11 min.
90°C	4-5 min.

**Containers:**

30/50/100 Kg;

Specification 2.2.2.2

TYPE B

TYPE B is a glue based on an aqueous dispersion of a single vinyl component with a high resistance to the effects of water and heat.

It produces bonds conforming to standards DIN 68602 Group B3. Because of its high resistance to creep it is particularly recommended for the manufacture of garden furniture.

Characteristics

Base	Polyvinyl acetate
Colour	White: the dried film is transparent
Viscosity Epprecht at 20°C	9,000 +/- 1,000 cps.
pH at 20°C	3.0 approx.
Minimum working temperature	7-8°C
Storage stability at 20°C	6 months approx.
Resistance according to DIN 68602	Group B3
Creep at 20°C	21 days

Field of use

TYPE B is principally used for gluing decorative plastic laminates, veneer, in the construction and assembly of furniture components, for joinery construction, doors and windows, bathrooms showers, kitchens and furniture construction, for tropical climates where a bond which is

sufficiently resistant to water and humidity is required. Because of its high resistance to creep at 20°C it is also recommended for the manufacture of chairs where there is also a need for resistance to humidity (garden furniture).

Conditions of use

The optimum conditions of the use of TYPE B are as follows:

Temperature of glue, materials and shop	18-20°C
Moisture content of the timber	8-12%
Relative humidity of the air	50-70%
Pressure	1.5 Kg/cm <sup>2</sup>
Open time (for 150 g/m <sup>3</sup> )	7-9 min.
Press time (for bonding wood to wood)	10 min.

For gluing decorative laminates the following table is useful:

Spread	Temperature & Press time			Pressing method
	20°C	40°C	60°C	
80 g/m <sup>2</sup>	-	1.2	0.9	Single daylight press
100 g/m <sup>2</sup>	7.0	1.5	1.2	Single or multi daylight press
120 g/m <sup>2</sup>	9.0	2.0	-	Multi daylight press
140 g/m <sup>2</sup>	12.0	2.0	-	Multi daylight press

TYPE B is ready to use. Additions of whatever type can affect the characteristics of the glue. If the glue has become too viscous through excessively long storage it is necessary only



to stir thoroughly to restore it to a normal condition. If water has evaporated, however, because the glue has been left in an open container, sufficient water may be added to reduce it to the original viscosity. Excessive additions of water will increase the pressing time and in extreme cases reduce the strength of the bond.

TYPE B resists the effects of water and humidity giving bonds resistant to the tests in Standard DIN 68602 Group B3.

Packages

Pails of 10 Kg

Kegs of 30 Kgs

Barrels 50 & 100 Kg

**Specification 2.2.2.3**

**TYPE C**

**Range of Vinyl Adhesives type C**

Ready to use liquid vinyl adhesive, with a characteristically short curing cycle. Recommended especially for assembly work and for hot working on lumber composing machines (e.g. Torwegge).

**Characteristics**

Acqueous dispersion of polyvinyl acetate homopolymer

Colour	Milky-white
Viscosity at 20°C (measured with Epprecht viscometer at 200 rpm).	10,000 +/- 1,000 cps
Minimum film-forming temperature	5-6°C

**Applications:**

TYPE C is used whenever special characteristics of fast setting are required, either hot or cold. It is particularly suitable for assembly work, for gluing mouldings and heavy ornamental parts, edgings, and for laminating in continuous short cycle press lines.

Conditions of use

The ideal conditions of use for Type C are as follows:

Temperature of wood, glue and workshop	18-22°C
Moisture content of timber	8-10%
Relative humidity of atmosphere	65-75%
Spreading:	
for assembly work	160-180 g/m <sup>2</sup>
for laminating in short cycle press line	80-100 g/m <sup>2</sup>
Open time (for 180 g/m <sup>2</sup> spread)	6-9 min
Pressure	2-5 Kg/cm <sup>2</sup>
Pressing time:	
For assembly work at 18-20°C	3-5 min
With one part pre-heated	40-60 sec
Laminating on short-cycle press line at 50-60°C	50-60 secs.

Packages: 10 Kgs pails - 30/50/100 Kg drums

**Specification 2.2.2.4**

**TYPE D**

**Range of Foil Adhesives TYPE D**

An aqueous dispersion adhesive, ready to use, suitable for pumping and formulated specifically for gluing PVC foil to chipboard, plywood, fibreboard, etc. Due to its exceptional tackiness it is used when good green strength is required; particularly useful on discharge from the press. Resistant to heat and humidity.

**Characteristics**

Aqueous dispersion of modified synthetic resin.

Colour	Greyish white
Viscosity (brookfield at 20°C, 20 r.p.m.)	20,000 +/- 3,000 cps.
Heat resistance	up to 80°C
Resistance to cold	down to -10/-15°C

**Applications**

Type C is recommended for cold and hot gluing of rigid and plasticised PVC foils onto a varied range of substrata such as chipboard, plasterboard, plywood, etc. by means of platen presses or manual or automatic pressure rollers.

**Conditions of use**

The ideal conditions of working for TYPE D are as follows:

Temperature of material glue and shop	18-22°C
Moisture content of panel	7-10%
Spreading rate	100-150 g/m <sup>2</sup>
Open time	8-10 min
Pressure	1.0-1.5 Kg/cm <sup>2</sup>
Pressing time:	
at 20°C	12-15 min.
at 40°C	4-6 min

**Packages:**

10 Kg. pails - 30/50/100 Kg drums.

**Specification 2.2.2.5**

**TYPE E**

TYPE E is an aqueous emulsion vinyl adhesive particularly recommended for cold gluing difficult resin impregnated papers using either platen or roller presses. TYPE E has a high cold tack and gives gluing lines moderately resistant to moisture.

**Characteristics**

An aqueous dispersion of polyvinyl acetate.

Colour	whitish
Viscosity - Epprecht at 20°C (200 rpm)	10,000 +/- 1,000

**Field of use**

TYPE C is used for cold gluing all types of impregnated papers to chipboard, hardboard, plywood and other wood based panels using platen or roller presses in the manufacture of products which require resistance to water.

**Conditions of use**

Suitable conditions for use of TYPE E are as follows:

- temperature of timber,  
workshop and glue °C 18-22

- humidity of the wood	%	8-10
- relative humidity of the air	%	65-75
- spread	g/m <sup>2</sup>	80-150
- open time	min	2-5
- pressure	kg/cm <sup>2</sup>	1-5
- pressing time at 20°C		
a) for gluing in a flat platen press		
- with a spread of 100g/m <sup>2</sup>	min	2-5
- with a spread of 150g/m <sup>2</sup>	min	5-10
b) for gluing on roll presses		
- with a spread of 80-120g/m <sup>2</sup>		continuous

A suitably arranged source of heat can reduce the pressing time.

### Packages

Sacks of 10 kg

Tubs of 50/100 kg

Specification 2.2.2.6

TYPE F

Liquid vinyl adhesive ready for use with very high bond strength. Its characteristics are particularly suited to chair manufacture.

Characteristics

Acqueous dispersion of polyvinyl acetate homopolymer

Colour: Milky white or walnut, as required

Viscosity at 20°C (Epprecht viscometer 200 rpm) 7500-8000 cps.

Field of use

TYPE F is used for joints where a high bond strength is required.

TYPE F is particularly suited to gluing chairs and frames, for assembly work and work in hardwoods or timbers which are difficult to glue.

Working conditions

Favourable conditions for the use of Type F are as follows:

Temperature of timber, workshops and glue 18-20°C

Moisture content of timber 8-10%

Atmospheric relative humidity 65-75%



Spreading	160-180 g/m <sup>2</sup>
Open time	8-10 min
Pressure	2-5 Kgs/cm <sup>2</sup>
Press times and ambient conditions for assembly and construction: at ambient temperature	10-15 mins
with the surfaces pre-heated	5-10 mins

**Packages:**

- Bags of 10 Kg
- Kegs of 30, 50 and 100 Kgs

**Specification 2.2.2.7**

**TYPE G**

Contact adhesive in solution made from synthetic resins, ready for use. Especially recommended for numerous uses in the bonding of laminated plastic, metal, rubber, and other plastic materials to wood or to each other.

**Characteristics**

Solution of polychloroprene in organic solvents

Colour	scarlet red
Viscosity at 20°C (Epprecht viscosimeter 200 rpm)	400 +/- 50 cPs
Resistance to heat (measured with standard method)	65-75°C

**Field of use**

TYPE G is used with a spatula or brush for the bonding of different materials, such as laminate, metal, rubber and plastics usually to wood and for the bonding of one material to the other.

**Conditions of use**

Optimum conditions of use for TYPE G are:

- Temperature of the material environment  
and adhesive 18-20°C
- Relative humidity of the air 65-75%
- Coating (on both surfaces) 100-120 g/m<sup>2</sup>
- Open time 10-20 min.
- Pressure 1-2 Kg/cm<sup>2</sup>

The pressure should be applied instantly by a platen press or rollers, or applied manually with a roller or rubber mallet.

**Packages**

Tins of 2/5/14 Kg

**Specification 2.2.2.8**

**TYPE H**

Contact adhesive in solution made of synthetic resins, ready to use. Especially recommended for the bonding of laminated plastic to metal, rubber, and for the bonding of other materials to wood, or to each other.

**Characteristics**

Solution of polychloroprene in organic solvents.

Colour	yellow
Viscosity at 20°C (Epprecht viscosimeter 200 rpm)	4,000 +/- 500 cPs
Resistance to heat (measured with standard method)	70-80°C

**Field of use**

TYPE H is usually used with a spatula or brush for bonding various materials, such as laminate, metal, rubber and plastics to wood and for the bonding of one material to the other.

**Conditions of use**

Optimum conditions of use for TYPE H are:

- Temperature of the material, environment  
and adhesive 18-20°C
  - Relative humidity of the air 65-75%
  - Coating (on both surfaces) 120-140 g/m<sup>2</sup>
  - Open time 20-40 min.
  - Pressure 1-2 Kg/cm<sup>2</sup>
- Pressure should be applied instantly by a platen press or rollers, or applied manually with a roller or rubber mallet.

**Packages**

Tins of 1/5/15 Kg

**Specification 2.2.2.9**

**TYPE L**

Hot melt adhesive with low viscosity and good resistance to heat. Because of its good adhesion properties, it is especially recommended for the bonding of Alpi edges as well as laminated plastic and non-porous material.

**Characteristics**

Solid adhesive made from thermoplastic synthetic resins.

Form	granulated
Colour	light natural, walnut on request
Viscosity at 220°C	120,000+/-15,000 cPs
Resistance to heat 75°C	25+/-5 min

**Field of use**

TYPE L is used with automatic edge bonding machines for the bonding of PVC, ABS polyester and melanine edges, for laminated plastic, veneer and solid wood lippings

**Conditions of use**

Optimum conditions for the use of TYPE L are as follows:

Humidity of the material to be glued	8-10%
Temperature in the tank	160-180°C
Temperature at the roller	190-210°C
Optimum feed speed	20-30 m/min
Pressure on the rollers	3-5 Kg/cm <sup>2</sup>

Containers

30 Kg. bags

Specification 2.2.2.10

TYPE M

TYPE M is a hot melt adhesive with optimum application characteristics and is used for bonding edgings on automatic edgebanders.

Because of its high adhesive characteristics TYPE M is ideal for bonding a wide range of edgings, in particular PVC and solid wood lippings, max. 3 mm.

As it has medium resistance to high temperatures, TYPE M melts quickly in the tank and does not string in application.

Characteristics

A solid adhesive based on synthetic thermo-plastic resins.

Form	Granular
Colour	Neutral
	Walnut
	White

Viscosity at 220°C with Brookfield viscosimeter and Thermosel at 10 rpm	cPs 40.000+/-5.000
---	--------------------

Resistance to heat (according to WPS 68)	°C 70-75
---	----------

Field of use

TYPE M is used with automatic edgebonding machines for bonding edges in PVC, ABS, Polyester, Melanine, Plastic laminate, veneer and solid wood.



Condition of use:

The most favourable conditions for the use of TYPE M are as follows:

Moisture content of material to be bonded	8-10%
Glue tank temperature	160-180°C
Temperature of the application roller	190-210°C
Optimum chain speed	20-30 m/min
Pressure on the edging	3-5 Kg/cm <sup>2</sup>

Containers

Cardboard cartons of 30 Kg with an internal polythene bag.

TYPE N

TYPE N is an aqueous dispersion P.V.A. glue, specifically suitable for the bonding of high thickness coated casings. Featuring a long open time and a good tack, as well as a good filming power even at low temperatures.

Characteristics

Polyvinyl acetate based aqueous dispersion

Colour	milky white
Viscosity at 20°C measured with Brookfield viscosimeter at 20 rpm	12.000+/-1.000 cPs
Film	elastic, transparent

Fields of use

TYPE N is specifically suitable for the bonding of high thickness coated casings, on sticking and bending machines, with high production outputs.

It is further suitable for microwave-joining on automatic and semi-automatic machines, for the packing of casings in high speed packing machines and for the bonding of bag-bottoms manufactured with high quality papers.

Conditions of use

The most favourable conditions for the use of TYPE N are as follows:

Temperature (ambient, glue and materials)	18-20°C
Relative humidity of air	65-75%
Humidity of materials to be glued	8-10%

Packaging

Standard pails of 24 Kg net weight

Specification 2.2.2.12

TYPE P

TYPE P is a vinyl glue in aqueous dispersion, specifically suitable for gluing high thickness coated cases.

It features a long open time, and a very fast setting time.

Characteristics

Polyvinyl acetate based aqueous dispersion

Colour	milky white
Viscosity at 20°C measured with Brookfield viscosimeter at 20 rpm	12.500+/-500 cPs
Film	elastic, transparent

Fields of use

TYPE P is specifically suitable for the gluing of high thickness coated cases on bending-bonding machines, with high output. Recommended for bonding of microwave onto automatic and semi-automatic machines, for the making of cases on high speed packaging machines and for the gluing of the bottoms of bags made of high quality papers.

Conditions of use

The most favourable conditions for the use of TYPE P are as follows:

Temperature (ambient, glue and materials) 18-20°C

Relative humidity of air 65-75%

Humidity of materials to be glued 8-10%

Packaging

Standard pails of 24 Kg net weight.

TYPE R

TYPE R is a vinyl glue in aqueous dispersion, medium-plasticized, specifically suitable for the gluing of book back-sides in bookbinding. TYPE R features a medium viscosity allowing a very good spreadability even at high production cycles.

Characteristics

Polyvinyl acetate based aqueous dispersion.

Colour	milky white
Viscosity at 20°C measured with brookfield viscosimeter at 20 rpm	14.000+/-1.000 cPs
Film	plastic

Fields of use

TYPE R is a vinyl glue in aqueous dispersion used for the gluing of low-thickness book back-sides or wherever no "rounding-up" of back-sides is required.

Conditions of use

The most favourable conditions for the use of TYPE R are as follows:

Temperature (ambient, glue and materials)	18-20°C
Relative humidity of air	65-75%
Humidity of materials to be glued	8-10%

**Packaging**

Standard pails of 24 Kg net weight

Specification 2.2.2.14

TYPE S

TYPE S is a medium plasticized copolymer emulsion adhesive especially suited for labelling spiral wound or linear barrels, with plastic labels.

Characteristics

A copolymer based aqueous dispersion

Colour	milky white
Viscosity at 20°C (brookfield viscometer at 20 rpm)	6,500+/-500 cps
Film	elastic, transparent

Field of use

TYPE S is used for labelling with plastic labels, for sealing PVC coated boxes, for gluing paper to expanded polystyrene and for gluing PVC foil to wood.

Conditions of use

Conditions suitable for the use of TYPE S are:

Temperature of workshop, glue and materials to be glued	18-20°C
---	---------



Relative humidity of the air 65-75%  
Moisture content of materials to be glued 8-10%

Packages

Kegs of 25 Kg  
Tanks of 1,000 Kg

Specification 2.2.2.15

TYPE T

TYPE T is a hot-melt adhesive with a very short open time, specifically suited for sealing corrugated cardboard boxes.

Characteristics

Colour	bright yellow
Open time at 180°C	2 secs
Working temperature	180 °C
Melting point (Ball and Ring)	106°C
Viscosity (Brookfield viscometer with Thermosel system at 20rpm)	
at 180°C	485 cPs
at 160°C	805 cPs
at 140°C	1,430 cPs
Setting time	very rapid

Field of use

TYPE T is essentially intended for the manufacture and sealing of corrugated cardboard boxes and for the manufacture of boxes on high speed machines which require very short setting times.

Packages

Boxes of 25 Kg.

Specification 2.2.2.16

TYPE W

TYPE W is a hot melt adhesive, specifically suitable for the gluing according to the U.S. method of book back-siding and for any production requiring a medium-long time.

Characteristics

Colour	semi-mat white
Open time at 180°C	6 sec
Working temperature	170 °C
Melting point (Ball and Ring)	80°C
Viscosity (Brookfield viscometer with Thermosel system at 20 rpm):	
at 180°C	4.600 cPs
at 160°C	8.000 cPs
at 140°C	15.000 cPs

Field of use

TYPE W is a hot-melt glue specifically suitable for the binding of backs of books, even on kinds of papers which are particularly difficult to glue. TYPE W features a very short structure, which makes it easy for use on machines not supplied with glue interrupting devices.

Packages

Bags of 25 Kg

Specification 2.2.2.17

TYPE Y

A transparent adhesive recommended for gluing any TYPE of rubber sole (synthetic, filled or foamed, natural vulcanized or not, crepe) to itself, to leather, skin and other various materials currently used in footwear.

Characteristics

Polychloroprene solution in organic solvents

Colour	clear, nut, brown
Viscosity at 20°C (Epprecht viscometer at 200 rpm)	1,500+/-200 cPs
Specific weight at 20°C	0.860+/-0.010 g/cm <sup>3</sup>
Maximum open time at 20°C and 65% relative humidity	min 90
Pot life of mixture with 5% activator at 20°C and 65% R.H. hours	4
Heat resistance	
- with activator	+100°C
- without activator	+60°C

Conditions of use

After carefully mixing the adhesive with 5% of activator apply it with a brush or spreading machine in a uniform film, twice,

with an interval of 10 minutes on absorbent materials (skin, leather, cloth, cork) and only once on non porous materials (rubber, plastic, EVA).

Allow to dry for 20-45 minutes, then unite the two pieces by applying an even pressure. The maximum bond strength will develop 48-72 hours after pressing, after which time the optimum resistance to mineral oil, benzine and heat upto 100°C will be achieved.

The solvent formulation complies with Italian Law no.245 of 5/3/1963. No benzene. Toluene and xylene less than 5% by weight of the solvent.

Packages

Pails of 1/5/15 Kg

Specification 2.2.2.18

TYPE Z

Polyurethane adhesive with very quick setting, with clear colour and particularly suitable for the sticking of synthetic materials, for the connection of soles made by hard and flexible polyurethane or PVC to synthetic and leather vamps. TYPE Z, which must always be used with a 5% of Hardener (Activator), is also recommended for sticking very fat leather and every kind of rubber sole (provided it is already treated with a suitable Primer on every vamp).

Characteristics

Solution of rubbers and synthetic resins in organic solvents  
(1)

Colour	ivory
Viscosity at 20°C (Epprecht viscometer 200 rpm)	1.850+/-150cPs
Specific gravity	0,825+/-0,010 g/cm <sup>3</sup>
Maximum open time at 20°C and 65% of relative humidity	about 20 min
Pot life of adhesive mixture with 5% of hardener at 20°C and 65% of u.r.	about 5 hours
Heat resistance:	
- with hardener	+100°C
- without hardener	+60°C

(1) Solvent formula according to Italian law n.245 dated 5/3/1963. Absence of benzene. Toluene and xylene equal to 5% by weight of solvent.

Conditions of use

Mix the adhesive carefully with 5% of hardener. Spread an adhesive coat with a stiff bristle, brush on both dry and clean surfaces. Let dry for 5-15 minutes, then join the two surfaces exerting a light and uniform pressure. To obtain better results, even at application temperatures lower than 15°C, it is recommended to take, after drying the adhesive coat of at least one of the two substrates up to a temperature of 60°C with the help of a heat source (I.R. quartz-lamps or others).

Packages

Cans of 14. nett.

U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF CALCIUM HYPOCHLORITE  
IN ETHIOPIA

PROJECT DP/ETH/85/004

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CONSULTING ENGINEERS



I N D E X

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

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**ANNEXE 3 - DRW. B162-16-1 - SIMPLIFIED FLOW DIAGRAM  
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**ANNEXE 4 - FINANCIAL AND FOREIGN EXCHANGE EVALUATIONS FOR  
CHLOR-ALKALI AND CALCIUM HYPOCHLORITE PRODUCTION IN  
ONE PLANT.**

0. SUMMARY AND CONCLUSIONS

This opportunity study analyses the possibility of producing Calcium Hypochlorite in Ethiopia once that chlorine is available from the proposed chlor-alkali plant in Assab that has been described in another opportunity study.

Calcium Hypochlorite can be used as a sterilizing or bleaching agent and may replace both chlorine and sodium hypochlorite. C.H. is as effective as chlorine gas and bleach but has the added advantage of being in powdered form and may easily be stored in hot climates. Dosage (in terms of active chlorine) is identical to that of chlorine gas.

It may therefore be used as substitute of Chlorine for a number of extremely important applications (also as far as its social impact is concerned) such as:

- .. water treatment: disinfection of city and well water, water tanks etc.
- disinfection of public facilities, hospitals, schools etc.
- disinfection of food processing plants (meat, dairies, canning, soft drinks, sugar refineries etc)
- industrial applications: bleaching of cotton yarn and cotton cloth etc.

It would be produced by using three main raw materials: chlorine gas, lime and caustic soda.

All three would be of local origin.

The plant would be located in Assab (where chlorine and caustic soda can be made available) and would employ 99 persons.

The fixed investment has been evaluated as 7.7 Mil. \$ (5.6 Mil \$ the foreign exchange portion).

The financial evaluation has been developed in two alternatives: one as an autonomous plant and one as an integrated production of the chlor-alkali plant.

In the first case the IRR is 9.85 while in the second case the IRR of the combined production is 9.16. Since the foreign exchange effect is also favourable the preparation of a detailed feasibility study in conjunction with the chlor-alkaly project is recommended.

1. INTRODUCTION

Calcium hypochlorite is a bleaching agent with the formula  $\text{Ca}(\text{OCl})_2$ .

The strength (or the oxidizing power) of hypochlorite solutions is usually measured in terms of "available chlorine".

"Available chlorine" may be expressed as a percentage, which is grams of available chlorine per 100 ml solution.

Calcium hypochlorite contains 70 to 73% "available chlorine" and this is the distinctive feature of this product also known as HSH "high strength hypochlorite". The technical product is in the form of briquets and/or free flowing granules.

Due to the low content of hygroscopic calcium chloride impurity, the product shows good chemical stability with very low decomposition rate.

A typical analysis of the HSH is as follows:

Ca (OCl) <sub>2</sub>	min	70%	w/w
NaCl		15-17%	"
Ca (OH) <sub>2</sub>		3-4 %	"
Ca Cl <sub>2</sub>		1-2 %	"
Ca CO <sub>3</sub>		2-4 %	"
Ca (ClO <sub>3</sub> ) <sub>2</sub>		1-2 %	"
Others		1-2 %	"
Water	max.	5 %	"

The mother liquor which remains after the filtration of HSH is an important by-product that can be used directly as a bleaching solution.

A typical analysis of such a mother liquor is as follows:

Ca (OCl) <sub>2</sub>	9-11% w/w
-----------------------	-----------

NaCl	19-20% "
Water	balance

2. MARKET AND PLANT CAPACITY

2.1 Uses

Calcium Hypochlorite can be used as sterilizing or bleaching agent. In this field it has the same uses as well known products such as chlorine or sodium hypochlorite; but, compared with each of these, it has the following advantages:

- solid form (granules or briquets), easy to handle, pack, transport and store;
- no danger of pollution, even if stored in large amounts;

It has in addition these other benefits when compared with sodium hypochlorite only:

- chemical stability
- higher "available chlorine" content

All these characteristics have caused the success of this new product in the industrialized countries and its use is highly recommended in Ethiopia where it could be used for the following main applications:

- a) Water treatment: disinfection of city and well waters, disinfection of water tanks, removal and prevention of the growth of algae in tanks.
- b) Bleaching: bleaching of cotton yarn and cotton cloth, bleaching and disinfection of children's clothing and hospital linen.

- c) Industry: disinfection of facilities at meat processing plants, dairies, canning factories, soft drink factories and sugar refineries; disinfection of bottles and water used in the production of soft drinks; bleaching and disinfection of raw vegetables and fruits.
  
- d) Public facilities: disinfecting, deodorizing and bleaching of floors, walls, drains and toilets at hospitals, schools, railway station and other public buildings.
  
- e) Domestic uses: disinfecting, deodorizing and bleaching

This product would therefore have a very effective social impact taking into consideration the water and sanitation problems of a rural population (the product can be easily transported and stored) and it would be used also in basic industries already existing in the country.

## 2.2 Forecast demand and plant capacity

At present this product is neither produced nor imported in Ethiopia; but, since it competes with chlorine in the field of water treatment and bleaching, its possible consumption can be estimated on the basis of the forecast chlorine consumption.



As pointed out in the interim report, the total foreseeable demand for chlorine by 1993/94 would be:

- for water and sewage treatment	1000 t/y
- for bleaching (paper pulp mill)	1000 t/y
Total	2000 t/y

and at least 10% more by the end of the century.

A large part of this consumption may be assumed as immediately replaceable by HSH(1); but taking into account the advantages offered by this new product, as illustrated above, a larger growth in demand can easily be anticipated.

For this reason, and taking into consideration the minimum economical size for this plant, the capacity of 2500 t/y of HSH technical grade (that is 1750 t/y of pure calcium hypochlorite) has been selected.

In addition the plant produces, as a by-product, 11,000t of calcium hypochlorite solution with a 11% "available chlorine" that can be sold as such for similar disinfecting and bleaching purposes.

### 2.3 Sales price and total revenues

At present there is no quotation for calcium hypochlorites, neither for the solid product nor for the liquid one; their sale prices then must be estimated on the basis of other conditions as shown below.

- (1) This means that once the HSH plant is operating, the production of Chlorine correspondent to the requirements of sterilizing or bleaching agents will be diverted to supply the HSH process plant.

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As far as calcium hypochlorite solution is concerned, its sale price can be fixed on the basis of the "available chlorine" content, that is on the basis of an amount of chlorine of equivalent effect.

As stated above this available chlorine content is about 11%; so the price of the calcium hypochlorite solution should be 11% of the price of chlorine. The chlorine is at present all imported and its price in Assab (not considering the price of cylinders or tanks) is 818 \$/t, CF price, plus 12% for such charges as clearing, loading, unloading, bank commissions and others, that is 916 \$/t; this value must be considered as the minimum price (ex works price) for chlorine imported or produced in Ethiopia by a factory located near Assab. Taking this value as base price for chlorine, the price of the calcium hypochlorite solution can be evaluated as  $916 \times 0.11 = 101$  \$/t.

For the HSH (solid calcium hypochlorite) on the other hand, the value is higher than the equivalent amount of chlorine, due to its easier distribution, storage and utilization. On the international market it is quoted at about 2000 \$/t (1) and this can be assumed as the selling price in Ethiopia.

Consequently the total annual revenues at full capacity (2500 t/y of HSH technical grade and 11,000 m<sup>3</sup> of calcium hypochlorite solution) result as follows:

- HSH		
2500 t/y x 2000 \$/t =		5,000,000 \$/y
- calcium hypochlorite solution		
11,000 t/y x 101 \$/t =		<u>1,111,000 \$/y</u>
	Total	6,111,000 \$/y

(1) Source: Chemical Marketing Report, Nov. 1986

3. MATERIAL AND INPUTS

3.1 Chemistry

The chemistry of the plant, i.e. the production of HSH can be represented by the following main reaction:



As a consequence the main required raw materials are calcium oxide(1) and chlorine; caustic soda and sodium sulfate are also needed.

Caustic soda will be available in the Country (NCC will soon implement a production unit from Lake Abiata brines). Chlorine (as well as caustic soda) could also be available in Assab if a new chlor-alkali plant is constructed as suggested in an opportunity study now under consideration.

Calcium oxide, largely available in the country, should have the following specifications:

CaO	min	85%
Mgo	max	1%
SiO <sub>2</sub>	"	1%
CaSo <sub>4</sub>	"	0.5%
CaCO <sub>3</sub> (unbacked)	"	6.5%
CaCOB <sub>3</sub> (overbacked)	"	4.5%
Fe <sub>2</sub> O <sub>3</sub> + Al <sub>2</sub> O <sub>3</sub>	"	0.5%
Ni, Co, Mn	"	traces

3.2 Material and utilities requirements and costs

The complete list of inputs and utilities (amounts, and costs) to be supplied annually to the plant at full capacity (2500 t/y) is:

- (1) for milk lime preparation

**RAW MATERIALS**

		birr/y
Chlorine		
(100% basis)	2875 t x 1,896 birr/t	= 5,451,000
(1) Calcium oxide	(" ") 1500 " x 112 "	= 168,000
Caustic soda	(" ") 1625 " x 818 "	= 1,329,250
Sodium Sulfite	12.5 " x 1,000 "	= 12,500
		-----
	total A)	6,960,750

**UTILITIES**

		birr/y
Electric Power	2,150,000 kWh x 0.2 birr/kWh=	430,000
Steam (10 ate)	8,125 t x 35.7 birr/t =	290,062
Cooling Water		
(T range) = 10°)	350,000m3 x 0.029 birr/t =	10,150
		-----
	total B)	730,212

For the financial evaluation, these costs can be summarized as follows:

- foreign raw materials	12,500 birr/y =	6,038 \$/y
- local raw materials	6,948,250 birr/y =	3,356,642 \$/y
- energy (foreign)	290,062 birr/y =	140,126 \$/y
- other utilities (local)	440,150 birr/y =	212,632 \$/y
		-----
TOTAL	7,690,962 birr/y =	3,715,438 \$/y

(1) Expressed as cost of the Limestone raw material

3.3 Raw materials purchasing and storage volumes

On the assumptions of installing the plant next to the proposed chlor-alkali plant, no stock of chlorine and caustic soda has been considered necessary, since these two products have been presumed to be piped directly from the production plant to the user.

For sodium sulfite, being imported raw material, a stock equivalent to six months consumption at full capacity is advisable) while for calcium oxide one month is enough.

As a result the following amounts of chemicals must be considered as a minimum stock:

- sodium sulfite	6t	equivalent to	2,900 \$
- calcium oxide	125t	equivalent to	6,760 \$
			-----
		Total	9,660 \$

4. LOCATION

Due to the strict connection of this production with the chlor-alkali plant, its location should be next or as an extension of the chlor-alkali plant.

5. PROJECT ENGINEERING

5.1 Process description

The proposed process essentially consists of three-stage reaction, followed by filtration, drying and drum filling of the main product, as shown in the attached process flowsheet B162-16-1.

Raw materials to be fed into the reactors are chlorine gas, milk of lime and caustic soda solution.

While chlorine and caustic soda, as produced in the adjacent chloralkali plant, can be considered suitable processable chemicals, the commercially available slaked lime might show a wide range of impurity content that could affect the quality and uniformity of the final product. It is preferable to provide the on-site slaking of commercial quick lime: a well designed slaker improves the quality of the milk of lime by separating inerts and grits and by producing milk of uniform strength.

Three reactors are operated batchwise. A dosed amount of milk of lime is fed to the reactor and, under pH and temperature control, chlorine is added until the fed milk of lime is partially chlorinated. Caustic soda is then added to the reaction system and the reaction is completed under pH and temperature control.

All the reactors are provided with titanium coolers to remove reaction heat.

The final product of the reaction is a slurry that flows to a receiver provided with agitator and refrigerating coil.

Pressure inside the reactors is nearly atmospheric (slightly negative). The amount of chlorine contaminated

gas to be vented to the chlorine neutralization unit depends on the concentration of the feed chlorine: the higher the concentration, the less waste gas is eliminated.

From the receiver, the slurry is pumped to a rotary filter where most of the mother liquor is separated from the wet cake. The mother liquor, collected in a storage tank, is a bleach solution with about 11%  $\text{Ca}(\text{OCl})_2$  content, free of calcium chloride impurity.

The cake enters the dryer properly mixed with the recycles in a granulator. In the drying chamber the product enters into contact with hot air and flows concurrently down through the drying chamber. Hot air is obtained by indirect heating with steam.

The dry product from the fluidized bed is pneumatically conveyed to an add-back silo which feeds a sieve machine separating the HSH of proper granulometry from powders and large granules that are recycled to the granulator. HSH is collected in a storage silo and packaged in 25 kg drums provided with internal plastic bags.

Spent air leaves the drying chamber and passes to a cyclone separation system. Spent air from the cyclone is vented to the atmosphere after being de-powdered in a bag filter and scrubbed in a packed tower in counter-current with alkaline water.

In normal storage conditions the product will lose 3 to 5% of its available chlorine content in a year.

## 5.2 Packaging

The HSH will be packed in 25 kg plastic bags estimated 0.7 \$ per piece; for the whole production 70,000 \$ per year.



5.3 Layout

See the attached drawing B162 - 16 - 2

5.4 Investment costs: depreciation and maintenance.

	LC	FC	Total
	M\$	M\$	M\$
Machinery and equipment for process and utilities FOB European port	--	4.199	4.199
Transportation	0.420	0.420	0.840
Erection	0.630	0.210	0.840
Insulations and paintings	0.077	0.050	0.127
Land and site preparation	0.071	--	0.071
Civil work	0.714	--	0.714
Spare parts	--	0.210	0.210
	-----	-----	-----
TOTAL	1.912	5.089	7.001
CONTINGENCIES	0.188	0.511	0.699
GRAND TOTAL	2.100	5.600	7.700

The industrial life of the plant can be considered as 15 years.

4% of the machinery and equipment cost can be assumed as average annual value of the maintenance.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

Machinery FC	5.600 million dollars		
Machinery LC	1.127	"	"
Site preparation LC	0.071	"	"
Civil Works LC	0.902	"	"
		-----	
TOTAL	7.700 million dollars		

6. PLANT ORGANIZATION

This plant should be considered as strictly integrated with the chlor-alkali plant, that is with utilities, administrative offices and social services in common with this plant.

Two alternatives solutions, however, have been considered in the financial evaluation, one as an autonomous unit and another one as an unit included together with the chlore alkali plant in one factory.

7. MANPOWER

7.1 Management

		birr/m	birr/y
- General Manager	n. 1	1,500	
- Technical Manager	n. 1	1,200	
		-----	-----
		2,700	32,400

7.2 Administrative dept.

- Finance Manager	n. 1	1,000	
- Accountants	n. 2	800	
- Purchasing dept.	n. 2	800	
- Warehouse keepers	n. 2	800	
- Sales dept.	n. 2	800	
- Clerks & secretary	n. 6	1,800	
- Guards	n. 9	1,350	
- Drivers	n. 3	1,050	
- Others	n. 3	1,050	
		-----	-----
Total	n. 30	9,450	113,400

Total Management + Administrative depts. 145,800  
(70,435 \$/y)

**7.3 Production and maintenance dept.**

		birr/m	birr/y
<u>Production Dept.</u>			
- Production Manag	n. 1	1,000	
- Shift foreman	n. 8	3,200	
- " operators	n. 20	7,000	
- Semiskilled shift workers	n. 20	6,000	
- Chemist	n. 1	700	
- Analysts	n. 3	1,050	
- Clerk	n. 1	350	
		-----	-----
<b>Total</b>	<b>n. 54</b>	<b>19,300</b>	<b>231,600</b>
			(111,884 \$/y)

		birr/m	birr/y
<u>Maintenance Dept.</u>			
- Chief engineer	n. 1	800	
- Foremen	n. 2	800	
- Electricians	n. 2	800	
- Mechanical fitters	n. 4	800	
- Semiskilled worker	n. 2	600	
- Unskilled workers	n. 2	400	
		-----	-----
<b>Total</b>	<b>n. 13</b>	<b>4,200</b>	<b>50,400</b>
			(24,348 \$/y)

**Summary:**

Administration	145,800 birr/y =	70,435 \$/y
Production	231,600 birr/y =	111,884 \$/y
Maintenance	50,400 birr/y =	24,348 \$/y
		-----
<b>Total</b>		<b>206,667</b>

8. IMPLEMENTATION SCHEDULING

From the moment the financing of the project is finalized, 30 months will be needed in order to design, build and commission the plant.

9. FINANCIAL EVALUATIONS

The financial evaluation for the autonomous factory is attached as Annexe 1.

Such evaluation has been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operating period (two years) has been taken into account and indicated as "foreign factory overheads".

- the packaging costs have been included as "other raw materials"

- the production program has been assumed as follows:  
1st y: 40% capacity (1000t HSH+4400t Calc. Hyp. solut.)  
2nd y: 60% capacity (1500t HSH+6600t Calc. Hyp. solut.)  
3rd y: 80% capacity (2000t HSH+8800t Calc. Hyp. solut.)  
From the 4th to the 15th year 100% capacity (2500 HSH+11000t Calc. Hyp. solut.).

Selling prices:

HSH 2000 \$/t

Calcium Hyp. solution 101 \$/t

The evaluation yields an IRR equal to 9.28% and a BEP equal to 47%.

10. FOREIGN EXCHANGE EFFECT

The foreign exchange effect evaluation has not been carried out for the solution foreseeing the autonomous plant for the production of calcium hypochlorite. In fact this product replaces chlorine (imported or produced locally) for the same applications.

It has been calculated in case Calcium hypochlorite is produced within the chlor-alkali plant; in this case the discounted net foreign exchange effect (10% discount rate) is 6,147,000 \$



11. INTEGRATED CHLOR-ALKALI AND CALCIUM HYPOCHLORITE FACTORY

The financial advantage deriving from the production in a same factory of chlore and calcium hypochlorite (HSH), has also been analyzed.

The main advantages are:

- a) The utility plants (in particular the electrical substations) can be unified and the relevant reduction in investment costs has been evaluated 300,000 \$.
- b) Some buildings (administrative offices and social services) can be shared in common and this gives another reduction of 140,000 \$.
- c) Administrative and maintenance personnel quantity can be reduced and this leads to a reduction of 57,681 \$/y for the administrative department and 9,276 \$/y for the maintenance.
- d) The chlore will be supplied to the calcium hypochlorite production at the production cost.

The sale programme at 100% capacity and the annual revenues result modified as follows:

- chlore		
675 t/y x 816 \$/t	=	550,800 \$/y (export market)
- calcium hypochlorite		
2500 t/y x 2000 \$/t	=	5,000,000 \$/y
- Calcium hypochlorite solut.		
11,000 t/y x 101 \$/t	=	1,111,000 \$/y
- Sodium hypochlorite		
200 t/y x 137,5 \$/t	=	27,500 \$/y
- Hydrochloric acid		
250 t/y x 325 \$/t	=	81,250 \$/y
- Caustic soda		
2715 t/y x 396 \$/t	=	1,075,140 \$/y
		-----
		7,845,690 \$/y

On these basis and assuming 0.05 birr/kwh as electricity cost financial and foreign exchange effect evaluations (Annexe 4) have been prepared; the IRR is equal to 9.16% and the discounted net foreign exchange effect (1) equal to 6,147,000 \$.

(1) The import substitution effect has been estimated on the basis of the production of chlorine, HCl and sodium hypochlorite as done for the Chlore Alkali plant.

**baldo & c.**  
CONSULTING ENGINEERS

Calcium Hypochlorite

ANNEXE 1

FINANCIAL EVALUATION



COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

CALCIUM HYPOCHLORITE  
February 88  
BASIC PROJECT

3 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	8306.00	73.152 % foreign
current assets:	0.00	0.000 % foreign
total assets:	8306.00	73.152 % foreign

**Source of funds during construction phase**

equity & grants:	3070.00	0.000 % foreign
foreign loans:	4700.00	
local loans:	0.00	
total funds:	7830.00	60.792 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1847.85	2637.93	3369.00
depreciation :	533.99	533.99	526.89
interest . :	476.00	416.50	357.00
production costs	2857.84	3588.42	4252.89
thereof foreign	36.22 %	28.92 %	23.08 %
total sales :	2444.40	3666.60	4888.80
gross income :	-413.44	78.18	635.91
net income :	-413.44	39.09	317.95
cash balance :	-855.43	-189.51	93.55
net cashflow :	215.57	821.99	1045.55

Net Present Value at: 10.00 % = -82.30  
Internal Rate of Return: 9.85 %  
Return on equity1: 9.29 %  
Return on equity2: 9.88 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US DOLLARS**

Year . . . . .	1987	1988	1989
<b>Fixed investment costs</b>			
Land, site preparation, development	71.00	0.00	0.00
Buildings and civil works . . . . .	270.00	496.00	136.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant machinery and equipment . . .	1120.00	3220.00	2387.00
<b>Total fixed investment costs . . . .</b>	<b>1461.00</b>	<b>3716.00</b>	<b>2523.00</b>
Pre-production capital expenditures.	20.00	30.00	556.00
Net working capital . . . . .	0.00	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>1481.00</b>	<b>3746.00</b>	<b>3079.00</b>
<b>Of it foreign, in % . . . . .</b>	<b>75.62</b>	<b>74.75</b>	<b>70.02</b>



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Total Current Investment in 1000 US DOLLARS

Year . . . . .	1990	1991	1992	1993
Fixed investment costs				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00
Total fixed investment costs . . . .	0.00	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00
Working capital . . . . .	380.98	167.59	156.30	168.80
Total current investment costs . . .	380.98	167.59	156.30	168.80
Of it foreign, % . . . . .	28.63	28.46	23.29	28.97

CALCIUM HYPOCHLORITE — February 88



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product):	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	1345.08	2017.60	2690.13	3362.68	3362.68	3362.68
Other raw materials .....	28.00	42.00	56.00	70.00	70.00	70.00
Utilities .....	1.96	2.94	3.92	4.90	4.90	4.90
Energy .....	139.14	208.72	278.28	347.86	347.86	347.86
Labour, direct .....	111.88	111.88	111.88	111.88	111.88	111.88
Repair, maintenance .....	24.35	24.35	24.35	24.35	24.35	24.35
Spares .....	67.00	100.00	134.00	168.00	168.00	168.00
Factory overheads .....	60.00	60.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1777.41</b>	<b>2567.49</b>	<b>3298.56</b>	<b>4089.67</b>	<b>4089.67</b>	<b>4089.67</b>
Administrative overheads .....	70.44	70.44	70.44	70.44	70.44	70.44
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	533.99	533.99	526.89	519.79	519.79	493.79
Financial costs .....	476.00	416.50	357.00	297.50	238.00	178.50
<b>Total production costs .....</b>	<b>2857.84</b>	<b>3588.42</b>	<b>4252.89</b>	<b>4977.40</b>	<b>4917.90</b>	<b>4832.40</b>
<b>Costs per unit (single product) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	36.22	28.92	23.08	19.79	18.82	17.92
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	182.32	182.32	182.32	182.32	182.32	182.32

CALCIUM HYPOCHLORITE — February 88



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - B&LO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1996	1997	1998-99	2000-2	2003	2004
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	3362.68	3362.68	3362.68	3362.68	3362.68	3362.68
Other raw materials .....	70.00	70.00	70.00	70.00	70.00	70.00
Utilities .....	4.90	4.90	4.90	4.90	4.90	4.90
Energy .....	347.86	347.86	347.86	347.86	347.86	347.86
Labour, direct .....	111.88	111.88	111.88	111.88	111.88	111.88
Repair, maintenance .....	24.35	24.35	24.35	24.35	24.35	24.35
Spares .....	168.00	168.00	168.00	168.00	168.00	168.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>4089.67</b>	<b>4089.67</b>	<b>4089.67</b>	<b>4089.67</b>	<b>4089.67</b>	<b>4089.67</b>
Administrative overheads .....	70.44	70.44	70.44	70.44	70.44	70.44
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	493.79	493.79	493.79	448.69	221.32	0.00
Financial costs .....	119.00	59.50	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>4772.90</b>	<b>4713.40</b>	<b>4653.90</b>	<b>4608.80</b>	<b>4381.43</b>	<b>4160.11</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	16.90	15.85	14.78	14.92	11.38	7.55
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	182.32	182.32	182.32	182.32	182.32	182.32

CALCIUM HYPOCHLORITE — February 88





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year .....		1990	1991	1992	1993	1994-2004
Coverage .....	mdc coto					
Current assets &						
Accounts receivable . . . . .	30 12.0	153.99	219.83	280.75	346.68	346.68
Inventory and materials . . . . .	30 11.9	115.44	173.15	230.87	288.59	288.59
Energy . . . . .	13 28.4	4.90	7.35	9.80	12.25	12.25
Spares . . . . .	360 1.0	67.00	100.00	134.00	168.00	168.00
Work in progress . . . . .	1 360.0	4.94	7.13	9.16	11.36	11.36
Finished products . . . . .	30 12.0	153.99	219.83	280.75	346.68	346.68
Cash in hand . . . . .	15 24.0	13.90	15.28	14.19	15.61	15.61
Total current assets . . . . .		514.15	742.57	959.53	1189.16	1189.16
Current liabilities and						
Accounts payable . . . . .	28 13.0	133.18	194.00	254.67	315.50	315.50
Net working capital . . . . .		380.98	548.56	704.86	873.67	873.67
Increase in working capital . . . . .		380.98	167.59	156.30	168.80	0.00
Net working capital, local . . . . .		271.89	391.80	511.70	631.61	631.61
Net working capital, foreign . . . . .		109.08	156.77	193.16	242.06	242.06

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987	1988	1989
Equity, ordinary ..	3070.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	4760.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	4760.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	476.00
Total funds .....	7830.00	0.00	476.00

CALCIUM HYPOCHLORITE — February 88



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-595.00	-595.00	-595.00	-595.00	-595.00	-595.00	-595.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-595.00	-595.00	-595.00	-595.00	-595.00	-595.00	-595.00
Current liabilities	133.18	60.83	60.66	60.83	0.00	0.00	0.00
Bank overdraft ....	855.43	189.50	-93.55	-322.79	-521.34	-538.09	-45.17
Total funds .....	393.60	-344.67	-627.89	-856.95	-1116.34	-1133.09	-640.17

CALCIUM HYPOCHLORITE — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1997
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-595.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	-595.00
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	-595.00

CALCIUM HYPOCHLORITE — February 88



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987	1988	1989
Total cash inflow . .	7830.00	0.00	0.00
Financial resources .	7830.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00
Total cash outflow . .	1481.00	3746.00	3079.00
Total assets . . . .	1481.00	3746.00	2603.00
Operating costs . . .	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	476.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	6349.00	-3746.00	-3079.00
Cumulated cash balance	6349.00	2603.00	-476.00
Inflow, local . . . .	3070.00	0.00	0.00
Outflow, local . . . .	361.00	946.00	923.00
Surplus ( deficit ) .	2709.00	-946.00	-923.00
Inflow, foreign . . .	4760.00	0.00	0.00
Outflow, foreign . . .	1120.00	2800.00	2156.00
Surplus ( deficit ) .	3640.00	-2800.00	-2156.00
Net cashflow . . . . .	-1481.00	-3746.00	-2603.00
Cumulated net cashflow	-1481.00	-5227.00	-7830.00



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995
Total cash inflow ..	2577.58	3727.43	4949.46	6171.83	6111.00	6111.00
Financial resources .	133.18	60.83	60.66	60.83	0.00	0.00
Sales, net of tax ..	2444.40	3666.60	4888.80	6111.00	6111.00	6111.00
Total cash outflow ..	3433.00	3916.93	4855.91	5849.04	5589.66	5572.91
Total assets .....	514.15	228.41	216.96	229.64	0.00	0.00
Operating costs ...	1847.85	2637.93	3369.00	4160.11	4160.11	4160.11
Cost of finance ...	476.00	416.50	357.00	297.50	238.00	178.50
Repayment .....	595.00	595.00	595.00	595.00	595.00	595.00
Corporate tax ...	0.00	39.09	317.95	566.80	596.55	639.30
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-855.43	-189.51	93.55	322.79	521.34	538.09
Cumulated cash balance	-1331.43	-1520.93	-1427.39	-1104.60	-583.26	-45.17
Inflow, local .....	2577.06	3727.25	4949.45	6171.66	6111.00	6111.00
Outflow, local .....	2066.93	2609.88	3616.58	4593.30	4442.49	4465.24
Surplus ( deficit ) .	510.13	1117.38	1332.87	1578.35	1668.51	1625.76
Inflow, foreign ...	0.52	0.17	0.01	0.18	0.00	0.00
Outflow, foreign ...	1366.07	1307.06	1239.33	1255.74	1147.17	1087.67
Surplus ( deficit ) .	-1365.55	-1306.88	-1239.32	-1255.57	-1147.17	-1087.67
Net cashflow .....	215.57	821.99	1046.55	1215.29	1354.34	1311.59
Cumulated net cashflow	-7614.43	-6792.43	-5746.89	-4531.60	-3177.26	-1865.67



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1996	1997	1998	1999	2000	2001
Total cash inflow ..	6111.00	6111.00	6111.00	6111.00	6111.00	6111.00
Financial resources ..	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	6111.00	6111.00	6111.00	6111.00	6111.00	6111.00
Total cash outflow ..	5543.16	5513.41	4888.66	4888.66	4911.21	4911.21
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs .....	4160.11	4160.11	4160.11	4160.11	4160.11	4160.11
Cost of finance .....	119.00	59.50	0.00	0.00	0.00	0.00
Repayment .....	595.00	595.00	0.00	0.00	0.00	0.00
Corporate tax .....	609.05	698.80	728.55	728.55	751.10	751.10
Dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) ..	567.84	597.59	1222.34	1222.34	1199.79	1199.79
Cumulated cash balance	522.67	1120.26	2342.61	3564.95	4764.74	5964.53
Inflow, local .....	6111.00	6111.00	6111.00	6111.00	6111.00	6111.00
Outflow, local .....	4514.99	4544.74	4574.49	4574.49	4597.04	4597.04
Surplus ( deficit ) ..	1596.01	1566.26	1536.51	1536.51	1513.96	1513.96
Inflow, foreign .....	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign .....	1028.17	968.67	314.17	314.17	314.17	314.17
Surplus ( deficit ) ..	-1028.17	-968.67	-314.17	-314.17	-314.17	-314.17
Net cashflow .....	1281.84	1252.09	1222.34	1222.34	1199.79	1199.79
Cumulated net cashflow	-583.83	668.27	1890.61	3112.95	4312.74	5512.53

CALCIUM HYPOCHLORITE — February 81



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	2002	2003	2004
Total cash inflow ..	6111.00	6111.00	6111.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax ..	6111.00	6111.00	6111.00
Total cash outflow ..	4911.21	5024.90	5135.55
Total assets .....	0.00	0.00	0.00
Operating costs .....	4160.11	4160.11	4160.11
Cost of finance .....	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00
Corporate tax .....	751.10	864.79	975.45
Dividends paid .....	0.00	0.00	0.00
Surplus ( deficit ) .	1199.79	1086.10	975.45
Cumulated cash balance	7164.32	8250.42	9225.87
Inflow, local .....	6111.00	6111.00	6111.00
Outflow, local .....	4597.04	4710.73	4821.38
Surplus ( deficit ) .	1513.96	1400.27	1289.62
Inflow, foreign .....	0.00	0.00	0.00
Outflow, foreign .....	314.17	314.17	314.17
Surplus ( deficit ) .	-314.17	-314.17	-314.17
Net cashflow .....	1199.79	1086.10	975.45
Cumulated net cashflow	6712.32	7798.42	8773.87

CALCIUM HYPOCHLORITE — February 20



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Cashflow Discounting:**

a) Equity paid versus Net income flow:			
Net present value .....	-215.19	at	10.00 %
Internal Rate of Return (IARE1) ..	9.29	%	
b) Net Worth versus Net cash return:			
Net present value .....	-48.49	at	10.00 %
Internal Rate of Return (IARE2) ..	9.98	%	
c) Internal Rate of Return on total investment:			
Net present value .....	-82.30	at	10.00 %
Internal Rate of Return ( IRR ) ..	9.85	%	
Net Worth = Equity paid plus reserves			

CALCIUM HYPOCHLORITE — February 88





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994
Total sales, incl. sales tax .....	2444.40	3666.60	4888.80	6111.00	6111.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	2444.40	3666.60	4888.80	6111.00	6111.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	2381.84	3171.92	3895.89	4679.90	4679.90
Operational margin .....	62.56	494.68	992.91	1431.10	1431.10
As % of total sales .....	2.56	13.49	20.31	23.42	23.42
Cost of finance .....	476.00	416.50	357.00	297.50	298.00
Gross profit .....	-413.44	78.18	635.91	1133.60	1193.10
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	-413.44	78.18	635.91	1133.60	1193.10
Tax .....	0.00	39.09	317.95	566.80	596.55
Net profit .....	-413.44	39.09	317.95	566.80	596.55
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	-413.44	39.09	317.95	566.80	596.55
Accumulated undistributed profit .....	-413.44	-374.35	-56.40	510.40	1106.95
Gross profit, % of total sales .....	-16.91	2.13	13.01	18.55	19.52
Net profit, % of total sales .....	-16.91	1.07	6.50	9.28	9.76
ROE, Net profit, % of equity .....	-13.47	1.27	10.36	18.46	19.43
ROI, Net profit+interest, % of invest. ....	0.76	5.44	7.91	9.93	9.59



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year .....	1995	1996	1997	1998	1999
Total sales, incl. sales tax .....	6111.00	6111.00	6111.00	6111.00	6111.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	6111.00	6111.00	6111.00	6111.00	6111.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	4653.90	4653.90	4653.90	4653.90	4653.90
Operational margin .....	1457.10	1457.10	1457.10	1457.10	1457.10
As % of total sales .....	23.84	23.84	23.84	23.84	23.84
Cost of finance .....	178.50	119.00	59.50	0.00	0.00
Gross profit .....	1278.60	1338.10	1397.60	1457.10	1457.10
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	1278.60	1338.10	1397.60	1457.10	1457.10
Tax .....	639.30	669.05	698.80	728.55	728.55
Net profit .....	639.30	669.05	698.80	728.55	728.55
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	639.30	669.05	698.80	728.55	728.55
Accumulated undistributed profit .....	1746.25	2415.30	3114.10	3842.65	4571.20
Gross profit, % of total sales .....	20.92	21.90	22.87	23.84	23.84
Net profit, % of total sales .....	10.46	10.95	11.44	11.92	11.92
RCE, Net profit, % of equity .....	20.82	21.79	22.76	23.73	23.73
ROI, Net profit+interest, % of invest.	9.40	9.05	8.71	8.37	8.37



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	6111.00	6111.00	6111.00	6111.00	6111.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	6111.00	6111.00	6111.00	6111.00	6111.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	4608.80	4608.80	4608.30	4381.43	4160.11
Operational margin . . . . .	1502.20	1502.20	1502.20	1729.57	1950.89
As % of total sales . . . . .	24.58	24.58	24.58	28.30	31.92
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	1502.20	1502.20	1502.20	1729.57	1950.89
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1502.20	1502.20	1502.20	1729.57	1950.89
Tax . . . . .	751.10	751.10	751.10	864.79	975.45
Net profit . . . . .	751.10	751.10	751.10	864.79	975.45
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	751.10	751.10	751.10	864.79	975.45
Accumulated undistributed profit . . . . .	5322.30	6073.40	6824.50	7689.29	8664.73
Gross profit, % of total sales . . . . .	24.58	24.58	24.58	28.30	31.92
Net profit, % of total sales . . . . .	12.29	12.29	12.29	14.15	15.96
ROE, Net profit, % of equity . . . . .	24.47	24.47	24.47	28.17	31.77
ROI, Net profit+interest, % of invest. . . . .	8.63	8.63	8.63	9.94	11.21



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987	1988	1989
Total assets .....	7830.00	7830.00	8306.00
Fixed assets, net of depreciation	0.00	1481.00	5227.00
Construction in progress .....	1481.00	3746.00	3079.00
Current assets .....	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00
Cash surplus, finance available .	6349.00	2603.00	0.00
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	7830.00	7830.00	8306.00
Equity capital .....	3070.00	3070.00	3070.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	4760.00	4760.00	4760.00
Current liabilities .....	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	476.00
Total debt .....	4760.00	4760.00	5236.00
Equity, % of liabilities .....	39.21	39.21	36.9%

CALCIUM HYPOCHLORITE — February 88



**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
Total assets .....	8699.60	8394.03	8045.01	7436.90	6860.71	6366.92
Fixed assets, net of depreciation	7772.01	7238.02	6711.13	6191.34	5671.54	5177.75
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	500.25	727.29	945.32	1173.55	1173.55	1173.55
Cash, bank .....	13.90	15.28	14.19	15.61	15.61	15.61
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	413.44	374.35	56.40	0.00	0.00
Loss .....	413.44	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	8699.60	8394.03	8045.01	7436.90	6860.71	6366.92
Equity capital .....	3070.00	3070.00	3070.00	3070.00	3070.00	3070.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	510.40	1106.95
Profit .....	0.00	39.09	317.95	566.80	596.55	639.30
Long and medium term debt .....	4165.00	3570.00	2975.00	2380.00	1785.00	1190.00
Current liabilities .....	133.18	194.00	254.67	315.50	315.50	315.50
Bank overdraft, finance required ..	1331.43	1520.93	1427.38	1104.60	583.26	45.17
Total debt .....	5629.60	5284.94	4657.05	3800.10	2682.76	1550.67
Equity, % of liabilities .....	35.29	36.57	38.16	41.28	44.75	48.22

CALCIUM HYPOCHLORITE — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	6395.80	6499.60	7228.15	7956.70	8707.80	9458.90
Fixed assets, net of depreciation	4683.96	4190.17	3696.38	3202.59	2753.90	2305.21
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1173.55	1173.55	1173.55	1173.55	1173.55	1173.55
Cash, bank .....	15.61	15.61	15.61	15.61	15.61	15.61
Cash surplus, finance available ..	522.67	1120.26	2342.60	3564.94	4764.73	5964.53
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	6395.80	6499.60	7228.15	7956.70	8707.80	9458.90
Equity capital .....	3070.00	3070.00	3070.00	3070.00	3070.00	3070.00
Reserves, retained profit .....	1746.25	2415.30	3114.10	3842.65	4671.20	5322.30
Profit .....	669.05	698.80	720.55	728.55	751.10	751.10
Long and medium term debt .....	595.00	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	315.50	315.50	315.50	315.50	315.50	315.50

Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt . . . . .	910.50	315.50	315.50	315.50	315.50	315.50
Equity, % of liabilities . . . .	48.00	47.23	42.47	38.58	35.26	32.46

CALCIUM HYPOCHLORITE — February 88



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year .....	2002	2003	2004
Total assets .....	10210.00	11074.78	12050.23
Fixed assets, net of depreciation	1856.52	1635.20	1635.20
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1173.55	1173.55	1173.55
Cash, bank .....	15.61	15.61	15.61
Cash surplus, finance available .	7164.32	8250.42	9225.86
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	10210.00	11074.78	12050.23
Equity capital .....	3070.00	3070.00	3070.00
Reserves, retained profit .....	6073.40	6824.50	7689.29
Profit .....	751.10	864.79	975.45
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	315.50	315.50	315.50
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	315.50	315.50	315.50
Equity, % of liabilities .....	30.07	27.72	25.48

CALCIUM HYPOCHLORITE — February 88

**Calcium Hypochlorite**

**ANNEXE 2**

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>6111</u>
2) VARIABLE COSTS:	<u>3901.32</u>
. RAW MATERIALS	3436.68
. UTILITIES	4.90
. ENERGY	347.86
. LABOUR	111.88
3) FIXED COSTS	<u>1080.08</u>
. REPAIR-MAINTENANCE	24.35
. SPARES	168
. ADMINISTRATION	70.44
. DEPRECIATION	519.79
. FINANCIAL COSTS	297.50
4) TOTAL PRODUCTION COSTS	<u>4981.4</u>

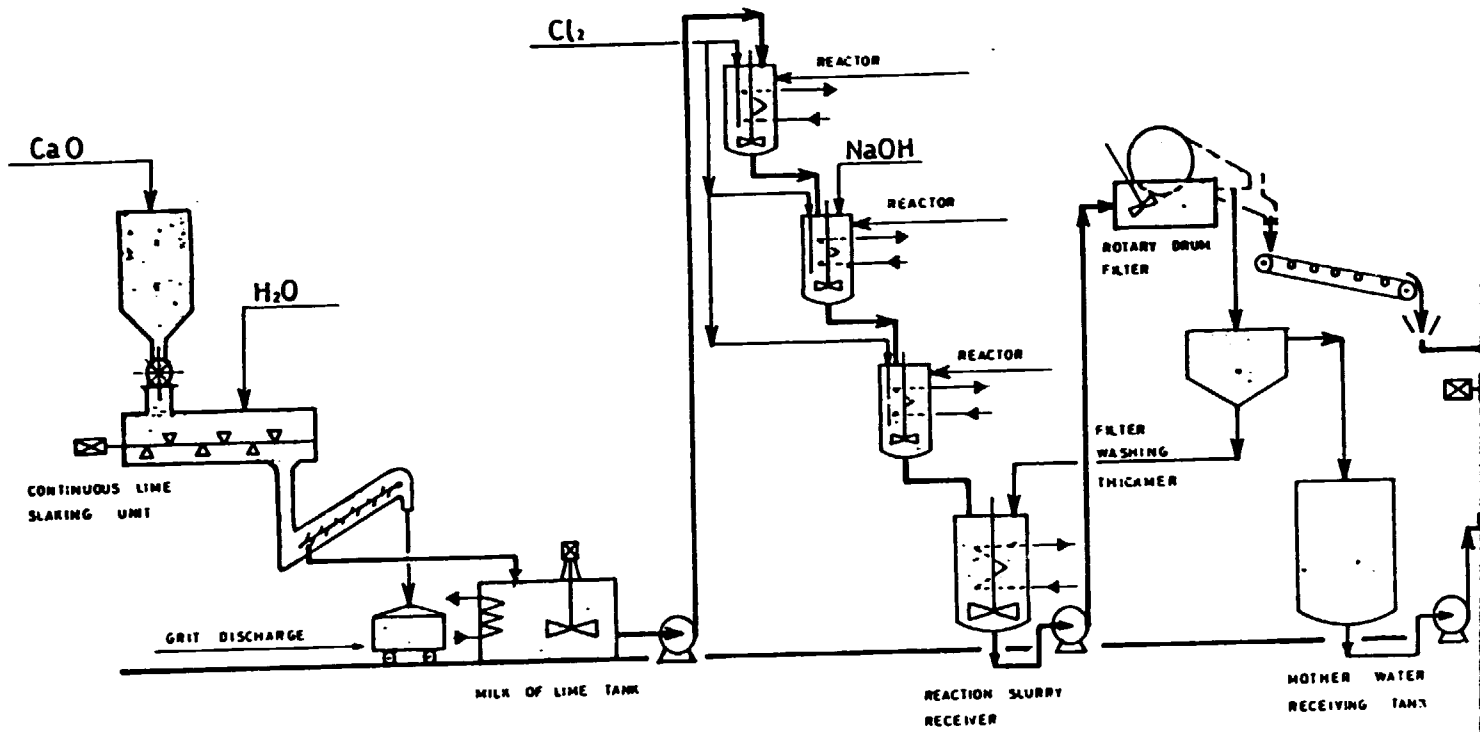
$$\text{BEP} = \frac{1080.08}{6111 - 3901.32} \times 100 = 48.9\%$$

**Calcium Hypochlorite**

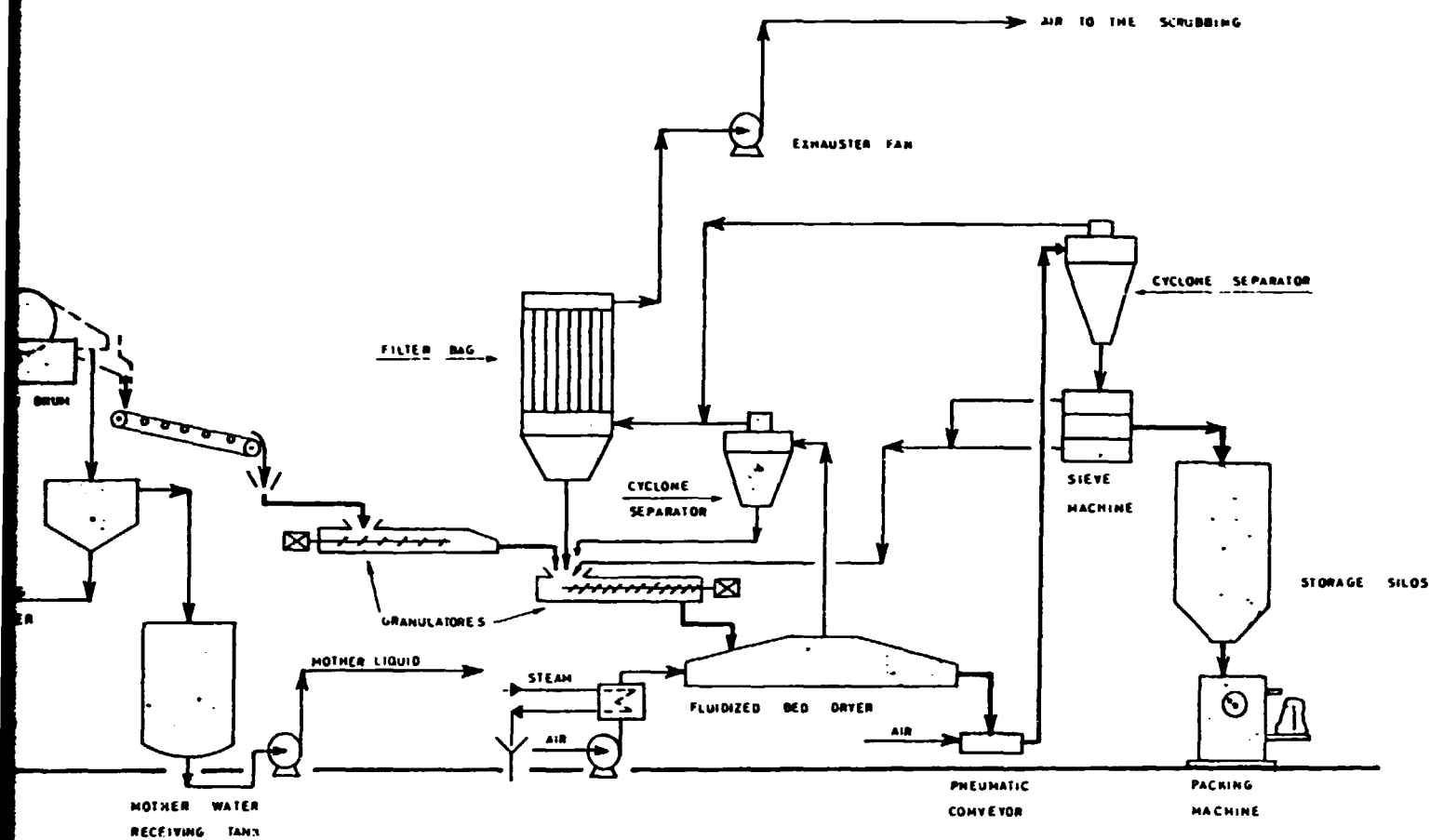
**ANNEXE 3**

DRW. B162 - 16 - 1  
SIMPLIFIED FLOW DIAGRAM

DRW. B162 - 16 - 2  
EQUIPMENT LAY OUT

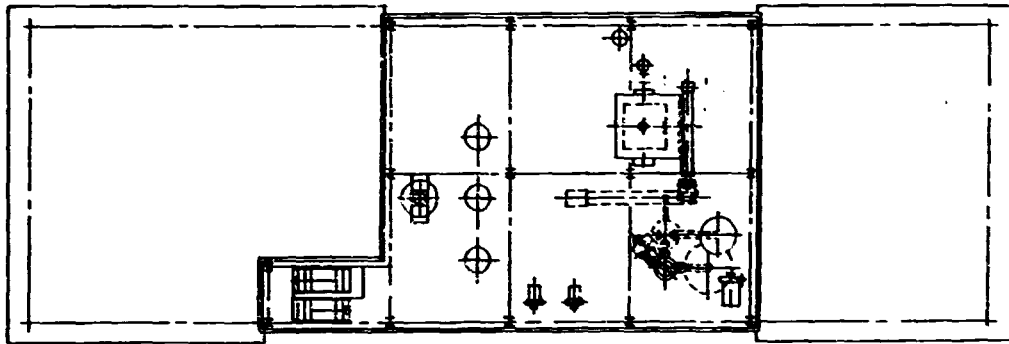


SECTION 1

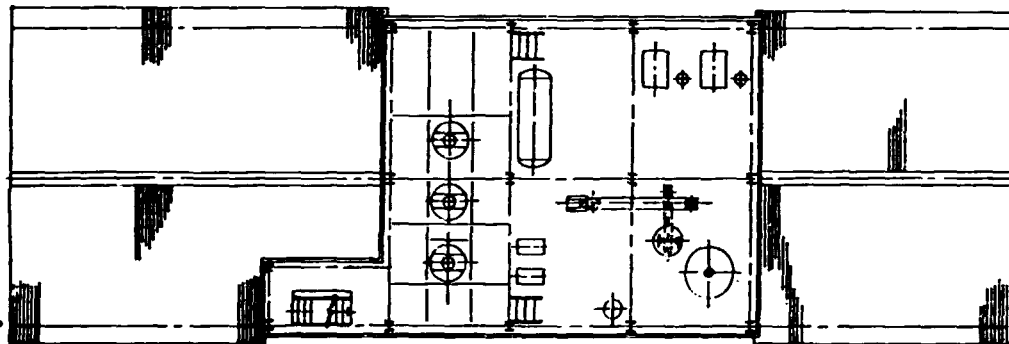


## SECTION .2

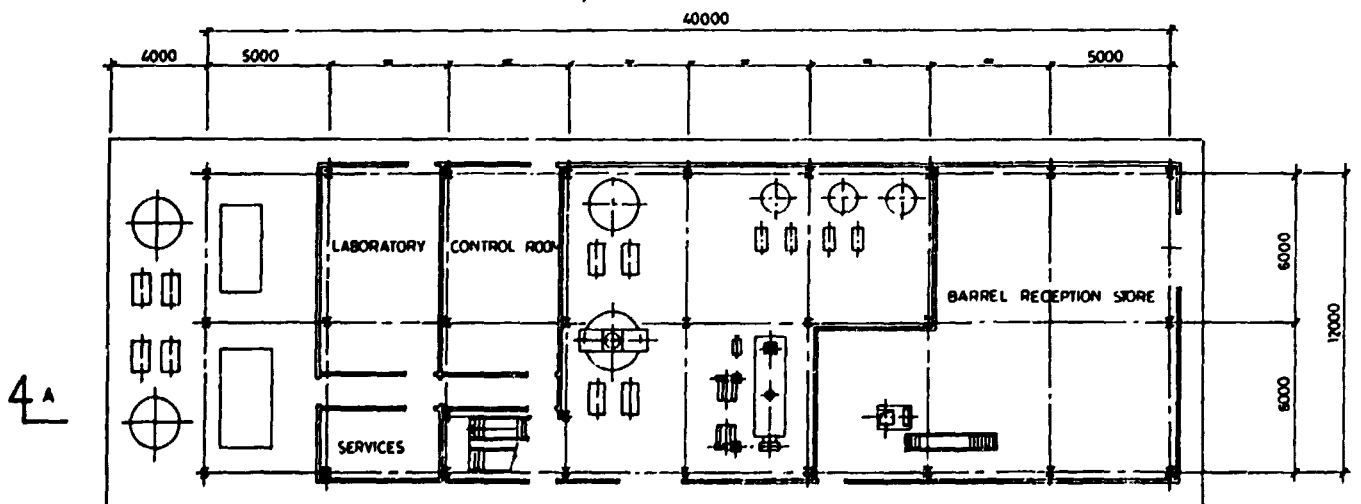
CLIENTE CUSTOMER	COMMESSA N. JOB N.	
<b>HIGH CONCENTRATION GRANULAR          CALCIUM HYPOCHLORITE</b>	CONTROLLATO APPROVED	DATA DATE
	DISEGNATO DRAWN	DATA DATE
<b>SIMPLIFIED FLOW DIAGRAM</b>	SCALA SCALE	
<b>baldo &amp; c.</b> CONSULTING ENGINEERS		DIS. N. DWG N. <b>B.162 - 16-1</b>
Via Sillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229		REV.



ELEVATION PLAN +10000

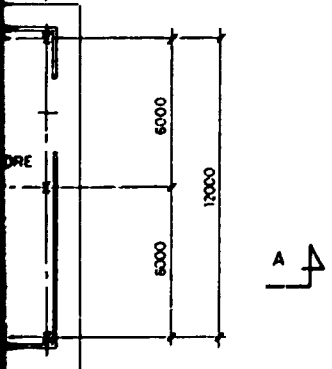
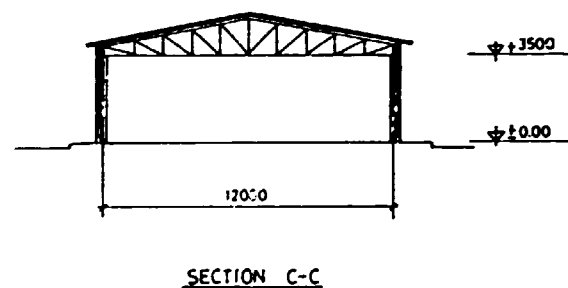
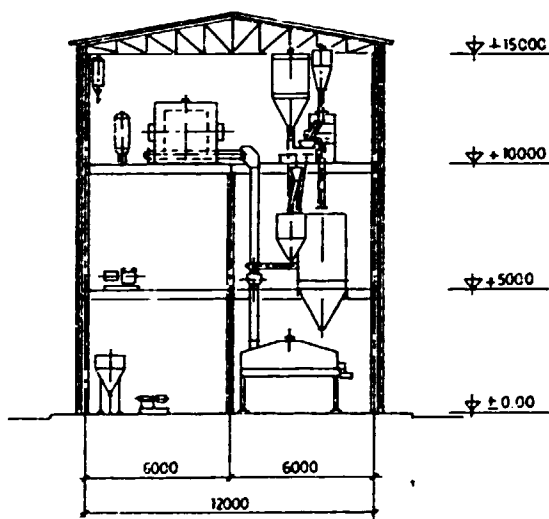
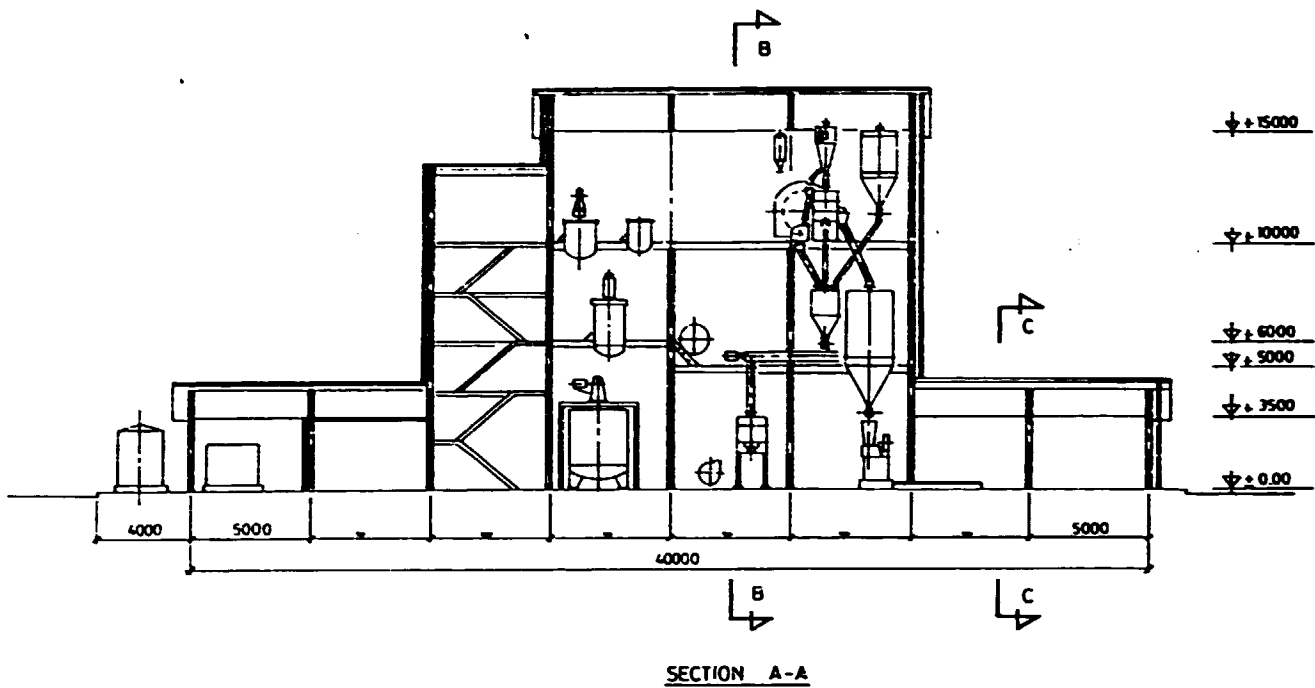


ELEVATION PLAN +5000+6000



ELEVATION PLAN ± 0.00

SECTION 1



## SECTION .2

CLIENTE DPSA		COMMESSA N° 001/87	
CALCIUM HYPOCHLORITE PLANT		CONTROLLATO DATA	DATA
EQUIPMENT LAY-OUT		DISIGNATO DATA	DATA
		SCALA 1:100	
		08/87 09/87	B.162-16-2
<b>baldo &amp; c.</b> <small>CONSUMI E TUBERIE</small>		Via Silicane 26 20154 MILANO PH. N. 3102 Tel. N. 330079	

Calcium Hypochlorite

ANNEXE 4

FINANCIAL AND FOREIGN EXCHANGE EFFECT EVALUATIONS  
FOR CHLOR - ALKALI  
AND CALCIUM HYPOCHLORITE PRODUCTION  
IN ONE PLANT



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COMFAR 2.0 - INLBO & CO. S.R.L., MILANO

CHLORIDE ALKALI + CALCIUM HYPOCHLORITE  
February 88  
Integr. factory - Power at 0.05 €/kWh

3 years) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 \$

**Total initial investment during construction phase**

fixed assets:	26928.00	75.788 % foreign
current assets:	0.00	0.000 % foreign
total assets:	26928.00	75.788 % foreign

**Source of funds during construction phase**

equity & grants:	9342.00	0.000 % foreign
foreign loans :	15988.00	
local loans :	0.00	
total funds :	25330.00	63.119 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1298.33	1645.40	1873.47
depreciation :	1701.14	1701.14	1679.04
interest :	1598.00	1398.95	1199.10
production costs	4598.27	4745.49	4751.61
thereof foreign	71.58 %	68.49 %	65.02 %
total sales :	3140.00	4710.00	6280.00
gross income :	-1458.27	-35.49	1528.39
net income :	-1458.27	-35.49	764.20
cash balance :	-2194.18	-504.46	296.90
net cashflow :	1403.12	2892.99	3494.50

Net Present Value at: 10.00 % = -1405.48  
Internal Rate of Return on total investment: 9.16 %  
Equity paid versus Net income flow (IRR): 7.83 %  
Net Worth versus Net Cash Return (IRR): 9.20 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement





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**Total Initial Investment in 1000 \$**

Year . . . . .	1987	1988	1989
<b>Fixed investment costs</b>			
Land, site preparation, development	221.00	0.00	0.00
Buildings and civil works . . . . .	930.00	1526.00	368.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant machinery and equipment . . .	4020.00	14070.00	3975.00
<b>Total fixed investment costs . . . .</b>	<b>5171.00</b>	<b>15596.00</b>	<b>4343.00</b>
Pre-production capital expenditures.	20.00	30.00	1768.00
Net working capital . . . . .	0.00	0.00	0.00
<b>Total initial investment costs . . .</b>	<b>5191.00</b>	<b>15626.00</b>	<b>6111.00</b>
Of it foreign, in I . . . . .	73.59	76.48	73.90

CHLORINE ALKALI + CALCIUM HYPOCHLORITE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Current Investment in 1000 \$**

Year . . . . .	1990	1991	1992	1993
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capital expenditures.	0.00	0.00	0.00	0.00
Working capital . . . . .	438.55	171.61	147.83	172.83
<b>Total current investment costs . . .</b>	<b>438.55</b>	<b>171.61</b>	<b>147.83</b>	<b>172.83</b>
Of it foreign, I . . . . .	73.95	86.84	84.72	86.93

CHLORINE ALKALI + CALCIUM HYPOCHLORITE — February 88

Total Production Costs in 1000 \$

Year . . . . .	1990	1991	1992	1993	1994	1995
1 of non. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 . . . . .	131.11	196.66	262.22	327.78	327.78	327.78
Other raw materials . . . . .	28.00	42.00	56.00	70.00	70.00	70.00
Utilities . . . . .	16.45	24.67	32.90	41.13	41.13	41.13
Energy . . . . .	296.58	444.00	593.16	741.46	741.46	741.46
Labour, direct . . . . .	295.07	295.07	295.07	295.07	295.07	295.07
Repair, maintenance . . . . .	96.81	96.81	96.81	96.81	96.81	96.81
Spares . . . . .	223.00	334.00	446.00	558.00	558.00	558.00
Factory overheads . . . . .	120.00	120.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1207.02</b>	<b>1554.09</b>	<b>1782.16</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>
Administrative overheads . . . . .	91.31	91.31	91.31	91.31	91.31	91.31
Indir. costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1701.14	1701.14	1679.04	1656.94	1656.94	1612.94
Financial costs . . . . .	1598.00	1398.95	1199.10	999.25	799.40	599.55
<b>Total production costs . . . . .</b>	<b>4598.27</b>	<b>4745.49</b>	<b>4751.61</b>	<b>4877.75</b>	<b>4677.90</b>	<b>4434.05</b>
<b>Costs per unit ( single product ) . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, 1 . . . . .	71.58	68.49	65.02	62.52	60.91	59.76
Of it variable, 2 . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>	<b>386.38</b>



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 \$**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
I of noc. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	327.78	327.78	327.78	327.78	327.78	327.78
Other raw materials . . . . .	70.00	70.00	70.00	70.60	70.00	70.00
Utilities . . . . .	41.13	41.13	41.13	41.13	41.13	41.13
Energy . . . . .	741.46	741.46	741.46	741.46	741.46	741.46
Labour, direct . . . . .	295.07	295.07	295.07	295.07	295.07	295.07
Repair, maintenance . . . . .	96.81	96.81	96.81	96.81	96.81	96.81
Spares . . . . .	558.00	558.00	558.00	558.00	558.00	558.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>	<b>2130.25</b>
Administrative overheads . . . . .	91.31	91.31	91.31	91.31	91.31	91.31
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	1612.94	1612.94	1612.94	1471.74	725.93	0.00
Financial costs . . . . .	399.70	199.85	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>4234.28</b>	<b>4034.35</b>	<b>3834.50</b>	<b>3693.30</b>	<b>2947.49</b>	<b>2221.56</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, I . . . . .	57.86	55.77	53.46	55.51	47.98	35.81
Of it variable, I . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	386.38	386.38	386.38	386.38	386.38	386.38

CHLORINE ALKALI + CALCIUM HYPOCHLORITE --- February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 \$**

Year .....	1990	1991	1992	1993	1994-2004
<b>Coverage .....</b> <b>ndc</b> <b>coto</b>					
<b>Current assets &amp;</b>					
Accounts receivable . . . 30 12.0	108.19	137.12	156.12	185.13	185.13
Inventory and materials . 40 9.1	19.38	29.07	38.76	48.46	48.46
Energy . . . . . 9 40.6	7.30	10.95	14.60	18.25	18.25
Spares . . . . . 360 1.0	223.00	334.00	446.00	558.00	558.00
Work in progress . . . . 1 360.0	3.35	4.32	4.95	5.92	5.92
Finished products . . . 30 12.0	108.19	137.12	156.12	185.13	185.13
Cash in hand . . . . . 15 24.0	34.42	39.05	38.72	43.38	43.38
<b>Total current assets . . . . .</b>	<b>503.85</b>	<b>691.62</b>	<b>855.28</b>	<b>1044.27</b>	<b>1044.27</b>
<b>Current liabilities and</b>					
Accounts payable . . . . . 19 18.8	65.30	81.46	97.28	113.44	113.44
<b>Net working capital . . . . .</b>	<b>438.55</b>	<b>610.16</b>	<b>757.99</b>	<b>930.83</b>	<b>930.83</b>
<b>Increase in working capital . . . . .</b>	<b>438.55</b>	<b>171.61</b>	<b>147.83</b>	<b>172.83</b>	<b>0.00</b>
<b>Net working capital, local . . . . .</b>	<b>114.26</b>	<b>136.85</b>	<b>159.43</b>	<b>182.02</b>	<b>182.02</b>
<b>Net working capital, foreign . . . . .</b>	<b>324.29</b>	<b>473.31</b>	<b>598.56</b>	<b>748.81</b>	<b>748.81</b>

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - MALING & CO. S.R.L., MILANO

Source of Finance, construction in 1000 \$

Year .....	1987	1988	1989
Equity, ordinary ..	9342.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	15988.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	15988.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	1598.80
Total funds .....	25330.00	0.00	1598.80

CHLORE ALKAL. + CALCIUM HYPOCHLORITE --- February 88



**COMFAR**<sup>C</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 \$

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50	-1998.50
Current liabilities	65.30	16.16	15.82	16.16	0.00	0.00	0.00
Bank overdraft ....	2194.18	504.46	-296.90	-971.73	-1244.49	-1322.41	-461.91
Total funds .....	260.98	-1477.88	-2279.57	-2954.07	-3242.99	-3320.91	-2440.41

CHLORINE ALKALI + CALCIUM HYPOCHLORITE --- February 88

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 \$

Year .....	1997
Equity, ordinary ..	0.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	-1998.50
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	-1998.50
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	-1998.50

CHLORINE ALKALI + CALCIUM HYPOCHLORITE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 \$

Year . . . . .	1987	1988	1989
Total cash inflow . .	25330.00	0.00	0.00
Financial resources .	25330.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00
Total cash outflow . .	5191.00	15626.00	6111.80
Total assets . . . .	5191.00	15626.00	4513.00
Operating costs . . .	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	1598.80
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) . .	20139.00	-15626.00	-6111.80
Cumulated cash balance	20139.00	4513.00	-1598.80
Inflow, local . . . . .	9342.00	0.00	0.00
Outflow, local . . . .	1371.00	3676.00	1473.00
Surplus ( deficit ) . .	7971.00	-3676.00	-1473.00
Inflow, foreign . . . .	15988.00	0.00	0.00
Outflow, foreign . . .	3820.00	11950.00	4638.80
Surplus ( deficit ) . .	12168.00	-11950.00	-4638.80
Net cashflow . . . . .	-5191.00	-15626.00	-4513.00
Cumulated net cashflow	-5191.00	-20817.00	-25330.00



## Cashflow tables, production in 1000 \$

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	3205.30	4726.16	6295.82	7866.16	7850.00	7850.00
Financial resources .	65.30	16.16	15.82	16.16	0.00	0.00
Sales, net of tax . .	3140.00	4710.00	6280.00	7850.00	7850.00	7850.00
Total cash outflow . .	5399.48	5230.62	5998.72	6894.43	6605.51	6527.59
Total assets . . . .	503.85	187.77	163.66	188.99	0.00	0.00
Operating costs . . .	1298.33	1645.40	1873.47	2221.56	2221.56	2221.56
Cost of finance . . .	1598.80	1398.95	1199.10	999.25	799.40	599.55
Repayment . . . . .	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50
Corporate tax . . . .	0.00	0.00	764.20	1486.13	1586.05	1707.98
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2194.18	-504.46	296.90	971.73	1244.49	1322.41
Cumulated cash balance	-3792.98	-4297.44	-4000.54	-3028.81	-1784.33	-461.91
Inflow, local . . . .	2548.29	3742.02	4984.11	6226.22	6210.50	6210.50
Outflow, local . . . .	1038.69	1087.23	2039.99	2950.52	3012.14	3134.07
Surplus ( deficit ) .	1509.60	2654.78	2944.12	3275.70	3198.36	3076.43
Inflow, foreign . . .	657.02	984.14	1311.71	1639.94	1639.50	1639.50
Outflow, foreign . . .	4360.79	4143.39	3958.93	3943.91	3593.37	3393.52
Surplus ( deficit ) .	-3703.78	-3159.25	-2647.22	-2303.97	-1953.87	-1754.02
Net cashflow . . . . .	1403.12	2892.99	3474.50	3969.48	4042.39	3920.46
Cumulated net cashflow	-23926.88	-21033.89	-17539.39	-13569.91	-9527.52	-5607.06



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Cashflow tables, production in 1000 \$

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	7850.00	7850.00	7850.00	7850.00	7850.00	7850.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	7850.00	7850.00	7850.00	7850.00	7850.00	7850.00
Total cash outflow . .	6427.66	6327.74	4229.31	4229.31	4299.91	4299.91
Total assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	2221.56	2221.56	2221.56	2221.56	2221.56	2221.56
Cost of finance . . .	399.70	199.85	6.00	0.00	0.00	0.00
Repayment . . . . .	1998.50	1998.50	6.00	0.00	0.00	0.00
Corporate tax . . . .	1807.90	1907.83	2007.75	2007.75	2078.35	2078.35
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1422.34	1522.26	3620.69	3620.69	3550.09	3550.09
Cumulated cash balance	960.42	2482.68	6103.37	9724.06	13274.15	16824.23
Inflow, local . . . . .	6210.50	6210.50	6210.50	6210.50	6210.50	6210.50
Outflow, local . . . .	3233.99	3333.92	3433.84	3433.84	3504.44	3504.44
Surplus ( deficit ) .	2976.51	2876.58	2776.66	2776.66	2706.06	2706.06
Inflow, foreign . . . .	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
Outflow, foreign . . .	3193.67	2993.82	795.47	795.47	795.47	795.47
Surplus ( deficit ) .	-1554.17	-1354.32	844.03	844.03	844.03	844.03
Net cashflow . . . . .	3820.54	3720.61	3620.69	3620.69	3550.09	3550.09
Cumulated net cashflow	-1786.52	1934.09	5554.78	9175.46	12725.55	16275.64



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 \$

Year . . . . .	2002	2003	2004
Total cash inflow . .	7850.00	7850.00	7850.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	7850.00	7850.00	7850.00
Total cash outflow . .	4299.91	4672.81	5035.78
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	2221.56	2221.56	2221.56
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	2078.35	2451.25	2814.22
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	3550.09	3177.19	2814.22
Cumulated cash balance	20374.32	23551.51	26365.72
Inflow, local . . . . .	6210.50	6210.50	6210.50
Outflow, local . . . .	3504.44	3877.34	4240.31
Surplus ( deficit ) .	2706.06	2333.16	1970.19
Inflow, foreign . . . .	1639.50	1639.50	1639.50
Outflow, foreign . . .	795.47	795.47	795.47
Surplus ( deficit ) .	844.03	844.03	844.03
Net cashflow . . . . .	3350.09	3177.19	2814.22
Cumulated net cashflow	19825.73	23002.91	25817.13



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-1954.96 at	10.00 %
Internal Rate of Return (IRRE1) ..	7.83 %	
b) Net Worth versus Net cash return:		
Net present value .....	-834.49 at	10.00 %
Internal Rate of Return (IRRE2) ..	9.28 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-1405.48 at	10.00 %
Internal Rate of Return (IRR) ..	9.16 %	

Net Worth = Equity paid plus reserves

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CHLORE ALKALI + CALCIUM HYPOCHLORITE --- February 88



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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 \$**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	3140.00	4710.00	6280.00	7850.00	7850.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3140.00	4710.00	6280.00	7850.00	7850.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2999.47	3346.54	3552.51	3878.50	3878.50
Operational margin . . . . .	140.53	1363.46	2727.49	3971.50	3971.50
As % of total sales . . . . .	4.48	28.95	43.43	50.59	50.59
Cost of finance . . . . .	1598.00	1398.95	1199.10	999.25	799.40
Gross profit . . . . .	-1458.27	-35.49	1528.39	2972.25	3172.10
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1458.27	-35.49	1528.39	2972.25	3172.10
Tax . . . . .	0.00	0.00	764.20	1486.13	1586.05
Net profit . . . . .	-1458.27	-35.49	764.20	1486.13	1586.05
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1458.27	-35.49	764.20	1486.13	1586.05
Accumulated undistributed profit . . .	-1458.27	-1493.75	-729.56	756.57	2342.62
Gross profit, % of total sales . . . . .	-46.44	-0.75	24.34	37.86	40.51
Net profit, % of total sales . . . . .	-46.44	-0.75	12.17	18.93	20.20
ROE, Net profit, % of equity . . . . .	-15.61	-0.39	8.18	15.91	16.98
ROI, Net profit+interest, % of invest.	0.35	5.26	7.53	9.46	9.08



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 \$**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3834.50	3834.50	3834.50	3834.50	3834.50
Operational margin . . . . .	4015.50	4015.50	4015.50	4015.50	4015.50
As % of total sales . . . . .	51.15	51.15	51.15	51.15	51.15
Cost of finance . . . . .	599.55	399.70	199.85	0.00	0.00
Gross profit . . . . .	3415.95	3615.80	3815.65	4015.50	4015.50
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	3415.95	3615.80	3815.65	4015.50	4015.50
Tax . . . . .	1707.98	1807.90	1907.83	2007.75	2007.75
Net profit . . . . .	1707.98	1807.90	1907.83	2007.75	2007.75
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1707.98	1807.90	1907.83	2007.75	2007.75
Accumulated undistributed profit . . .	4050.60	5858.50	7766.33	9774.08	11781.83
Gross profit, % of total sales . . . . .	43.52	46.06	48.61	51.15	51.15
Net profit, % of total sales . . . . .	21.76	23.03	24.30	25.58	25.58
ROE, Net profit, % of equity . . . . .	18.28	19.35	20.42	21.49	21.49
ROI, Net profit+interest, % of invest.	8.79	8.41	8.03	7.65	7.65



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COMFAR 2.0 - IMILSO & CO. S.R.L., MILANO

**Net Income Statement in 1000 \$**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	7850.00	7850.00	7850.00	7850.00	7850.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	3693.30	3693.30	3693.30	2947.49	2221.56
Operational margin . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
As % of total sales . . . . .	52.95	52.95	52.95	62.45	71.70
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	4156.70	4156.70	4156.70	4902.51	5628.44
Tax . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Net profit . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	2078.35	2078.35	2078.35	2451.25	2814.22
Accumulated undistributed profit . . .	13860.19	15938.54	18016.89	20468.14	23282.36
Gross profit, % of total sales . . . .	52.95	52.95	52.95	62.45	71.70
Net profit, % of total sales . . . .	26.48	26.48	26.48	31.23	35.85
ROE, Net profit, % of equity . . . .	22.25	22.25	22.25	26.24	30.12
ROI, Net profit+interest, % of invest.	7.91	7.91	7.91	9.33	10.72



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 \$

Year .....	1987	1988	1989
Total assets .....	25330.00	25330.00	26928.00
Fixed assets, net of depreciation	0.00	5191.00	20017.00
Construction in progress .....	5191.00	15626.00	611.00
Current assets .....	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00
Cash surplus, finance available	20139.00	4513.00	0.00
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	25330.00	25330.00	26928.00
Equity capital .....	9342.00	9342.00	9342.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	15988.00	15988.00	15988.00
Current liabilities .....	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	1598.00
Total debt .....	15988.00	15988.00	17586.00
Equity, % of liabilities .....	36.88	36.88	34.69





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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 \$**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets</b> .....	<b>27189.78</b>	<b>25711.90</b>	<b>24196.52</b>	<b>21964.38</b>	<b>19577.89</b>	<b>17964.96</b>
Fixed assets, net of depreciation	25227.66	23526.53	21847.49	20190.56	18533.62	16920.69
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	469.43	652.57	816.56	1000.89	1000.89	1000.89
Cash, bank .....	34.42	39.85	38.72	43.39	43.38	43.38
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Less carried forward .....	0.00	1458.27	1493.75	729.56	0.00	0.00
Less .....	1458.27	35.49	0.00	0.00	0.00	0.00
<b>Total liabilities</b> .....	<b>27189.78</b>	<b>25711.90</b>	<b>24196.52</b>	<b>21964.38</b>	<b>19577.89</b>	<b>17964.96</b>
Equity capital .....	9342.00	9342.00	9342.00	9342.00	9342.00	9342.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	756.57	2342.62
Profit .....	0.00	0.00	764.20	1486.13	1586.05	1707.98
Long and medium term debt .....	13989.50	11991.00	9992.50	7994.00	5995.50	3997.00
Current liabilities .....	65.30	81.46	97.28	113.44	113.44	113.44
Bank overdraft, finance required ..	3792.98	4297.44	4000.54	3028.81	1784.32	461.91
<b>Total debt</b> .....	<b>17847.78</b>	<b>16389.90</b>	<b>14090.32</b>	<b>11136.25</b>	<b>7893.27</b>	<b>4572.36</b>
<b>Equity, % of liabilities</b> .....	<b>34.36</b>	<b>36.33</b>	<b>38.61</b>	<b>42.53</b>	<b>47.72</b>	<b>52.00</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 \$**

Year .....	1996	1997	1998	1999	2000	2001
<b>Total assets .....</b>	<b>17312.44</b>	<b>17221.77</b>	<b>19229.52</b>	<b>21237.28</b>	<b>23315.63</b>	<b>25393.98</b>
Fixed assets, net of depreciation	15307.75	13694.81	12081.88	10468.94	8997.21	7525.47
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	1000.89	1000.89	1000.89	1000.89	1000.89	1000.89
Cash, bank .....	43.38	43.38	43.38	43.38	43.38	43.38
Cash surplus, finance available .	960.42	2482.69	6103.37	9724.06	13274.15	16824.24
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>17312.44</b>	<b>17221.77</b>	<b>19229.52</b>	<b>21237.28</b>	<b>23315.63</b>	<b>25393.98</b>
Equity capital .....	9342.00	9342.00	9342.00	9342.00	9342.00	9342.00
Reserves, retained profit .....	4050.60	5858.50	7766.33	9774.08	11781.83	13860.19
Profit .....	1807.90	1907.83	2007.75	2007.75	2078.35	2078.35
Long and medium term debt .....	1998.50	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	113.44	113.44	113.44	113.44	113.44	113.44
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>2111.94</b>	<b>113.44</b>	<b>113.44</b>	<b>113.44</b>	<b>113.44</b>	<b>113.44</b>
<b>Equity, % of liabilities .....</b>	<b>53.96</b>	<b>54.25</b>	<b>48.58</b>	<b>43.99</b>	<b>40.07</b>	<b>36.79</b>



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 \$**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>27472.33</b>	<b>29923.58</b>	<b>32737.80</b>
Fixed assets, net of depreciation	6653.74	5327.80	5327.80
Construction in progress .....	0.00	0.00	0.00
Current assets .....	1000.89	1000.89	1000.89
Cash, bank .....	43.38	43.38	43.38
Cash surplus, finance available .	20374.32	23551.51	26365.73
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>27472.33</b>	<b>29923.58</b>	<b>32737.80</b>
Equity capital .....	9342.00	9342.00	9342.00
Reserves, retained profit .....	15938.54	18016.89	20469.14
Profit .....	2078.35	2451.25	2814.22
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	113.44	113.44	113.44
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>113.44</b>	<b>113.44</b>	<b>113.44</b>
<b>Equity, % of liabilities .....</b>	<b>34.01</b>	<b>31.22</b>	<b>28.54</b>

CHLORINE ALKALI + CALCIUM HYPOCHLORITE --- February 88



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	construction		production	
				1987	1988	1989	1990
total foreign inflow . .	38615.31	15988.00	22627.31	15988.00	0.00	0.00	657.02
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	15990.21	15988.00	2.21	15988.00	0.00	0.00	1.22
exports . . . . .	22625.10	0.00	22625.10	0.00	0.00	0.00	655.80
indirect effects . . . . .							
total foreign outflow .	51329.88	20408.80	30921.08	3820.00	11950.00	4638.80	4360.79
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	15330.20	18810.00	-3479.80	3820.00	11950.00	3040.00	325.50
imported materials . . .	11216.07	0.00	11216.07	0.00	0.00	0.00	437.99
repayment loans & overd.	15990.21	0.00	15990.21	0.00	0.00	0.00	1998.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	8793.40	1598.80	7194.60	0.00	0.00	1598.80	1598.80
indirect costs . . . . .							
net foreign exchge flow	-12714.57	-4420.80	-8293.77	12168.00	-11950.00	-4638.80	-3703.78
import substit'n effect	42750.00	0.00	42750.00	0.00	0.00	0.00	1500.00
net forgn exchge effect	30035.43	-4420.80	34456.23	12168.00	-11950.00	-4638.80	-2203.78
present values at 10.00 %							
foreign exchange flow .	-11071.50						
net forgn exchge effect	6147.31						



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**Foreign Exchange Effect in 1000 \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	984.14	1311.71	1639.94	1639.50	1639.50	1639.50	1639.50
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.44	0.11	0.44	0.00	0.00	0.00	0.00
exports . . . . .	983.70	1311.60	1639.50	1639.50	1639.50	1639.50	1639.50
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	4143.37	3958.93	3943.91	3593.37	3393.52	3193.67	2993.82
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	149.47	125.36	150.69	0.00	0.00	0.00	0.00
imported materials . . .	596.47	635.97	795.47	795.47	795.47	795.47	795.47
repayment loans & overd.	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50	1998.50
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	1398.95	1199.10	999.25	799.40	599.55	399.70	199.85
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-3159.25	-2647.22	-2303.97	-1953.87	-1754.02	-1554.17	-1354.32
import substit'n effect	2250.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
net foreign exchange effect	-909.25	352.78	696.03	1046.13	1245.98	1445.83	1645.68
present values at 10.00 %							
foreign exchange flow .	-11071.50						
net foreign exchange effect	6147.31						



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**Foreign Exchange Effect in 1000 \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50	1639.50
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	795.47	795.47	795.47	795.47	795.47	795.47	795.47
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	795.47	795.47	795.47	795.47	795.47	795.47	795.47
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	844.03	844.03	844.03	844.03	844.03	844.03	844.03
import substit'n effect	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
net foreign exchange effect	3844.03	3844.03	3844.03	3844.03	3844.03	3844.03	3844.03
present values at 10.00 %							
foreign exchange flow .	-11071.50						
net foreign exchange effect	6147.31						



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**Foreign Exchange Effect in 1000 \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	production 2005
total foreign inflow . .	0.00
equity capital . . . . .	0.00
subsidies, grants . . .	0.00
loans & overdraft . . .	0.00
exports . . . . .	0.00
indirect effects . . . . .	.....
total foreign outflow .	-4228.61
royalties . . . . .	0.00
equipment . . . . .	-4230.82
imported materials . . .	0.00
repayment loans & overd.	2.21
other repayments . . . .	0.00
repatriated wages . . .	0.00
dividends paid . . . . .	0.00
interests . . . . .	0.00
indirect costs . . . . .	.....
net foreign exchange flow	4228.61
import substit'n effect	0.00
net foreign exchange effect	4228.61
present values at 10.00 %	
foreign exchange flow .	-11071.50
net foreign exchange effect	6147.31

U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
DIVERSIFICATION OF CEMENT USES  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS



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ANNEXES

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0. SUMMARY AND CONCLUSIONS

A production surplus of approximately 100 - 150,000 tons of Portland Cement exists in Ethiopia.

This study investigates the possibility of diversifying the uses of cement in order to find an useful application for this surplus.

Most applications such as the production of poles, slabs etc. are already fulfilled by existing or planned plants therefore the consultant's attention concentrated on the construction of cement paved roads.

The amount of cement available as surplus would be enough to construct over 300 km of road per year.

Cement roads are usually more expensive than asphalted ones, but last much longer and require little maintenance.

The technical and financial evaluation has shown that even by considering the "selling price" of the cement road equal to the one of an asphalted road the implementation of a mobile unit for cement road construction is viable.

1. INTRODUCTION

Cement is a very versatile construction material and this characteristic can explain why its use has expanded so rapidly.

The average composition of the present product is much the same as a hundred years ago (25% clay, 75% calcareous material), but the modern product has a more constant quality degree and faster hardening.

As well as its classical utilization in the construction of building structures or foundations, many other applications have been developed.

The reasons for such expansion are various and equally valid for both industrialized and developing countries, the main ones being:

- possibility of producing at low costs many pre-fabricated components of civil works
- better technical characteristics, compared with other materials, particularly for specific applications requiring, for instance, corrosion or wear or fire resistance
- suitability to the production of both standard or special elements, either in a factory or in the field
- suitability for mixing with other materials (asbestos, wood, straw, resins) in order to obtain prefabricated products of special characteristics such as lightness, impermeability, elasticity, mechanical strength, workability, etc.

The list of such applications includes:

- a) the construction of roads, playgrounds, safety barriers for highway, airport runways and parking areas

b) the production of pre-fabricated items such as:

- pipes, from small to large diameters, for both low and high pressure service
- poles for electric or telephone lines or lighting
- rigid slabs (or other shapes) for paving works.
- lights slabs to be used as partition walls or ceilings.
- floor tiles
- corrugated and plain sheets, particularly for covering roofs
- tanks
- beams of different shapes and sizes
- boats
- railway sleepers

Generally speaking it can be stated that the development of these activities depends on the price of the cement: while at present in Europe this price is in the range of 5.1 (Italy, Greece and Spain) to 8.25 \$/ql (Portland cement type 325, supplied ex works without packaging), in Ethiopia it is over 9 \$/ql. Even so many of the above mentioned items are already in production (or are going to be) by the four factories belonging to the Ethiopian Construction materials Co., by ELPA and by other factories of the private sector.

Therefore the present study will deal with the use of cement for the construction of roads, as this is a potentially large market due to the existing large programmes of expansion of the road network of the country.

2. MARKET AND PLANT CAPACITY

2.1 Uses

Distinctive characteristics of a good road are :

- good resistance to the degrading actions of both atmospheric agents and traffic;
- few maintenance requirements
- rough surface of clear colour, not reflecting and not dusty
- short construction time and, strictly related to this characteristic, easiness to open, remake or repair the roads particularly in urban areas
- good rigidity of the work, low rolling resistance, good grip in any conditions
- no foundations or sub-grade of particular strength
- moderate construction costs

The cement roads match very well the majority of these requirements, in particular as far as the maintenance is concerned: in fact the English Transport and Road Research Laboratory and the American Portland Ass. suggest taking 40 years as the useful life of a cement road. This means that a cement road of good construction has practically no need of maintenance. A constraint, however, to the adoption of the cement road is the time required for the construction and the consequent difficulties for traffic, in case of reopening, remaking or repairing of the road; this characteristic makes cement roads more suitable for extraurban or suburban areas than for urban ones where the necessity of reopening is very frequent. This characteristic emphasizes also the necessity of a subgrade of good quality, not as supporting strength, but as uniformity

of composition and stability to meteorological actions; these are requirements valid for all the roads but are particularly important for the cement road because in the case of failure, the repair is more burdensome for the latter than for roads of other types.

As for the construction costs, available comparisons state that cement road costs are not quite different from those of an asphalted road.

For a road subject to heavy traffic as an highway the cost comparison in Europe is estimated as follows (costs based on December 1987) :

asphalted road

- Carpet; thick. : 4 cm	4.20 \$/sq.m
- Binder; thick. : 6 cm	2.50 \$ sq.m
- Bitumated all in aggregate; thick : 16 cm	12.92 \$/sq.m
- Cemented all in aggregate; thick : 20 cm	7.75 \$/sq.m
	-----
	27.37 \$/sq.m

cement road

- Concrete slab; thickness : 26 cm	23.47 \$/sq.m
- Cemented all-in aggregate; thickness : 20 cm	7.75 \$/sq.m
	-----
	31.22 \$/sq.m

These costs are total production costs, inclusive of all construction expenses (labour, materials and equipment and are referred to a cement price of 5.15 \$/ton (ex-works in bulk).

In the concrete slab cost is also included the cost of the joints, this cost is in the range of 3.8 to 5.4 \$/sq.m and is practically independent from the slab thickness.

The above cost comparison is not valid for all the types of road. For rural and feeder roads, for instance, normally 3-5 m wide in Europe, the cost of cement road should be lower than for asphalted road since it is usual to cast the concrete directly on the ground without any subgrade.

**2.2 Forecast demand and plant capacity**

The development of the road network in the country, is a must that has also been emphasized by recent study. The per capita length of the road network in Ethiopia is in



fact lower than the average of 29 developing countries (0.002 km). (1)

The 10 years plan foresees the construction of 1,440 Km of concrete asphalt roads over the plan period.

Primary highways are 7 meters wide while secondary ones have a width of 6 meters.

This study will therefore take into consideration the evaluation of equipment and construction costs for the implementation of 100 Km of 6m wide roads, in order to be conservative.

### 2.3 Sales prices and total revenues

According to the information collected from the Road Department of the Municipality of Addis Ababa the cost of construction of a road made of bituminous conglomerate (on flat area) is 12.1 \$/sq. mt.

Information provided by DPGA and other agencies show a cost (on flat area) of 18-20\$/sq. mt. The second figure has been taken as basis for the calculations.

The goal of this study is to analyze the profitability of using cement to construct roads.

- (1) "Road Transport Study" by Roy Jorgensen Ass. Inc. and Hughes Economic Planning. - Feb. 1984 G.C. prepared for the Road Transport Authority. (Natracor).

The comparison of costs in Europe indicates that cement roads are more expensive than asphalted ones but their main advantage is that they are nearly maintenance free for up to 40 years while asphalted roads have an average life of 10-15 years and their maintenance cost is presently estimated, in Ethiopia, 1,600 \$/km. The net present value considering 40 years period and 10% discount rate is 2.2 \$/sq.mt (road considered 7 m wide). The result of this calculation is that we shall analyse the convenience of constructing cement roads and "selling" them at the same value of the asphalted ones plus the difference in maintenance the selling price is therefore 20\$/sq.mt and the total revenues of the company constructing the road is  $20\$ \times 6 \text{ m} \times 100,000 = 12,000,000 \$$ .

3. MATERIALS AND INFUTS

3.1 Technology

The construction of a cement road consists of two successive steps:

- a) preparation of the subgrade
- b) casting of the concrete

The materials to be used are:

- sand
- gravel
- cement
- water

All the raw materials must be of good quality.

The sand may be of natural or artificial origin and should have the following characteristics:

- particular size less than 3 mm
- not originating from decomposing rocks or gypsum
- clean and free from organic substances, mud, salt, etc

The gravel (pebbles or crushed stones) must be composed with elements of good strength which also shall be frost-proof, not crumbling, free from other substances, earth, salt; dirty gravels must be thoroughly washed with fresh water.

The following size distribution is suggested for the mixture of sand+gravel (or crushed stones) :

100%	by weight passing through a 30mm sieve
65+75%	" " " 15mm sieve
50+60%	" " " 7mm sieve
32+45%	" " " 3mm sieve
18+30%	" " " 1mm sieve
3:7%	" " " 0,2mm sieve

The cement may be of standard quality, Portland type, with a resistance of 32.5 N/m sq.mt.

The concrete will have the following average composition:

sand (0.3mm) 0.400 m<sup>3</sup>

gravel 0.800 m<sup>3</sup>

cement 325 300 Kg

water 150lt (water to cement ratio from 40 to 60%).

The concrete can be directly cast on the ground if of suitable characteristic and properly tamped. Otherwise it is necessary to prepare a bed (from 15 to 30 cm) made of all-in aggregate, rolled and tamped.

For these raw materials, the following costs have been assumed as valid all over the country; these costs are estimated on the costs valid in Addis Ababa increased by 30% for taking into account transportation costs:

- sand 2.6 \$/cu.mt
- gravel 13\$/cu.mt
- cement 11.96 \$/ql
- all-in aggregate 11.7 \$/cu.mt

Based on these figures, the cost of 1 cu.mt of concrete amounts to 47.32 \$.

### 3.2 Materials and utilities: requirements and costs

The cost of raw materials and utilities needed to build(1) 100 km of 6 m wide road made up of a concrete layer (20 cm thick) over a 23 cm thick sub-grade are as follows:

- (1) All the costs common to all types of roads (such as for instance, route selection, design and drawings, excavation, etc) are excluded.

1) costs per sq. m

- sub grade  
0.23m x 11.7 \$/cu.mt = 2.69 \$/m2

- concrete  
0.2 m x 47.32 \$/cu.mt = 9.46 \$/m2

- joints = 4 \$/m2

- electricity (1) for  
concrete preparation  
0.20 m x 10 Kwh/cu.mt  
x 0.096 \$/Kwh = 0.19 \$/m2

- gasoil (1) for  
tampening and concrete  
transportation = 0.2 \$/m2

-----  
total 16.54 \$/m2

and for a total of 600,000 sq.m, the annual expenses amount to 9,924,000 \$/y

(1) Estimated on conservative available parameters.

4. LOCATION

The plant for the preparation and casting of the concrete consists of transportable equipment which will be installed in the proximity of the track of the road that is to be constructed, as will be better described at the para 5.1.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The construction of road can be divided in the following four steps:

- concrete preparation
- sub grade settlement
- concrete casting
- setting and curing

a) Concrete preparation

The concrete must be mixed by means of a mechanical equipment in order to obtain the best results; the dosing of the various ingredients must be very accurate, preferably by means of a scale. Above all the water to cement ratio is the most important value and it must be matched exactly. The loading of the ingredients into the mixing machine will take place in a prefixed order: first the coarser aggregate, then the medium coarse one followed by the sand and cement together and, finally, gradually the water. The concrete must be cast within two hours from mixing, less if the weather is hot and dry; for this reason the equipment for the storage of the raw materials and their mixing must be installed not far from the road track and so cannot serve more than 50+70 Km of the road under construction.

b) Sub-grade settlement

Generally speaking all types of ground are suitable for cement roads, except those subject to sliding movements; claysh grounds are also suitable if water

infiltration is prevented.

The concrete layer can be directly supported by the existing ground if it has suitable characteristics and has been properly vibro-tamped, that is if it is of uniform quality and firm under meteorological actions; when such a condition is not assured, it is necessary to proceed to the reclaiming of the bed for a thickness sufficient to make it independent from external actions (for instances: drains, rise of the road platform, lateral ditches, ecc.)

c) Concrete casting

Lateral guides acting as mould must be installed for the concrete platform execution; these guides are metallic and their profile and rigidity must be such as to assure a perfect job; in addition the guides help to control the thickness of the concrete platform and act as a support for the auxiliary equipment necessary to settle the concrete properly ; the ground surface must be wet and covered with a thin sand layer; the concrete cast must be first evenly distributed and compacted by means of a hand-operated plank , and afterwards vibrated with an electrical equipment operating, sustained by the guides, on the entire width of the road.

A viscous slurry is segretated on the surface of the cast during the vibrating operation, making it uniform and compact; the vibrating operation must not last too long in order to avoid decomposition of the mixture.

The concrete laying must be completed within two hours from the mixing.

Two final operations are then executed:



- brushing of the surface in order to make it anti-slippery
- formation of the expansion joints.

The joints must be executed in such a way that the road is divided into sectors whose side length are in the 3 to 5 ratio or (maximum) 1 to 2.

These joints, called "apparent joints", consist in an interruption of the concrete; this interruption or slot does not affect all the thickness of the layer, but only a fourth of it; this slot is performed by means of a steel T-bar equipped with a vibrator, so that it can act as a vibrating blade; after the cutting the joint is filled with a hard plastic strip.

d) Setting and curing

The concrete must be allowed to set for at least three weeks; during the first ten days the surface must be kept wet, protecting it from the action of the wind or sun; for this purpose the surface must be covered with wet straw or saw-dust or sand; this curing operation is very important in order to obtain a cast of the max strength.

All the phases of concrete casting can be executed mechanically by suitable machines; but in the present case manual operations seems more suitable; while a mechanical system seems more appropriate for the preparation of concrete, due to the importance of the accurate dosing of the various ingredients, (water in particular).

As far as the sizing of the machinery is concerned the

unit has been considered operating "on one shift".

The equipment list will include: (1)

- a) one concrete production center producing 300 cu.mt/d (40 cu.mt/h) of concrete (400 cu.mt/d nominal capacity); the center includes (see the annexed drawings).
  - . 2 silos for cement stocking
  - . 2 storage bins for the various aggregates equipped with proportioning systems.
  - . 1 concrete mixer
  - . 1 belt conveyor for the transfer of aggregates to the mixer
  - . 7 trucks with dumping body for the transport of concrete to the yard
- b) n.1 set for concrete laying, each including:
  - steel guides
  - vibrating boards
  - T-bars, complete with vibrator
- c) n.3 road rollers
- d) utilities (electric power connection, compressed air, water etc).

- (1) This list does not include all the means of transport necessary to supply daily cement and gravel to the centers.

**5.2 Layout and civil works**

An area of about 2500 sq.mt. is necessary for the center. This area is levelled-off and well paved in order to allow the movements of the trucks in any conditions. Since at the end of the work the unit has to be shifted to another place, the administrative offices, workshop and other utilities will be installed in skid-mounted portable housing.

**5.3 Investment costs**

The investment cost for the supplying and installation of the above described machinery is as follows:

	FC	LC	TOTAL
	M\$	M\$	M\$
<b>Machinery and Equipment</b>			
FOB European port	0.600	-	0.600
or ex works		0.215	0.215
			-----
			0.815
Transportations	0.060	0.06	0.120
Erection	0.020	0.04	0.060
Civil Works		0.180	0.180
Spare parts	0.060	0.02	0.080
	-----	-----	-----
	0.740	0.515	1.255
Contingencies	0.060	0.045	0.105
	-----	-----	-----
	0.800	0.560	1.360

In the financial analysis the investment costs (contingencies included) are grouped as follows:

machinery	FC 0.800 M\$
"	LC 0.335 M\$
civil works	LC 0.225 M\$
	-----
	1.360 M\$

The life cycle of the plant can be estimated as 10 years but a part of the machinery must be substituted after 5 years, as taken into account in the financial evaluation.

The annual maintenance costs has been evaluated in the range of 10% of the cost of machinery and equipment, i.e. approximately 80,000 \$/y.

6. PLANT ORGANIZATION

For the economical and financial evaluation, the organization for the road construction has been conceived as an operating unit within any Ethiopian agency for roads construction. The cement will be sold to this company by the Cement Corporation at normal values.

7. MANPOWER

No particular ability is required of the technical personnel, except for the foremen of the team employed on the road construction, since the perfect execution of the various phases of the work requires well trained or experienced workers.

Concrete Centers

		birr/m	birr/y
Production manager	1	1,200	
Foremen	4	1,600	
Divers	10	3,500	
Skilled workers	10	3,500	
Semi skilled workers	20	6,000	
Unskilled workers	30	6,000	
	-----	-----	-----
	75	21,800	261,600
			(126,377\$/y)

Road construction

Foremen	10	4,000	
Skilled workers	20	7,000	
Semiskilled workers	40	12,000	
Unskilled workers	60	12,000	
	-----	-----	-----
	130	35,000	420,000
			(202,898\$/y)

Maintenance Dept.

Engineer	1	1,000	
Foremen	4	1,600	
Mechanics	12	4,200	
Electricians	3	1,050	
Unskilled workers	12	2,400	
	-----	-----	-----
	32	10,250	123,000
			(59,420\$/y)

Summarizing: Prod. dept. 681,600 birr/y = 329,275 \$/y

Maint. dept. 123,000 birr/y = 59,420 \$/y

8. IMPLEMENTATION SCHEDULING

18 months are needed for the design and construction of the equipment.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached in Annexe 1. This evaluation is based on the data indicated in the forward and in the study and on the following:

- the assistance of one foreign expert for the first operation period (one year) has been taken into account and indicated as "foreign factory overheads"
- the replacement of part of the machinery has been reported in the current investment schedule.
- the expenses relevant to the annual relocation of the concrete center have been charged as "utilities".
- the production programme has been assumed as follows:

1st year: 50% capacity (300000 sq.m of finished road)

2nd year: 70% capacity (420.000 sq.m)

from the 3rd

to the 10th year: 100% capacity (600,000 sq.m)

Selling price: 20 \$/sq.m



24d

**baldo & c.**  
CONSULTING ENGINEERS

Cement  
Annexe 1

**FINANCIAL EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**DIVERSIFICATION OF CEMENT USES**

February 88

**BASIC PROJECT**

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	1540.00	56.36% foreign
current assets:	0.00	0.00% foreign
total assets:	1540.00	56.36% foreign

**Source of funds during construction phase**

equity & grants:	940.00	0.00% foreign
foreign loans :	680.00	
local loans :	0.00	
total funds :	1620.00	41.97% foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	5452.00	7514.20	10594.00
depreciation :	181.85	181.85	181.85
interest :	68.00	59.50	51.00
production costs	5701.85	7755.55	10826.85
thereof foreign	5.23 %	3.42 %	2.87 %
total sales :	6000.00	8400.00	12000.00
gross income :	298.15	644.45	1173.15
net income :	149.07	322.22	586.58
cash balance :	-841.26	19.20	60.92
net cashflow :	-688.26	163.70	196.92

Net Present Value at: 10.00 % = 2187.56

Internal Rate of Return: 20.58 %

Return on equity<sup>1</sup>: 34.47 %

Return on equity<sup>2</sup>: 20.49 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



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2.1 UNICO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works .....	150.00	50.00	17.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00
Plant machinery and equipment ...	260.00	540.00	335.00	0.00
<b>Total fixed investment costs .....</b>	<b>410.00</b>	<b>590.00</b>	<b>352.00</b>	<b>0.00</b>
<b>Pre-production capital expenditures.</b>	<b>5.00</b>	<b>15.00</b>	<b>134.00</b>	<b>34.00</b>
<b>Net working capital .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total initial investment costs ...</b>	<b>415.00</b>	<b>605.00</b>	<b>486.00</b>	<b>34.00</b>
<b>Of it foreign, in % .....</b>	<b>38.55</b>	<b>72.73</b>	<b>48.15</b>	<b>100.00</b>

DIVERSIFICATION OF CEMENT USES — February 88



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Total Current Investment in 1000 US DOLLARS

Year .....	1989	1990	1991	1992-93	1994
Fixed investment costs					
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	145.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00	0.00	0.00
Total fixed investment costs .....	0.00	0.00	0.00	0.00	145.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00
Working capital .....	1087.19	399.88	622.50	0.00	0.00
Total current investment costs ...	1087.19	399.88	622.50	0.00	145.00
Of it foreign, % .....	6.21	1.85	5.16	0.00	0.00

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	50.00	70.00	100.00	100.00	100.00	100.00
Raw material 1 .....	3645.00	5103.20	7290.00	7290.00	7290.00	7290.00
Other raw materials .....	1200.00	1600.00	2400.00	2400.00	2400.00	2400.00
Utilities .....	0.00	200.00	200.00	200.00	200.00	200.00
Energy .....	117.00	164.00	234.00	234.00	234.00	234.00
Labour, direct .....	330.00	330.00	330.00	330.00	330.00	330.00
Repair, maintenance .....	60.00	60.00	60.00	60.00	60.00	60.00
Spares .....	40.00	57.00	80.00	80.00	80.00	80.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>5452.00</b>	<b>7514.20</b>	<b>10594.00</b>	<b>10594.00</b>	<b>10594.00</b>	<b>10594.00</b>
Administrative overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	181.85	181.85	181.85	181.85	114.85	90.85
Financial costs .....	68.00	59.50	51.00	42.50	34.00	25.50
<b>Total production costs .....</b>	<b>5701.85</b>	<b>7755.55</b>	<b>10826.85</b>	<b>10818.35</b>	<b>10742.85</b>	<b>10710.35</b>
<b>Costs per unit ( single product ) .</b>	<b>19.01</b>	<b>18.47</b>	<b>18.04</b>	<b>18.03</b>	<b>17.90</b>	<b>17.85</b>
Of it foreign, % .....	5.23	3.42	2.87	2.80	2.74	2.67
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	330.00	330.00	330.00	330.00	330.00	330.00



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21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999-2003
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	7290.00	7290.00	7290.00	7290.00	7290.00
Other raw materials .....	2400.00	2400.00	2400.00	2400.00	2400.00
Utilities .....	200.00	200.00	200.00	200.00	200.00
Energy .....	234.00	234.00	234.00	234.00	234.00
Labour, direct .....	330.00	330.00	330.00	330.00	330.00
Repair, maintenance .....	60.00	60.00	60.00	60.00	60.00
Spares .....	80.00	80.00	80.00	80.00	80.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>10594.00</b>	<b>10594.00</b>	<b>10594.00</b>	<b>10594.00</b>	<b>10594.00</b>
Administrative overheads .....	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Depreciation .....	119.85	119.85	119.85	39.85	0.00
Financial costs .....	17.00	8.50	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>10730.85</b>	<b>10722.35</b>	<b>10713.85</b>	<b>10633.85</b>	<b>10594.00</b>
<b>Costs per unit ( single product ) .</b>	<b>17.88</b>	<b>17.87</b>	<b>17.86</b>	<b>17.72</b>	<b>17.66</b>
Of it foreign, % .....	2.58	2.50	2.43	1.69	1.70
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00
Total labour .....	330.00	330.00	330.00	330.00	330.00



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year .....	1989	1990	1991	1992-2003	
Coverage .....	mdc	coto			
<b>Current assets &amp;</b>					
Accounts receivable . . . . .	30 12.0	454.33	626.18	882.83	882.83
Inventory and materials . . . . .	29 12.2	403.75	559.16	808.06	808.06
Energy . . . . .	16 22.7	5.16	7.22	10.32	10.32
Spares . . . . .	360 1.0	40.00	57.00	80.00	80.00
Work in progress . . . . .	10 36.0	151.44	208.73	294.28	294.28
Finished products . . . . .	30 12.0	454.33	626.18	882.83	882.83
Cash in hand . . . . .	15 24.0	20.42	18.63	19.58	19.58
Total current assets . . . . .		1529.44	2103.10	2977.90	2977.90
<b>Current liabilities and</b>					
Accounts payable . . . . .	29 12.2	442.25	616.03	868.33	868.33
Net working capital . . . . .		1087.19	1487.06	2109.57	2109.57
Increase in working capital . . . . .		1087.19	399.88	622.50	0.00
Net working capital, local . . . . .		1019.69	1412.16	2002.57	2002.57
Net working capital, foreign . . . . .		67.50	74.90	107.00	107.00

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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2.1 UNIDO

COMFAR 2.1 - BALDO & C. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1
Equity, ordinary ..	940.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	680.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	680.00
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	1620.00

DIVERSIFICATION OF CEMENT USES — February 88





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21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-85.00	-85.00	-85.00	-85.00	-85.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-85.00	-85.00	-85.00	-85.00	-85.00
Current liabilities	442.25	173.78	252.30	0.00	0.00
Bank overdraft ....	761.26	-19.20	-60.92	-681.14	0.00
Total funds .....	1118.51	69.59	106.38	-766.14	-85.00

DIVERSIFICATION OF CEMENT USES — February 88



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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2	1988.1	1988.2
Total cash inflow ..	1620.00	0.00	0.00	0.00
Financial resources .	1620.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow ..	415.00	605.00	486.00	34.00
Total assets . . . .	415.00	605.00	452.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	34.00	34.00
Repayment . . . . .	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1205.00	-605.00	-486.00	-34.00
Cumulated cash balance	1205.00	600.00	114.00	80.00
Inflow, local . . . . .	940.00	0.00	0.00	0.00
Outflow, local . . . .	255.00	165.00	252.00	0.00
Surplus ( deficit ) .	685.00	-165.00	-252.00	0.00
Inflow, foreign . . . .	680.00	0.00	0.00	0.00
Outflow, foreign . . .	160.00	440.00	234.00	34.00
Surplus ( deficit ) .	520.00	-440.00	-234.00	-34.00
Net cashflow . . . . .	-415.00	-605.00	-452.00	0.00
Cumulated net cashflow	-415.00	-1020.00	-1472.00	-1472.00

DIVERSIFICATION OF CEMENT USES — February 88



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2.1 UNICO

COMEFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993	1994
Total cash inflow ..	6442.25	8573.85	12252.30	12000.00	12000.00	12000.00
Financial resources .	442.25	173.85	252.30	0.00	0.00	0.00
Sales, net of tax ..	6000.00	8400.00	12000.00	12000.00	12000.00	12000.00
Total cash outflow ..	7283.51	8554.65	12191.38	11312.33	11341.58	11494.33
Total assets .....	1529.44	573.66	874.80	0.00	0.00	145.00
Operating costs ...	5452.00	7514.20	10594.00	10594.00	10594.00	10594.00
Cost of finance ...	68.00	59.50	51.00	42.50	34.00	25.50
Repayment .....	85.00	85.07	85.00	85.00	85.00	85.00
Corporate tax ...	149.07	322.22	586.58	590.83	628.58	644.83
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-841.26	19.20	60.92	687.67	658.42	505.67
Cumulated cash balance	-761.26	-742.06	-681.14	6.53	664.96	1170.63
Inflow, local .....	6441.83	8573.85	12252.15	12000.00	12000.00	12000.00
Outflow, local .....	6912.59	8276.75	11843.13	11004.83	11042.58	11203.83
Surplus ( deficit ) .	-470.76	297.10	409.02	995.17	957.42	796.17
Inflow, foreign ...	0.42	0.00	0.15	0.00	0.00	0.00
Outflow, foreign ...	370.92	277.90	348.25	307.50	299.00	290.50
Surplus ( deficit ) .	-370.50	-277.90	-348.10	-307.50	-299.00	-290.50
Net cashflow .....	-688.26	163.70	196.92	815.17	777.42	616.17
Cumulated net cashflow	-2160.26	-1996.56	-1799.64	-984.47	-207.04	409.13

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2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1975	1976	1977	1978	1979	2000
Total cash inflow . . .	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00
Financial resources . .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . . .	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00
Total cash outflow . . .	11330.58	11326.33	11237.08	11277.08	11297.00	11297.00
Total assets . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . . .	10594.00	10594.00	10594.00	10594.00	10594.00	10594.00
Cost of finance . . . .	17.00	8.50	0.00	0.00	0.00	0.00
Repayment . . . . .	85.00	85.00	0.00	0.00	0.00	0.00
Corporate tax . . . . .	634.58	634.58	643.08	683.08	703.00	703.00
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . . .	669.42	673.67	762.92	722.92	703.00	703.00
Cumulated cash balance	1840.06	2513.73	3276.66	3999.58	4702.58	5405.58
Inflow, local . . . . .	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00
Outflow, local . . . . .	11048.58	11052.83	11057.08	11097.08	11117.00	11117.00
Surplus ( deficit ) . . .	951.42	947.17	942.92	902.92	883.00	883.00
Inflow, foreign . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . . .	282.00	273.50	180.00	180.00	180.00	180.00
Surplus ( deficit ) . . .	-282.00	-273.50	-180.00	-180.00	-180.00	-180.00
Net cashflow . . . . .	771.42	767.17	762.92	722.92	703.00	703.00
Cumulated net cashflow	1180.56	1947.73	2710.66	3433.58	4136.58	4839.58



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	12000.00	12000.00	12000.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	12000.00	12000.00	12000.00
Total cash outflow . .	11297.00	11297.00	11297.00
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	10594.00	10594.00	10594.00
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	703.00	703.00	703.00
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) . .	703.00	703.00	703.00
Cumulated cash balance	6108.58	6811.58	7514.58
Inflow, local . . . . .	12000.00	12000.00	12000.00
Outflow, local . . . . .	11117.00	11117.00	11117.00
Surplus ( deficit ) . .	883.00	883.00	883.00
Inflow, foreign . . . .	0.00	0.00	0.00
Outflow, foreign . . . .	180.00	180.00	180.00
Surplus ( deficit ) . .	-180.00	-180.00	-180.00
Net cashflow . . . . .	703.00	703.00	703.00
Cumulated net cashflow	5542.58	6245.58	6948.58



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2.1 UNIDO

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	2866.84 at	10.00 %
Internal Rate of Return (IRRE1) ..	34.47 %	
b) Net Worth versus Net cash return:		
Net present value .....	2032.13 at	10.00 %
Internal Rate of Return (IRRE2) ..	20.49 %	
c) Internal Rate of Return on total investment:		
Net present value .....	2187.56 at	10.00 %
Internal Rate of Return ( IRR ) ..	20.58 %	
Net Worth = Equity paid plus reserves		

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DIVERSIFICATION OF CEMENT USES — February 88



**COMFAR**  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993
Total sales, incl. sales tax .....	6000.00	8400.00	12000.00	12000.00	12000.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	6000.00	8400.00	12000.00	12000.00	12000.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	5633.85	7696.05	10775.85	10775.85	10708.85
Operational margin .....	366.15	703.95	1224.15	1224.15	1291.15
As % of total sales .....	6.10	8.38	10.20	10.20	10.76
Cost of finance .....	68.00	59.50	51.00	42.50	34.00
Gross profit .....	298.15	644.45	1173.15	1181.65	1257.15
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	298.15	644.45	1173.15	1181.65	1257.15
Tax .....	149.07	322.22	586.58	590.83	628.58
Net profit .....	149.07	322.22	586.58	590.83	628.58
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	149.07	322.22	586.58	590.83	628.58
Accumulated undistributed profit .....	149.07	471.30	1057.88	1648.70	2277.28
Gross profit, % of total sales .....	4.97	7.67	9.78	9.85	10.48
Net profit, % of total sales .....	2.48	3.84	4.89	4.92	5.24
ROE, Net profit, % of equity .....	15.86	34.28	62.40	62.85	66.87
ROI, Net profit+interest, % of invest. ....	8.48	12.90	17.80	17.68	18.50



**COMFAR**<sup>®</sup>  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	12000.00	12000.00	12000.00	12000.00	12000.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	12000.00	12000.00	12000.00	12000.00	12000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	10684.85	10713.85	10713.85	10713.85	10633.85
Operational margin . . . . .	1315.15	1286.15	1286.15	1286.15	1366.15
As % of total sales . . . . .	10.96	10.72	10.72	10.72	11.38
Cost of finance . . . . .	25.50	17.00	8.50	0.00	0.00
Gross profit . . . . .	1289.65	1269.15	1277.65	1286.15	1366.15
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1289.65	1269.15	1277.65	1286.15	1366.15
Tax . . . . .	644.83	634.58	638.83	643.08	683.08
Net profit . . . . .	644.83	634.58	638.83	643.08	683.08
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	644.83	634.58	638.83	643.08	683.08
Accumulated undistributed profit . . . . .	2922.10	3556.68	4195.50	4830.58	5521.65
Gross profit, % of total sales . . . . .	10.75	10.58	10.65	10.72	11.38
Net profit, % of total sales . . . . .	5.37	5.29	5.32	5.36	5.69
ROE, Net profit, % of equity . . . . .	68.60	67.51	67.96	68.41	72.67
ROI, Net profit+interest, % of invest. . . . .	17.99	17.48	17.37	17.26	18.33





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**Net Income Statement in 1000 US DOLLARS**

Year .....	1999	2000	2001	2002	2003
Total sales, incl. sales tax .....	12000.00	12000.00	12000.00	12000.00	12000.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	12000.00	12000.00	12000.00	12000.00	12000.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	10594.00	10594.00	10594.00	10594.00	10594.00
Operational margin .....	1406.00	1406.00	1406.00	1406.00	1406.00
As % of total sales .....	11.72	11.72	11.72	11.72	11.72
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
Gross profit .....	1406.00	1406.00	1406.00	1406.00	1406.00
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	1406.00	1406.00	1406.00	1406.00	1406.00
Tax .....	703.00	703.00	703.00	703.00	703.00
Net profit .....	703.00	703.00	703.00	703.00	703.00
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	703.00	703.00	703.00	703.00	703.00
Accumulated undistributed profit .....	6224.65	6927.65	7630.65	8333.65	9036.65
Gross profit, % of total sales .....	11.72	11.72	11.72	11.72	11.72
Net profit, % of total sales .....	5.86	5.86	5.86	5.86	5.86
ROE, Net profit, % of equity .....	74.79	74.79	74.79	74.79	74.79
ROI, Net profit+interest, % of invest. ....	18.86	18.86	18.86	18.86	18.86



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2
Total assets .....	1620.00	1620.00	1620.00	1620.00
Fixed assets, net of depreciation	0.00	415.00	1020.00	1506.00
Construction in progress .....	415.00	605.00	486.00	34.00
Current assets .....	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00
Cash surplus, finance available .	1205.00	600.00	114.00	80.00
Loss carried forward .....	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00
Total liabilities .....	1620.00	1620.00	1620.00	1620.00
Equity capital .....	940.00	940.00	940.00	940.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00
Long and medium term debt .....	680.00	680.00	680.00	680.00
Current liabilities .....	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00
Total debt .....	680.00	680.00	680.00	680.00
Equity, % of liabilities .....	58.02	58.02	58.02	58.02

DIVERSIFICATION OF CEMENT USES — February 88



**COMFAR**  
21 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>2887.59</b>	<b>3279.40</b>	<b>3972.35</b>	<b>3797.03</b>	<b>4340.61</b>	<b>4900.43</b>
Fixed assets, net of depreciation	1358.15	1176.30	994.45	812.60	697.75	606.90
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	145.00
<b>Current assets .....</b>	<b>1519.02</b>	<b>2084.47</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>
Cash, bank .....	20.42	18.63	19.58	19.58	19.58	19.58
Cash surplus, finance available ..	0.00	0.00	0.00	6.53	644.96	1170.63
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>2887.59</b>	<b>3279.40</b>	<b>3972.35</b>	<b>3797.03</b>	<b>4340.61</b>	<b>4900.43</b>
Equity capital .....	940.00	940.00	940.00	940.00	940.00	940.00
Reserves, retained profit .....	0.00	149.07	471.30	1057.88	1648.70	2277.28
Profit .....	149.07	322.22	586.58	590.83	628.58	644.83
Long and medium term debt .....	595.00	510.00	425.00	340.00	255.00	170.00
Current liabilities .....	442.25	616.03	868.33	868.33	868.33	868.33
Bank overdraft, finance required.	761.26	742.06	681.14	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1798.51</b>	<b>1868.10</b>	<b>1974.47</b>	<b>1208.33</b>	<b>1123.33</b>	<b>1038.33</b>
<b>Equity, % of liabilities .....</b>	<b>32.55</b>	<b>28.66</b>	<b>23.66</b>	<b>24.76</b>	<b>21.66</b>	<b>19.18</b>

DIVERSIFICATION OF CEMENT USES — February 1989

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999	2000
<b>Total assets .....</b>	<b>9450.01</b>	<b>6003.83</b>	<b>6646.91</b>	<b>7329.98</b>	<b>8032.98</b>	<b>8735.98</b>
Fixed assets, net of depreciation	632.05	512.20	392.35	352.50	352.50	352.50
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Current assets .....</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>	<b>2958.32</b>
Cash, bank .....	19.58	19.58	19.58	19.58	19.58	19.58
Cash surplus, finance available ..	1840.06	2513.73	3276.66	3999.58	4702.58	5405.58
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>9450.01</b>	<b>6003.83</b>	<b>6646.91</b>	<b>7329.98</b>	<b>8032.98</b>	<b>8735.98</b>
Equity capital .....	940.00	940.00	940.00	940.00	940.00	940.00
Reserves, retained profit .....	2922.10	3556.68	4195.50	4838.58	5521.65	6224.65
Profit .....	634.58	638.33	643.08	683.08	703.00	703.00
Long and medium term debt .....	85.00	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	868.33	868.33	868.33	868.33	868.33	868.33
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>953.33</b>	<b>868.33</b>	<b>868.33</b>	<b>868.33</b>	<b>868.33</b>	<b>868.33</b>

Equity, % of liabilities . . . .	17.25	15.66	14.14	12.82	11.70	10.76
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DIVERSIFICATION OF CEMENT USES — february 88



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

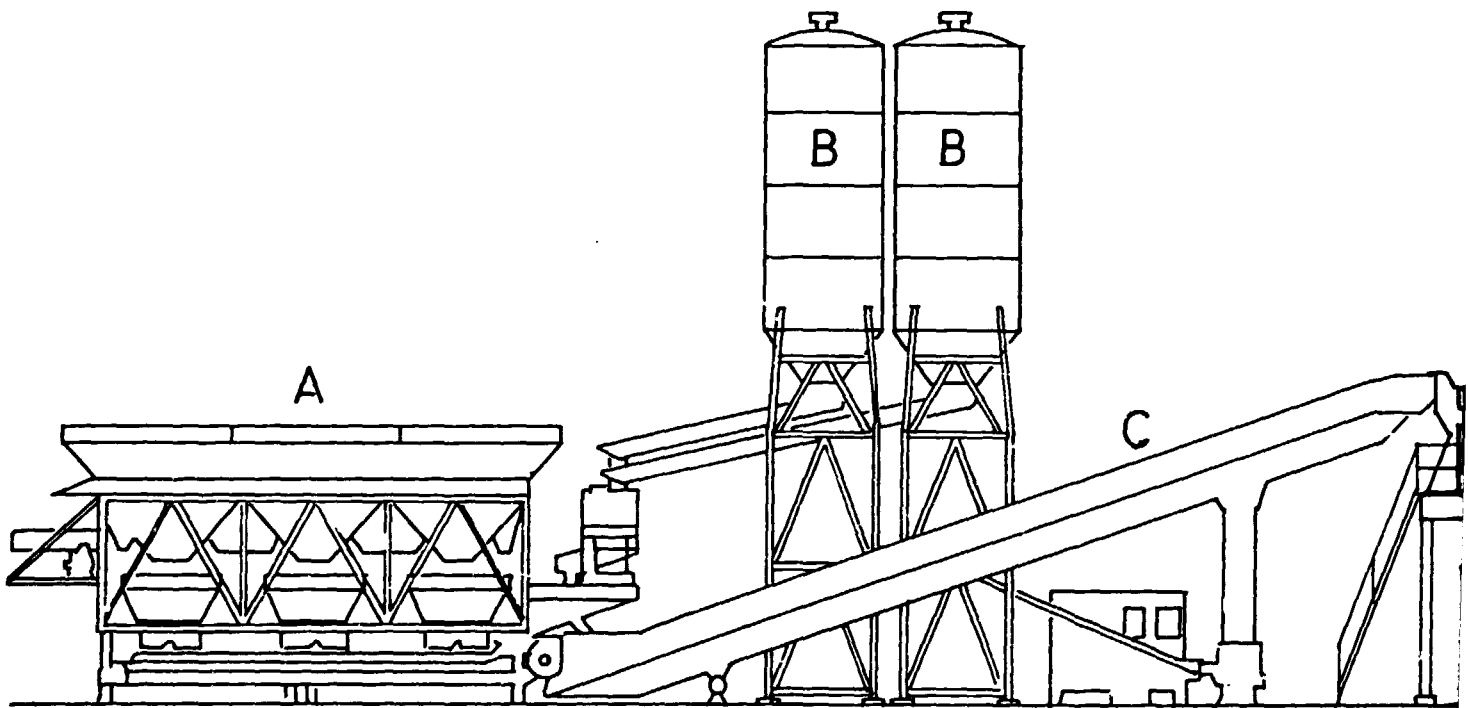
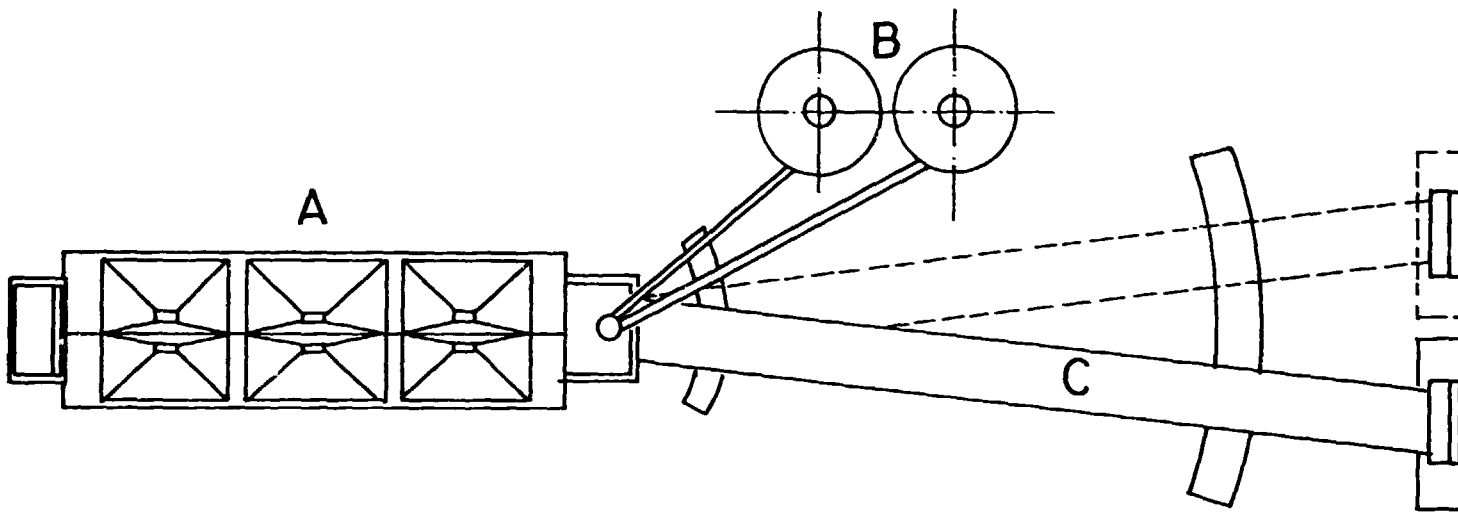
Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>9438.98</b>	<b>10141.98</b>	<b>10844.98</b>
Fixed assets, net of depreciation	352.50	352.50	352.50
Construction in progress .....	0.00	0.00	0.00
Current assets .....	2958.32	2958.32	2958.32
Cash, bank .....	19.58	19.58	19.58
Cash surplus, finance available .	6108.58	6811.58	7514.58
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>9438.98</b>	<b>10141.98</b>	<b>10844.98</b>
Equity capital .....	940.00	940.00	940.00
Reserves, retained profit .....	6927.65	7630.65	8333.65
Profit .....	703.00	703.00	703.00
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	868.33	868.33	868.33
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>868.33</b>	<b>868.33</b>	<b>868.33</b>
<b>Equity, % of liabilities .....</b>	<b>9.96</b>	<b>9.27</b>	<b>8.67</b>

**baldo & c.**  
CONSULTING ENGINEERS

Cement  
Annexe 2

DRW. B162 - 21 -1

CONCRETE PRODUCTION PLANT



SECTION 1

LEGENDA

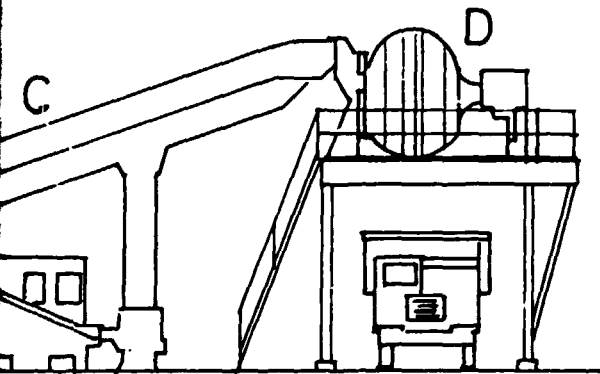
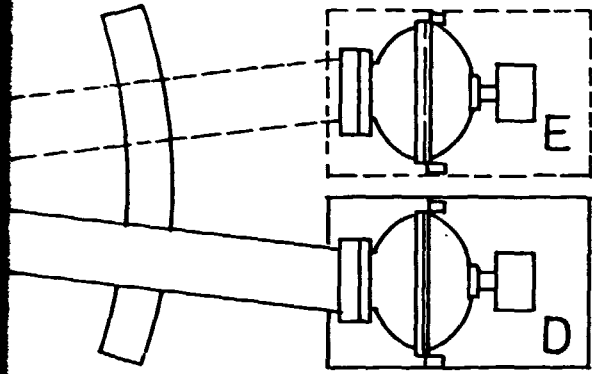
A- BINS FOR SAND, GRAVEL, PEBBLES, ETC.

B- SILOS FOR CEMENT

C- BELT CONVEYOR

D- CONCRETE MIXER

E- CONCRETE MIXER



SECTION .2

CLIENTE CUSTOMER	COMMESSA N. B-162 JOB N.	
CONCRETE PRODUCTION PLANT	CONTROLLATO APPROVED	DATA DATE
	DISEGNATO DRAWN <i>A. Puro</i>	DATA DATE
	SCALA SCALE	//
<b>baldo &amp; c.</b> CONSULTING ENGINEERS	DIS. N. DWG N. B-162-21-1	
	Via Stilicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	
REV.		



SUMMARY

1st VOLUME

BASIC ASSUMPTIONS FOR THE PREPARATION OF FINANCIAL ANALYSIS OF ALL PROJECTS

INVESTMENT PROMOTION SUGGESTIONS

ANIMAL FEED FROM AGRICULTURAL WASTES

INDUSTRIAL CANVAS

HYGIENIC PRODUCTS

CHLOR-ALKALI

BIOMASS BASED CHEMICALS

INDUSTRIAL EXPLOSIVES

CALCIUM CARBIDE

CALCIUM CYANAMIDE

2nd VOLUME

BLEACHING EARTH FROM BENTONITE

DIATOMITE

HYDROGEN PEROXIDE

BONE BASED CHEMICALS

SULPHONATION CHEMICALS

INDUSTRIAL ADHESIVES

CALCIUM HYPOCHLORITE

DIVERSIFICATION OF CEMENT USES

**3rd VOLUME**

**FURFURAL**

**LEATHER & CANVAS SHOES**

**BROMINE**

**ESSENTIAL OILS**

**CANNED FISH**

U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF FURFURAL  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

I N D E X

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 4 - DRW. B162 - 5 - 2 - PROCESS EQUIPMENT LAY OUT  
DRW. B162 - 5 - 2 - PROCESS FLOW DIAGRAM**

0. SUMMARY AND CONCLUSIONS

Furfural is a chemical that is used in lubrication oil and fuel processing, in a number of chemical processes and as intermediate for the production of resins.

At present there is no possibility of furfural utilization in Ethiopia, while the market is wide in Europe which, with the U.S.A., is the largest consumer. The proposed plant will therefore export 100% of its production that will be, when at full operation, 3,000 tons of furfural per year.

The main raw material is the corn cob which is considered to be the best feed stock for this production (other biomasses could also be used); the use of bagasse has been taken into consideration but not selected for economic reasons. The plant could be located in the Sidamo region where corn is grown in large quantity. The State farms and local cooperatives can assure the amount of cobs needed to feed the plant.

The selling price is 1,000 \$/ton ex-works. The product could be distributed in the European market through existing importers/dealers or through producers who do not wish to expand their facilities.

The production process also requires the following major inputs:

- sulphuric acid 1,000 tons
- soda ash 1,200 tons

Sulphuric acid (approximately 70% of the cost of all inputs) is presently imported in limited quantities and NCC is now about to implement a production unit.

The output of this unit (7,000 tons mainly used for Aluminium Sulphate production) is not enough to supply Acid to all new "projects proposed" namely:

- Furfural 1,000 tons/year
- Bone based chemicals 16,000 tons/year
- Bentonite 1,500 tons/year

This amount of Sulphuric Acid justifies the much more economic purchase in bulk by sea. This would mean the construction of a small Sulphuric Acid terminal with a capacity of 20,000 tons at Assab Harbour. The ships will unload the Acid in one or two tanks that will in turn fill tank trucks for delivery to the various sites. In this case the cost of the Sulphuric Acid delivered at factory site will be 310 \$ compared with the 550 \$ that should be considered as present cost.

Financial evaluations have been carried out using as input the reduced cost of Sulphuric Acid (a Comfar analysis carried out with Sulphuric Acid at 550 \$ has shown an IRR of only 4%).

The plant will require a fixed investment of 12.6 Million US \$ (10.3 in foreign currency) and will have a staff of 127.

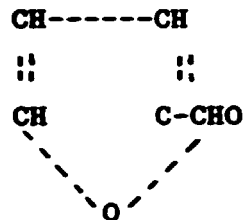
The internal rate of return is low, being 5.39% only but the foreign exchange effect is quite interesting (7,741,000 \$ net present value).

It is therefore recommended that a detailed feasibility study be carried out.

1. INTRODUCTION

Furfural is the most important member of the family of heterocyclic compounds known as the "furans" which are characterized by a double unsaturated ring of four carbon atoms and one oxygen atom.

Furfural is an aldehyde with the -CHO group in the 2 (or alfa) position and corresponds to the following structural formula:



It is obtained from several fibrous natural products (such as rice husks, corn cobs, bagasse, cotton seed, hull bran, oak tanbark etc.) as raw materials.

Furfural is a colourless liquid when freshly distilled, but it darkens on standing in contact with air.

Industrial Furfural is generally light yellow to brown in colour.

It is normally handled and stored in iron or steel vessels without any special precautions, although there is a gradual darkening in colour and a slight increase in acidity and in polymer formation when it is stored in contact with air: this autoxidation can be prevented by storing it in an oxygen free atmosphere.

The main physical properties of the pure product are as follows:

Molecular weight: 96.082

Specific weight at 20°C: 1.1598



Boiling point: 161.7 °C  
Freezing point: -36.5°C  
Flash point (open cup): 68.3°C  
Ignition temperature: 393°C  
Viscosity: 1.49 cP at 25°C

A typical analysis of a good technical product could be as follows:

Specific weight at 20°C : 1.16  
Purity: 99%  
Moisture by volume: 0,15%  
Acidity as sulphuric acid: nil  
Solubility in water at 20°C: 8.3%

2. MARKET AND PLANT CAPACITY

2.1 Uses

Furfural can be utilized either directly or as a chemical intermediate.

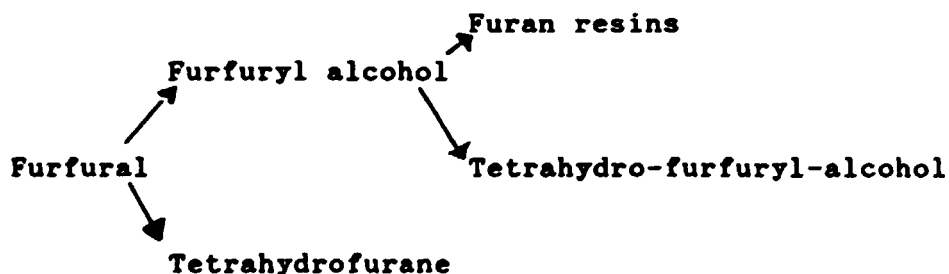
a) Direct utilisation

One of the widest uses is as a selective solvent for separating saturated from unsaturated compounds in petroleum lubricating oils, gasoil, and Diesel fuel (Texaco process) as well as in the vegetable oils.

Other important applications are: in butadiene extraction from petroleum, as decolourizing agent for wood resin, as component of resins together with phenol, as reactive solvent in the manufacture of resinoid-bonded gear wheels etc.

b) As chemical intermediate

Furfural is a very important chemical intermediate because it gives rise to different derivatives as shown in the following diagram:



Among these furfuryl alcohol is the most important derivative from which the furan resins are manufactured.

These resins are primarily used in the foundry industry to make liquid sand binders required for the preparation of moulds and cores.

## 2.2 Forecast demand and plant capacity

At present there is in practice no possibility of furfural utilization in Ethiopia, since the above mentioned industries are not yet sufficiently developed. As a consequence the production of furfural in Ethiopia can be conceived only for export.

With regard to the international market, more up-dated reliable information and figures than that reported by ITC (1978) are not available.

At that time the total production was estimated about 200,000 t/y, of which: 100,000 t in the U.S.A.; 32,000 in the Dominican Republic; 50,000 in the Eastern Europe and China and the balance in Western Europe and other Countries.

Major consumers were, accordingly, the U.S.A. and the Western Europe.

New plants are now in construction in India, Indonesia, Kenya, etc., while world consumption seems rather stable. As a consequence the competition is on price.

As far as capacity is concerned, a 3000 t/y plant has been considered, since this is the economical size of this type of plant and, furthermore, larger sizes involve huge problems for raw material transportation due to the large amount required (12 t of corn cobs with 15% moisture per ton of furfural produced). (1)

### 2.3 Sale price and total revenue

The sale price must be fixed on the basis of the present price valid on the European as well on the American markets, that is 1.60 \$/Kg. This means that, taking into account the cost of transportation from the factory to Assab and from Assab to an European port, the ex works price must be about 1.0 \$/Kg.

On that basis the total annual revenue, ex works, results: 3,000,000\$

- (1) As ascertained through a test performed at Awasa by the consultant every quintal (100 kg) of corn corresponds to 133÷150 kg of corn + cobs ; so the weight of cobs discarded for every quintal of corn is from 33 to 50 kg (with 10-15% moisture).

To produce 3000 t/y of furfural, 35,000 t/y of cobs are required, which corresponds to 700,000 - 1,000,000 ql of corn; assuming a yield of about 30 ql/ha, the required amount of cobs needs a cultivated surface of about 20000 - 30000 ha.

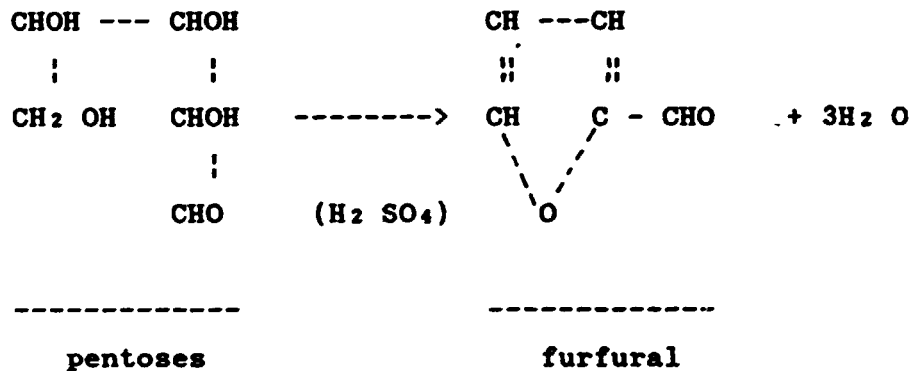
3. MATERIALS AND INPUTS

3.1 Chemistry

Furfural is obtained from fibrous natural products which contain pentosanes.

The pentosanes are hydrolized to pentoses by means of mineral acids: in the same time a cyclisation of the pentoses takes place with the formation of the heterocyclic ring of furane.

The cyclisation process starting from pentoses could be represented by the following scheme:



The following table 3.1 shows the agro-based products that can be used as main raw material.

TABLE 3.1

Furfural yield of selected raw materials  
(Percentage per dry weight)

RAW MATERIAL	PENTOSAN CONTENT	FURFURAL YIELD
	(average)	INDUSTRIAL OPERATIONS
Corn-cobs	30-32	10
Oat husks	min. 32	10
Almond husks	min. 30	9-10
Bagasse and bagasse pith	25-27	8-9
Cotton husks	27	8-9
Hazelnut husks	24	7-8
Hardwoods (birch)	21-24	6-8
Sunflower husks	23-24	6-7
Rice husks	16-18	6
Beech bark	19-21	5-6
Chestnut wood after tanning extraction	18	5-6
Olive press cake	21-23	5-6
Quebracho wood after tanning extraction	19	5-6

Source: W. Jaeggle, Integrated production of furfural and acetic acid from fibrous residues in a continuous process (Ravensburg, Germany, Fed. Rep.: Escher Wyss GmbH, 1975); UNIDO, Manufacturing guide - furfural.

The corn-cob is the material with the highest yield in industrial operation and is available in many regions of Ethiopia at practically no cost. Bagasse is also available in large quantity, but it has a lower yield and, more important, is at present used efficiently as fuel in the sugar process: its valorisation as fuel (based on fuel oil price) makes the utilization of bagasse non economic, considering the international market situation (para 2.2) and as can be seen by the financial and economical evaluation. The other two raw materials, Sulphuric acid and Soda ash, will both be available in Ethiopia (1).

- (1) A sulphuric acid plant is presently in the final planning stage within N.C.C. but the output will not be enough to supply H<sub>2</sub>SO<sub>4</sub> to all new projects proposed. On the other hand, as pointed out in the Summary and conclusions, the price of 1,110 birr/ton is too high, nearly double of price that could be obtained by buying the Sulphuric Acid in bulk. The idea is therefore to build a Sulphuric Acid terminal at Assab harbour, with a storing capacity of 20,000 tons, able to feed (by tank-truck and, in future by railroad) the following plants that are major users of Sulphuric Acid: Bentonite (1,500 tons/year H<sub>2</sub>SO<sub>4</sub>), Bone based chemicals (16,000 tons) Furfural (1,000 tons). In this case the following prices could be considered for further evaluation:

- international price is ranging	70-120 \$/ton FOB
- cost CIF Assab: 120 + 100 \$ =	220 \$/ton
- inland transportation and other charges	85 \$
	-----
	305 \$/ton

The proposed Sulphuric Acid terminal in Assab will receive two-three ships carrying Acid in bulk per year. The fixed investment is estimated 500,000 \$ and the operating expenses 50,000 \$ per year. The depreciation + operating expenses will increase the cost of Acid delivered at factory site at 310 \$/t.

3.2 Materials and utilities requirements and costs

The complete list of inputs and utilities (amounts and costs) to be supplied annually to the plant at full capacity (3000 t/y) is:

a) Raw materials

	birr/y
Corn-cobs (15% moisture) 35,300 t x 3 birr/t(1)	= 105,900
Sulphuric acid 98% 990 t x 1,110 birr/t(2)	= 1,098,900
Soda ash for the process 750 t x 400 birr/t	= 300,000
Soda ash for effluent neutralization 450 t x 400 birr/t	= 180,000
	-----
	1,684,800
	(813,913 \$/y)

(1) Estimated on the basis of an average transport distance of 15-20 km at 0.169 birr/t.km

(2) In the financial analysis the cost of sulfuric acid has been taken as 310 \$/t



b) Utilities

Electric power	1,500,000 kWh x 0.2 birr/kWh	300,000
Steam	-	-
Cooling water	375,000 m <sup>3</sup> x 0,029 birr/cu.mt	10,875
(10°C temperature range)		-----
		310,875
		(150,181 \$/y)

Total: 1,614,200+310,875 = 1,925,075 birr/y = 929,988 \$/y

3.3 Raw materials purchasing programme and storage volumes

Since the maize harvesting period takes place once a year and lasts three months (from mid-October to mid-December) all the quantity of corn-cob must be collected and transported to the storage in this short period.

As for the other chemicals, a stock equivalent to one months of the consumption at full capacity seems advisable.

As a result the following amount of corn cobs and other chemicals shall be considered as a minimum storage:

corn-cobs	35,300t	equivalent to	105,900 \$
sulfuric acid	85t	equivalent to	45,580 \$
soda ash	100t	equivalent to	19,300 \$
			-----
		total	170,780 \$

4. LOCATION

All major maize growing areas with particular favour for the sites near the railway to Assab. An area in Sidamo where corn is produced by State Farms and peasants' cooperatives was visited and the amount of raw material (cobs) assessed. It seemed sufficient to feed an economical plant having a capacity of 3,000 tons/year.

5. PROJECT ENGINEERING

5.1 Process description

Firstly, the necessity of the mechanical collection of the corn cobs must be emphasized, as this is essential to guarantee the smooth operation of the furfural plant and the quality of the final product.

Information collected by the consultants indicates the possibility of modifying the presently used maize harvesting machines to make possible the mechanical collection of the corn-cobs, separately from stalks and leaves; the modification should consist in the addition of some partition walls in the discharge case of the harvesting machine together with the installation of a collecting box beneath it. The corn-cobs collected are transported to the plant where they can be stored outdoors, piled directly on the ground (however during the rainy season the pile must be covered with plastic sheets).

The first step of the process is the crushing of the corn-cobs to the required size (2 to 3 mm) and the separation of extraneous matter, dust and finely divided material; then its transfer to the plant feeding silo (please refer to the attached flow diagram B162 - 5 - 2).

The raw material prepared in this way, together with diluted acid, is transferred into the reactor.

Basically the process consists in the hydrolysis of the pentosanes contained in the raw material into pentoses. When the pentosanes are treated with diluted acids under specific conditions of time, temperature and pressure a series of reactions take place.

Initially pentose carbohydrates are produced by hydrolysis.

Further reaction involves the opening of the pyranose ring structure in the pentose molecule, the removal of molecules of water and subsequently the closure of the ring to produce furfural.

In practice, because of some side reactions and the nature of the raw material, it is not possible to reach a yield of furfural equivalent to the pentosane content of the raw material.

Corn-cobs have proven to be one of the best raw material for the industrial production of furfural, the yield being about 10% wt/wt based on the dry raw material.

The process is carried out in reactors while the necessary heat is supplied by injection of steam at fairly high pressure.

At the same time the vapours are stripped off continuously carrying away the furfural from the reactor as soon as it is formed in order to avoid an excessive formation of polymerized products.

At the end of the reaction the pressure is vented off, the reactor discharged and the process repeated.

The process implies two or more reactors in order to obtain a continuous production of furfural.

The exhausted raw materials are discharged as solid residues from the bottom of the reactor and re-used as boiler fuel to produce the steam required for the process.

The main advantage of the process is that it is not only on heat balance (and therefore independent from external sources of energy) but that a surplus (about 25%) of steam is produced and it is available for other

uses.

The reaction vapours are condensed and the aqueous solutions of furfural are sent to the stripping column. The column operates at atmospheric pressure and it is provided with a steam heated reboiler.

Some of the top condensed vapours (mainly acetone and methanol) are returned as reflux to the column and the remainder are disposed off. The bottom stream is an aqueous solution of acetic acid and it is also disposed off.

The furfural/water azeotropic mixture taken as a side-stream from the column is condensed and cooled. This azeotrope then is separated into two layers: one is water rich layer and the second is a furfural rich layer.

The second layer may be further concentrated while the first is recycled to the column.

The furfural-rich layer is collected and neutralized by adding aqueous caustic soda or sodium carbonate before pumping to the purification column for dewatering and stripping of the impurities.

The furfural purification column operates under reduced pressure and is provided with a steam heated reboiler. The top product is condensed and sent to a separator where two layers are formed.

The bottom furfural-rich layer is returned to the column while the top-water-rich layer is recycled and mixed with the feed stream.

Pure furfural is collected in the Furfural column as a side stream, cooled and stored.

The tar bottoms are disposed off.

## 5.2 Packaging

Packaging of the final product has been considered in bulk lots, mainly in containers of 20 tons that can be shipped by sea, rail and road.

Users of small quantities, 200 litres for example, have not been considered.

It should be considered that the cost of drum packaging is about 7-10% more expensive than bulk.

## 5.3 Lay-out and civil works

The lay out of the plant is outlined in the attached drawing B162 - 5 - 1. The process plant is designed for outdoor installation and extends itself over an area of about 2000 sq.mt ; the highest platform will be at 26 m; only some special engines are installed under a roof. Next to the process plant an area of 15,000 to 20,000 sq.mt must be reserved for the corn-cobs storage. Another area, 125 to 150 sq.mt must be devoted to the storage of the finished product (Furfural) and sulphuric acid: 3 x 100 cu.mt tanks for furfural and 3 x 25 tanks for sulphuric acid.

Administrative offices, laboratory, storehouse and workshop will be housed in a two-storeyed building covering an area of 200 sq.mt.

The floor of the area covered by the plant or used as deposit is in asphalted reinforced concrete except for the zones under the reactors and acid tanks (about 1000 sq.mt) that are lined with an acid proof paving.

The area where the corn cobs are stored is simply rolled with the addition of gravel and protected by

water infiltration with a trench all around.

The building for administrative office and other services has supporting structure in reinforced concrete and the internal and external work in brickwork.

**5.4 Investment costs; depreciation and maintenance.**

	LC	FC	Total
	M\$	M\$	M\$
Machinery and equipment	-	6.00	6.00
License and technical assistance	-	1.40	1.40
Transportation	0.60	0.60	1.20
Insulation and paintings	0.05	-	0.05
Erection	0.60	0.60	1.20
Site preparation	0.15	-	0.15
Civil works	1.50	-	1.50
	-----	-----	-----
	2.90	8.60	11.50
Contingencies	0.20	0.90	1.10
	-----	-----	-----
Grand total	3.10	9.50	12.60

The investment costs are probably on the high side, even if the total value has been checked with two technology suppliers. On the other hand the plant operation is a quite sophisticated one and requires a lot of technical assistance and-on-the-job training. The life cycle of this plant can be considered 15 years.

The annual cost of maintenance has been assumed equivalent to 3% of the equipment cost.

In the financial evaluation the investment costs (contingencies included) are so subdivided:

Machinery	FC	9,500,000 \$
Machinery	LC	1,250,000 \$
Site preparation	LC	150,000 \$
Civil works	LC	1,700,000 \$
		-----
		12,600,000 \$



6. PLANT ORGANIZATION

The plant has been considered as an autonomous complete unit complete with utilities and facilities, operating under the direction of the National Chemical Co.

7. MANPOWER

7.1 Management

		Birr/m	Birr/y
- General Manager	n. 1	1,500	
- Technical Manager	n. 1	1,200	
		-----	-----
		2,700	32,400

7.2 Administrative Dep.

- Senior accountant	n. 1	800	
- Accountant	n. 1	400	
- Asst. Accountant	n. 1	350	
- Purchasing dept. Head	n. 1	400	
- " " Asst.	n. 2	700	
- Stores head	n. 1	400	
- " Asst.	n. 2	700	
- Sales dept. head	n. 1	400	
- " " ass.	n. 2	700	
- Clerks and secretaries	n. 4	1200	
- Transport officer	n. 1	700	
- Drivers (1)	n. 10	3500	
- Security officer	n. 1	400	
- Guards	n. 6	900	
		-----	-----
Total Administration			
dept. ..	n. 34	11550	138,600
Total manag. and adm. dep.			b/y 171,000
			(82608 \$/y)

(1) Including the drivers employed for the corn-cob transportation.

7.3 Production and maintenance Dep.

Production Dep.

		Birr/m	Birr/y
- Production manager	n. 1	1,000	
- Shift foremen	n. 4	1,600	
- Clerks	n. 2	600	
- Chemist	n. 1	700	
- Analysts	n. 4	1,050	
- Operators	n. 24	8,400	
- Semi skilled op.tors	n. 16	4,800	
	-----	-----	-----
Total production dept.	n. 52	18,150	217,800
			(105,217\$/y)

Engineering dept.

- Chief eng.	n. 1	800	
- Workshop head	n. 1	400	
- Mech. stores head	n. 1	400	
- Foreman	n. 3	1,200	
- Welders	n. 2	800	
- Electricians	n. 2	800	
- Mechanics	n. 2	800	
- Unskilled workers	n. 6	1,200	
	-----	-----	-----
Total Eng. Dept.	n. 18	6,400	76,800
			(37,101 \$/y)

Steam production

		Birr/m	Birr/y
- Chief engineer	n. 1	700	
- Shift foreman	n. 4	1,600	
- " operators	n. 4	1,400	
	-----	-----	-----
Total steam prod. dept.n. 9		3,700	44,400
			(21,449 \$/y)

8. IMPLEMENTATION SCHEDULING

The plant can be commissioned within 30 months from project start.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1.

This evaluation is based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (1 year) has been taken into account and indicated as "foreign factory overheads"

- the cost of sulfuric acid has been assumed as 310 \$/t, which correspond to a total amount for raw material of 589,943 \$/t instead of 813,913.

- the production programme has been assumed as follows:  
1st year : 40% capacity (1200 t)  
2nd year : 60% capacity (1800 t)  
3rd year : 80% capacity (2400 t)  
from the 4th to the 15th year: 100% capacity (3000 t)

Selling price 1000\$/t

The Financial Evaluation gives an IRR of 5.39% and a BEP of 76.6%; if the life cycle of the plant is extended to 20 years the IRR increase to 6.81%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items. Since Ethiopia has no consumption of furfural the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) is null.

Both the net foreign exchange flow (all the production is exported) and the foreign exchange effect are positive; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 7,741,000\$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 7,741,000 \$

**Furfural**

**ANNEXE 1**

**FINANCIAL EVALUATION**





**COMFAR**<sup>2.0</sup>  
UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., NIZANO

FURFURAL  
february 88  
BASIC PROJECT

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US DOLLARS

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**Total initial investment during construction phase**

fixed assets:	13552.50	76.056 % foreign
current assets:	0.00	0.000 % foreign
total assets:	13552.50	76.056 % foreign

---

**Source of funds during construction phase**

equity & grants:	4670.00	0.000 % foreign
foreign loans :	8075.00	
local loans :	0.00	
total funds :	12745.00	63.358 % foreign

---

**Cashflow from operations**

Years:	1	2	3
operating costs:	674.42	798.46	982.47
depreciation :	861.03	861.03	846.03
interest :	807.50	706.56	605.63
production costs	2342.95	2366.05	2434.12
thereof foreign	67.14 %	61.21 %	56.83 %
total sales :	1200.00	1800.00	2400.00
gross income :	-1142.95	-566.05	-34.12
net income :	-1142.95	-566.05	-34.12
cash balance :	-1474.25	-768.06	-263.63
net cashflow :	342.62	947.88	1351.37

Net Present Value at: 10.00 % = -3446.17

Internal Rate of Return on total investment: 5.39 %

Equity paid versus Net income flow (IRR): not found

Net Worth versus Net Cash Return (IRR): 3.75 %

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**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Fixed investment costs</b>						
Land, site preparation, development	150.00	0.00	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	510.00	510.00	510.00	170.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment ...	800.00	1000.00	3100.00	4300.00	1550.00	0.00
<b>Total fixed investment costs .....</b>	<b>950.00</b>	<b>1510.00</b>	<b>3610.00</b>	<b>4810.00</b>	<b>1720.00</b>	<b>0.00</b>
<b>Pre-production capital expenditures.</b>	<b>5.00</b>	<b>15.00</b>	<b>15.00</b>	<b>15.00</b>	<b>498.75</b>	<b>403.75</b>
<b>Net working capital .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total initial investment costs ...</b>	<b>955.00</b>	<b>1525.00</b>	<b>3625.00</b>	<b>4825.00</b>	<b>2218.75</b>	<b>403.75</b>
<b>Of it foreign, in \$ .....</b>	<b>83.77</b>	<b>65.57</b>	<b>78.62</b>	<b>78.76</b>	<b>65.52</b>	<b>100.00</b>

FURFURAL — february 88



**CUMFAR**  
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CUMFAR 2.0 - MALDO & CO. S.R.L., NILAND

**Total Current Investment in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992-93
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Working capital . . . . .</b>	<b>182.96</b>	<b>53.66</b>	<b>66.16</b>
<b>Total current investment costs . . .</b>	<b>182.96</b>	<b>53.66</b>	<b>66.16</b>
<b>Of it foreign, Z . . . . .</b>	<b>54.38</b>	<b>57.77</b>	<b>65.75</b>

FURFURAL — february 88



**COMFAR**  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
1 of non. capacity (single product) .	40.00	60.00	80.00	100.00	100.00	100.00
Raw material I .....	233.97	333.97	471.95	589.94	589.94	589.94
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	2.10	3.15	4.20	5.25	5.25	5.25
Energy .....	57.97	86.96	115.94	144.93	144.93	144.93
Labour, direct .....	126.67	126.67	126.67	126.67	126.67	126.67
Repair, maintenance .....	37.10	37.10	37.10	37.10	37.10	37.10
Spares .....	72.00	100.00	144.00	180.00	180.00	180.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>591.81</b>	<b>715.85</b>	<b>899.86</b>	<b>1083.89</b>	<b>1083.89</b>	<b>1083.89</b>
Administrative overheads .....	82.61	82.61	82.61	82.61	82.61	82.61
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	861.03	861.03	846.03	831.03	831.03	802.03
Financial costs .....	807.50	706.56	605.63	504.69	403.75	302.81
<b>Total production costs .....</b>	<b>2342.95</b>	<b>2346.05</b>	<b>2434.12</b>	<b>2502.21</b>	<b>2401.27</b>	<b>2271.34</b>
<b>Costs per unit ( single product ) .</b>	<b>1.95</b>	<b>1.31</b>	<b>1.01</b>	<b>0.83</b>	<b>0.80</b>	<b>0.76</b>
Of it foreign, I .....	67.14	61.21	56.83	52.69	50.70	49.15
Of it variable, I .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	209.28	209.28	209.28	209.28	209.28	209.28

FURFURAL --- february 88



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**Total Production Costs in 1000 US DOLLARS**

Year .....	1996	1997	1998-99	2000- 2	2003	2004
I of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I .....	589.94	589.94	589.94	589.94	589.94	589.94
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	5.25	5.25	5.25	5.25	5.25	5.25
Energy .....	144.93	144.93	144.93	144.93	144.93	144.93
Labour, direct .....	126.67	126.67	126.67	126.67	126.67	126.67
Repair, maintenance .....	37.10	37.10	37.10	37.10	37.10	37.10
Spares .....	100.00	100.00	100.00	100.00	100.00	100.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1083.89</b>	<b>1083.89</b>	<b>1083.89</b>	<b>1083.89</b>	<b>1083.89</b>	<b>1083.89</b>
Administrative overheads .....	82.61	82.61	82.61	82.61	82.61	82.61
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	802.03	802.03	802.03	717.03	353.67	0.00
Financial costs .....	201.00	100.94	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>2170.40</b>	<b>2069.46</b>	<b>1968.52</b>	<b>1803.52</b>	<b>1520.17</b>	<b>1166.50</b>
<b>Costs per unit ( single product ) .</b>	<b>0.72</b>	<b>0.69</b>	<b>0.66</b>	<b>0.63</b>	<b>0.51</b>	<b>0.39</b>
Of it foreign, I .....	46.79	44.19	41.33	43.20	32.40	15.43
Of it variable, I .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour .....</b>	<b>209.28</b>	<b>209.28</b>	<b>209.28</b>	<b>209.28</b>	<b>209.28</b>	<b>209.28</b>



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994-2004
Coverage ..... <i>ndc</i> <i>cote</i>					
<b>Current assets &amp;</b>					
Accounts receivable . . . 30 12.0	56.20	66.54	81.87	97.21	97.21
Inventory and materials . 30 12.1	19.67	29.51	39.34	49.18	49.18
Energy . . . . . 1 360.0	0.16	0.24	0.32	0.40	0.40
Spares . . . . . 360 1.0	72.00	100.00	144.00	180.00	180.00
Work in progress . . . . 1 360.0	1.64	1.99	2.50	3.01	3.01
Finished products . . . 30 12.0	56.20	66.54	81.87	97.21	97.21
Cash in hand . . . . . 15 24.0	15.77	14.77	16.27	17.77	17.77
<b>Total current assets</b> . . . . .	<b>221.64</b>	<b>287.58</b>	<b>366.17</b>	<b>444.77</b>	<b>444.77</b>
<b>Current liabilities and</b>					
Accounts payable . . . . . 25 14.3	38.68	50.95	63.39	75.82	75.82
<b>Net working capital</b> . . . . .	<b>182.96</b>	<b>236.62</b>	<b>302.79</b>	<b>368.95</b>	<b>368.95</b>
<b>Increase in working capital</b> . . . . .	<b>182.96</b>	<b>53.66</b>	<b>66.16</b>	<b>66.16</b>	<b>0.00</b>
Net working capital, local . . . . .	83.46	106.12	128.78	151.45	151.45
Net working capital, foreign . . . . .	99.50	130.50	174.00	217.50	217.50

Notes: *ndc* = minimum days of coverage ; *cote* = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987.1	1987.2-88.2	1989.1-89.2
Equity, ordinary ..	4670.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	8075.00	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	8075.00	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	0.00	0.00	403.75
Total funds .....	12745.00	0.00	403.75

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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38	-1009.38
Current liabilities	38.68	12.27	12.43	12.44	0.00	0.00	0.00
Bank overdraft ....	1474.25	768.06	263.63	-4.38	-121.01	-156.98	-207.43
Total funds .....	503.56	-229.04	-733.31	-1001.32	-1130.39	-1166.36	-1216.82

FURFURAL --- february 88

CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1997	1998	1999
Equity, ordinary ..	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00
Loan A, foreign .	-1009.38	0.00	0.00
Loan B, foreign..	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00
Total loan .....	-1009.38	0.00	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft ....	-257.92	-1317.76	-1247.94
Total funds .....	-1267.29	-1317.76	-1247.94

FURFURAL --- february 88





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	12745.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	12745.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	955.00	1525.00	3625.00	4825.00	2218.75	403.75
Total assets . . . .	955.00	1525.00	3625.00	4825.00	1815.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	403.75	403.75
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	11790.00	-1525.00	-3625.00	-4825.00	-2218.75	-403.75
Cumulated cash balance	11790.00	10265.00	6640.00	1815.00	-403.75	-807.50
Inflow, local . . . . .	4670.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	155.00	525.00	775.00	1025.00	765.00	0.00
Surplus ( deficit ) .	4515.00	-525.00	-775.00	-1025.00	-765.00	0.00
Inflow, foreign . . . .	8075.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	800.00	1000.00	2850.00	3800.00	1453.75	403.75
Surplus ( deficit ) .	7275.00	-1000.00	-2850.00	-3800.00	-1453.75	-403.75
Net cashflow . . . . .	-955.00	-1525.00	-3625.00	-4825.00	-1815.00	0.00
Cumulated net cashflow	-955.00	-2480.00	-6105.00	-10930.00	-12745.00	-12745.00

FURFURAL --- february 88



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	1238.68	1812.34	2412.43	3012.44	3000.00	3000.00
Financial resources .	38.68	12.34	12.43	12.44	0.00	0.00
Sales, net of tax . .	1200.00	1800.00	2400.00	3000.00	3000.00	3000.00
Total cash outflow . .	2712.94	2580.40	2676.06	3008.05	2878.99	2843.02
Total assets . . . .	221.64	65.93	78.59	78.60	0.00	0.00
Operating costs . . .	674.42	798.46	982.47	1166.50	1166.50	1166.50
Cost of finance . . .	807.50	706.56	605.63	504.69	403.75	302.81
Repayment . . . . .	1009.38	1009.44	1009.38	1009.38	1009.38	1009.38
Corporate tax . . . .	0.00	0.00	0.00	248.89	299.36	364.33
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1474.26	-768.06	-263.63	4.38	121.01	156.98
Cumulated cash balance	-2281.75	-3049.82	-3313.45	-3309.07	-3188.05	-3031.07
Inflow, local . . . .	38.32	12.34	12.33	12.34	0.00	0.00
Outflow, local . . . .	644.20	725.46	873.46	1270.39	1285.86	1330.83
Surplus ( deficit ) .	-625.88	-713.12	-861.13	-1258.06	-1285.86	-1330.83
Inflow, foreign . . .	1200.37	1800.00	2400.10	3000.10	3000.00	3000.00
Outflow, foreign . . .	2048.74	1854.94	1802.60	1737.66	1593.13	1492.19
Surplus ( deficit ) .	-848.38	-54.94	597.50	1262.44	1406.88	1507.81
Net cashflow . . . . .	342.62	947.88	1351.37	1518.44	1534.14	1469.17
Cumulated net cashflow	-12402.38	-11454.50	-10103.13	-8584.69	-7050.55	-5381.38

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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
Total cash outflow . .	2792.35	2742.08	1682.24	1682.24	1724.74	1724.74
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1166.50	1166.50	1166.50	1166.50	1166.50	1166.50
Cost of finance . . .	201.88	100.94	0.00	0.00	0.00	0.00
Repayment . . . . .	1009.38	1009.38	0.00	0.00	0.00	0.00
Corporate tax . . .	414.80	465.27	515.74	515.74	558.24	558.24
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	207.45	257.92	1317.76	1317.76	1275.26	1275.26
Cumulated cash balance	-2823.62	-2565.70	-1247.94	69.82	1345.08	2620.35
Inflow, local . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	1401.30	1451.77	1502.24	1502.24	1544.74	1544.74
Surplus ( deficit ) .	-1401.30	-1451.77	-1502.24	-1502.24	-1544.74	-1544.74
Inflow, foreign . . .	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
Outflow, foreign . . .	1391.25	1290.31	180.00	180.00	180.00	180.00
Surplus ( deficit ) .	1608.75	1709.69	2820.00	2820.00	2820.00	2820.00
Net cashflow . . . . .	1418.70	1368.23	1317.76	1317.76	1275.26	1275.26
Cumulated net cashflow	-4162.68	-2794.45	-1476.69	-158.93	1116.33	2391.60

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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2002	2003	2004
Total cash inflow . .	3000.00	3000.00	3000.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	3000.00	3000.00	3000.00
Total cash outflow . .	1724.74	1906.41	2083.25
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1166.50	1166.50	1166.50
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	558.24	739.91	916.75
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	1275.26	1093.59	916.75
Cumulated cash balance	3895.61	4989.20	5905.95
Inflow, local . . . .	0.00	0.00	0.00
Outflow, local . . . .	1544.74	1726.41	1903.25
Surplus ( deficit ) .	-1544.74	-1726.41	-1903.25
Inflow, foreign . . .	3000.00	3000.00	3000.00
Outflow, foreign . . .	180.00	180.00	180.00
Surplus ( deficit ) .	2820.00	2820.00	2820.00
Net cashflow . . . . .	1275.26	1093.59	916.75
Cumulated net cashflow	3666.86	4760.45	5677.20

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:  
Net present value ..... -3987.31 at 10.00 %  
Internal Rate of Return (IRRE1) .. not found

b) Net Worth versus Net cash return:  
Net present value ..... -3403.00 at 10.00 %  
Internal Rate of Return (IRRE2) .. 3.75 %

c) Internal Rate of Return on total investment:  
Net present value ..... -3446.17 at 10.00 %  
Internal Rate of Return (IRR) .. 5.39 %

Net Worth = Equity paid plus reserves

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COMFAR 2.0 - DALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	1200.00	1800.00	2400.00	3000.00	3000.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1200.00	1800.00	2400.00	3000.00	3000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1535.45	1659.48	1828.50	1997.52	1997.52
Operational margin . . . . .	-335.45	140.52	571.50	1002.48	1002.48
As % of total sales . . . . .	-27.95	7.81	23.81	33.42	33.42
Cost of finance . . . . .	807.50	706.56	605.63	504.69	403.75
Gross profit . . . . .	-1142.95	-566.05	-34.12	497.79	598.73
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1142.95	-566.05	-34.12	497.79	598.73
Tax . . . . .	0.00	0.00	0.00	248.89	299.36
Net profit . . . . .	-1142.95	-566.05	-34.12	248.89	299.36
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1142.95	-566.05	-34.12	248.89	299.36
Accumulated undistributed profit . . .	-1142.95	-1708.99	-1743.11	-1494.22	-1194.86
Gross profit, % of total sales . . . . .	-95.25	-31.45	-1.42	16.59	19.96
Net profit, % of total sales . . . . .	-95.25	-31.45	-1.42	8.30	9.98
RDE, Net profit, % of equity . . . . .	-24.47	-12.12	-0.73	5.33	6.41
ROI, Net profit+interest, % of invest.	-2.59	1.08	4.38	5.75	5.36



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	3000.00	3000.00	3000.00	3000.00	3000.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3000.00	3000.00	3000.00	3000.00	3000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1968.52	1968.52	1968.52	1968.53	1968.53
Operational margin . . . . .	1031.48	1031.48	1031.48	1031.47	1031.47
As % of total sales . . . . .	34.38	34.38	34.38	34.38	34.38
Cost of finance . . . . .	302.81	201.88	100.94	0.00	0.00
Gross profit . . . . .	728.66	829.60	930.54	1031.47	1031.47
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	728.66	829.60	930.54	1031.47	1031.47
Tax . . . . .	364.33	414.80	465.27	515.74	515.74
Net profit . . . . .	364.33	414.80	465.27	515.74	515.74
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	364.33	414.80	465.27	515.74	515.74
Accumulated undistributed profit . . .	-830.52	-415.72	49.54	565.28	1081.02
Gross profit, % of total sales . . . .	24.29	27.65	31.02	34.38	34.38
Net profit, % of total sales . . . .	12.14	13.83	15.51	17.19	17.19
ROE, Net profit, % of equity . . . .	7.80	8.88	9.96	11.04	11.04
ROI, Net profit+interest, % of invest.	5.09	4.70	4.32	3.93	3.93

FURFURAL --- february 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	3000.00	3000.00	3000.00	3006.00	3000.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3000.00	3000.00	3000.00	3000.00	3000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1883.53	1883.53	1883.53	1520.18	1166.50
Operational margin . . . . .	1116.47	1116.47	1116.47	1479.82	1833.50
As % of total sales . . . . .	37.22	37.22	37.22	49.33	61.12
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	1116.47	1116.47	1116.47	1479.82	1833.50
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1116.47	1116.47	1116.47	1479.82	1833.50
Tax . . . . .	558.24	558.24	558.24	739.91	916.75
Net profit . . . . .	558.24	558.24	558.24	739.91	916.75
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	558.24	558.24	558.24	739.91	916.75
Accumulated undistributed profit . . .	1639.26	2197.49	2755.73	3495.64	4412.39
Gross profit, % of total sales . . . .	37.22	37.22	37.22	49.33	61.12
Net profit, % of total sales . . . .	18.61	18.61	18.61	24.66	30.56
ROE, Net profit, % of equity . . . .	11.95	11.95	11.95	15.84	19.63
ROI, Net profit+interest, % of invest.	4.26	4.26	4.26	5.64	6.99





COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US DOLLARS

Year	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets	12745.00	12745.00	12745.00	12745.00	13148.75	13352.50
Fixed assets, net of depreciation	0.00	955.00	2480.00	6105.00	10930.00	13148.75
Construction in progress	955.00	1525.00	3625.00	4825.00	2218.75	403.75
Current assets	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	11790.00	10265.00	6640.00	1615.00	0.00	0.00
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	12745.00	12745.00	12745.00	12745.00	13148.75	13352.50
Equity capital	4670.00	4670.00	4670.00	4670.00	4670.00	4670.00
Reserves, retained profit	0.00	0.00	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt	8075.00	8075.00	8075.00	8075.00	8075.00	8075.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00	403.75	807.50
Total debt	8075.00	8075.00	8075.00	8075.00	8478.75	8882.50
Equity, % of liabilities	36.64	36.64	36.64	36.64	35.52	34.46

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>14056.06</b>	<b>13827.02</b>	<b>13093.71</b>	<b>12341.20</b>	<b>11261.36</b>	<b>10159.90</b>
Fixed assets, net of depreciation	12691.47	11830.45	10984.42	10153.40	9322.37	8520.35
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	205.60	272.81	349.91	427.01	427.01	427.01
Cash, bank .....	15.77	14.77	16.27	17.77	17.77	17.77
Cash surplus, finance available .	0.00	0.30	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	1142.95	1708.99	1743.11	1494.22	1194.86
Loos .....	1142.95	566.05	34.12	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>14056.06</b>	<b>13827.02</b>	<b>13093.71</b>	<b>12341.20</b>	<b>11261.36</b>	<b>10159.90</b>
Equity capital .....	4670.00	4670.00	4670.00	4670.00	4670.00	4670.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	248.89	299.36	364.33
Long and medium term debt .....	7965.63	6056.25	5046.88	4037.50	3020.13	2018.75
Current liabilities .....	38.68	50.95	63.39	75.82	75.82	75.82
Bank overdraft, finance required.	2281.75	3049.82	3313.45	3309.06	3188.05	3031.07
<b>Total debt .....</b>	<b>9386.06</b>	<b>9157.02</b>	<b>8423.71</b>	<b>7422.39</b>	<b>6292.00</b>	<b>5125.64</b>
<b>Equity, % of liabilities .....</b>	<b>33.22</b>	<b>33.77</b>	<b>35.67</b>	<b>37.84</b>	<b>41.47</b>	<b>45.96</b>

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year . . . . .	1996	1997	1998	1999	2000	2001
Total assets . . . . .	8993.62	7776.79	6559.04	5826.84	6385.08	6943.32
Fixed assets, net of depreciation	7718.32	6916.30	6114.27	5312.25	4595.22	3878.20
Construction in progress . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Current assets . . . . .	427.01	427.01	427.01	427.01	427.01	427.01
Cash, bank . . . . .	17.77	17.77	17.77	17.77	17.77	17.77
Cash surplus, finance available .	0.00	0.00	0.00	69.82	1345.09	2628.35
Loss carried forward . . . . .	830.52	415.72	0.00	0.00	0.00	0.00
Loss . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities . . . . .	8993.62	7776.79	6559.04	5826.84	6385.08	6943.32
Equity capital . . . . .	4670.00	4670.00	4670.00	4670.00	4670.00	4670.00
Reserves, retained profit . . . .	0.00	0.00	49.54	545.28	1081.02	1639.26
Profit . . . . .	414.00	465.27	515.74	515.74	558.24	558.24
Long and medium term debt . . . .	1009.38	0.00	0.00	0.00	0.00	0.00
Current liabilities . . . . .	75.82	75.82	75.82	75.82	75.82	75.82
Bank overdraft, finance required.	2823.62	2565.70	1247.94	0.00	0.00	0.00
Total debt . . . . .	3908.82	2641.53	1323.76	75.82	75.82	75.82
Equity, % of liabilities . . . . .	51.93	60.05	71.20	80.15	73.14	67.26

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**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>7501.56</b>	<b>8241.47</b>	<b>9158.22</b>
Fixed assets, net of depreciation	3161.17	2807.50	2807.50
Construction in progress .....	0.00	0.00	0.00
Current assets .....	427.01	427.01	427.01
Cash, bank .....	17.77	17.77	17.77
Cash surplus, finance available	3895.61	4989.20	5905.95
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>7501.56</b>	<b>8241.47</b>	<b>9158.22</b>
Equity capital .....	4670.00	4670.00	4670.00
Reserves, retained profit .....	2197.49	2755.73	3495.64
Profit .....	558.24	739.91	916.75
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	75.82	75.82	75.82
Bank overdraft, finance required	0.00	0.00	0.00
<b>Total debt .....</b>	<b>75.82</b>	<b>75.82</b>	<b>75.82</b>
<b>Equity, % of liabilities .....</b>	<b>62.25</b>	<b>56.66</b>	<b>50.99</b>

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**ANNEXE 2**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (4TH YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	<u>3000</u>
2) VARIABLE COSTS:	<u>866.82</u>
. RAW MATERIALS	589.94
. UTILITIES	5.25
. ENERGY	144.93
. LABOUR	126.70
3) FIXED COSTS	<u>1635.43</u>
. REPAIR-MAINTENANCE	37.10
. SPARES	180
. ADMINISTRATION	82.61
. DEPRECIATION	831.03
. FINANCIAL COSTS	504.69
4) TOTAL PRODUCTION COSTS	<u>2502.25</u>

$$\text{BEP} = \frac{1635.43}{3000 - 866.82} \times 100 = 76.6 \%$$

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**ANNEXE 3**

**FOREIGN EXCHANGE EFFECT EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

				.....construction.....			
	grand total	total constr.	total produc.	1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	49475.57	8075.00	41400.57	8075.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	8075.57	8075.00	0.57	8075.00	0.00	0.00	0.00
exports . . . . .	41400.00	0.00	41400.00	0.00	0.00	0.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	22803.32	10307.50	12495.82	800.00	1000.00	2850.00	3800.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	7742.50	9500.00	-1757.50	800.00	1000.00	2850.00	3800.00
imported materials . . .	2544.00	0.00	2544.00	0.00	0.00	0.00	0.00
repayment loans & overj.	8075.57	0.00	8075.57	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	4441.25	807.50	3633.75	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchnge flow	26672.25	-2232.50	28904.75	7275.00	-1000.00	-2850.00	-3800.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foregn exchnge effect	26672.25	-2232.50	28904.75	7275.00	-1000.00	-2850.00	-3800.00
present values at 10.00 %							
foreign exchange flow .	7741.05						
net foregn exchnge effect	7741.05						





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	.....construction.....		production				
	1988.1	1989.2	1992	1993	1994	1995	1996
total foreign inflow ..	0.00	0.00	1200.37	1800.00	2400.10	3000.10	3000.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.37	0.00	0.10	0.10	0.00
exports . . . . .	0.00	0.00	1200.00	1800.00	2400.00	3000.00	3000.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1453.75	403.75	2048.74	1854.94	1802.60	1737.66	1593.13
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1050.00	0.00	99.87	30.93	43.60	43.60	0.00
imported materials . . .	0.00	0.00	132.00	108.00	144.00	180.00	180.00
repayment loans & overd.	0.00	0.00	1009.38	1009.44	1009.38	1009.38	1009.38
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	403.75	403.75	807.50	706.56	605.63	504.69	403.75
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1453.75	-403.75	-848.38	-54.94	597.50	1262.44	1406.88
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-1453.75	-403.75	-848.38	-54.94	597.50	1262.44	1406.88

present values at 10.00 %  
foreign exchange flow . 7741.05  
net foreign exchange effect 7741.05



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### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow ..	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00	3000.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	1492.19	1391.25	1290.31	180.00	180.00	180.00	180.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . . .	180.00	180.00	180.00	180.00	180.00	180.00	180.00
repayment loans & overd.	1009.38	1007.38	1009.38	0.00	0.00	0.00	0.00
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
reprinted wages . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	302.81	201.88	100.94	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	1507.81	1608.75	1709.69	2820.00	2820.00	2820.00	2820.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	1507.81	1608.75	1709.69	2820.00	2820.00	2820.00	2820.00
present values at foreign exchange flow .	10.00 %	7741.05					
net forgn exchge effect		7741.05					



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COMFAR 2.1 - BALDI & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow . .	3000.00	3000.00	3000.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	3000.00	3000.00	3000.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	180.00	180.00	180.00	-1975.00
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-1975.50
imported materials . . .	180.00	180.00	180.00	0.00
repayment loans & overd.	0.00	0.00	0.00	0.50
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	2820.00	2820.00	2820.00	1975.00
import substit'n effect	0.00	0.00	0.00	0.00
net foreign exchange effect	2820.00	2820.00	2820.00	1975.00
present values at 10.00 %				
foreign exchange flow .	7741.05			
net foreign exchange effect	7741.05			

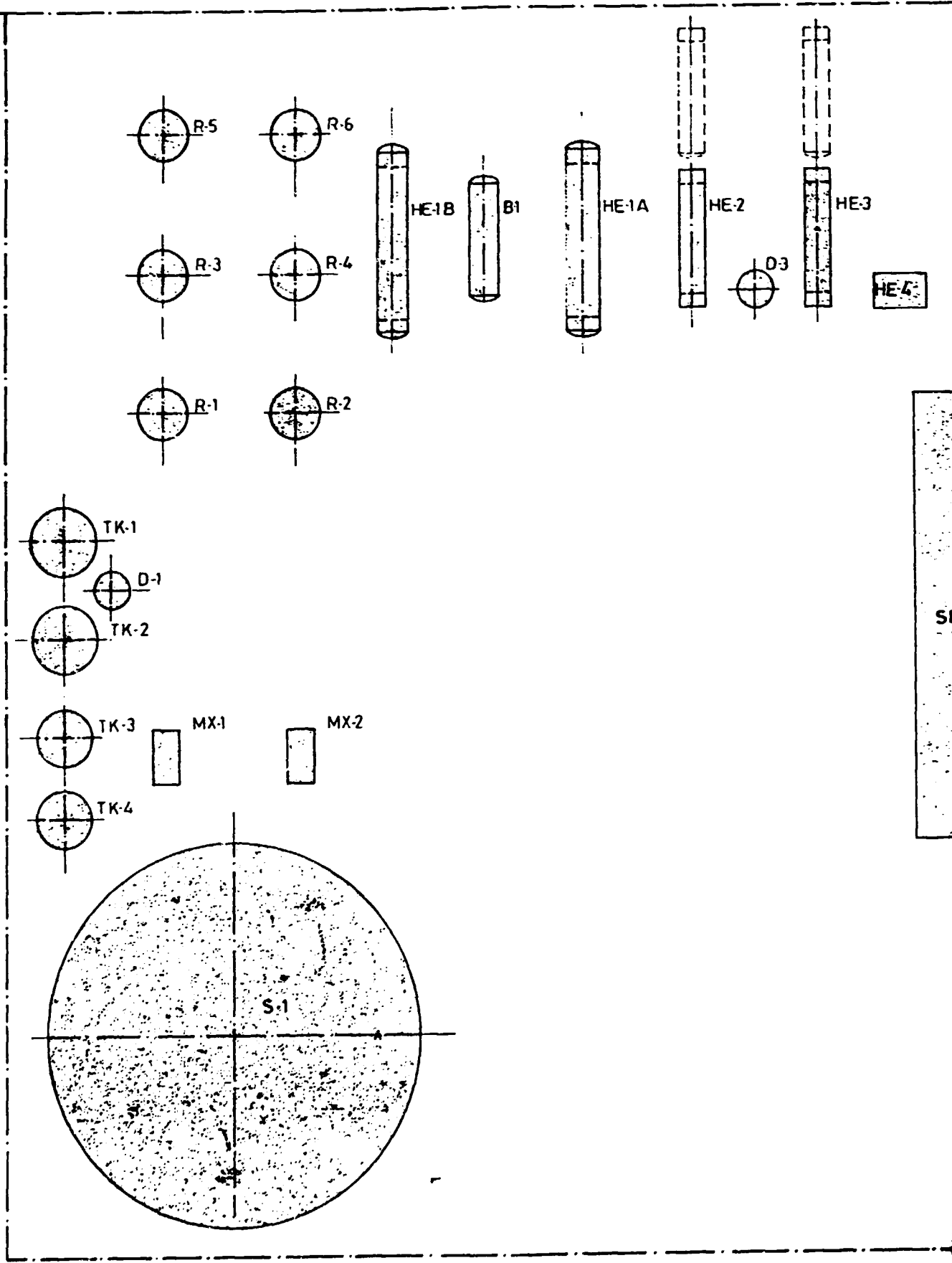
**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXE 4**

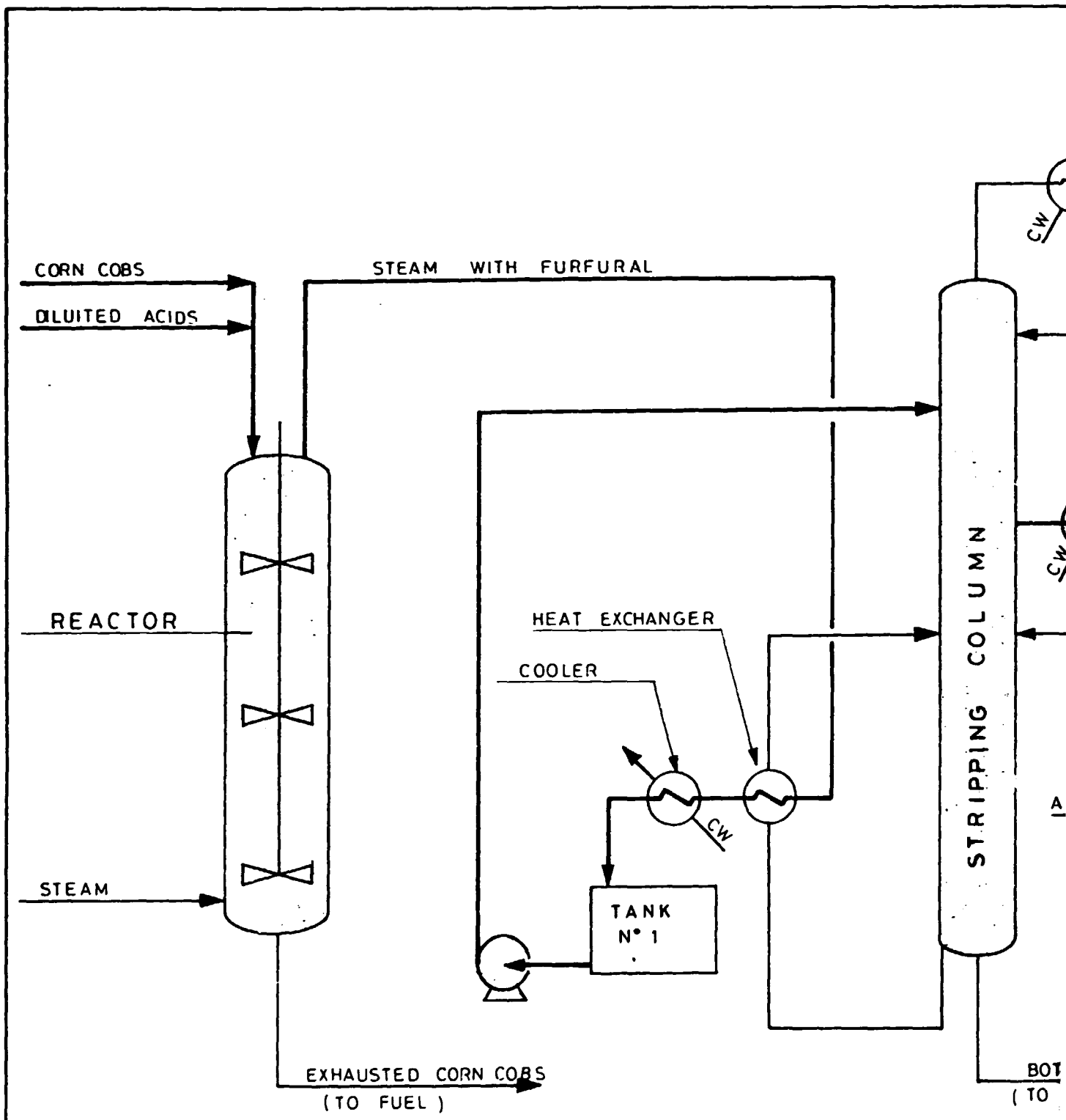
DRW. B162 - 5 - 1  
PROCESS EQUIPMENT LAY OUT

DRW. B162 5 2  
PROCESS FLOW DIAGRAM

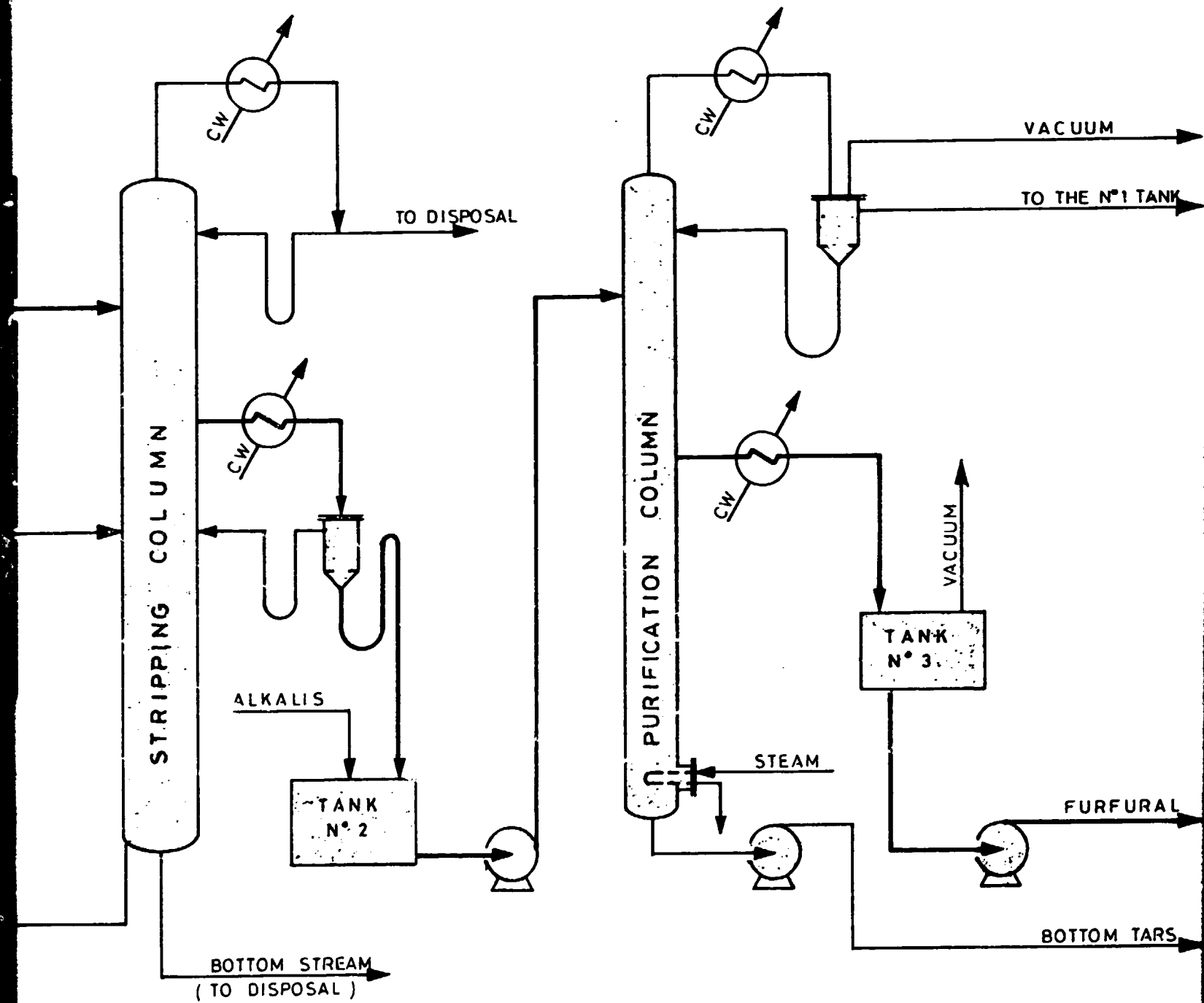


SECTION 1





SECTION 1



SECTION .2

FURFURAL PRODUCTION UNIT PROCESS FLOW DIAGRAM		DIS. N° DWG N° <b>B. 162- 5-2</b>						
<b>baldo &amp; c.</b> CONSULTING ENGINEERS	Via Stillcone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	REV. <table border="1"> <tr> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>						



U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF LEATHER AND CANVAS SHOES  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & c.**  
CONSULTING ENGINEERS

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DRW. B162 - 1 - 2 - EQUIPMENT LAY OUT

0. SUMMARY AND CONCLUSIONS

The implementation of a new plant for the production of high quality leather shoes and training shoes is justified both by the increasing domestic market and by actual possibilities of export.

The domestic market will attain a demand of 3.5-4 million pairs per year by 1994/95 assuming a growth rate of 6-8% per year.

The international market is in need of good quality shoes at competitive price and it is anticipated that Ethiopia can play an important role in this sector because of the following main facts:

- good quality raw material available
- skilled and not expensive manpower
- existing experience in the production of shoes

Due to the above facts this study deals with a plant for the production of good quality leather and training shoes for both domestic and export market. Various scenarios and alternatives have been studied including:

- two alternative sizes for leather shoes
- both shoes types production in a single plant or in two separate factories

The financial analysis has been carried out by assuming a relatively low export quote (25%).

This has been done only to be on the conservative side but it could be much higher if quality is competitive.

The new plant will require, when at full production, a large amount of leather that, otherwise, would be exported as raw material. From this fact derives the importance of increasing the export share of the plant with consequent beneficial effect because of the added value on exported leather as shoes.

The production of training shoes (nearly equal to canvas as far as production process but differing because of the better quality of raw materials used) have been foreseen mainly because of their best acceptance in export market than canvas shoes. the same plant can produce canvas shoes just by modifying inputs (raw materials).

The capacities taken into consideration by the study are:

- 1,200 pairs of leather lady shoes per shift
- 1,800 pairs of leather man shoes per shift
- 3,000 pairs of training shoes per shift

Working on two shifts, 8 hours each, the total output will be:

- 1,500,000 pairs of leather shoes per year
- 1,500,000 pairs of training shoes per year

The main alternatives analysed are:

- a) the production of both types of shoes in one factory
- b) two separate factories, one for leather shoes manufacturing and one for training shoes.

The first alternative (Alternative A) requires a fixed investment of 7,600,000 US \$ (4,000,000 in foreign currency) and a staff of 732 workers.

As far as the second alternative is concerned, the leather shoes factory (Alternative B1) requires an investment of 4,700,000 US \$ and a staff of 471 workers, while the training shoes factory (Alternative B2) an investment of 4,590,000 US \$ and a staff of 341 workers.

The IRR is 31.58% for the first alternative; 39.95% for alternative B1 and 21.12% for alternative B2.

A sensitivity analysis has been carried out for the leather shoes factory in case of a lower production capacity (30%). This scenario (Alternative C) foresees a fixed capital investment reduced to 3,760,000 US\$, a staff of 345 and an IRR of 30.3%.

The discounted net foreign exchange effect is as follows:

Alternative A	40,250,000 US \$
" B1	30,316,000 US \$
" B2	9,582,000 US \$

The project seems profitable and it is recommended that a detailed feasibility study be carried out.

15 d

1. INTRODUCTION

The leather industry with all its multiple applications represents a significant source of employment and profit, particularly for developing countries.

Shoe manufacturing is certainly the main activity of this industry. In the past shoes were hand-made by craftsmen but now, although this activity has not been completely abandoned, the greater part of shoe production in the world is mechanized: shoes are manufactured through the carrying out of a number of simple operations (considerably over one hundred for a simple shoe) made by specialized machines; this technology has brought about a considerable increase of world shoe manufacturing capacity. This can be explained as follows:

- worker training is simpler; it is easier for a worker to learn to carry out one or a few operations with the help of machines, than to acquire sufficient ability to carry out all the operations necessary to complete a shoe by hand
- increase in production speed due to the standardization of products and manufacturing processes
- lower consumption of raw material
- lower production costs

This improvement has benefited considerably from the positive development in the leather tanning process (chrome tanning) that has allowed the use of a larger variety of skins and from the use, especially for sports shoes, of canvas (fabrics of cotton or hemp, plastic fibres or mixed fibres) and plastic materials.

## 2. MARKET AND PLANT CAPACITY

### 2.1 Uses

It would be superfluous to give an illustration of the field of application of these articles, since their importance as one of the main components of personal clothing has always been recognized.

It is worth noting, however, that its diffusion is keeping up with the economic development of the Country as is also apparent from statistical data on the Ethiopian market.

The most interesting characteristic of this growing process is the differentiation of the manufactured types, the production being geared to satisfy, with specific models, a large variety of uses, especially in the fields of work and leisure.

As a basis for the present study however, the following three models have only been taken into consideration:

- leather shoes

. gentleman lasted moccasin

. lady shoes

- training shoes

The reason of this selection is that this study is mainly devoted to highlight quality requirements and relevant costs for producing shoes of a standard competitive on the export market and these three models are among those of major diffusion.

The selection must not be intended as a limitation of



the proposed plants, since with the same machines , as suggested, is equally possible to produce other types of leather shoes as well as canvas shoes instead of training shoes (training and canvas shoes as far as the market and the manufacturing procedure are concerned, should be considered as two models of the same type of shoes).

## 2.2 Forecast demand and plant capacity

### 2.2.1 Leather shoes

As in the case of other projects, the historical survey of production for leather shoes and boots shows fluctuations clearly not due to year-to-year variations in market demand. The general trend points undoubtedly upwards, however, and we see a reasonable good correlation with the evolution of non-agricultural GDP at factor cost in the last 19 years for which information is available. As can be expected, correlation is less good with total GDP: rural population is not often in a position to afford leather shoes, while the same is not true of urban population, whose purchasing power can roughly be assumed to grow with the country's non-agricultural GDP (1). Retail prices are said to vary between 28 and 75 birr per pair. The Corporation's average selling price has been kept constant in the most recent years at about 26.5 birr/pair.

(1) A linear regression equation describing the above relationship works out as follows:

$$y = -302 + 0.45x \quad (r=0.94)$$

where y=leather shoes and boots production in thousands of pairs and x=non-agricultural GDP at factor cost in constant 1980/81 million birr.

The relationship between per capita GDP (non-agricultural) and leather footwear production is less satisfactory, possibly because the amounts involved are small, thus rounding off has an effect on the results.

In addition, it is known that current production as shown in CSO's latest surveys of manufacturing industry - around 1,5 million pairs, of which the National Leather and Shoes Corporation (NLSC) accounts for roughly 9/10 - is only part of the national total: another million pairs is estimated to be produced by craftsmen and small enterprises. How such a production has developed during the period considered above is not known, but it seems likely that it has risen apace with the industrial one: which in turn means that the rate of growth of the market is probably higher than the CSO production series suggests. At the same time, it shows that the above relationship, based as it is on production data for enterprises with ten or more workers rather than on total production (that can be equated with domestic demand) is probably underestimating the dynamism of demand.

NLSC has a project idea for the eventual production of another three million pairs of leather shoes, more than doubling present capacity of over 2 million pairs. The Corporation has undoubtedly a "feeling" for the market situation, encouraged by the development of production and sales in the last 20 years.

A tentative projection based on the linear relationship seen above and GDP projections up to 1994/95 presented earlier gives a total of 3.5 million pairs for the mid-nineties. (1) As has been said, this is a rough, and possibly underestimated, projection. Yet it does suggest that if the Ethiopian economy actually progresses as can be expected, an expansion of production capacity will definitely be necessary.

(1) which corresponds to a growth at the rate of 6-8% per year.

Export possibilities have also been mentioned to the Consultants. They should not be disregarded but, as NLSC is perfectly aware, quality improvement and purchasing agreements with international traders will be a first priority.

### 2.2.1 Canvas shoes

Production of canvas shoes has developed greatly in the last decade, from an average of just below 1.3 million between 1971/2 and 1974/5 G.C. to over 3.5 million in 1983/4 close to total capacity. A rather sharp fall in the following two years does not seem to be due to falling demand. A survey similar to the one carried out for leather footwear again gives a high correlation with non-agricultural GDP (1).

In this case production is entirely (or almost entirely) accounted for by NLSC, and also corresponds to actual consumption. The corporation has mentioned a projected idea for adding a further capacity of 7.5 million pairs to the existing one. It is possibly premature to encourage such an expansion in the near future, but the demand can surely be expected to grow.

Applied to the tentative projection of urban GDP mentioned earlier, the above relationship yields a production/demand for 1994/95 of around 8 million pairs.

- (1) The linear regression equation works out:  $y = - 2,239 + 1.22x$ . ( $r = 0.94$ ) where  $y$  stands for production in thousands of pairs and  $x$  for non-agricultural GDP at factor cost in constant 1980/81 million birr. Corporation-selling prices are currently around 6.5 birr/pair; retail prices between 8 and 9 birr/pair.

In this case, it can well be assumed that the rural population will take a more active part in demand. On the working hypothesis that the general economic setting will continue to improve, a project for a canvas shoe factory appears worth studying.

### 2.2.2 Plant capacity

The proposed plant is based on the standard capacities of machinery and equipment available on the international market. The resulting plant is of acceptable size for a factory of this type and is capable of producing 12,000 pairs of shoes daily, in two shifts of 8 hours (480 min.) each. That is, on the assumption of 250 working days per annum, 3.000.000 pairs of shoes per year. (1)

Production has been divided into the following types of shoes to be produced in two separate factories A) and B) (or in two departments of the same factory, as the case may be):

- (1) A financial evaluation for a leather shoe factory with a lower capacity has been also carried out. As stated in para 9, the capacities there considered correspond to two thirds of the above mentioned capacities, that is:

- 1200 pairs per shift for gentleman shoes
- 800 pairs per shift for lady shoes.

A) 1,200 pairs per shift of ladies' leather shoes

Upper material : leather  
lining material : leather  
construction : cemented and/or stitched  
process  
sole : imported prefabricated leather  
soles

1,800 pairs per shift of men's leather shoes

Upper material : leather  
lining material : leather  
construction : cemented and/or stitched  
process  
sole : imported prefabricated leather  
soles

B) 3,000 pairs per shift of training shoes

Upper material : split leather  
lining material : P.V.C.  
construction : stitched insole  
sole : P.U. one colour direct soling

In order to be able to evaluate the opportunity of both alternatives (one factory comprising two departments or two separate factories) all the data (consumptions, manpower, investment costs, etc). will be given separately for each production as indicated above.

2.3 Sale prices and total annual revenue

According to the information given to the Consultants by the Corporation itself, the average price for leather shoes has been kept constant in recent years at about 26.5 birr/pair (U.S. \$ 12.8) and at 6.5 birr/pair (U.S. \$ 3.14) for canvas shoes.

International prices for shoes of premium quality on the European market are approx.: \$ 54/pair for men's shoes, \$ 46/pair for ladies' shoes and \$ 30/pair for training shoes.

As above stated the materials and fabrication processes taken into consideration in the present study have been selected with the aim of producing articles of the quality required by the international market and, consequently, a product that will also be readily accepted on the home market both with regard to leather shoes and, especially, the training shoes.

In order to take into account such considerations we assume, as a basis for the economical evaluation of the project, the following sales programme (ex works prices):

- for the domestic market: 75% of the production,

. 1,125,000 leather shoes pairs	
at 16\$/p	= 18,000,000 \$/y
. 1,125,000 training shoes pairs	
at 12\$/p	= 13,500,000 \$/y
	-----
	31,500,000 \$/y

- for the export market: 25% of the production,	
375,000 leather shoes pairs	
at 26 \$/p	= 9,750,000 \$/y
375,000 training shoes pairs	
at 20 \$/p	= 7,500,000 \$/y
	-----
	17,250,000 \$/y
GRAND TOTAL	48,750,000 \$/Y



3. MATERIAL AND INPUTS

3.1 Technology

The manufacture of a shoe consists in two main steps, that is:

- preparation or purchasing of the single components of the shoes; the most important step in this group is the cutting of skins to obtain the uppers as plane development
- assembly of all the components, that is the forming, sewing, bonding, and nailing on a suitable last of all the parts, uppers, soles, insoles, linings, heels reinforcements and eyelets.

The quality of the production, especially in view of intention to export, depends mainly on the following elements:

- a) quality of the components and consumables
- b) appropriate machinery
- c) training of the personnel employed in the key positions of the production line

On the first point the prevailing opinion of the Consultant is to suggest the importing of some components and consumables, according to the indications given on the tables that follow.

The recommendation implied in the second point has been taken into consideration in the selection of the proposed machinery.

3.2 Materials and utilities: requirements and costs

The annual requirements and costs for the planned production are provided in the following tables:

table 3.2.1 for ladies' footwear

table 3.2.2 for gentlemen's footwear (lasted moccasins)

table 3.2.3 for training shoes

Table 3.2.1

GENTLEMEN'S LEATHER SHOES (Lasted mocassins)

ANNUAL REQUIREMENTS AND COSTS  
Production: 900,000 pairs/y

COMPONENT DESCRIPTION	CONSUMPTION		UNIT COSTS	ANNUAL EXPENDITURE		
	PER PAIR	PER YEAR		LC M\$	FC M\$	TOTAL M\$
Upper leather	1.90 ft2	1,710,000 ft2	2.15 \$/ft2	3.676	-	3.67
Lining leather (including hygienic insole)	1.96 ft2	1,764,000 ft2	1.23 \$/ft2	2.170	-	2.17
Threads for upper	20 m	18,000,000 m	0.01 \$/m	-	0.180	0.180
Glue for upper	0.03 Kg	27,000 kg	1.3 \$/kg	0.035	-	0.035
Glue for soles and shoe assembly	0.06 kg	54,000 kg	1.7 \$/kg	0.092	-	0.092
Nails	0.012 kg	10,800 kg	4.6 \$/kg	0.050	-	0.050
Toe puff (thermo-adhesive)	1 pair	900,000 pairs	0.10 \$/pair	0.090	-	0.090
Back counter	1 pair	900,000 pairs	0.20 \$/pair	-	0.180	0.180
Insoles	1 pair	900,000 pairs	0.40 \$/pair	-	0.360	0.360
Unit sole	1 pair	900,000 pairs	3.23 \$/pair	2.907	-	2.907
Waxes and dyeing stuff	0,006 kg	5,400 Kg	1.6 \$/Kg	-	0.009	0.009
Reinforcements (self-adhesive bands)	4m	3,600,000 m	0.10 \$/m	-	0.360	0.360
Laces	1 pair	900,000 pairs	0.04 \$/pair	0.036	-	0.036
Eyelets and/or rivets	1 set	900,000 sets	0.04 \$/set	-	0.036	0.036
Elastic bands	1 pair	900,000 pairs	0.04 \$/pair	-	0.036	0.036
Buckles	1 pair	900,000 pairs	0.04 \$/pair	-	0.036	0.036
<b>TOTAL</b>				<b>9.056</b>	<b>1.197</b>	<b>10.253</b>
<b>UNIT COST \$/PAIR</b>						<b>11.4</b>

Table 3.2.2

**LADIES' SHOES**

**ANNUAL REQUIREMENTS AND COSTS**  
Production: 600.000 pairs/y (2.400 pairs/d)

COMPONENT DESCRIPTION	CONSUMPTIONS		UNIT COSTS	ANNUAL EXPENDITURES		
	PER PAIR	PER YEAR		LC M\$	FC M\$	TOTAL M\$
Upper leather	1.350 ft <sup>2</sup>	810,000 ft <sup>2</sup>	2.15 \$/ft <sup>2</sup>	1.742	-	1.742
Lining leather (including hygienic insole)	1.420 ft <sup>2</sup>	852,000 ft <sup>2</sup>	1.23 \$/ft <sup>2</sup>	1.048	-	1.048
Threads for upper	14 m	8,400,000 m	0.01 \$/m	-	0.084	0.084
Glue for upper	0.025 Kg	15,000 Kg	1.3 \$/Kg	0.020	-	0.020
Glue for sole and shoe assembling	0.050 Kg	30,000 Kg	1.7 \$/Kg	0.051	-	0.051
Nails	0.008 Kg	4,800 Kg	4.6 \$/Kg	0.022	-	0.022
Toe-puff (thermo-adhesive)	1 pair	600,000 pair	0.10 \$/pair	0.060	-	0.060
Back counter	1 pair	600,000 pair	0.20 \$/pair	-	0.120	0.120
Insoles	1 pair	600,000 pair	0.40 \$/pair	-	0.240	0.240
Unit sole	1 pair	600,000 pair	3.23 \$/pair	1.938	-	1.938
Waxes and dyeing stuff	0.006 Kg	3,600 Kg	1.6 \$/kg	-	0.006	0.006
Reinforcements (self-adhesive bands)	4 m	2,400,000 m	0.10 \$/m	-	0.240	0.240
<b>TOTAL</b>				<b>4.881</b>	<b>0.690</b>	<b>5.571</b>
<b>UNIT COST \$/pair</b>						<b>9.285</b>

Table 3.2.3

TRAINING SHOES

ANNUAL REQUIREMENTS AND COSTS  
Production: 1,500,000 (6000 pairs/d)

COMPONENT DESCRIPTION	CONSUMPTIONS		UNIT COSTS	ANNUAL EXPENDITURES		
	PER PAIR	PER YEAR		LC M\$	FC M\$	TOTAL M\$
Upper splits	1.9 ft2	2,850,000 ft2	1.6 \$/ft2	4.560	-	4.56
Stitching lining	0.3 ft2	450,000 ft2	0.2 \$/ft2	0.090	-	0.09
Lining for back turning	0.6 ft2	900,000 ft2	0.3 \$/ft2	0.270	-	0.27
Canvas for sock lasting	0.4 ft2	600,000 ft2	0.5 \$/ft2	0.300	-	0.30
Threads for upper	3.5 ft2	5,250,000 m	0.3 \$/m	-	1.560	1.56
Eyelets (n°32 per pair)	1 set	1,500,000 set	0.1 \$/set	-	0.150	0.15
Crossed laces	1 m	1,500,000 m	0.1 \$/m	0.150	-	0.15
"Salpa" counters (1mm)	1 pair	1,500,000 pair	0.25 \$/pair	0.375	-	0.37
Thermoplastic toe-puff	1 pair	1,500,000 pair	0.15 \$/pair	0.225	-	0.22
Glue for binding and assembling operation	0,03 Kg	45,000 Kg	0.2 \$/Kg	0.090	-	0.09
"Juger type" sole	1 pair	1,500,000 pair	0.8 \$/pair	-	1.200	1.20
Stamping (hot mark)	1 pair	1,500,000 pair	0.2 \$/pair	0.300	-	0.30
PU sole to be assembled	0.350 Kg	525,000 Kg	3.57 \$/Kg	1.875	-	1.87
PU sole to be injected	0.250 Kg	375,000 Kg	4.40 \$/Kg	1.650	-	1.65
<b>TOTAL</b>				<b>9.885</b>	<b>2.910</b>	<b>12.79</b>
<b>UNIT COST \$/PAIR</b>						<b>8.5</b>

The following costs for consumable, materials and utilities should be added to the figures shown in the table:

	FC	LC	Total
	M\$	M\$	M\$
<b>a) <u>leather shoe department</u></b>			
consumable materials such as:			
lasts, thermoadhesive metal			
points; steel dies; emery			
cloth; machine tacks, rolled			
nails, heel fixing screws;			
square cross section steel			
wire; brushes for wax and			
dressings; inked types;			
cartoons for models; mills,			
blades, plates, embossing			
rollers and mould for press;			
needles for sewing machine			
1.5 \$/pair x 1,500,000	2.25		2.25
electric power			
405 Kwh/hx4000 h/y x 0.097 \$/kwh		0.16	0.16
	2.25	0.16	2.41
-----			
<b>b) <u>training shoe department</u></b>			
consumables: 1.5\$/pair			
x 1.500.000 pair/y	2.25		2.25
electric power			
256 Kwh/h x 4000 h/y x 0.097		0.099	0.099
	2.25	0.099	2.349
-----			

Adding up all these expenses, the following total costs result:

	LC	FC	Total
	M\$	M\$	M\$
a) total for leather shoes	14.097	4.112	18.209
b) for training shoes	9.984	5.160	15.144
	-----		
	24.081	9.272	33.353

**3.3 Raw material purchasing programme and storage volume**

A quantity equivalent to six months' production at full capacity is suggested as stock for imported materials; while one month's equivalent stock is enough for the materials purchased on the local market.

4. LOCATION

Any industrial area, but preferably near tanneries



5. PROJECT ENGINEERING

5.1 Description of manufacturing process and main equipment

5.1.1 Leather shoe manufacturing process

Selected models: - Gentlemen's lasted moccasins  
- Ladies' shoes

Production operation sequences and working locations.

a) Pattern preparation:

this department is the true center of the shoe factory, in that the pattern maker has to carry out the following activities:

- draft of the model in three dimensions (drawing on the shoe last covered with special paper);
- transfer of the soft board model onto the steel sheet and cutting of the master pattern using manual machine
- hard board pattern guarding and cutting (full range of sizes)
- manual cutting of the first leather sample to be used for production
- preparation of the upper for lasting
- checking of the finished shoe
- transfer of the full range of sizes of the selected model to the workshop for clicking dies execution
- control of the executed clicking dies
- preparation of the style identity card.

b) Upper and lining skins selection in store:

skins selection, as per job card, according to:

- footage workable by each cutting operator
- combination of colours
- percentage of grades

c) Transport:

transport of the skins from the store to the various cutting operators by means of trolley-horses as per job cards.

d) Cutting of upper and lining parts:

by use of trolley press, appropriate clicking dies and hand cutters for lining only, if necessary; each cutting operator prepares the various parts of upper and lining as per quantity stated in the job card.

e) Splitting of upper parts:

upper material thickness is essential to obtain good result in finished shoes.

The splitting machine reduces the leather upper parts to a corrected thickness, in accordance with the technical data requirements.

f) Numbering of upper and lining parts:

this operation is carried out by means of a numbering machine (it is important to number properly the parts of upper and lining which must be assembled together).

g) Upper preparation, stitching and assembling:

these should be considered as multiple operations, effected using one machine only, "the stitching conveyor" complete with sewing machines.

The stitching conveyor prepares and assembles the

upper parts.

By means of this conveyor, the uppers can be completed following (on the so called identify card) the sequence of operations programmed by the pattern department head, independently of the sequence of machines positioned on the conveyor.

The main operations for upper preparation, stitching and assembling are the following:

- upper edge skivying (if necessary)
- upper edge folding
- upper glueing by hand brush
- upper assembling
- upper stitching (if necessary)
- lining and upper joining
- reinforcement applying and pounding up
- lining and upper stitching
- lining trimming.

h) Main operations for gentlemen's moccasin lasting, by means of the chain-conveyor:

- insole fixing on the shoe last and trimming (if necessary)
  - toe-puff applying
  - back counter applying and shaping
  - upper inside edge roughing
  - toe-puff humidifying
  - upper application on the last, edge binding and fixing to the insoles (front part)
  - back counter humidifying
  - seat and waist edge fixing to the insole
  - lining fixing to the last
  - pounding up of the edge fixed on the bottom
  - toe-end pounding up and heel seat forming

- upper seasoning (by means of an oven)
- lasted upper edge roughing
- lasted sole and bottom gluing (manually)
- lasted sole and bottom glue reactivation
- sole applying
- groove lifting
- shoe last pulling over
- sole stitching
- shoe last pulling
- grooving laying after stitching operation
- sole edge trimming
- heel nailing (with ten nails)
- edge waxing
- sole brushing and polishing
- shoe last pulling over
- brand stamping on the sole
- box numbering and stamping
- cleaning of connection points between upper and sole
- inside insole gluing
- inside insole applying (manually)
- shoe back part reforming
- polishing spray cabin

h bis) Main operations for lasting of ladies' shoes, by means of the chain-conveyor:

- insole fixing on the shoe last and trimming (if necessary)
- toe-puff applying
- back counter applying and shaping
- upper inside edge roughing
- toe-puff humidifying
- upper application on the last, edge binding and

- fixing to the insole (front part)
- back counter humidifying
- seat and waist edge fixing to the insole
- lining fixing to the last
- pounding up of the edge fixed on the bottom
- toe-end pounding up and heel seat forming
- upper seasoning (through an oven)
- lasted upper edge roughing
- lasted sole and bottom gluing (manually)
- lasted sole and bottom glue reactivation
- sole applying
- sole preforming to shoe last bottom
- heel nailing (with five nails)
- edge waxing
- sole brushing and polishing
- shoe last pulling over
- brand stamping on the sole
- box numbering and stamping
- cleaning of connection point between upper and sole
- inside insole gluing
- inside insole applying (manually)
- shoe back part reforming
- polishing/spraying cabin

i) Workshop:

department responsible for minor repairs and preparation of clicking dies for upper, lining and heavy material such as sole leather.

1) Bottom part preparation:

department responsible for the preparation of the unit sole by pig sole leather, of injected plastic

heels and of cover slices for plastic heels:

a) Sole preparation, main operations:

- . sole leather cutting
- . sole leather splitting
- . sole leather heel seat roughing
- . sole leather buffing
- . sole leather equalizing
- . sole leather Louis heel chamfering
- . sole leather edge roughing
- . sole leather stamping
- . welt applying to the sole leather (if necessary)

b) Heel cover slice preparation:

- . sole leather sheet cutting
- . sole leather sheet roughing
- . sole leather sheet gluing (manual operation)
- . sole leather sheet staking on
- . sole leather block slicing
- . sole leather cover slice reducing
- . sole leather preparation for mould (manual operation)

c) . cover slices preparation for mould (manual operation)

- . heel injection

d) . sole leather channelling and grooving for preparation to sole stitching operation.

5.1.2 Equipment list for leather shoe manufacturing

Q.ty    Description

-----

Pattern section

1        Pattern cutting and grading machine  
1        Pattern shears  
1        Hole making device

Upper cutting section

16       Swing beam press  
2        Lining numbering machine  
1        Splitting machine

Stitching section

1        Pneumatic rivetting machine with pedal  
1        Eyeletting machine  
4        Upper skiving machine  
3        Thermo folding machine  
15       Single-needle sewing machine  
4        Dual needle, heavy duty, work stitch, flat-bed sewing machine  
4        Single needle lockstitch, post bed sewing machine  
4        Two needle post-bed sewing machine  
3        Single needle lock-stitch cylinder-bed sewing machine  
2        High speed zig-zag sewing machine

- 4 Lining trimming machine
- 1 Two ways automatic belt conveyor (38 stations)

Assembling and finishing section (men's and children's shoes)

Equipment and machines included in the assembling and finishing section are listed according to their actual position in the line. Some equipment are duplicated for lay out optimization reasons.

- 1 Conveyor with 2 independent chains of 48 m
- 1 Insole applying machine with trimmer
- 1 Toe-puff press applying machine
- 1 Back counter shaping machine
- 1 Upper edge roughing machine
- 1 Toe-puff humidifier by superheated steam
- 1 Pulling over and lasting machine
- 1 Back counter humidifier
- 1 Seat and waist lasting machine
- 1 Lining fixing machine
- 1 Heavy duty pounding up machine
- 1 Light weight pounding up machine
- 1 Pneumatic toe-end pounding up and heel fixing machine
- 1 Lasting margin pounding up machine
- 1 Seasoning oven
- 1 Roughing machine
- 1 Glue reactivating machine
- 1 Hydraulic sole press
- 1 Groove opening machine
- 1 Hydraulic last pulling out machine
- 1 Sewing machine for leather insole



- 1 Pneumatic uppers assembly apparatus
- 1 Hydraulic automatic cycle heel nailing machine
- 1 Sole edge trimming machine
- 1 Polishing machine, with four independent places, and temperature control
- 3 Brushing machine for heels/edge/ bottom parts of shoes
- 1 Last pulling out machine
- 2 Pneumatic insole stamping machine for brand embossing
- 1 Box numbering machine
- 1 Sock lining cementing machine
- 2 Brushing machine
- 1 Spraying and polishing machine
- 1 Back part reforming machine

Assembling and finishing section (ladies' shoes)

- 1 Conveyor with 2 independent chains, 48 m length
- 1 Insole applying machine with trimmer
- 1 Back counter shaping machine
- 1 Toe-puff press applying machine
- 1 Upper edge roughing machine
- 1 Pulling over and lasting machine
- 1 Seat and waist lasting machine
- 1 Automatic heat setter with conveyor for ironing and conditioning shoes
- 1 Pounding up machine (light type)
- 1 Roughing machine
- 1 Glue reactivating machine
- 1 Hydraulic sole press
- 1 Hydraulic last pulling out machine
- 1 Hydraulic automatic cycle heel nailing machine

- 1 Socklining cementing machine
- 1 Finishing table
- 1 Brushing machine
- 1 Box numbering machine

### 5.1.3 Training shoe manufacturing process

#### Cutting and clicking dept.

The work carried out in this section consists in transforming the raw leathers and canvas into the pieces of material necessary for the finished uppers.

The first operation is the preparation of the working sheets, whose operative programme is on this basis:

- control and preparation of hides and/or canvas to be distributed to the cutting
- distribution of the clicking dies at the cutting machines
- the numbering of pieces to be cut
- quantity and quality control of cut pieces
- thickness levelling of the cut pieces
- number size stamping on the inside quarter of the upper
- collecting of all the pieces and transferring at sewing department

#### Preparation and closing department

This section carries out the assembly of the actual upper ready for soling by stitching and mounting, using the tracing on the individual parts as a guideline for the sewing operations. The edge of each piece, where

overlapping occurs, are skived, and the open edges are cleaned.

The reinforcing pieces are positioned and attached; after the assembly is completed the rivets, eyelets, etc. are added using the appropriate machine for the purpose.

The main working phases are as follows:

- loading of the conveyor for all the working phases
- skiving
- sewing of the quarters, back strips and outside counter
- preparation and sewing of the facing stay and bellow tongue
- preparation of the lining on the vamp
- sewing of the bellows tongue on the vamps
- attaching of the eyelets
- quality control of finished upper.

#### Injection department

The machine used is a rotary injection machine, with 24 stations, where the uppers are mounted onto the aluminium lasts and processed at each station.

Automatically, while going around the table, the lasted upper descends into a mould which closes and then the PU mixture is injected into the mould and after the chemical reaction of foaming takes place the PU adheres to the upper and takes the shape and design of the sole from the mould.

After curing (while the machine continues to rotate) the mould opens, the last rises, and the operator removes the finished shoes from their aluminium last.

A new upper is then lasted and the complete cycle is repeated.

The finished shoes are then inspected, laced, polished and boxed for sending to the finished goods store.

Lasting and finishing dept.

Here the assembly of the actual upper onto a plastic or wooden last is made, adding toe-puff, counter and insole. Again, a moving conveyor system is used for these operations.

Finally the last is removed and the complete upper passed to the next section, the direct injection soling section or unit sole section, depending on the production programme.

5.1.4 Equipment list for canvas and training shoe manufacturing

Q.ty Description

-----

Pattern section

1	Pattern cutting and grading machine
1	Pattern shears
1	Hole making device

Upper cutting section

10	Swing beam press
2	Hydraulic cutting press with movable beam
2	Hydraulic cutting press with movable trolley
2	Lining numbering machine
1	Splitting machine

Stitching section

1	Pneumatic rivetting machine with pedal
1	Eyeletting machine
2	Upper skiving machine
2	Thermo-folding machine
1	Sewing machine
15	Single needle sewing machine
4	Dual needle heavy duty flat-bed sewing machine
2	Single needle post-bed sewing machine
4	Dual needle post-bed sewing machine

- 2 Single needle lock stitch cylinder bed sewing machine
- 2 High speed zig-zag sewing machine
- 2 Lining trimming machine
- 1 Two-way automatic belt conveyor (38 stations)

Assembling and finishing section

- 2 Injection machine-24 sections-2 colours
- 1 Lining numbering machine
- 1 Manual conveyor for lasting
- 1 Insole trimming machine
- 1 High speed glueing machine
- 1 Box marking machine
- 2 Trimming machine

5.2 Packaging

Both types of shoes, leather shoes and training shoes, will be packaged in cardboard boxes, one for each pair. The entire operation will be carried out manually. The cost of each box has been estimated at 0.5 \$.

5.3 Layout and civil works

The lay-out of the plant is shown on the attached drawing.

All the process equipment, the utilities and facilities plants and the administrative offices are installed in single-storey buildings:

- 9000 sq.m for the leather shoe factory only
- 6000 sq.m for the training shoe factory only
- 10100 sq.m for the manufacture of both articles.

The building has a supporting structure made of reinforced concrete; external and internal walls of the brickwork type; the roof is covered with corrugated asbestos-cement, insulated with mineral wool lagging; the floors of the processing rooms, storage rooms, workshops and utility installations are made of concrete with a hard aggregate as finishing surface. The offices and the rooms for social facilities have tiled floors. The courtyard around the building is covered with rolled gravel.

A fence, made of a steel wire-netting supported by small steel poles, encloses the entire factory area.

5.4 Investment costs, depreciation and maintenance

The investment cost for one single factory for leather and canvas or training shoes manufacturing are as follows:

	LC	FC	TOTAL
	M\$	M\$	M\$
Process machinery and equipment for leather shoes manufacture FOB European port	-	1.136	1.136
Process machinery and equipment for training shoes manufacture FOB European port	-	1.564	1.564
Utility and general facility plants, FOB European port, including:			
. electric substation and distribution system (1300 KVA)			
. compressed air system			
. water system			
. facilities for weighing, receiving and shipping goods			
. internal means of transport	-	0.405	0.405
		-----	
	-	3.105	3.105
Transportation	0.310	0.310	0.620
Erection	0.465	0.155	0.620
Land and site preparation	0.225	-	0.225



Civil works	2.250	-	2.250
Spare parts	-	0.120	0.120
	-----		
	3.250	3.690	6.940
Contingencies	0.350	0.310	0.660
	-----		
Grand total	3.600	4.000	7.600

In the event of the construction of two separate factories, one for leather shoes and one for training shoes, the total investment will be:

	LC M\$	FC M\$	Total
a) for leather shoes	2,810	1,890	4,700
b) for training shoes	2.230	2,460	4,690

The life cycle of the plant is estimated as 15 years. Annual maintenance expenditure is evaluated as equivalent to the 2% of the cost of machinery and equipment, that is 62000 \$/y.

In the financial evaluations, the investment costs (contingencies included) are grouped as follows:

- for one factory

Machinery	FC	4.000	million dollars
Machinery	LC	0.775	" "
Site preparation	LC	0.225	" "
Civil works	LC	2.600	" "
		-----	
		7.600	" "

- for two separate factories

. leather shoes

Machinery	FC	1.890	million dollars		
Machinery	LC	0.360	"	"	
Site preparation	LC	0.200	"	"	
Civil works	LC	2.250	"	"	
		-----			
		4.700	"	"	

. training shoes

Machinery	FC	2.460	million dollars		
Machinery	LC	465	"	"	
Site preparation	LC	134	"	"	
Civil works	LC	1.531	"	"	
		-----			
		4.590	"	"	

6. PLANT ORGANIZATION

The factory or factories are conceived as autonomous production units, operating under the direction of the NLSC.

7. MANPOWER

Accurate training is necessary if high quality production is to be attained, especially for the export market. Particular attention should be paid to the training of supervisors foremen, maintenance supervisors and stylist.

It is recommended that one or two foreign experts provide technical assistance for approximately 6 months. This assistance will make on-the-job training possible.

7.1 Management and administrative department

If one single factory is built, for the production of both leather and training shoes, the following personnel is required:

		birr/m	birr/y
General manager	1	1500	
Technical manager	1	1200	
Financial Manager	1	1000	
Senior Accountant	1	400	
Purchasing Dep.Head	1	400	
Sale Dep.Head	1	400	
Warehouse Head	1	400	
Senior clerks	8	2800	
Secretaries and clerks	10	3000	
Drivers	3	1050	
Guards	12	2400	
	--	-----	-----
	38	11850	142200
			(68,696 \$/y)

If there are two separate factories both these figures would, in practice, be doubled.

7.2 Production department

The following figures are valid either for one single factory (sum of A + B + C) or for two separate factories (A+C and B+C separately):

		birr/m	birr/y
<b>A) <u>leather shoes department (two shifts)</u></b>			
Production manager	1	1000	
Section supervisors	10	7000	
Foremen	18	7200	
Clerks	12	3600	
Workers	360	97920	
of whom:			
skilled	22%		
semiskilled	39%		
unskilled	39%	-----	-----
	400	116,720	1,400,640
<b>B) <u>training shoe department</u></b>			
Production Manager	1	1000	
Section supervisors	9	6300	
Foremen	15	6000	
Clerks	6	1800	
Workers	240	65280	
of whom:			
skilled	22%		
semiskilled	39%		
unskilled	39%	-----	-----
	270	80380	964,560

C) Pattern Department

Stylist	1	700	
Assistants	2	700	
	--	----	-----
	3	1400	16,800
 Total			 2,382,000
b/y			(1,150,725 \$/y)

7.3 Maintenance department

The following figures are estimated for one single factory. For two separate factories the total requirements are given by multiplying this value by 1.6.

Chief engineer	1	1000	
Supervisors	2	1400	
Mechanics	6	2400	
Electricians	4	1600	
Instrument specialists	4	1600	
Handymen	4	1050	
	--	----	-----
	21	9050	108600
			(52,464 \$/y)

8. IMPLEMENTATION SCHEDULING

From the signing of the contract with the contractor, a total construction time of two years will be required.

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. The evaluation has been based on the data indicated in the foreword, in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	30
work in progress	7	7
energy	1	1

- the assistance of two foreign experts for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"

- packaging costs have been included in "utilities"

- the production programme has been assumed as follows

1st year: 40% capacity, that is:

150,000 leather shoes (export market)  
450,000 leather shoes (domestic market)  
150,000 training shoes (export market)  
450,000 training shoes (domestic market)

2nd year: 60% capacity, that is:

225,000 leather shoes (export market)  
675,000 leather shoes (domestic market)  
225,000 training shoes (export market)  
675,000 training shoes (domestic market)



3rd year: 80% capacity, that is:

300,000 leather shoes (export market)

900,000 leather shoes (domestic market)

300,000 training shoes (export market)

900,000 training shoes (domestic market)

from 4th to 5th year: 100% capacity, that is

375,000 leather shoes (export market)

1,125,000 leather shoes (domestic market)

375,000 training shoes (export market)

1,125,000 training shoes (domestic market)

Selling price:

26 \$/p for leather shoes for export market

16 \$/p for leather shoes for domestic market

20 \$/p for training shoes per export market

12 \$/p for training shoes for domestic market

The evaluation has been carried out for two alternatives:

Alternative A: one factory, with a production program as above shown; construction costs, for this solution, are indicated in par. 3.2.

Alternative B: two separate factories, one for leather shoes (B1) and one for training shoes, (B2); production program as above shown; construction costs, for this second solution, are indicated in par. 3.2.

The evaluation gives an IRR of 31.58% for the Alternative A, 33.95% for the Alternative B1 and 21.2% for the Alternative B2. The BEP results, in the same order, 72%, 6.7% and 11.7%.

Another alternative has been considered (alternative C) consisting in a leather shoes factory with a production capacity of :

400,000 pairs/y of lady shoes	
600,000 pairs/y of gentleman lasted moccasins	
-----	
1,000,000	

This capacity corresponds to 67% of the capacity of the Alternative B1, but the investment costs are not less than the 80% of that solution; in fact only the machinery of "stitching section" are substantially modified; the other sections remaining practically unchanged (the length of the conveyor chains passes from 40 to 30 m).

Administrative and maintenance personnel is the same of Alternative B1, while production costs can be reduced to 67%. The production programme is : 40% the 1st year, 60% the 2nd, 80% the 3rd and 100% from the 4th to the 15th year.

On this basis the evaluation gives an IRR of 30% and a BEP of 8.4%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 6.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items. Since Ethiopia has no import of shoes the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) is zero. Consequently both the net foreign exchange flow and the foreign exchange effect have the same value. The result of the computation is positive; by discounting the annual net foreign exchange flow at the rate of 10% the calculation arrives at a present value of the foreign exchange flow amounting to 40,250,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 40,250,000 \$.

The discounted net foreign exchange effect for the other alternatives is as follows:

- Alternative B1 - 30,316,000 \$
- " B2 - 9,582,000 \$

Leather and canvas shoes

ANNEXE 1

**FINANCIAL EVALUATION**  
**FOR ALTERNATIVE A**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

LEATHER & CANVAS SHOES  
February 83  
Altern.C. Leath. shoes lower capacity

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US \$

---

**Total initial investment during construction phase**

fixed assets:	4063.50	40.372 % foreign
current assets:	0.00	0.000 % foreign
total assets:	4063.50	40.372 % foreign

---

**Source of funds during construction phase**

equity & grants:	2650.00	0.000 % foreign
foreign loans :	1285.00	
local loans :	0.00	
total funds :	3935.00	32.656 % foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	5714.26	8186.39	10718.52
depreciation :	277.06	277.06	261.06
interest :	128.50	112.44	96.38
production costs	6119.82	8575.89	11075.95
thereof foreign	22.75 %	21.78 %	21.70 %
total sales :	7400.00	11100.00	14800.00
gross income :	1280.18	2524.11	3724.05
net income :	640.09	1262.06	1862.02
cash balance :	-837.39	646.59	1217.06
net cashflow :	-948.26	919.65	1474.06

Net Present Value at: 10.00 % = 10719.50  
Internal Rate of Return: 30.30 %  
Return on equity1: 42.03 %  
Return on equity2: 31.84 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US \$**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	160.00	0.00
Buildings and civil works .....	1500.00	300.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	302.00	1498.00
<b>Total fixed investment costs ....</b>	<b>1962.00</b>	<b>1798.00</b>
Pre-production capital expenditures.	20.00	283.50
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>1982.00</b>	<b>2081.50</b>
<b>Of it foreign, in % .....</b>	<b>15.2%</b>	<b>64.30</b>

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**Total Current Investment in 1000 US \$**

Year .....	1989	1990	1991-92
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital .....	1593.91	731.90	745.40
<b>Total current investment costs ...</b>	<b>1593.91</b>	<b>731.90</b>	<b>745.40</b>
Of it foreign, % .....	48.34	49.87	50.78



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**Total Production Costs in 1000 US \$**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material I .....	12038.68	12038.68	12038.68	12038.68	12038.68	12038.68
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	500.25	500.25	500.25	500.25	500.25	500.25
Energy .....	106.72	106.72	106.72	106.72	106.72	106.72
Labour, direct .....	479.33	479.33	479.33	479.33	479.33	479.33
Repair, maintenance .....	41.97	41.97	41.97	41.97	41.97	41.97
Spares .....	15.00	15.00	15.00	15.00	15.00	15.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>13181.95</b>	<b>13181.95</b>	<b>13181.95</b>	<b>13181.95</b>	<b>13181.95</b>	<b>13181.95</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	210.06	210.06	210.06	120.06	59.22	0.00
Financial costs .....	32.13	16.06	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>13492.83</b>	<b>13476.77</b>	<b>13460.71</b>	<b>13370.71</b>	<b>13309.87</b>	<b>13250.65</b>
<b>Costs per unit ( single product ) .</b>	<b>13.49</b>	<b>13.48</b>	<b>13.46</b>	<b>13.37</b>	<b>13.31</b>	<b>13.25</b>
Of it foreign, % .....	21.42	21.33	21.24	21.38	21.09	20.81
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	548.03	548.03	548.03	548.03	548.03	548.03





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Total Production Costs in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product)	40.00	60.00	80.00	100.00	100.00	100.00
Raw material 1 .....	4815.47	7223.21	9630.94	12038.68	12038.68	12038.68
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	200.10	300.15	400.20	500.25	500.25	500.25
Energy .....	42.69	64.03	85.38	106.72	106.72	106.72
Labour, direct .....	479.33	479.33	479.33	479.33	479.33	479.33
Repair, maintenance .....	41.97	41.97	41.97	41.97	41.97	41.97
Spares .....	6.00	9.00	12.00	15.00	15.00	15.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>5945.56</b>	<b>8117.69</b>	<b>10649.82</b>	<b>13181.95</b>	<b>13181.95</b>	<b>13181.95</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	277.06	277.06	261.06	245.06	245.06	210.06
Financial costs .....	128.50	112.44	96.38	80.31	64.25	48.19
<b>Total production costs .....</b>	<b>6119.82</b>	<b>8575.89</b>	<b>11075.95</b>	<b>13576.02</b>	<b>13559.96</b>	<b>13508.90</b>
<b>Costs per unit (single product) .</b>	<b>15.30</b>	<b>14.29</b>	<b>13.84</b>	<b>13.58</b>	<b>13.56</b>	<b>13.51</b>
Of it foreign, % .....	22.75	21.78	21.70	21.65	21.55	21.52
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	548.03	548.03	548.03	548.03	548.03	548.03

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US \$**

Year .....		1989	1990	1991	1992	1993-2003
Coverage .....	ndc coto					
<b>Current assets &amp;</b>						
Accounts receivable . . . . .	30 12.0	476.19	682.20	893.21	1104.22	1104.22
Inventory and materials . . . . .	63 5.7	875.08	1312.62	1750.16	2187.70	2187.70
Energy . . . . .	1 360.0	0.12	0.18	0.24	0.30	0.30
Spares . . . . .	360 1.0	6.00	9.00	12.00	15.00	15.00
Work in progress . . . . .	7 51.4	109.77	157.84	207.08	256.32	256.32
Finished products . . . . .	30 12.0	476.19	682.20	893.21	1104.22	1104.22
Cash in hand . . . . .	15 24.0	27.33	24.96	25.08	25.21	25.21
Total current assets . . . . .		1970.68	2869.00	3780.98	4692.96	4692.96
<b>Current liabilities and</b>						
Accounts payable . . . . .	24 15.0	376.77	543.19	709.77	876.35	876.35
Net working capital . . . . .		1593.91	2325.81	3071.22	3816.62	3816.62
Increase in working capital . . . . .		1593.91	731.90	745.40	745.40	0.00
Net working capital, local . . . . .		823.39	1190.28	1557.17	1924.06	1924.06
Net working capital, foreign . . . . .		770.52	1135.53	1514.04	1892.55	1892.55

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.1 - GALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	2650.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1285.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1285.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	128.50
Total funds .....	3935.00	128.50

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-160.63	-160.63	-160.63	-160.63	-160.63
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-160.63	-160.63	-160.63	-160.63	-160.63
Current liabilities	376.77	166.41	166.58	166.58	0.00
Bank overdraft ....	837.39	-846.59	-319.30	0.00	0.00
Total funds .....	1053.53	-640.80	-313.34	5.96	-160.63

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US \$

Year . . . . .	1987	1988
Total cash inflow . .	3935.00	0.00
Financial resources .	3935.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	1982.00	2081.50
Total assets . . . .	1982.00	1953.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	128.50
Repayment . . . . .	0.00	0.00
Corporate tax . . .	0.00	0.00
Dividends paid . . .	0.00	0.00
Surplus ( deficit ) .	1953.00	-2081.50
Cumulated cash balance	1953.00	-128.50
Inflow, local . . . .	2850.00	0.00
Outflow, local . . . .	1680.00	743.00
Surplus ( deficit ) .	970.00	-743.00
Inflow, foreign . . .	1285.00	0.00
Outflow, foreign . . .	302.00	1338.50
Surplus ( deficit ) .	983.00	-1338.50
Net cashflow . . . . .	-1982.00	-1953.00
Cumulated net cashflow	-1982.00	-3935.00

## Cashflow tables, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994
Total cash inflow ..	7776.77	11266.41	14966.58	18666.58	18500.00	18500.00
Financial resources ..	376.77	166.41	166.58	166.58	0.00	0.00
Sales, net of tax ..	7400.00	11100.00	14800.00	18500.00	18500.00	18500.00
Total cash outflow ..	8614.16	10619.83	13749.52	16865.56	15945.55	15955.02
Total assets .....	1970.68	898.32	911.98	911.98	0.00	0.00
Operating costs ...	5714.26	8186.39	10718.52	13250.65	13250.65	13250.65
Cost of finance ...	128.50	112.44	96.38	80.31	64.25	48.19
Repayment .....	160.63	160.63	160.63	160.63	160.63	160.63
Corporate tax ...	640.09	1282.06	1862.02	2461.99	2470.02	2495.55
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-837.39	646.59	1217.06	1801.02	2554.45	2544.98
Cumulated cash balance	-965.89	-319.30	897.76	2698.78	5253.23	7798.22
Inflow, local .....	5173.54	7365.05	9765.05	12165.05	12000.00	12000.00
Outflow, local .....	6388.20	8325.77	10906.32	13486.88	12962.97	12988.50
Surplus ( deficit ) .	-1214.66	-960.72	-1141.27	-1321.83	-962.97	-988.50
Inflow, foreign ...	2603.23	3901.37	5201.53	6501.53	6500.00	6500.00
Outflow, foreign ...	2225.96	2294.06	2843.20	3378.68	2982.58	2966.51
Surplus ( deficit ) .	377.27	1607.31	2358.33	3122.85	3517.42	3533.49
Net cashflow .....	-548.26	919.65	1474.06	2041.96	2779.33	2753.80
Cumulated net cashflow	-4483.26	-3563.61	-2089.55	-47.60	2731.73	5485.53



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	18500.00	18500.00	18500.00	18500.00	18500.00	18500.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	18500.00	18500.00	18500.00	18500.00	18500.00	18500.00
Total cash outflow . .	15946.98	15938.95	15770.30	15770.30	15815.30	15815.30
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	13250.65	13250.65	13250.65	13250.65	13250.65	13250.65
Cost of finance . . .	32.13	16.06	0.00	0.00	0.00	0.00
Repayment . . . . .	160.63	160.63	0.00	0.00	0.00	0.00
Corporate tax . . . .	2503.58	2511.61	2519.65	2519.65	2564.65	2564.65
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	2553.02	2561.05	2729.70	2729.70	2684.70	2684.70
Cumulated cash balance	10351.23	12912.28	15641.98	18371.69	21056.39	23741.09
Inflow, local . . . . .	12000.00	12000.00	12000.00	12000.00	12000.00	12000.00
Outflow, local . . . .	12996.53	13004.56	13012.60	13012.60	13057.60	13057.60
Surplus ( deficit ) . .	-996.53	-1004.56	-1012.60	-1012.60	-1057.60	-1057.60
Inflow, foreign . . . .	6500.00	6500.00	6500.00	6500.00	6500.00	6500.00
Outflow, foreign . . . .	2950.45	2934.39	2757.70	2757.70	2757.70	2757.70
Surplus ( deficit ) . .	3549.55	3565.61	3742.30	3742.30	3742.30	3742.30
Net cashflow . . . . .	2745.77	2737.73	2729.70	2729.70	2684.70	2684.70
Cumulated net cashflow	8231.30	10969.03	13698.73	16428.44	19113.14	21797.84



Cashflow tables, production in 1000 US \$

Year .....	2001	2002	2003
Total cash inflow ..	18500.00	18500.00	18500.00
Financial resources ..	0.00	0.00	0.00
Sales, net of tax ..	18500.00	18500.00	18500.00
Total cash outflow ..	15815.30	15845.72	15875.33
Total assets .....	0.00	0.00	0.00
Operating costs ...	13250.65	13250.65	13250.65
Cost of finance ...	0.00	0.00	0.00
Repayment .....	0.00	0.00	0.00
Corporate tax ...	2564.65	2595.06	2624.67
Dividends paid ...	0.00	0.00	0.00
Surplus ( deficit ) .	2684.70	2654.28	2624.67
Cumulated cash balance	26425.79	29080.08	31704.75
Inflow, local .....	12000.00	12000.00	12000.00
Outflow, local .....	13057.60	13088.02	13117.63
Surplus ( deficit ) .	-1057.60	-1088.02	-1117.63
Inflow, foreign ...	6500.00	6500.00	6500.00
Outflow, foreign ...	2757.70	2757.70	2757.70
Surplus ( deficit ) .	3742.30	3742.30	3742.30
Net cashflow .....	2684.70	2654.28	2624.67
Cumulated net cashflow	24482.55	27136.83	29761.50





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	11818.08 at	10.00 %
Internal Rate of Return (IRRE1) ..	42.03 %	
b) Net Worth versus Net cash return:		
Net present value .....	10658.77 at	10.00 %
Internal Rate of Return (IRRE2) ..	31.84 %	
c) Internal Rate of Return on total investment:		
Net present value .....	10719.50 at	10.00 %
Internal Rate of Return (IRR) ..	30.30 %	

Net Worth = Equity paid plus reserves

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LEATHER & OWNS SHOES — February 88



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**Net Income Statement in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	7400.00	11100.00	14800.00	18500.00	18500.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	7400.00	11100.00	14800.00	18500.00	18500.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	5991.32	8463.46	10979.58	13495.71	13495.71
Operational margin . . . . .	1408.68	2636.55	3820.42	5004.29	5004.29
As % of total sales . . . . .	19.04	23.75	25.81	27.05	27.05
Cost of finance . . . . .	128.50	112.44	96.38	80.31	64.25
Gross profit . . . . .	1280.18	2524.11	3724.05	4923.98	4940.04
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	1280.18	2524.11	3724.05	4923.98	4940.04
Tax . . . . .	640.09	1262.06	1862.02	2461.99	2470.02
Net profit . . . . .	640.09	1262.06	1862.02	2461.99	2470.02
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	640.09	1262.06	1862.02	2461.99	2470.02
Accumulated undistributed profit . . . . .	640.09	1902.15	3744.17	6226.16	8696.18
Gross profit, % of total sales . . . . .	17.30	22.74	25.16	26.62	26.70
Net profit, % of total sales . . . . .	8.65	11.37	12.58	13.31	13.35
ROE, Net profit, % of equity . . . . .	24.15	47.62	70.27	92.91	93.21
ROI, Net profit+interest, % of invest. . . . .	13.90	21.95	27.95	32.80	32.69



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	18500.00	18500.00	18500.00	18500.00	18500.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	18500.00	18500.00	18500.00	18500.00	18500.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	13460.71	13460.71	13460.71	13460.71	13460.71
Operational margin . . . . .	5039.29	5039.29	5039.29	5039.29	5039.29
As % of total sales . . . . .	27.24	27.24	27.24	27.24	27.24
Cost of finance . . . . .	48.19	32.13	16.06	0.00	0.00
Gross profit . . . . .	4991.10	5007.17	5023.23	5039.29	5039.29
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	4991.10	5007.17	5023.23	5039.29	5039.29
Tax . . . . .	2495.55	2503.58	2511.61	2519.65	2519.65
Net profit . . . . .	2495.55	2503.58	2511.61	2519.65	2519.65
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	2495.55	2503.58	2511.61	2519.65	2519.65
Accumulated undistributed profit . . . . .	11191.73	13695.31	16206.92	18726.57	21246.21
Gross profit, % of total sales . . . . .	26.98	27.07	27.15	27.24	27.24
Net profit, % of total sales . . . . .	13.49	13.53	13.58	13.62	13.62
ROE, Net profit, % of equity . . . . .	94.17	94.47	94.78	95.08	95.08
ROI, Net profit+interest, % of invest. . . . .	32.82	32.71	32.61	32.50	32.50

**Net Income Statement in 1000 US \$**

Year .....	1999	2000	2001	2002	2003
Total sales, incl. sales tax .....	18500.00	18500.00	18500.00	18500.00	18500.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	18500.00	18500.00	18500.00	18500.00	18500.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	13370.71	13370.71	13370.71	13309.87	13250.65
Operational margin .....	5129.29	5129.29	5129.29	5190.13	5249.35
As % of total sales .....	27.73	27.73	27.73	28.05	28.37
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
Gross profit .....	5129.29	5129.29	5129.29	5190.13	5249.35
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	5129.29	5129.29	5129.29	5190.13	5249.35
Tax .....	2544.65	2544.65	2544.65	2595.06	2624.67
Net profit .....	2584.65	2584.65	2584.65	2595.06	2624.67
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	2584.65	2584.65	2584.65	2595.06	2624.67
Accumulated undistributed profit .....	23810.86	26375.50	28940.15	31535.21	34159.89
Gross profit, % of total sales .....	27.73	27.73	27.73	28.05	28.37
Net profit, % of total sales .....	13.86	13.86	13.86	14.03	14.19
ROE, Net profit, % of equity .....	96.78	96.78	96.78	97.93	99.04
ROI, Net profit+interest, % of invest. ....	33.09	33.09	33.09	33.48	33.86



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US \$

Year .....	1987	1988
Total assets .....	3935.00	4063.50
Fixed assets, net of depreciation	0.00	1982.00
Construction in progress .....	1932.00	2081.50
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	1953.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	3935.00	4063.50
Equity capital .....	2650.00	2650.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1285.00	1285.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	128.50
Total debt .....	1285.00	1413.50
Equity, % of liabilities .....	67.34	65.21



Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt . . . . .	1036.97	876.35	876.35	876.35	876.35	876.35
Equity, % of liabilities . . . .	15.25	13.43	11.91	10.70	9.69	8.86

LEATHER & CANVAS SHOES — February 88



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>32466.49</b>	<b>35061.56</b>	<b>37686.23</b>
Fixed assets, net of depreciation	1347.72	1288.50	1288.50
Construction in progress .....	0.00	0.00	0.00
Current assets .....	4667.76	4667.76	4667.76
Cash, bank .....	25.21	25.21	25.21
Cash surplus, finance available .	26425.81	29080.09	31704.77
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>32466.49</b>	<b>35061.56</b>	<b>37686.23</b>
Equity capital .....	2650.00	2650.00	2650.00
Reserves, retained profit .....	26375.50	28940.15	31535.21
Profit .....	2584.65	2595.06	2624.67
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	876.35	876.35	876.35
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>876.35</b>	<b>876.35</b>	<b>876.35</b>
<b>Equity, % of liabilities .....</b>	<b>8.16</b>	<b>7.56</b>	<b>7.03</b>



Leather and canvas shoes

ANNEXE 2

FINANCIAL EVALUATION  
FOR ALTERNATIVE B1



**LEATHER & CANVAS SHOES**

February 88

Altern.B2 - Train shoes separate factory

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	4979.10	53.606 % foreign
current assets:	0.00	0.000 % foreign
total assets:	4979.10	53.606 % foreign

**Source of funds during construction phase**

equity & grants:	2679.00	0.000 % foreign
foreign loans :	2091.00	
local loans :	0.00	
total funds :	4770.00	43.836 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	7018.38	10145.18	13331.98
depreciation :	334.45	334.45	321.05
interest :	209.10	182.96	156.82
production costs	7561.93	10662.59	13809.85
thereof foreign	33.23 %	32.52 %	32.45 %
total sales :	8400.00	12600.00	16800.00
gross income :	838.07	1937.41	2990.15
net income :	419.04	968.70	1495.07
cash balance :	-1836.15	-57.67	441.80
net cashflow :	-1365.67	386.67	860.00

Net Present Value at: 10.00 % = 6996.62

Internal Rate of Return on total investment: 21.12 %

Equity paid versus Net income flow (IRR): 36.04 %

Net Worth versus Net Cash Return (IRR): 22.37 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US \$**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	134.00	0.00
Buildings and civil works .....	1300.00	231.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	492.00	2433.00
<b>Total fixed investment costs .....</b>	<b>1926.00</b>	<b>2664.00</b>
Pre-production capital expenditures.	20.00	369.10
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>1946.00</b>	<b>3033.10</b>
<b>Of it foreign, in % .....</b>	<b>25.28</b>	<b>71.78</b>

LEATHER & CANVAS SHOES — February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US \$**

Year .....	1989	1990	1991	1992
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00
Working capital .....	2328.25	1099.45	1112.95	1110.50
<b>Total current investment costs . . .</b>	<b>2328.25</b>	<b>1099.45</b>	<b>1112.95</b>	<b>1110.50</b>
Of it foreign, % .....	62.00	63.80	64.24	64.16

LEATHER & CANVAS SHOES — February 88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of max. capacity (single product).	40.00	60.00	80.00	100.00	100.00	100.00
Raw material 1 . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Other raw materials . . . . .	6018.00	9027.00	12036.00	15045.00	15045.00	15045.00
Utilities . . . . .	300.00	450.00	600.00	750.00	750.00	750.00
Energy . . . . .	39.60	59.40	79.20	99.00	99.00	99.00
Labour, direct . . . . .	474.11	474.11	474.11	474.11	474.11	474.11
Repair, maintenance . . . . .	41.97	41.97	41.97	41.97	41.97	41.97
Spares . . . . .	16.00	24.00	32.00	38.00	38.00	38.00
Factory overheads . . . . .	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>6949.68</b>	<b>10076.48</b>	<b>13263.28</b>	<b>16448.09</b>	<b>16448.08</b>	<b>16448.08</b>
Administrative overheads . . . . .	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	334.45	334.45	321.05	307.65	307.65	271.65
Financial costs . . . . .	209.10	182.96	156.82	130.69	104.55	78.41
<b>Total production costs . . . . .</b>	<b>7561.93</b>	<b>10662.59</b>	<b>13809.85</b>	<b>16955.12</b>	<b>16928.98</b>	<b>16866.84</b>
<b>Costs per unit ( single product ) .</b>	<b>12.60</b>	<b>11.85</b>	<b>11.51</b>	<b>11.30</b>	<b>11.29</b>	<b>11.24</b>
Of it foreign, % . . . . .	33.23	32.52	32.45	32.40	32.29	32.26
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total labour . . . . .</b>	<b>542.81</b>	<b>542.81</b>	<b>542.81</b>	<b>542.81</b>	<b>542.81</b>	<b>542.81</b>



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COMFAR 2.0 - ERLIO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US \$**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	0.00	0.00	0.00	0.00	0.00	0.00
Other raw materials .....	15045.00	15045.00	15045.00	15045.00	15045.00	15045.00
Utilities .....	750.00	750.00	750.00	750.00	750.00	750.00
Energy .....	99.00	99.00	99.00	99.00	99.00	99.00
Labour, direct .....	474.11	474.11	474.11	474.11	474.11	474.11
Repair, maintenance .....	41.97	41.97	41.97	41.97	41.97	41.97
Spares .....	38.00	38.00	38.00	38.00	38.00	38.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>16448.08</b>	<b>16448.08</b>	<b>16448.08</b>	<b>16448.08</b>	<b>16448.08</b>	<b>16448.08</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	271.65	271.65	271.65	195.10	96.23	0.00
Financial costs .....	52.28	26.14	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>16840.70</b>	<b>16814.56</b>	<b>16788.43</b>	<b>16711.88</b>	<b>16613.01</b>	<b>16516.78</b>
<b>Costs per unit ( single product ) .</b>	<b>11.23</b>	<b>11.21</b>	<b>11.19</b>	<b>11.14</b>	<b>11.08</b>	<b>11.01</b>
Of it foreign, % .....	32.15	32.04	31.94	32.09	31.78	31.47
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	542.81	542.81	542.81	542.81	542.81	542.81

LEATHER & CANVAS SHOES — February 88



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US \$

Year .....	1989	1990	1991	1992	1993-2003
Coverage ..... <i>ndc</i> <i>coto</i>					
<b>Current assets &amp;</b>					
Accounts receivable . . . . . 30 12.0	594.87	845.43	1111.00	1376.40	1376.40
Inventory and materials . . . . . 79 4.5	1386.50	2079.75	2773.00	3466.25	3466.25
Energy . . . . . 1 360.0	0.11	0.17	0.22	0.28	0.28
Spares . . . . . 360 1.0	16.00	24.00	32.00	38.00	38.00
Work in progress . . . . . 7 51.4	135.13	195.93	257.90	319.82	319.82
Finished products . . . . . 30 12.0	594.87	845.43	1111.00	1376.40	1376.40
Cash in hand . . . . . 15 24.0	27.53	25.37	25.70	25.95	25.95
<b>Total current assets</b> . . . . .	<b>2735.01</b>	<b>4016.08</b>	<b>5310.81</b>	<b>6603.99</b>	<b>6603.09</b>
<b>Current liabilities and</b>					
Accounts payable . . . . . 21 17.3	406.75	588.37	770.16	951.95	951.95
<b>Net working capital</b> . . . . .	<b>2328.25</b>	<b>3427.70</b>	<b>4540.65</b>	<b>5651.15</b>	<b>5651.15</b>
<b>Increase in working capital</b> . . . . .	<b>2328.25</b>	<b>1099.45</b>	<b>1112.95</b>	<b>1110.50</b>	<b>0.00</b>
<b>Net working capital, local</b> . . . . .	<b>884.75</b>	<b>1282.70</b>	<b>1680.65</b>	<b>2078.60</b>	<b>2078.60</b>
<b>Net working capital, foreign</b> . . . . .	<b>1443.50</b>	<b>2145.00</b>	<b>2860.00</b>	<b>3572.55</b>	<b>3572.55</b>

Note: *ndc* = minimum days of coverage ; *coto* = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	2679.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	2091.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	2091.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	209.10
Total funds .....	4770.00	209.10

LEATHER & CANVAS SHOES — February 88



Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-261.38	-261.38	-261.38	-261.38	-261.38	-261.38
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total loan .....</b>	<b>-261.38</b>	<b>-261.38</b>	<b>-261.38</b>	<b>-261.38</b>	<b>-261.38</b>	<b>-261.38</b>
Current liabilities	406.75	181.62	181.79	181.78	0.00	0.00
Bank overdraft ....	1836.15	57.67	-441.80	-958.22	-702.90	0.00
<b>Total funds .....</b>	<b>1981.52</b>	<b>-22.08</b>	<b>-521.38</b>	<b>-1037.81</b>	<b>-964.28</b>	<b>-261.38</b>



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Cashflow Tables, construction in 1000 US \$

Year .....	1987	1988
Total cash inflow ..	4770.00	0.00
Financial resources .	4770.00	0.00
Sales, net of tax ..	0.00	0.00
Total cash outflow ..	1946.00	3033.10
Total assets .....	1946.00	2824.00
Operating costs ...	0.00	0.00
Cost of finance ...	0.00	209.10
Repayment .....	0.00	0.00
Corporate tax ...	0.00	0.00
Dividends paid ...	0.00	0.00
Surplus ( deficit ) .	2824.00	-3033.10
Cumulated cash balance	2824.00	-209.10
Inflow, local .....	2679.00	0.00
Outflow, local .....	1454.00	856.00
Surplus ( deficit ) .	1225.00	-856.00
Inflow, foreign ...	2091.00	0.00
Outflow, foreign ...	492.00	2177.10
Surplus ( deficit ) .	1599.00	-2177.10
Net cashflow .....	-1946.00	-2824.00
Cumulated net cashflow	-1946.00	-4770.00

LEATHER & CANVAS SHOES — February 88



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Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	8806.75	12781.62	16981.79	21181.78	21000.00	21000.00
Financial resources .	406.75	181.62	181.79	181.78	0.00	0.00
Sales, net of tax . .	8400.00	12600.00	16800.00	21000.00	21000.00	21000.00
Total cash outflow . .	10642.90	12839.29	16539.99	20223.57	18918.22	18923.15
Total assets . . . .	2735.01	1281.07	1294.74	1292.28	0.00	0.00
Operating costs . . .	7018.38	10145.18	13331.98	16516.78	16516.78	16516.78
Cost of finance . . .	209.10	182.96	156.82	130.69	104.95	78.41
Repayment . . . . .	261.38	261.38	261.38	261.38	261.38	261.38
Corporate tax . . . .	419.04	968.70	1495.07	2022.44	2035.51	2066.58
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1836.15	-57.67	441.80	958.22	2081.78	2076.85
Cumulated cash balance	-2045.25	-2102.92	-1661.12	-702.90	1378.88	3455.73
Inflow, local . . . . .	5800.81	8278.90	10978.90	13678.90	13500.00	13500.00
Outflow, local . . . .	6582.98	8570.73	11243.90	13918.07	13354.29	13385.36
Surplus ( deficit ) .	-782.17	-291.83	-265.00	-239.17	145.71	114.64
Inflow, foreign . . . .	3005.94	4502.72	6002.89	7502.88	7500.00	7500.00
Outflow, foreign . . .	4059.92	4268.56	5296.09	6305.50	5563.92	5537.79
Surplus ( deficit ) .	-1053.98	234.16	706.80	1197.39	1936.08	1962.21
Net cashflow . . . . .	-1365.67	386.67	860.00	1350.28	2447.71	2416.64
Cumulated net cashflow	-6135.67	-5749.00	-4889.01	-3538.73	-1091.02	1325.62



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year .....	1975	1976	1977	1978	1979	2000
Total cash inflow ..	21000.00	21000.00	21000.00	21000.00	21000.00	21000.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	21000.00	21000.00	21000.00	21000.00	21000.00	21000.00
Total cash outflow ..	18910.08	18897.81	18622.57	18622.57	18660.84	18660.84
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs ....	16516.78	16516.78	16516.78	16516.78	16516.78	16516.78
Cost of finance ....	52.28	26.14	0.00	0.00	0.00	0.00
Repayment .....	261.38	261.38	0.00	0.00	0.00	0.00
Corporate tax ....	2079.65	2072.72	2105.79	2105.79	2144.06	2144.06
Dividends paid ....	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	2089.92	2102.99	2377.43	2377.43	2339.16	2339.16
Cumulated cash balance	5545.65	7648.64	10026.07	12403.51	14742.67	17081.82
Inflow, local .....	13500.00	13500.00	13500.00	13500.00	13500.00	13500.00
Outflow, local .....	13398.43	13411.50	13424.57	13424.57	13462.84	13462.84
Surplus ( deficit ) .	101.57	88.50	75.43	75.43	37.16	37.16
Inflow, foreign ...	7500.00	7500.00	7500.00	7500.00	7500.00	7500.00
Outflow, foreign ...	5511.65	5485.51	5198.00	5198.00	5198.00	5198.00
Surplus ( deficit ) :	1988.35	2014.49	2302.00	2302.00	2302.00	2302.00
Net cashflow .....	2403.57	2390.50	2377.43	2377.43	2339.16	2339.16
Cumulated net cashflow	3729.19	6119.69	8497.13	10874.56	13213.72	15552.88



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US \$

Year . . . . .	2001	2002	2003
Total cash inflow . .	21000.00	21000.00	21000.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	21000.00	21000.00	21000.00
Total cash outflow . .	18660.84	18710.28	18758.39
Total assets . . . . .	0.00	0.00	0.00
Operating costs . . .	16516.78	16516.78	16516.78
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	2144.06	2193.50	2241.61
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	2339.16	2289.72	2241.61
Cumulated cash balance	19420.98	21710.71	23952.31
Inflow, local . . . . .	13500.00	13500.00	13500.00
Outflow, local . . . .	13462.84	13512.28	13560.39
Surplus ( deficit ) .	37.16	-12.28	-60.39
Inflow, foreign . . . .	7500.00	7500.00	7500.00
Outflow, foreign . . .	5198.00	5198.00	5198.00
Surplus ( deficit ) .	2302.00	2302.00	2302.00
Net cashflow . . . . .	2339.16	2289.72	2241.61
Cumulated net cashflow	17892.04	20181.76	22423.37

LEATHER & CANVAS SHOES — February 88



**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	9170.90 at	10.00 %
Internal Rate of Return (IRRE1) ..	36.04 %	
b) Net Worth versus Net cash return:		
Net present value .....	6929.98 at	10.00 %
Internal Rate of Return (IRRE2) ..	22.37 %	
c) Internal Rate of Return on total investment:		
Net present value .....	6996.62 at	10.00 %
Internal Rate of Return ( IRR ) ..	21.12 %	
Net Worth = Equity paid plus reserves		



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COMFAR 2.0 - BALDO & CO. S.R.L., MELANO

**Net Income Statement in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	8400.00	12600.00	16800.00	21000.00	21000.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	8400.00	12600.00	16800.00	21000.00	21000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	7352.83	10479.63	13653.03	16824.43	16824.43
Operational margin . . . . .	1047.17	2120.37	3146.97	4175.57	4175.57
As % of total sales . . . . .	12.47	16.83	18.73	19.88	19.88
Cost of finance . . . . .	209.10	182.96	156.82	130.69	104.55
Gross profit . . . . .	838.07	1937.41	2990.15	4044.88	4071.02
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	838.07	1937.41	2990.15	4044.88	4071.02
Tax . . . . .	419.04	968.70	1495.07	2022.44	2035.51
Net profit . . . . .	419.04	968.70	1495.07	2022.44	2035.51
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	419.04	968.70	1495.07	2022.44	2035.51
Accumulated undistributed profit . . . . .	419.04	1387.74	2882.81	4905.25	6940.77
Gross profit, % of total sales . . . . .	9.98	15.38	17.80	19.26	19.39
Net profit, % of total sales . . . . .	4.99	7.69	8.90	9.63	9.69
ROE, Net profit, % of equity . . . . .	15.64	36.16	55.81	75.49	75.98
ROI, Net profit+interest, % of invest. . . . .	8.85	14.05	17.74	20.66	20.54



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	21000.00	21000.00	21000.00	21000.00	21000.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	21000.00	21000.00	21000.00	21000.00	21000.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	16788.43	16788.43	16788.43	16788.43	16788.43
Operational margin .....	4211.57	4211.57	4211.57	4211.57	4211.57
As % of total sales .....	20.06	20.06	20.06	20.06	20.06
Cost of finance .....	78.41	52.28	26.14	0.00	0.00
Gross profit .....	4133.16	4159.30	4185.43	4211.57	4211.57
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	4133.16	4159.30	4185.43	4211.57	4211.57
Tax .....	2066.58	2079.65	2092.72	2105.79	2105.79
Net profit .....	2066.58	2079.65	2092.72	2105.79	2105.79
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	2066.58	2079.65	2092.72	2105.79	2105.79
Accumulated undistributed profit .....	9007.34	11086.99	13179.71	15285.50	17391.28
Gross profit, % of total sales .....	19.68	19.81	19.93	20.06	20.06
Net profit, % of total sales .....	9.84	9.90	9.97	10.03	10.03
ROE, Net profit, % of equity .....	77.14	77.63	78.12	78.60	78.60
ROI, Net profit+interest, % of invest. ....	20.58	20.46	20.33	20.21	20.21

LEATHER & CANVAS SHOES — February 98





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US \$

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	21000.00	21000.00	21000.00	21000.00	21000.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	21000.00	21000.00	21000.00	21000.00	21000.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	16711.88	16711.88	16711.88	16613.01	16516.78
Operational margin . . . . .	4288.12	4288.12	4288.12	4386.99	4483.22
As % of total sales . . . . .	20.42	20.42	20.42	20.89	21.35
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	4288.12	4288.12	4288.12	4386.99	4483.22
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	4288.12	4288.12	4288.12	4386.99	4483.22
Tax . . . . .	2144.06	2144.06	2144.06	2173.50	2241.61
Net profit . . . . .	2144.06	2144.06	2144.06	2193.50	2241.61
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	2144.06	2144.06	2144.06	2193.50	2241.61
Accumulated undistributed profit . . .	19535.34	21679.40	23823.46	26016.96	28258.57
Gross profit, % of total sales . . . . .	20.42	20.42	20.42	20.89	21.35
Net profit, % of total sales . . . . .	10.21	10.21	10.21	10.45	10.67
ROE, net profit, % of equity . . . . .	80.03	80.03	80.03	81.88	83.67
ROI, Net profit+interest, % of invest.	20.57	20.57	20.57	21.05	21.51



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
<b>Total assets .....</b>	<b>4770.00</b>	<b>4979.10</b>
Fixed assets, net of depreciation	0.00	1946.00
Construction in progress .....	1946.00	3033.10
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	2824.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>4770.00</b>	<b>4979.10</b>
Equity capital .....	2679.00	2679.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	2091.00	2091.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	209.10
<b>Total debt .....</b>	<b>2091.00</b>	<b>2300.10</b>
<b>Equity, % of liabilities .....</b>	<b>56.16</b>	<b>53.80</b>



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COMFAR 2.0 - BALOO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	1989	1990	1991	1992	1993	1994
Total assets .....	7379.66	8326.28	9299.97	10284.60	11355.84	13161.04
Fixed assets, net of depreciation	4644.65	4310.20	3989.16	3681.51	3373.86	3102.21
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	2707.47	3990.71	5285.11	6577.15	6577.15	6577.15
Cash, bank .....	27.53	25.37	25.70	25.95	25.95	25.95
Cash surplus, finance available .	0.00	0.00	0.00	0.00	1378.88	3455.73
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	7379.65	8326.28	9299.97	10284.60	11355.84	13161.04
Equity capital .....	2679.00	2679.00	2679.00	2679.00	2679.00	2679.00
Reserves, retained profit .....	0.00	419.04	1387.74	2882.81	4905.25	6940.77
Profit .....	419.04	968.70	1495.07	2022.44	2035.51	2066.58
Long and medium term debt .....	1829.63	1568.25	1306.88	1045.50	784.13	522.75
Current liabilities .....	406.75	588.37	770.16	951.95	951.95	951.95
Bank overdraft, finance required.	2045.25	2102.92	1661.12	702.90	0.00	0.00
Total debt .....	4281.62	4259.94	3738.16	2700.35	1736.07	1474.70
Equity, % of liabilities .....	36.30	32.18	28.81	26.05	23.59	20.36



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1975	1976	1977	1978	1979	2000
<b>Total assets .....</b>	<b>14779.31</b>	<b>16810.66</b>	<b>18916.44</b>	<b>21022.23</b>	<b>23166.29</b>	<b>25310.35</b>
Fixed assets, net of depreciation	2830.56	2558.92	2287.27	2015.62	1820.52	1625.42
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	6577.15	6577.15	6577.15	6577.15	6577.15	6577.15
Cash, bank .....	25.95	25.95	25.95	25.95	25.95	25.95
Cash surplus, finance available .	5545.65	7648.65	10026.08	12402.51	14742.67	17081.83
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>14779.31</b>	<b>16810.66</b>	<b>18916.44</b>	<b>21022.23</b>	<b>23166.29</b>	<b>25310.35</b>
Equity capital .....	2679.00	2679.00	2679.00	2679.00	2679.00	2679.00
Reserves, retained profit .....	9007.34	11086.99	13179.71	15285.50	17391.28	19535.34
Profit .....	2079.65	2072.72	2105.79	2105.79	2144.06	2144.06
Long and medium term debt .....	261.38	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	951.95	951.95	951.95	951.95	951.95	951.95
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1213.32</b>	<b>951.95</b>	<b>951.95</b>	<b>951.95</b>	<b>951.95</b>	<b>951.95</b>
<b>Equity, % of liabilities .....</b>	<b>17.88</b>	<b>15.94</b>	<b>14.16</b>	<b>12.74</b>	<b>11.56</b>	<b>10.58</b>



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - B-LDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
Total assets .....	27454.41	29647.91	31889.52
Fixed assets, net of depreciation	1430.33	1334.10	1334.10
Construction in progress .....	0.00	0.00	0.00
Current assets .....	6577.15	6577.15	6577.15
Cash, bank .....	25.95	25.95	25.95
Cash surplus, finance available .	19420.99	21710.71	23952.32
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	27454.41	29647.91	31889.52
Equity capital .....	2679.00	2679.00	2679.00
Reserves, retained profit .....	21679.40	23823.46	26016.96
Profit .....	2144.06	2193.50	2241.61
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	951.95	951.95	951.95
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	951.95	951.95	951.95
Equity, % of liabilities .....	9.76	9.04	8.40

LEATHER & CANVAS SHOES — February 88

Leather and canvas shoes

ANNEXE 3

FINANCIAL EVALUATION  
FOR ALTERNATIVE B2



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**LEATHER & CANVAS SHOES**

February 88

Altern. B1 - Leath. shoes separate fact.

2 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency

local currency 1 unit = 1.0000 units accounting currency

accounting currency: 1000 US \$

**Total initial investment during construction phase**

fixed assets:	5100.60	40.203 % foreign
current assets:	0.00	0.000 % foreign
total assets:	5100.60	40.203 % foreign

**Source of funds during construction phase**

equity & grants:	3334.00	0.000 % foreign
foreign loans :	1606.00	
local loans :	0.00	
total funds :	4940.00	32.510 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	8447.82	12184.02	15980.22
depreciation :	350.58	350.58	330.58
interest :	160.60	140.52	120.45
production costs	8959.00	12675.12	16431.24
thereof foreign	22.33 %	21.67 %	21.63 %
total sales :	11100.00	16650.00	22200.00
gross income :	2141.00	3974.88	5768.76
net income :	1070.50	1987.44	2884.38
cash balance :	-1147.30	1033.34	1896.78
net cashflow :	-785.95	1374.62	2217.98

Net Present Value at: 10.00 % = 17087.11

Internal Rate of Return on total investment: 33.95 %

Equity paid versus Net income flow (IRR): 48.09 %

Net Worth versus Net Cash Return (IRR): 35.58 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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**Total Initial Investment in 1000 US \$**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	200.00	0.00
Buildings and civil works .....	1800.00	450.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	380.00	1870.00
<b>Total fixed investment costs .....</b>	<b>2380.00</b>	<b>2320.00</b>
Pre-production capital expenditures.	20.00	380.60
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>2400.00</b>	<b>2700.60</b>
<b>Of it foreign, in % .....</b>	<b>15.83</b>	<b>61.86</b>

LEATHER & CANING SHOES — February 88





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**Total Current Investment in 1000 US \$**

Year . . . . .	1989	1990	1991-92
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities . .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital . . . . .	2367.63	1103.92	1117.42
<b>Total current investment costs . . .</b>	<b>2367.63</b>	<b>1103.92</b>	<b>1117.42</b>
<b>Of it foreign, % . . . . .</b>	<b>48.50</b>	<b>50.17</b>	<b>50.77</b>



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**Total Production Costs in 1000 US \$**

Year .....	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	40.00	60.00	80.00	100.00	100.00	100.00
Raw material 1 .....	7219.60	10829.40	14439.20	18049.00	18049.00	18049.00
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	300.00	450.00	600.00	750.00	750.00	750.00
Energy .....	64.00	96.00	128.00	160.00	160.00	160.00
Labour, direct .....	684.75	684.75	684.75	684.75	684.75	684.75
Repair, maintenance .....	41.97	41.97	41.97	41.97	41.97	41.97
Spares .....	8.80	13.20	17.60	22.00	22.00	22.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>8379.12</b>	<b>12115.32</b>	<b>15911.52</b>	<b>19707.72</b>	<b>19707.72</b>	<b>19707.72</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	350.58	350.58	330.58	310.58	310.58	262.58
Financial costs .....	160.60	140.52	120.45	100.38	80.30	60.22
<b>Total production costs .....</b>	<b>8959.00</b>	<b>12675.12</b>	<b>16431.24</b>	<b>20187.37</b>	<b>20167.29</b>	<b>20099.22</b>
<b>Costs per unit ( single product ) .</b>	<b>14.93</b>	<b>14.08</b>	<b>13.69</b>	<b>13.46</b>	<b>13.44</b>	<b>13.40</b>
Of it foreign, % .....	22.33	21.67	21.63	21.60	21.52	21.49
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	753.45	753.45	753.45	753.45	753.45	753.45

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**Total Production Costs in 1000 US \$**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00	100.00
Raw material 1 .....	18049.00	18049.00	18049.00	18049.00	18049.00	18049.00
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	750.00	750.00	750.00	750.00	750.00	750.00
Energy .....	160.00	160.00	160.00	160.00	160.00	160.00
Labour, direct .....	684.75	684.75	684.75	684.75	684.75	684.75
Repair, maintenance .....	41.97	41.97	41.97	41.97	41.97	41.97
Spares .....	22.00	22.00	22.00	22.00	22.00	22.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>19707.72</b>	<b>19707.72</b>	<b>19707.72</b>	<b>19707.72</b>	<b>19707.72</b>	<b>19707.72</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	262.58	262.58	262.58	150.07	74.03	0.00
Financial costs .....	40.15	20.08	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>20079.14</b>	<b>20059.07</b>	<b>20038.99</b>	<b>19926.49</b>	<b>19850.44</b>	<b>19776.42</b>
<b>Costs per unit ( single product ) .</b>	<b>13.39</b>	<b>13.37</b>	<b>13.36</b>	<b>13.28</b>	<b>13.23</b>	<b>13.18</b>
Of it foreign, % .....	21.42	21.34	21.26	21.38	21.14	20.90
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	753.45	753.45	753.45	753.45	753.45	753.45



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**Net Working Capital in 1000 US \$**

Year .....		1989	1990	1991	1992	1993-2003
Coverage .....	adc coto					
<b>Current assets &amp;</b>						
Accounts receivable . . .	30 12.0	703.98	1015.34	1331.68	1648.03	1648.03
Inventory and materials .	63 5.7	1311.97	1967.95	2623.93	3279.92	3279.92
Energy .....	1 360.0	0.18	0.27	0.36	0.44	0.44
Spares .....	360 1.0	8.80	13.20	17.60	22.00	22.00
Work in progress . . . .	7 51.4	162.93	235.58	309.39	383.21	383.21
Finished products . . .	30 12.0	703.98	1015.34	1331.68	1648.04	1648.04
Cash in hand .....	15 24.0	36.01	33.69	33.88	34.06	34.06
<b>Total current assets .....</b>		<b>2927.85</b>	<b>4281.35</b>	<b>5648.53</b>	<b>7015.70</b>	<b>7015.70</b>
<b>Current liabilities and</b>						
Accounts payable .....	24 15.0	560.22	809.80	1059.55	1309.29	1309.29
<b>Net working capital .....</b>		<b>2367.63</b>	<b>3471.55</b>	<b>4588.98</b>	<b>5706.40</b>	<b>5706.40</b>
<b>Increase in working capital .....</b>		<b>2367.63</b>	<b>1103.92</b>	<b>1117.42</b>	<b>1117.42</b>	<b>0.00</b>
<b>Net working capital, local .....</b>		<b>1219.40</b>	<b>1769.47</b>	<b>2319.53</b>	<b>2869.59</b>	<b>2869.59</b>
<b>Net working capital, foreign .....</b>		<b>1148.23</b>	<b>1702.09</b>	<b>2269.45</b>	<b>2836.82</b>	<b>2836.82</b>

Notes: adc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US \$

Year .....	1987	1988
Equity, ordinary ..	3334.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1606.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1606.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	160.60
Total funds .....	4940.00	160.60

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Source of Finance, production in 1000 US \$

Year .....	1989	1990	1991	1992	1993-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-200.75	-200.75	-200.75	-200.75	-200.75
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-200.75	-200.75	-200.75	-200.75	-200.75
Current liabilities	560.22	249.58	249.75	249.75	0.00
Bank overdraft ....	1147.30	-1033.34	-274.56	0.00	0.00
Total funds .....	1506.77	-784.51	-225.56	49.00	-200.75

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 100C US \$

Year . . . . .	1987	1988
Total cash inflow . .	4940.00	0.00
Financial resources .	4940.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	2400.00	2700.60
Total assets . . . .	2400.00	2540.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	160.60
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	2540.00	-2700.60
Cumulated cash balance	2540.00	-160.60
Inflow, local . . . . .	3334.00	0.00
Outflow, local . . . .	2020.00	1030.00
Surplus ( deficit ) .	1314.00	-1030.00
Inflow, foreign . . . .	1606.00	0.00
Outflow, foreign . . .	380.00	1670.60
Surplus ( deficit ) .	1226.00	-1670.60
Net cashflow . . . . .	-2400.00	-2540.00
Cumulated net cashflow	-2400.00	-4940.00



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Cashflow tables, production in 1000 US \$

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	11660.22	16879.58	22449.75	27979.75	27750.00	27750.00
Financial resources .	560.22	249.58	249.75	249.75	0.00	0.00
Sales, net of tax . .	11100.00	16650.00	22200.00	27750.00	27750.00	27750.00
Total cash outflow . .	12807.52	15866.24	20552.97	25226.03	23848.82	23862.79
Total assets . . . .	2927.85	1353.50	1367.17	1367.17	0.00	0.00
Operating costs . . .	847.82	12184.02	15980.22	19776.42	19776.42	19776.42
Cost of finance . . .	160.60	140.52	120.45	100.38	80.30	60.22
Repayment . . . . .	200.75	200.75	200.75	200.75	200.75	200.75
Corporate tax . . . .	1070.50	1987.44	2884.38	3781.32	3791.35	3825.39
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1147.30	1033.34	1896.78	2773.71	3901.18	3887.21
Cumulated cash balance	-1307.90	-274.56	1622.21	4395.93	8297.11	12184.32
Inflow, local . . . . .	7755.46	11047.45	14447.45	18247.45	18000.00	18000.00
Outflow, local . . . . .	9579.59	12488.57	16354.91	20221.25	19433.77	19467.81
Surplus ( deficit ) .	-1824.13	-1441.12	-1707.46	-1973.80	-1433.77	-1467.81
Inflow, foreign . . . .	3904.76	5852.13	7802.30	9752.30	9750.00	9750.00
Outflow, foreign . . . .	3227.94	3377.67	4198.06	5004.79	4415.05	4394.98
Surplus ( deficit ) .	676.82	2474.46	3604.24	4747.51	5334.95	5355.02
Net cashflow . . . . .	-785.95	1374.62	2217.98	3074.84	4182.23	4148.19
Cumulated net cashflow	-575.95	-4351.34	-2133.36	941.48	5123.71	9271.89





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Cashflow tables, production in 1000 US \$

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	27750.00	27750.00	27750.00	27750.00	27750.00	27750.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	27750.00	27750.00	27750.00	27750.00	27750.00	27750.00
Total cash outflow . .	23652.75	23622.71	23631.93	23631.93	23688.18	23688.18
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	19776.42	19776.42	19776.42	19776.42	19776.42	19776.42
Cost of finance . . .	40.15	20.08	0.00	0.00	0.00	0.00
Repayment . . . . .	200.75	200.75	0.00	0.00	0.00	0.00
Corporate tax . . . .	3835.43	3845.47	3855.50	3855.50	3911.75	3911.75
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	3997.25	3907.29	4118.07	4118.07	4061.82	4061.82
Cumulated cash balance	16081.57	19988.86	24106.93	28225.01	32286.83	36348.66
Inflow, local . . . . .	18000.00	18000.00	18000.00	18000.00	18000.00	18000.00
Outflow, local . . . .	19477.85	19487.89	19497.93	19497.93	19554.18	19554.18
Surplus ( deficit ) .	-1477.85	-1487.89	-1497.93	-1497.93	-1554.18	-1554.18
Inflow, foreign . . . .	9750.00	9750.00	9750.00	9750.00	9750.00	9750.00
Outflow, foreign . . .	4374.90	4354.83	4134.00	4134.00	4134.00	4134.00
Surplus ( deficit ) .	5375.10	5395.17	5616.00	5616.00	5616.00	5616.00
Net cashflow . . . . .	4138.15	4128.11	4118.08	4118.08	4061.83	4061.83
Cumulated net cashflow	13410.04	17538.16	21656.23	25774.31	29836.13	33897.96



## Cashflow tables, production in 1000 US \$

Year .....	2001	2002	2003
Total cash inflow ..	27750.00	27750.00	27750.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax ..	27750.00	27750.00	27750.00
Total cash outflow ..	23688.18	23726.20	23763.21
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	19776.42	19776.42	19776.42
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . .	3711.75	3777.78	3786.79
Dividends paid . . .	0.00	0.00	0.00
Surplus ( deficit ) .	4061.82	4023.80	3786.79
Cumulated cash balance	40410.48	44434.28	48221.07
Inflow, local . . . .	18000.00	18000.00	18000.00
Outflow, local . . . .	19594.18	19592.20	19629.21
Surplus ( deficit ) .	-1594.18	-1592.20	-1629.21
Inflow, foreign . . .	9750.00	9750.00	9750.00
Outflow, foreign . . .	4134.00	4134.00	4134.00
Surplus ( deficit ) .	5616.00	5616.00	5616.00
Net cashflow . . . . .	4061.83	4023.80	3786.79
Cumulated net cashflow	37957.78	41983.58	45770.37



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	18945.69	at 10.00 %
Internal Rate of Return (IRRE1) ..	48.09	%
b) Net Worth versus Net cash returns:		
Net present value .....	17002.20	at 10.00 %
Internal Rate of Return (IRRE2) ..	35.58	%
c) Internal Rate of Return on total investment:		
Net present value .....	17087.11	at 10.00 %
Internal Rate of Return ( IRR ) ..	33.95	%
Net Worth = Equity paid plus reserves		

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**Net Income Statement in 1000 US \$**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	11100.00	16650.00	22200.00	27750.00	27750.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	11100.00	16650.00	22200.00	27750.00	27750.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	8798.40	12534.59	16310.79	20086.99	20086.99
Operational margin . . . . .	2301.60	4115.41	5889.21	7663.01	7663.01
As % of total sales . . . . .	20.74	24.72	26.53	27.61	27.61
Cost of finance . . . . .	160.60	140.52	120.45	100.38	80.30
Gross profit . . . . .	2141.00	3974.88	5768.76	7562.63	7582.71
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2141.00	3974.88	5768.76	7562.63	7582.71
Tax . . . . .	1070.50	1987.44	2884.38	3781.32	3791.35
Net profit . . . . .	1070.50	1987.44	2884.38	3781.32	3791.35
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1070.50	1987.44	2884.38	3781.32	3791.35
Accumulated undistributed profit . . . . .	1070.50	3057.94	5942.32	9723.64	13514.99
Gross profit, % of total sales . . . . .	19.29	23.87	25.99	27.25	27.33
Net profit, % of total sales . . . . .	9.64	11.94	12.99	13.63	13.66
ROE, Net profit, % of equity . . . . .	32.11	59.61	86.51	113.42	113.72
ROI, Net profit+interest, % of invest. . . . .	16.85	25.30	31.53	36.46	36.37



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**Net Income Statement in 1000 US \$**

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	27750.00	27750.00	27750.00	27750.00	27750.00
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	27750.00	27750.00	27750.00	27750.00	27750.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	20038.99	20038.99	20039.00	20038.99	20038.99
Operational margin . . . . .	7711.01	7711.01	7711.00	7711.01	7711.01
As % of total sales . . . . .	27.79	27.79	27.79	27.79	27.79
Cost of finance . . . . .	60.22	40.15	20.08	0.00	0.00
Gross profit . . . . .	7650.78	7670.86	7690.93	7711.01	7711.01
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	7650.78	7670.86	7690.93	7711.01	7711.01
Tax . . . . .	3825.39	3835.43	3945.47	3855.50	3855.50
Net profit . . . . .	3825.39	3835.43	3945.46	3855.50	3855.50
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	3825.39	3835.43	3945.46	3855.50	3855.50
Accumulated undistributed profit . . . . .	17340.38	21175.81	25021.27	28876.77	32732.28
Gross profit, % of total sales . . . . .	27.57	27.84	27.72	27.79	27.79
Net profit, % of total sales . . . . .	13.79	13.82	13.86	13.89	13.89
ROE, Net profit, % of equity . . . . .	114.74	115.04	115.34	115.54	115.84
ROI, Net profit+interest, % of invest. . . . .	36.50	36.40	36.31	36.21	36.21



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US \$**

Year .....	1999	2000	2001	2002	2003
Total sales, incl. sales tax .....	27750.00	27750.00	27750.00	27750.00	27750.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	27750.00	27750.00	27750.00	27750.00	27750.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	19926.49	19926.49	19926.49	19850.45	19776.42
Operational margin .....	7823.51	7823.51	7823.51	7899.55	7973.58
As % of total sales .....	28.19	28.19	28.19	28.47	28.73
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
Gross profit .....	7823.51	7823.51	7823.51	7899.55	7973.58
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	7823.51	7823.51	7823.51	7899.55	7973.58
Tax .....	3911.75	3911.75	3911.75	3949.78	3986.79
Net profit .....	3911.75	3911.75	3911.75	3949.78	3986.79
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	3911.75	3911.75	3911.75	3949.78	3986.79
Accumulated undistributed profit .....	3664.03	4055.79	4467.54	4847.32	5244.11
Gross profit, % of total sales .....	28.19	28.19	28.19	28.47	28.73
Net profit, % of total sales .....	14.10	14.10	14.10	14.23	14.37
ROE, Net profit, % of equity .....	117.33	117.33	117.33	118.47	119.58
ROI, Net profit+interest, % of invest. ....	36.74	36.74	36.74	37.10	37.45



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US \$**

Year .....	1987	1988
Total assets .....	4940.00	5100.60
Fixed assets, net of depreciation	0.00	2400.00
Construction in progress .....	2400.00	2700.60
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	2940.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	4940.00	5100.60
Equity capital .....	3334.00	3334.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1606.00	1606.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	160.60
Total debt .....	1606.00	1766.60
Equity, % of liabilities .....	67.47	65.36



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>7677.88</b>	<b>8680.80</b>	<b>11339.62</b>	<b>15169.93</b>	<b>18760.53</b>	<b>22385.17</b>
Fixed assets, net of depreciation	4750.02	4399.45	4068.87	3758.30	3447.72	3185.15
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	2891.84	4247.66	5614.85	6981.64	6981.64	6981.64
Cash, bank .....	36.01	33.69	33.88	34.06	34.06	34.06
Cash surplus, finance available .....	0.00	0.00	1622.22	4395.93	8297.11	12184.33
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>7677.88</b>	<b>8680.80</b>	<b>11339.62</b>	<b>15169.93</b>	<b>18760.53</b>	<b>22385.17</b>
Equity capital .....	3334.00	3334.00	3334.00	3334.00	3334.00	3334.00
Reserves, retained profit .....	0.00	1070.50	3057.94	5942.32	9723.64	13514.99
Profit .....	1070.50	1987.44	2884.38	3781.32	3791.35	3825.39
Long and medium term debt .....	1405.25	1204.50	1003.75	803.00	602.25	401.50
Current liabilities .....	560.22	809.80	1059.55	1309.29	1309.29	1309.29
Bank overdraft, finance required .....	1307.90	274.56	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>3273.37</b>	<b>2288.86</b>	<b>2063.30</b>	<b>2112.29</b>	<b>1911.54</b>	<b>1710.79</b>
<b>Equity, % of liabilities .....</b>	<b>43.42</b>	<b>38.41</b>	<b>29.40</b>	<b>21.98</b>	<b>17.77</b>	<b>14.89</b>





COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US \$

Year .....	1995	1996	1997	1998	1999	2000
Total assets .....	26019.85	29664.56	33520.07	37375.57	41287.32	45199.08
Fixed assets, net of depreciation	2922.57	2660.00	2397.43	2134.85	1984.78	1834.70
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	6981.64	6981.64	6981.64	6981.64	6981.64	6981.64
Cash, bank .....	34.06	34.06	34.06	34.06	34.06	34.06
Cash surplus, finance available	16081.58	19988.87	24106.95	28225.02	32286.85	36348.68
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	26019.85	29664.56	33520.07	37375.57	41287.32	45199.08
Equity capital .....	3334.00	3334.00	3334.00	3334.00	3334.00	3334.00
Reserves, retained profit .....	17340.38	21175.81	25021.27	28876.77	32732.28	36644.03
Profit .....	3835.43	3845.46	3855.50	3855.50	3911.75	3911.75
Long and medium term debt .....	200.75	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	1309.29	1309.29	1309.29	1309.29	1309.29	1309.29
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
Total debt .....	1510.04	1309.29	1309.29	1309.29	1309.29	1309.29
Equity, % of liabilities .....	12.81	11.24	9.95	8.92	8.08	7.38



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US \$**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>49110.83</b>	<b>53060.61</b>	<b>57047.40</b>
Fixed assets, net of depreciation	1684.63	1610.60	1610.60
Construction in progress .....	0.00	0.00	0.00
Current assets .....	6981.64	6981.64	6981.64
Cash, bank .....	34.06	34.06	34.06
Cash surplus, finance available	40410.51	44434.31	48421.10
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>49110.83</b>	<b>53060.61</b>	<b>57047.40</b>
Equity capital .....	3334.00	3334.00	3334.00
Reserves, retained profit .....	40555.79	44467.54	48417.32
Profit .....	3911.75	3949.78	3986.79
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	1309.29	1309.29	1309.29
Bank overdraft, finance required	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1309.29</b>	<b>1309.29</b>	<b>1309.29</b>
<b>Equity, % of liabilities .....</b>	<b>6.79</b>	<b>6.28</b>	<b>5.84</b>

Leather and canvas shoes

ANNEXE 4

FINANCIAL EVALUATION  
ALTERNATIVE C



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

LEATHER & CANVAS SHOES  
February 88  
Altern. A - One factory

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	8340.00	52.038 % foreign
current assets:	0.00	0.000 % foreign
total assets:	8340.00	52.038 % foreign

**Source of funds during construction phase**

equity & grants:	4600.00	0.000 % foreign
foreign loans :	3400.00	
local loans :	0.00	
total funds :	8000.00	42.500 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	15298.09	22220.69	29204.29
depreciation :	573.49	573.49	550.99
interest :	340.00	297.50	255.00
production costs	16211.58	23091.68	30010.28
thereof foreign	27.14 %	26.70 %	26.62 %
total sales :	19500.00	29250.00	39000.00
gross income :	3288.42	6158.32	8989.72
net income :	1644.21	3079.16	4474.86
cash balance :	-2869.89	1011.27	2389.75
net cashflow :	-2104.89	1733.77	3069.75

Net Present Value at: 10.00 % = 25702.60  
Internal Rate of Return on total investment: 31.58 %  
Equity paid versus Net income flow (IRR): 51.77 %  
Net Worth versus Net Cash Return (IRR): 33.85 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	225.00	0.00
Buildings and civil works .....	2000.00	600.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	800.00	3975.00
<b>Total fixed investment costs .....</b>	<b>3025.00</b>	<b>4575.00</b>
Pre-production capital expenditures.	20.00	720.00
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>3045.00</b>	<b>5295.00</b>
<b>Of it foreign, in % .....</b>	<b>26.27</b>	<b>66.86</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992
<b>Fixed investment costs</b>				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil work .....	0.00	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital .....	462.60	2216.38	2231.11	2229.88
<b>Total current investment costs ...</b>	<b>462.60</b>	<b>2216.38</b>	<b>2231.11</b>	<b>2229.88</b>
<b>Of it foreign, % .....</b>	<b>55.30</b>	<b>57.23</b>	<b>57.51</b>	<b>57.49</b>

LEATHER & COMFAR SHOES — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	7219.60	10829.40	14439.20	18049.00	18049.00	18049.00
Other raw materials .....	6018.00	9027.00	12036.00	15045.00	15045.00	15045.00
Utilities .....	600.00	900.00	1200.00	1500.00	1500.00	1500.00
Energy .....	103.60	155.40	207.20	259.00	259.00	259.00
Labour, direct .....	1150.73	1150.73	1150.73	1150.73	1150.73	1150.73
Repair, maintenance .....	52.46	52.46	52.46	52.46	52.46	52.46
Spares .....	25.00	37.00	50.00	62.00	62.00	62.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>15229.39</b>	<b>22151.99</b>	<b>29135.59</b>	<b>36118.19</b>	<b>36118.19</b>	<b>36118.19</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	573.49	573.49	550.99	528.49	528.49	448.49
Financial costs .....	340.00	297.50	255.00	212.50	170.00	127.50
<b>Total production costs .....</b>	<b>16211.58</b>	<b>23091.68</b>	<b>30010.28</b>	<b>36927.88</b>	<b>36885.38</b>	<b>36762.88</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	27.14	26.70	26.62	26.57	26.49	26.46
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	1219.43	1219.43	1219.43	1219.43	1219.43	1219.43

LEATHER & DINING SEDES — February 88



**COMFAR**  
2.0 UNIDO

COMFAR 2.0 - UNIDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year .....	1975	1976	1977-78	1979-2001	2002	2003
% of nom. capacity (single product)	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	18049.00	18049.00	18049.00	18049.00	18049.00	18049.00
Other raw materials .....	15045.00	15045.00	15045.00	15045.00	15045.00	15045.00
Utilities .....	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
Energy .....	259.00	259.00	259.00	259.00	259.00	259.00
Labour, direct .....	1150.73	1150.73	1150.73	1150.73	1150.73	1150.73
Repair, maintenance .....	52.46	52.46	52.46	52.46	52.46	52.46
Spares .....	62.00	62.00	62.00	62.00	62.00	62.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>36118.19</b>	<b>36118.19</b>	<b>36118.19</b>	<b>36118.19</b>	<b>36118.19</b>	<b>36118.19</b>
Administrative overheads .....	68.70	68.70	68.70	68.70	68.70	68.70
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	448.49	448.49	448.49	318.49	157.09	0.00
Financial costs .....	85.00	42.50	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>36720.38</b>	<b>36677.88</b>	<b>36635.38</b>	<b>36505.38</b>	<b>36343.98</b>	<b>36186.89</b>
Costs per unit ( single product ) .	0.00	0.00	0.00	0.00	0.00	0.00
Of it foreign, % .....	26.38	26.27	26.21	26.30	26.04	25.79
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	1219.43	1219.43	1219.43	1219.43	1219.43	1219.43



Net Working Capital in 1000 US DOLLARS

Year .....			1989	1990	1991	1992	1993-2003
Coverage .....	ndc	coto					
<b>Current assets &amp;</b>							
Accounts receivable . . .	30	12.0	1274.84	1851.72	2433.69	3015.57	3015.57
Inventory and materials .	70	5.1	2698.47	4047.70	5396.93	6746.17	6746.17
Energy .....	1	360.0	0.29	0.43	0.58	0.72	0.72
Spares .....	360	1.0	25.00	37.00	50.00	62.00	62.00
Work in progress .....	7	51.4	296.13	430.73	566.53	702.30	702.30
Finished products . . . .	30	12.0	1274.84	1851.72	2433.69	3015.57	3015.57
Cash in hand .....	15	24.0	56.54	54.54	55.08	55.58	55.58
Total current assets .....			5626.10	8273.85	10936.49	13597.91	13597.91
<b>Current liabilities and</b>							
Accounts payable .....	23	16.0	963.50	1374.87	1826.41	2257.94	2257.94
Net working capital .....			4662.60	6898.98	9110.08	11339.97	11339.97
Increase in working capital .....			4662.60	2216.38	2231.11	2229.88	0.00
Net working capital, local .....			2084.12	3032.13	3780.14	4728.15	4728.15
Net working capital, foreign .....			2578.47	3866.84	5129.94	6611.82	6611.82

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987	1988
Equity, ordinary ..	4600.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	3400.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	3400.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	340.00
Total funds .....	8000.00	340.00



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993-96
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-425.00	-425.00	-425.00	-425.00	-425.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-425.00	-425.00	-425.00	-425.00	-425.00
Current liabilities	963.50	431.37	431.54	431.53	0.00
Bank overdraft ....	2869.89	-1011.27	-2198.62	0.00	0.00
Total funds .	3408.40	-1004.90	-2192.09	6.53	-425.00

LEATHER & CANING SHOES — February 88



**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - 89.00 & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year .....	1987	1988
Total cash inflow ..	8000.00	0.00
Financial resources .	8000.00	0.00
Sales, net of tax ..	0.00	0.00
Total cash outflow ..	3045.00	5295.00
Total assets .....	3045.00	4955.00
Operating costs ...	0.00	0.00
Cost of finance ...	0.00	340.00
Repayment .....	0.00	0.00
Corporate tax ...	0.00	0.00
Dividends paid ...	0.00	0.00
Surplus ( deficit ) .	4955.00	-5295.00
Cumulated cash balance	4955.00	-340.00
Inflow, local .....	4600.00	0.00
Outflow, local .....	2245.00	1755.00
Surplus ( deficit ) .	2355.00	-1755.00
Inflow, foreign ...	3400.00	0.00
Outflow, foreign ...	800.00	3540.00
Surplus ( deficit ) .	2600.00	-3540.00
Net cashflow .....	-3045.00	-4955.00
Cumulated net cashflow	-3045.00	-8000.00



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	20463.50	29681.37	39431.54	49181.54	48750.00	48750.00
Financial resources .	963.50	431.37	431.54	431.53	0.00	0.00
Sales, net of tax . .	19500.00	29250.00	39000.00	48750.00	48750.00	48750.00
Total cash outflow . .	23333.40	28670.10	37041.79	46396.87	42714.20	42732.95
Total assets . . . .	5626.10	2647.75	2662.84	2661.42	0.00	0.00
Operating costs . . .	15298.09	22220.69	27204.29	36186.89	36186.89	36186.89
Cost of finance . . .	340.00	297.50	255.00	212.50	170.00	127.50
Repayment . . . . .	425.00	425.00	425.00	425.00	425.00	425.00
Corporate tax . . . .	1644.21	3079.16	4494.86	5911.06	5932.31	5993.56
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2869.89	1011.27	2389.75	3784.67	6035.80	6017.05
Cumulated cash balance	-3209.89	-2198.63	191.13	3975.79	10011.59	16028.64
Inflow, local . . . . .	13552.97	19326.35	25626.35	31926.35	31500.00	31500.00
Outflow, local . . . .	16185.59	21074.01	27605.91	34138.31	32785.20	32846.45
Surplus ( deficit ) .	-2632.62	-1747.66	-1979.56	-2211.96	-1285.20	-1346.45
Inflow, foreign . . . .	6910.54	10355.02	13805.19	17255.18	17250.00	17250.00
Outflow, foreign . . .	7147.81	7596.09	9435.89	11258.56	9929.00	9886.50
Surplus ( deficit ) .	-237.27	2758.93	4369.30	5996.63	7321.00	7363.50
Net cashflow . . . . .	-2104.89	1733.77	3069.75	4422.17	6630.80	6569.55
Cumulated net cashflow	-10104.89	-8371.13	-5301.38	-879.21	5751.59	12321.14



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	48750.00	48750.00	48750.00	48750.00	48750.00	48750.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	48750.00	48750.00	48750.00	48750.00	48750.00	48750.00
Total cash outflow . .	42711.70	42690.45	42244.20	42244.20	42309.20	42309.20
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	36186.89	36186.89	36186.89	36186.89	36186.89	36186.89
Cost of finance . . .	85.00	42.50	0.00	0.00	0.00	0.00
Repayment . . . . .	425.00	425.00	0.00	0.00	0.00	0.00
Corporate tax . . .	5014.81	6036.06	6057.31	6057.31	6122.31	6122.31
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	6038.30	6059.55	6505.80	6505.80	6440.80	6440.80
Cumulated cash balance	22066.95	28126.50	34632.30	41138.10	47578.90	54019.70
Inflow, local . . . .	31500.00	31500.00	31500.00	31500.00	31500.00	31500.00
Outflow, local . . . .	32867.70	32888.95	32910.20	32910.20	32975.20	32975.20
Surplus ( deficit ) .	-1367.70	-1388.95	-1410.20	-1410.20	-1475.20	-1475.20
Inflow, foreign . . .	17250.00	17250.00	17250.00	17250.00	17250.00	17250.00
Outflow, foreign . . .	9844.00	9801.50	9334.00	9334.00	9334.00	9334.00
Surplus ( deficit ) .	7406.00	7448.50	7916.00	7916.00	7916.00	7916.00
Net cashflow . . . . .	6548.30	6527.05	6505.80	6505.80	6440.80	6440.80
Cumulated net cashflow	18869.44	25396.49	31902.29	38408.09	44848.89	51289.70



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COMFAR 2.0 - BPLDO & CL. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	48750.00	48750.00	48750.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	48750.00	48750.00	48750.00
Total cash outflow . .	42309.20	42389.90	42468.45
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	36186.89	36186.89	36186.89
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	6122.31	6203.01	6281.56
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	6440.80	6360.10	6281.55
Cumulated cash balance	60460.50	66820.60	73102.16
Inflow, local . . . . .	31500.00	31500.00	31500.00
Outflow, local . . . .	32975.20	33055.90	33134.45
Surplus ( deficit ) .	-1475.20	-1555.90	-1634.45
Inflow, foreign . . . .	17250.00	17250.00	17250.00
Outflow, foreign . . .	9334.00	9334.00	9334.00
Surplus ( deficit ) .	7916.00	7916.00	7916.00
Net cashflow . . . . .	6440.80	6360.10	6281.55
Cumulated net cashflow	57730.50	64090.60	70372.15



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	30249.48	at 10.00 %
Internal Rate of Return ( IRR1 ) ..	51.77 %	
b) Net Worth versus Net cash return:		
Net present value .....	2561.24	at 10.00 %
Internal Rate of Return ( IRR2 ) ..	33.85 %	
c) Internal Rate of Return on total investment:		
Net present value .....	25702.60	at 10.00 %
Internal Rate of Return ( IRR ) ..	31.58 %	
Net Worth = Equity paid plus reserves		

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LEATHER & CANVAS SHOES — February 88





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COMFAR 2.0 - BALDI & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	19500.00	29250.00	39000.00	48750.00	48750.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	19500.00	29250.00	39000.00	48750.00	48750.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	15871.58	22794.18	29755.28	36715.38	36715.38
Operational margin . . . . .	3628.42	6455.82	9244.72	12034.62	12034.62
As % of total sales . . . . .	18.61	22.37	23.70	24.69	24.69
Cost of finance . . . . .	340.00	297.50	255.00	212.50	170.00
Gross profit . . . . .	3288.42	6158.32	8989.72	11822.12	11864.62
Allowances . . . . .	0.00	0.00	0.00	0.00	6.00
Taxable profit . . . . .	3288.42	6158.32	8989.72	11822.12	11864.62
Tax . . . . .	1644.21	3079.16	4494.86	5911.06	5932.31
Net profit . . . . .	1644.21	3079.16	4494.86	5911.06	5932.31
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1644.21	3079.16	4494.86	5911.06	5932.31
Accumulated undistributed profit . . .	1644.21	4723.37	9218.23	15129.28	21061.59
Gross profit, % of total sales . . . . .	16.86	21.05	23.05	24.25	24.34
Net profit, % of total sales . . . . .	8.43	10.53	11.53	12.13	12.17
ROE, Net profit, % of equity . . . . .	35.74	66.94	97.71	128.50	128.96
ROI, Net profit+interest, % of invest.	15.67	22.69	27.76	31.66	31.95



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1994	1995	1996	1997	1998
Total sales, incl. sales tax .....	48750.00	48750.00	48750.00	48750.00	48750.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	48750.00	48750.00	48750.00	48750.00	48750.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	36635.38	36635.38	36635.38	36635.38	36635.38
Operational margin .....	12114.62	12114.62	12114.62	12114.62	12114.62
As % of total sales .....	24.85	24.85	24.85	24.85	24.85
Cost of finance .....	127.50	85.00	42.50	0.00	0.00
Gross profit .....	11987.12	12029.62	12072.12	12114.62	12114.62
Allowances .....	0.00	0.00	0.00	0.00	0.00
Yemable profit .....	11987.12	12029.62	12072.12	12114.62	12114.62
Tax .....	5993.56	6014.81	6036.06	6057.31	6057.31
Net profit .....	5993.56	6014.81	6036.06	6057.31	6057.31
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	5993.56	6014.81	6036.06	6057.31	6057.31
Accumulated undistributed profit .....	27055.15	33069.96	39106.02	45163.33	51220.64
Gross profit, % of total sales .....	24.59	24.68	24.76	24.85	24.85
Net profit, % of total sales .....	12.29	12.34	12.38	12.43	12.43
ROE, Net profit, % of equity .....	130.29	130.76	131.22	131.68	131.68
ROI, Net profit+interest, % of invest. ....	31.65	31.54	31.43	31.32	31.32



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year .....	1999	2000	2001	2002	2003
Total sales, incl. sales tax .....	48750.00	48750.00	48750.00	48750.00	48750.00
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	48750.00	48750.00	48750.00	48750.00	48750.00
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	36505.38	36505.38	36505.38	36343.98	36186.89
Operational margin .....	12244.62	12244.62	12244.62	12406.02	12563.11
As % of total sales .....	25.12	25.12	25.12	25.45	25.77
Cost of finance .....	0.00	0.00	0.00	0.00	0.00
Gross profit .....	12244.62	12244.62	12244.62	12406.02	12563.11
Allowances .....	0.00	0.00	0.00	0.00	0.00
Tangible profit .....	12244.62	12244.62	12244.62	12406.02	12563.11
Tax .....	6122.31	6122.31	6122.31	6203.01	6281.56
Net profit .....	6122.31	6122.31	6122.31	6203.01	6281.55
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	6122.31	6122.31	6122.31	6203.01	6281.55
Accumulated undistributed profit .....	57342.95	63465.25	69587.56	75790.57	82072.13
Gross profit, % of total sales .....	25.12	25.12	25.12	25.45	25.77
Net profit, % of total sales .....	12.56	12.56	12.56	12.72	12.89
ROE, Net profit, % of equity .....	133.09	133.09	133.09	134.85	136.56
ROI, Net profit+interest, % of invest. ....	31.66	31.66	31.66	32.07	32.48



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COMFAR 2.0 - BALOO & CO. S.R.L., NOLANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987	1988
<b>Total assets .....</b>	<b>8000.00</b>	<b>8340.00</b>
Fixed assets, net of depreciation	0.00	3045.00
Construction in progress .....	3045.00	5275.00
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available ..	4955.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
<b>Total liabilities .....</b>	<b>8000.00</b>	<b>8340.00</b>
Equity capital .....	4600.00	4600.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	3400.00	3400.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required ..	0.00	340.00
<b>Total debt .....</b>	<b>3400.00</b>	<b>3740.00</b>
<b>Equity, % of liabilities .....</b>	<b>57.50</b>	<b>55.16</b>

LEATHER & CANVAS SHOES — February 88



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>13392.61</b>	<b>15466.86</b>	<b>17769.63</b>	<b>23687.23</b>	<b>29194.94</b>	<b>34763.10</b>
Fixed assets, net of depreciation	7766.51	7193.01	6642.02	6113.53	5585.03	5136.94
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	5569.56	8219.31	10881.42	13542.33	13542.33	13542.33
Cash, bank .....	56.94	94.94	55.08	55.58	55.58	55.58
Cash surplus, finance available ..	0.00	0.00	191.12	3975.79	10061.59	16028.65
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>13392.61</b>	<b>15466.86</b>	<b>17769.63</b>	<b>23687.23</b>	<b>29194.94</b>	<b>34763.10</b>
Equity capital .....	4600.00	4600.00	4600.00	4600.00	4600.00	4600.00
Reserves, retained profit .....	0.00	1644.21	4723.37	9218.23	15129.28	21061.59
Profit .....	1644.21	3079.16	4494.86	5911.06	5932.31	5993.56
Long and medium term debt .....	2975.00	2550.00	2125.00	1700.00	1275.00	850.00
Current liabilities .....	963.50	1394.87	1826.41	2257.94	2257.94	2257.94
Bank overdraft, finance required ..	3209.89	2198.62	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>7148.40</b>	<b>6143.50</b>	<b>3951.41</b>	<b>3957.94</b>	<b>3532.94</b>	<b>3107.94</b>
<b>Equity, % of liabilities .....</b>	<b>34.35</b>	<b>29.74</b>	<b>25.89</b>	<b>19.42</b>	<b>15.76</b>	<b>13.23</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1975	1976	1977	1978	1979	2000
<b>Total assets .....</b>	<b>40352.91</b>	<b>45763.96</b>	<b>52021.27</b>	<b>58078.58</b>	<b>64200.89</b>	<b>70323.20</b>
Fixed assets, net of depreciation	4688.05	4237.55	3791.06	3342.57	3024.08	2705.58
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	13542.33	13542.33	13542.33	13542.33	13542.33	13542.33
Cash, bank .....	55.58	55.58	55.58	55.58	55.58	55.58
Cash surplus, finance available ..	22866.95	28126.50	34632.30	41138.10	47578.91	54019.70
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>40352.91</b>	<b>45763.96</b>	<b>52021.27</b>	<b>58078.58</b>	<b>64200.89</b>	<b>70323.20</b>
Equity capital .....	4600.00	4600.00	4600.00	4600.00	4600.00	4600.00
Reserves, retained profit .....	27055.15	33049.96	37106.02	45163.33	51220.64	57342.95
Profit .....	6074.81	6036.06	6057.31	6057.31	6122.31	6122.31
Long and medium term debt .....	425.00	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	2257.94	2257.94	2257.94	2257.94	2257.94	2257.94
Bank overdraft, finance required ..	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>2682.94</b>	<b>2257.94</b>	<b>2257.94</b>	<b>2257.94</b>	<b>2257.94</b>	<b>2257.94</b>
<b>Equity, % of liabilities .....</b>	<b>11.40</b>	<b>10.01</b>	<b>8.84</b>	<b>7.92</b>	<b>7.17</b>	<b>6.54</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>7046.51</b>	<b>8294.52</b>	<b>88930.07</b>
Fixed assets, net of depreciation	2387.07	2230.00	2230.00
Construction in progress .....	0.00	0.00	0.00
Current assets .....	13542.33	13942.33	13942.33
Cash, bank .....	55.58	55.58	55.58
Cash surplus, finance available .	6040.51	66820.60	73102.16
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>7046.51</b>	<b>8294.52</b>	<b>88930.07</b>
Equity capital .....	4600.00	4600.00	4600.00
Reserves, retained profit .....	6346.25	69587.56	75790.57
Profit .....	6122.31	6203.01	6281.55
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	2257.94	2257.94	2257.94
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>2257.94</b>	<b>2257.94</b>	<b>2257.94</b>
<b>Equity, % of liabilities .....</b>	<b>6.02</b>	<b>5.57</b>	<b>5.17</b>

**Leather and canvas shoes**

**ANNEXE 5**

**BEP EVALUATION**



BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (4TH YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	ALT. A	ALT. B.1	ALT. B.2	ALT. C
1) TOTAL REVENUES	<u>48750</u>	<u>27750</u>	<u>21000</u>	<u>18500</u>
2) VARIABLE COSTS:	<u>36003.73</u>	<u>19643.75</u>	<u>16368.11</u>	<u>13124.98</u>
. RAW MATERIALS	33094	18049	15045	12038.68
. UTILITIES	1500	750	750	500.25
. ENERGY	259	160	99	106.72
. LABOUR	1150.73	684.75	474.11	479.33
3) FIXED COSTS	<u>924.15</u>	<u>543.63</u>	<u>587.01</u>	<u>451.04</u>
. REPAIR-MAINTENANCE	52.46	41.97	41.97	41.97
. SPARES	62	22	38	15
. ADMINISTRATION	68.7	68.7	68.7	68.7
. DEPRECIATION	528.49	310.58	307.65	245.06
. FINANCIAL COSTS	212.50	100.38	130.69	80.31
4) TOTAL PRODUCTION COSTS	<u>36927.88</u>	<u>20187.38</u>	<u>16955.12</u>	<u>13576.02</u>

$$\begin{array}{r} \text{BEP} \\ \text{(ALT.A)} \end{array} \quad \frac{924.15}{48750 - 36003.73} \times 100 = 7.2\%$$

$$\begin{array}{r} \text{BEP} \\ \text{(ALT.B)} \end{array} \quad \frac{543.63}{27750 - 19643.75} \times 100 = 6.7\%$$

$$\begin{array}{r} \text{BEP} \\ \text{(ALT.B.2)} \end{array} \quad \frac{587.01}{21000 - 16368.11} \times 100 = 11.7\%$$

$$\begin{array}{r} \text{BEP} \\ \text{(ALT.C)} \end{array} \quad \frac{451.04}{18500 - 13124.98} \times 100 = 8.4\%$$

**Leather and canvas shoes**

**ANNEXE 6**

**FOREIGN EXCHANGE EFFECT EVALUATION**

A L T E R N A T I V E    A



**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	241475.50	3400.00	238075.50	3400.00	0.00	6910.54	10355.02
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	3425.93	3400.00	25.93	3400.00	0.00	10.54	5.02
exports .....	238050.00	0.00	238050.00	0.00	0.00	6900.00	10350.00
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	137425.50	4340.00	133085.50	800.00	3540.00	7147.81	7596.09
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	3260.00	4000.00	-740.00	800.00	3200.00	2589.01	1273.39
imported materials ...	128869.60	0.00	128869.60	0.00	0.00	3793.80	5600.20
repayment loans & overd.	3425.93	0.00	3425.93	0.00	0.00	425.00	425.00
other repayments ....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	1870.00	340.00	1530.00	0.00	340.00	340.00	297.50
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	104050.40	-940.00	104990.40	2600.00	-3540.00	-237.27	2758.93
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	104050.40	-940.00	104990.40	2600.00	-3540.00	-237.27	2758.93
present values at 10.00 %							
foreign exchange flow .	40250.25						
net foreign exchange effect	40250.25						



**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
<b>total foreign inflow . .</b>	<b>13805.19</b>	<b>17255.18</b>	<b>17250.00</b>	<b>17250.00</b>	<b>17250.00</b>	<b>17250.00</b>	<b>17250.00</b>
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	5.19	5.18	0.00	0.00	0.00	0.00	0.00
exports . . . . .	13800.00	17250.00	17250.00	17250.00	17250.00	17250.00	17250.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
<b>total foreign outflow .</b>	<b>9435.89</b>	<b>11258.56</b>	<b>9929.00</b>	<b>9886.50</b>	<b>9844.00</b>	<b>9801.50</b>	<b>9334.00</b>
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1288.29	1287.06	0.00	0.00	0.00	0.00	0.00
imported materials . . .	7467.60	9334.00	9334.00	9334.00	9334.00	9334.00	9334.00
repayment loans & overd.	425.00	425.00	425.00	425.00	425.00	425.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	255.00	212.50	170.00	127.50	85.00	42.50	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
<b>net foreign exchange flow</b>	<b>4369.30</b>	<b>5996.63</b>	<b>7321.00</b>	<b>7363.50</b>	<b>7406.00</b>	<b>7448.50</b>	<b>7916.00</b>
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>net foreign exchange effect</b>	<b>4369.30</b>	<b>5996.63</b>	<b>7321.00</b>	<b>7363.50</b>	<b>7406.00</b>	<b>7448.50</b>	<b>7916.00</b>
present values at 10.00 %							
foreign exchange flow .	40250.25						
net foreign exchange effect	40250.25						



**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	1750.00	1750.00	1750.00	1750.00	1750.00	1750.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1750.00	1750.00	1750.00	1750.00	1750.00	1750.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	9334.00	9334.00	9334.00	9334.00	9334.00	9334.00	-7151.82
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-7177.74
imported materials . . .	9334.00	9334.00	9334.00	9334.00	9334.00	9334.00	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	25.93
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	7916.00	7916.00	7916.00	7916.00	7916.00	7916.00	7151.82
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	7916.00	7916.00	7916.00	7916.00	7916.00	7916.00	7151.82
present values at	10.00 %						
foreign exchange flow .	40250.25						
net foreign exchange effect	40250.25						


**Foreign Exchange Effect in 1000 US \$**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow . .	136167.50	1606.00	136661.50	1606.00	0.00	3904.76	5852.13
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	1617.48	1606.00	11.48	1606.00	0.00	4.76	2.13
exports . . . . .	13650.00	0.00	13650.00	0.00	0.00	3900.00	5850.00
indirect effects . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	61150.38	2050.60	59099.78	380.00	1670.60	3227.94	3377.67
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1540.40	1890.00	-349.60	380.00	1510.00	1152.99	555.99
imported materials . . .	57109.20	0.00	57109.20	0.00	0.00	1713.60	2480.40
repayment loans & overd.	1617.48	0.00	1617.48	0.00	0.00	200.75	200.75
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	883.30	160.60	722.70	0.00	160.60	160.60	140.52
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	75017.09	-444.60	75461.70	1226.00	-1670.60	676.82	2474.46
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	75017.09	-444.60	75461.70	1226.00	-1670.60	676.82	2474.46
present values at 10.00 %							
foreign exchange flow .	30316.00						
net forgn exchge effect	30316.00						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	7802.30	9752.30	9750.00	9750.00	9750.00	9750.00	9750.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	2.30	2.30	0.00	0.00	0.00	0.00	0.00
exports . . . . .	7800.00	9750.00	9750.00	9750.00	9750.00	9750.00	9750.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	4198.06	5004.79	4415.05	4394.98	4374.90	4354.83	4134.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	569.66	569.66	0.00	0.00	0.00	0.00	0.00
imported materials . . .	3307.20	4134.00	4134.00	4134.00	4134.00	4134.00	4134.00
repayment loans & overd.	200.75	200.75	200.75	200.75	200.75	200.75	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	120.45	100.38	80.30	60.22	40.15	20.08	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	3604.24	4747.51	5334.95	5355.02	5375.10	5395.17	5616.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	3604.24	4747.51	5334.95	5355.02	5375.10	5395.17	5616.00
present values at 10.00 %							
foreign exchange flow .	30316.00						
net foreign exchange effect	30316.00						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	9750.00	9750.00	9750.00	9750.00	9750.00	9750.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	9750.00	9750.00	9750.00	9750.00	9750.00	9750.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	4134.00	4134.00	4134.00	4134.00	4134.00	4134.00	-3186.42
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-3197.90
imported materials . . .	4134.00	4134.00	4134.00	4134.00	4134.00	4134.00	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	11.48
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	5616.00	5616.00	5616.00	5616.00	5616.00	5616.00	3186.42
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	5616.00	5616.00	5616.00	5616.00	5616.00	5616.00	3186.42
present values at 10.00 %							
foreign exchange flow .	30316.00						
net foreign exchange effect	30316.00						





COMFAR 2.1 - BALDO &amp; CO. S.R.L., MILANO

## Foreign Exchange Effect in 1000 US \$

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1987	1990
total foreign inflow . .	105605.40	2091.00	103514.40	2091.00	0.00	3005.94	4502.72
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	2105.44	2091.00	14.44	2091.00	0.00	5.94	2.72
exports . . . . .	103500.00	0.00	103500.00	0.00	0.00	3000.00	4500.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	77056.39	2669.10	74387.29	492.00	2177.10	4059.92	4268.56
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	2004.90	2460.00	-455.10	492.00	1968.00	1449.44	704.22
imported materials . . .	71796.00	0.00	71796.00	0.00	0.00	2140.00	3120.00
repayment loans & overd.	2105.44	0.00	2105.44	0.00	0.00	261.38	261.38
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	1150.05	209.10	940.95	0.00	209.10	209.10	182.96
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	28549.05	-578.10	29127.15	1599.00	-2177.10	-1053.98	234.16
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	28549.05	-578.10	29127.15	1599.00	-2177.10	-1053.98	234.16
present values at 10.00 %							
foreign exchange flow .	9582.39						
net foreign exchange effect	9582.39						



**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . . .	6002.89	7502.88	7500.00	7500.00	7500.00	7500.00	7500.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	2.89	2.88	0.00	0.00	0.00	0.00	0.00
exports . . . . .	6000.00	7500.00	7500.00	7500.00	7500.00	7500.00	7500.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	5296.09	6305.50	5563.92	5537.79	5511.65	5485.51	5198.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	717.89	715.43	0.00	0.00	0.00	0.00	0.00
imported materials . . .	4160.00	5198.00	5198.00	5198.00	5198.00	5198.00	5198.00
repayment loans & overd.	261.38	261.38	261.38	261.38	261.38	261.38	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	156.82	130.69	104.55	78.41	52.28	26.14	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	706.80	1197.39	1936.08	1962.21	1988.35	2014.49	2302.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	706.80	1197.39	1936.08	1962.21	1988.35	2014.49	2302.00
present values at 10.00 %							
foreign exchange flow .	9582.39						
net forgn exchge effect	9582.39						



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**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	7500.00	7500.00	7500.00	7500.00	7500.00	7500.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	7500.00	7500.00	7500.00	7500.00	7500.00	7500.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	5198.00	5198.00	5198.00	5198.00	5198.00	5198.00	-4027.65
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-4042.09
imported materials . . .	5198.00	5198.00	5198.00	5198.00	5198.00	5198.00	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	14.44
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	2302.00	2302.00	2302.00	2302.00	2302.00	2302.00	4027.65
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	2302.00	2302.00	2302.00	2302.00	2302.00	2302.00	4027.65
present values at 10.00 %							
foreign exchange flow .	9582.39						
net foreign exchange effect	9582.39						

ALTERNATIVE C



**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CI = 100.00 units local CI

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1987	1990
total foreign inflow ..	90992.66	1285.00	89707.66	1285.00	0.00	2603.23	3901.37
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	1292.66	1285.00	7.66	1285.00	0.00	3.23	1.37
exports .....	89700.00	0.00	89700.00	0.00	0.00	2600.00	3900.00
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow ..	41347.96	1640.50	39707.46	302.00	1338.50	2225.96	2294.06
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	1232.30	1512.00	-279.70	302.00	1210.00	773.75	366.38
imported materials ...	38116.25	0.00	38116.25	0.00	0.00	1163.08	1654.62
repayment loans & overd.	1292.66	0.00	1292.66	0.00	0.00	160.63	160.63
other repayments .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	706.75	128.50	578.25	0.00	128.50	128.50	112.44
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	49644.70	-355.50	50000.20	983.00	-1338.50	377.27	1607.31
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	49644.70	-355.50	50000.20	983.00	-1338.50	377.27	1607.31
present values at 10.00 %							
foreign exchange flow	19958.62						
net forgn exchge effect	19958.62						



**COMFAR**<sup>®</sup>  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	5201.53	6501.53	6500.00	6500.00	6500.00	6500.00	6500.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	1.53	1.53	0.00	0.00	0.00	0.00	0.00
exports . . . . .	5200.00	6500.00	6500.00	6500.00	6500.00	6500.00	6500.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	2843.20	3378.68	2982.57	2966.51	2950.45	2934.39	2757.70
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	380.04	380.04	0.00	0.00	0.00	0.00	0.00
imported materials . . . .	2206.16	2757.70	2757.70	2757.70	2757.70	2757.70	2757.70
repayment loans & overd.	160.63	160.63	160.63	160.63	160.63	160.63	0.00
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	96.38	80.31	64.25	48.19	32.13	16.06	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	2358.33	3122.85	3517.43	3533.49	3549.55	3565.61	3742.30
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	2358.33	3122.85	3517.43	3533.49	3549.55	3565.61	3742.30
present values at 10.00 %							
foreign exchange flow . .	19958.62						
net foreign exchange effect	19958.62						



**COMFAR**  
2.1 UNIDO

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US \$**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	6500.00	6500.00	6500.00	6500.00	6500.00	6500.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	6500.00	6500.00	6500.00	6500.00	6500.00	6500.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	2757.70	2757.70	2757.70	2757.70	2757.70	2757.70	-2172.25
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-2179.91
imported materials . . .	2757.70	2757.70	2757.70	2757.70	2757.70	2757.70	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	7.66
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	3742.30	3742.30	3742.30	3742.30	3742.30	3742.30	2172.25
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	3742.30	3742.30	3742.30	3742.30	3742.30	3742.30	2172.25
present values at 10.00 %							
foreign exchange flow .	19958.62						
net forgn exchge effect	19958.62						

**Leather and canvas shoes**

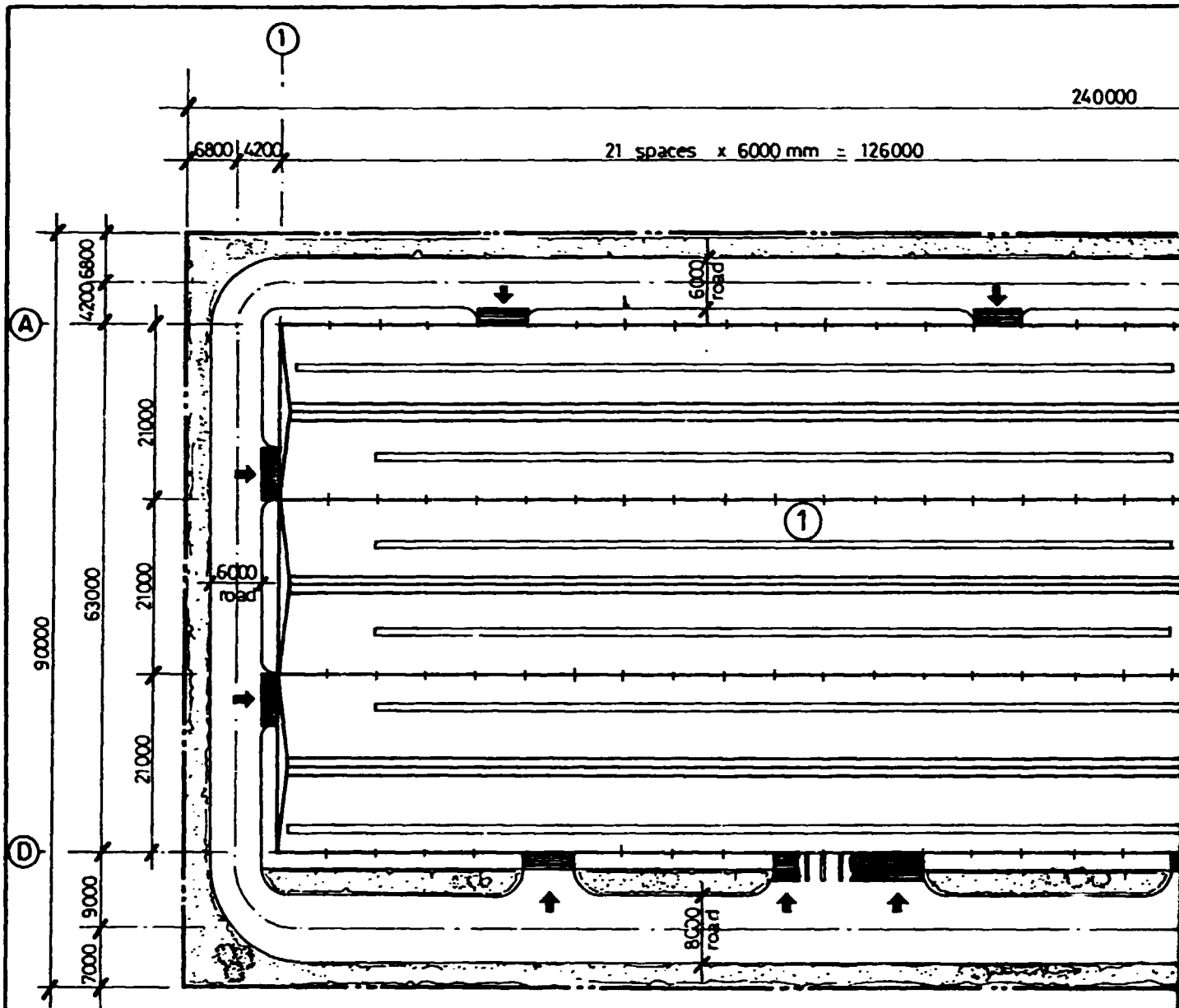
**ANNEXE 7**

DRW. B162-1-1

SITE LAYOUT

DRW. B162-1-2

EQUIPMENT LAY OUT



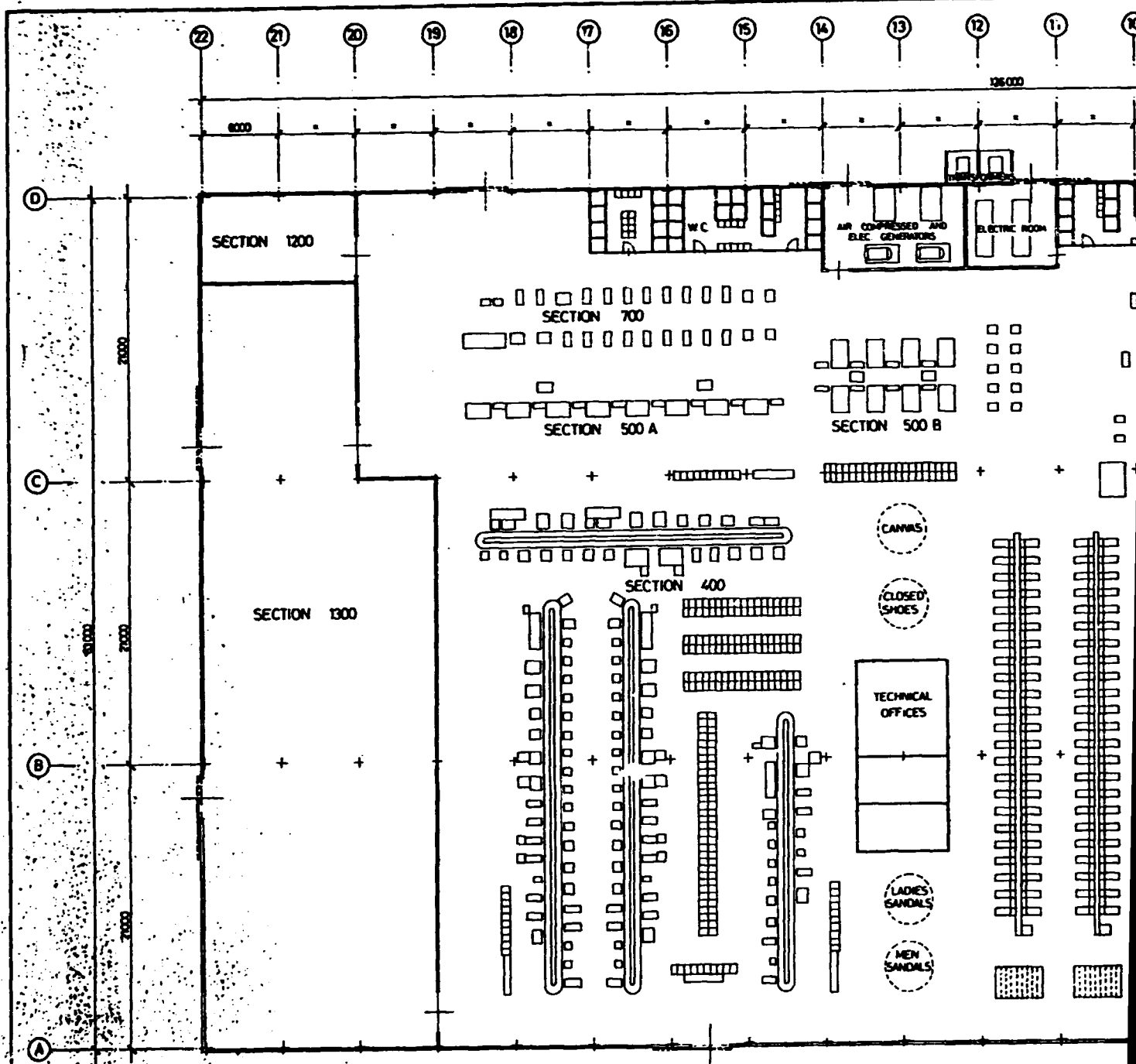
## LEGEND

- ① — PRODUCTION BUILDING
- ② — OFFICES - CANTEEN - CHANGING - BUILDING
- ③ — IMFLAMABLE STORE
- ④ — CARS WORKSHOP
- — PLATFORM ROOFING

## SECTION 1

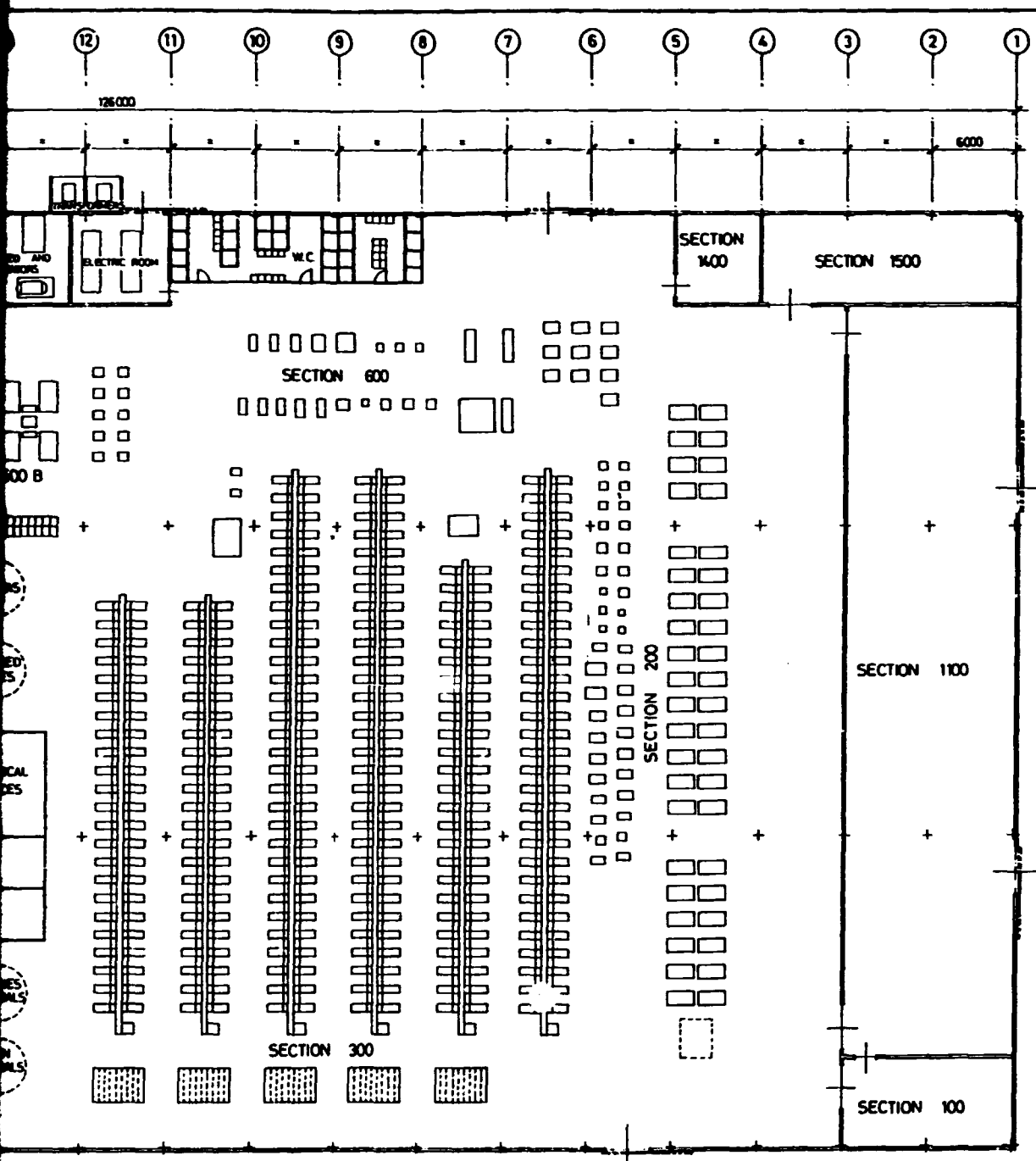






LEGEND	
SECTION	DESCRIPTION
100	PATTERN DEPARTEMENT
200	CUTTING DEPARTEMENT
300	CLOSING AND PREPARATION OPT
400	LASTING DEPARTEMENT
500	INJECTION DEPARTEMENT
600	BOTTOM DEPARTEMENT
700	FINISHING CANVAS SECTION
1100	RAW MATERIAL STORE
1200	MOULDS STORE
1300	FINISHED GOODS STORE
1400	LABORATORY ROOM
1500	WORKSHOP MAKING DIES PRODUCT

SECTION 1



# SECTION . 2

CLIENTE Sartoria	COMMISSIONE N° 777/77		
<b>SHOES FACTORY</b> <b>LAY-OUT</b>		CONTROLLATO G. Basso	DATA 06/77
		DISEGNATO G. Basso	DATA 06/77
SCALA 1:100			
<b>baldo &amp; c.</b> <small>CONCETTI E PROGETTI</small>		Via Silvano 39, 20154 MILANO Tel. N. 208 716 N. 208229	
C.N. N° 00000000		<b>B.162-1-2</b>	

**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF BROMINE**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION (Two alternatives)**

**ANNEXE 2 - BEP EVALUATION**

**ANNEXE 3 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 4 - DRW. B162 - 9 - 1 - LAY OUT**

**DRW. B162 - 9 - 2 - PROCESS FLOW DIAGRAM**

0. SUMMARY AND CONCLUSIONS

The possibility of extracting bromine from the Assab Salt Works brines is analyzed in this opportunity study. Representative samples were provided by NCC and analyzed in an Italian laboratory to ascertain their bromine content. The results showed that the average concentration is 2.63 kg/cu.mt. Taking into consideration that the amount of bitterns available at the Assab works is 250-300,000 tons/year, the quantity of bromine that can be extracted is 650 tons per year only.

Even when the planned salt works expansion is implemented, the amount of bromine that can be extracted will not be higher than 2,000 tons/year.

This value is extremely low if compared with the largest producers who have the monopoly of bromine commercialisation, namely:

- Great Lakes Co. (USA)
- Ethyl Corporation (USA)
- Dead Sea Bromine Compound (Israel)

All these companies, accounting for more than 90% of the world production, have facilities suitable for the production of more than 120-130,000 tons/year of bromine.

It is evident that even with an output of 2,000 tons/year the depreciation of the production unit alone would be very high (440 \$/ton) compared with the ex-works selling price that should not be over 740 \$/ton to be competitive on the international market.

The cost of the input is also very high, in excess of

1500 \$/ton (even considering a low price for the Sulphuric Acid), making the production cost of the Bromine considerably more expensive than the highest ex-works selling price. (Two alternative prices have been taken into consideration).

For these reasons no further action is recommended on this project.



1. INTRODUCTION

Bromine does not occur in nature as the free element, but is found only as the bromide, especially bound to silver. The most recoverable form of bromine occurs in the hydrosphere as soluble bromide salts.

In seawater the average content of bromide is about 65 g/cu.m. Bromides are also contained in salt lakes, in natural brine deposits and in inland seas.

Another source of bromine is bitters (mother liquors from salt pans), in which the concentration is about 2000-3000 g/cu.mt.

The richest source of bromine is Dead Sea, containing about 4000 g/m<sup>3</sup> of bromide at the surface: the effluents from Dead Sea potash production may reach even 12,000 g/cu.mt.

Bromine is a reddish-brown liquid, smoking and highly corrosive. The main chemical and physical properties of the pure product are as follows:

Atomic weight	79.916
Specific weight at 25°C	3.10
Boiling point	58.5° C

A good technical product should be specified as follows:

Purity	99.5% min.
Chlorine	150 ppm max
Water	70 ppm max

2. MARKET AND PLANT CAPACITY

2.1 Uses

Bromine is a basic raw material for manufacturing many different fine chemical compounds.

A list of the main bromine compounds is as follows:

Inorganic derivatives

Hydrobromic acid: used for preparing hydrobromides, as catalyst, as isomerizing agent, etc.

Bromides:                      Ammonium: used as flame retardant for paper and in the photographic bleaching process

Potassium: used in photographic film development and for pharmaceutical preparations.

Sodium: used as catalyst in terephthalic acid production and in photography field.

Organic derivatives: Methyl bromides: used as indoor fumigant in seeds nurseries, seed beds, green houses and in field scale fumigation and soil disinfection

Ethyl bromides: used as reagent and intermediate in organic synthesis.

Bromosuccinimide used as brominating agent in different fields such as rubber, textiles, plastics, photography and pharmaceuticals

In addition to the above compounds and uses, there are many other derivatives which are used in many sectors of fine chemicals.

## 2.2 Forecast demand and plant capacity

For the time being and for the near future a utilization of bromine is not envisaged in Ethiopia.

Therefore a possible bromine production can be foreseen only for exportation.

The major producers of bromine in the world are:

Great Lakes (U.S.A.)

Ethyl Corporation (U.S.A.)

Dead Sea Bromine Compound (Israel)

All these companies use concentrated raw brines; the Dead Sea in particular uses the effluent from potash production with the highest known content of bromine (12 kg/m<sup>3</sup>). The above mentioned producers account for more than 90% of world production and each of them has facilities suitable for the production of more than 120-130,000 t/y of bromine.

Other minor producers, who also use concentrated raw brines, with a minimum production of 8-10.000 t/y are present in various countries (China, Spain, etc.)

On the basis of the above considerations it is evident that the establishment of a new export-oriented

producing plant, can be considered only in the framework of commercial agreements to be reached with major marketing/producing companies active in this field.

The raw materials taken into consideration for bromine production are the bitters of the Assab salt works, that at present are available in an amount of 250,000/300,000 cu.mt./year suitable for an average production of 650 t/y of bromine. (1)

In any case considering the possible future enlargement of the salt works and, in turn, the increase in bitters availability, the plant has been designed for a max production of 2000 t/y which is the minimum economic size for this kind of plant. The plant will operate on a three shift per day basis when at full production. While the amount of bitters does not allow full production, the plant will operate at three shifts (the operation is continuous), but at a low production rate.

### 2.3 Sale prices and total revenues

Bromine is sold on the European market at a prevailing price of 1000, even if the official price is around 2000 \$/t.

- (1) Samples of Assab Salt Works bitters were analysed in laboratory (Montedison, Italy) and showed a content of 2.63 kg/cu.mt. bromine.

Considering costs of transportation (from Assab to European port) of 110 U.S.\$/ton and a wholesale discount of 15%, equivalent to 150 U.S.\$/ton, the maximum selling price for the Ethiopian producer, ex-works, can be 740 or 1606 \$/ton, so the total revenues (1) could be:

$740 \times 650 \text{ t} = 481.000 \text{ U.S. \$/year}$  or  
 $1606 \times 650 \text{ t} = 1,043,900$

At full capacity the plant could have a total revenue of  
 $740 \$ \times 2,000 \text{ tons} = 1,480,000 \text{ US \$/year}$  or  
 $1606 \$ \times 2,000 \text{ tons} = 3,212,000 \text{ US \$/year.}$

(1) Anyway, as pointed out in parag. 2.2, marketing area, selling price and, consequently, revenues are conditioned to an agreement with the major world producers.

### 3. MATERIALS AND INPUTS

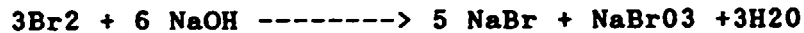
#### 3.1 Chemistry

The recovery of bromine from the bitters takes place by means of a reaction between chlorine and the bromine salts, at an acid pH, according to the following scheme:



where Na may be partially substituted by K, Mg etc.

The second step of the reaction (according to the selected process, see para 5.1) consists of an absorption of bromine by a solution of soda ash (or sodium hydroxide) according to the following reaction:



The so fixed bromine is then released by a treatment with sulphuric acid:



#### 3.2 Material and utilities: requirement and costs

In table 3.2 are shown in detail the costs for all the inputs, referred to the production of 650 t/y of bromine.

The characteristics of the raw materials are as follows:

Table 3.2 - Requirements and costs for an annual production of 650 t/y

DESCRIPTION	UNIT OF MEASURE	REQUIRED QUANTITY		UNIT COSTS \$		ANNUAL COSTS \$		
		1 TON	: YEAR	LC	FC	LC	FC	TOTAL
Bitterns	m3	450(1)	292,500	(2)	-	-	-	-
Chlorine	t	0.6	390	816	-	318,240	-	318,240
Sulphuric acid (98%)	t	2	1300	601	-	781,300	-	781,300
Sodium hydroxide 50% (as 100%)	t	0.8	520	387	-	201,240	-	201,240
1' Sub total: raw materials						1,300,780		1,300,780(3)
Electric power	kwh	1000	650,000	0,0966	-	62,790	-	62,790
Steam	t	3	1950	-	17,25	-	33,640	33,640
Water	m3	200	130,000	0,02	-	2,600	-	2,600
2' Sub total: utilities						65,390	33,640	99,030
GENERAL TOTAL (1'+2' subtotals)								1,397,860(3)
Unit Cost \$/t								2,153(4)

- (1) ON THE BASIS OF 2.63 kg/cu.mt. AS BROMINE CONTENT
- (2) THE COST OF THE BITTERNS IS DUE ONLY TO THE CONSUMPTION OF THE ELECTRIC POWER USED TO PUMP THEM; THIS COST HAS BEEN CONSIDERED IN THE UTILITY COSTS.
- (3) 922.480 and 1,021,510 \$ respectively with the sulphuric acid at 310 \$/t
- (4) 1571 \$ with the sulfuric acid at 310 \$/t

- Bitterns:

colourless liquid

bromine content: 2.63 kg/cu.mt

Note: the bromine content corresponds to the analysis of a sample taken the 13-3-1987 at ASW-Assab (number of the sample: ASW-LBS-014)

- Chlorine: commercial grade

- Sulphuric acid: commercial grade; title 98%

- Sodium hydroxide: commercial grade title 50%

In the financial evaluation, the above mentioned costs are shown as follows:

Raw materials	LC	1,300,786 \$/y	(922,480 with sulfuric acid at 310\$/t)
Energy (fuel)	FC	33,640 \$/y	
Energy (electricity)	LC	62,790 \$/y	
Utilities	LC	2,600 \$/y	
		-----	
		1,399,810 \$/Y	(1,021,510 with sulfuric acid at 310 \$/y)

**3.3 Raw material purchasing programme and storage volume**

In table 3.3 requirements and storage capacities are detailed.



**Table 3.3 Raw material purchasing programme and storage volume**

PRODUCT	ORIGIN	PURCHASING PROGRAMME			STORAGE		
		t	m3	DAYS*	Capacity m3	Time of storage	Tank material
Liquid chlorine	L	28,8	16,2	8	20	8 days	C-steel
Sulphuric acid 98%	L	360	200	30	200	30 days	C-steel
Caustic soda 50%	L	146	96	15	100	15 days	C-steel

\* Equivalent days of production at full capacity (2000 t/y)

Note: storage for bitters has not been foreseen

If the plant is installed in the proximity of the chloro-soda plant, a supply of chlorine gas through a pipe-line could be taken into consideration.

4. LOCATION

The bromine plant should be located where bitterns are available, that is near the salt works. This is also the location recommended for the installation of a possible chlor-alkali plant; if so, the proximity of the two plants would facilitate the supply of chlorine and caustic soda to the bromine plant.

5. PROJECT ENGINEERING

5.1 Description of process and main equipment

The most commonly used processes for manufacturing bromine are based on the following steps:

- 1) oxidation of the bromides to bromine by chlorine
- 2) removal of bromine vapours from the solution obtained

3) isolation of bromine from the vapours

In the second step two different processes may be followed:

- a) the steam-out process
- b) the blowing-out process

The steam-out process is generally used when the available brines have a rather high bromine concentration, while the blowing-out process, even if a little more complicated, is preferred with lower concentrations, because require a lower energy consumption.

In our case, due to the low content of Bromine in the bitters, the blowing out process is considered the only suitable.

The flow diagram is shown in the drawing B162-9-2.

The main equipment of the chosen process is:

- one blowing out tower
- two absorption towers
- one deabsorption tower

All these towers are filled with ceramic material. In particular the deabsorption tower is constructed in glass. The process is continuous. After acidification with H<sub>2</sub>SO<sub>4</sub> (in order to keep the pH lower than 3,5) and introduction of chlorine, in order to oxidize the

bromides and release the bromine, the bitterns are pumped to the top of the "blowing-up" tower.

The stream of waters then flow through the packed tower releasing the bromine which is blown out by a counter current air stream.

The outgoing air enriched with bromine passes through the two absorption towers (which work in series) where the bromine is absorbed by a caustic soda solution. In the first absorption tower the air is scrubbed with a rather exhausted alkaline liquor while in the second a fresh caustic soda solution is used. (1) In the two absorption towers the formation of a bromide-bromate solution takes place. This solution is then pumped to the top of the deabsorption tower where the reaction with sulphuric acid releases the bromine, which is stripped from the solution by steam.

Finally the bromine is separated from the condensed water and is sent to the storage.

## 5.2 Packaging

Bromine is mostly traded in bulk lots, usually in 20 foot frame containers loaded with 14 tons of the product. Each container is composed of four receptacles, each with a content of 3.5 tons.

The gross weight of the loaded containers is about 22 tons.

Containers are suitable for road, train and ship transportation, and must be returned by the client to the bromine producer.

- (1) Other blowing out processes use different reagents, but the scheme is practically the same.

5.3 Layout and civil works

The general lay-out is shown in drawing B162-9-1.

The area required for the installation of the process equipment with all the necessary utilities and facilities is about 5,000 sq.mt.

The whole process plant is installed outdoor, except for the deabsorption tower and related equipment which are sheltered by a roof.

Administrative offices, laboratory, workshop, social services and other facilities are grouped in a one-storey building covering an area of 700 sq.mt.

This building has a supporting structure of reinforced concrete; external and internal walls are of brickwork, while the roof is made of corrugated asbestos-cement, insulated by mineral wool lagging; the floor of the offices, laboratory and social services are covered with tiles while the workshop, warehouse and other rooms have concrete floors.

The roof on the deabsorption tower is supported by steel columns and covered by corrugated asbestos cement.

The floor of the process plant area is paved with concrete with a hard aggregate as finishing surface. The remaining area is covered with gravel and rolled.

The fence consists of a wire netting supported by small steel poles.

5.4 Investment costs; depreciation and maintenance

5.4.1 Investment cost of machinery and equipment U.S.\$

The investment costs, as shown below, are rather high: this is due to the small size of the plant (high incidence of the basic process design) and to the special technical characteristics of most of machinery and equipment due to the corrosiveness and toxicity of the chemicals involved in the process.

MACHINERY COST U.S.\$	LC	FC	TOTAL
Machinery and equipment, special container for the shipment of the product included, FOB European port	-	5,350,000	5,350,000
Transportation	17,000	250,000	267,000
Erection	500,000	570,000	1,070,000
Civil works	910,000	-	910,000
Insulation and painting	36,000	100,000	136,000
Spare parts	-	267,000	267,000
<b>TOTAL</b>	<b>1,463,000</b>	<b>6,537,000</b>	<b>8,000,000</b>
<b>CONTINGENCIES</b>	<b>137,000</b>	<b>663,000</b>	<b>800,000</b>
<b>GRAND TOTAL</b>	<b>1,600,000</b>	<b>7,200,000</b>	<b>8,800,000</b>

The life cycle of the plant can be estimated at ten years. The annual cost of plant maintenance has been assumed to be in the range of 7% of the cost of machinery.

In the financial evaluation, the investment costs (contingencies included) have been so subdivided:

Machiney	FC	7.2	million dollars
Machinery	LC	0.553	" "
Civil Works	LC	1.047	" "
		-----	
		8.800	million dollars



6. PLANT ORGANIZATION

The plant has been considered as an autonomous unit complete with utilities and facilities operating under the direction of the N.C.C.

7. MANPOWER

No particular skills are required of the personnel employed in the factory except for the production manager, chemist, engineer, and senior sale clerk, who must have through training in the technology involved in the process as well as in laboratory analysis, safety requirements, corrosion problems, international market regulations, etc. For all the other positions, the requirements are reasonably similar to those usually required in a chemical factory.

7.1 Management

		birr/m	birr/y
General manager	1	1500	
Technical manager	1	1200	
	---	-----	-----
	2	2700	32,400

7.2 Administrative dep.

Senior accountant	1	800	
Accountants	2	700	
Purchasing office clerks	2	750	
Sale office clerks	3	1100	
Warehouse keepers	2	750	
Drivers	2	700	
Clerks and secretaries	3	1050	
Guards	9	1800	
	---	-----	-----
	24	7650	91,800

Total Manag. and Administr. Dept. 124,200 birr/y (60,000 \$/y)

7.3 Production and maintenance depart.

		birr/m	birr/y
<b>Production department</b>			
Production man.	1	1000	
Shift foremen	4	1600	
Shift operators	24	8400	
Chemist	1	700	
Analyst	1	350	
Production clerk	1	350	
Unskilled workers	4	800	
	---	-----	-----
	36	13200	158,400
			(76,522 \$/y)
<b>Maintenance department</b>			
Chief engineer	1	800	
Supervisors	2	800	
Electricians	4	1400	
Mechanics	10	3500	
Civil work maintenance personnel	2	600	
	---	-----	-----
	19	7100	85,200
			(41,159 \$/y)

8. IMPLEMENTATION SCHEDULING

From the time the contract with contractor is signed, a total construction time of 30 months will be required.

9. FINANCIAL EVALUATIONS

The Comfar financial evaluation is attached as Annexe 1. This evaluation is based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (1 year) has been taken into account and indicated as "foreign factory overheads"

- the production programme has been assumed as follows:

1st year: 20% capacity: 400 t/y

From 2nd to 15th year: about 30% capacity: 650 t/y

Selling prices: 740 or 1606 \$/t

Being the production costs higher than the revenues, the result of evaluation is negative: no IRR has been found and the BEP value is negative.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items. The import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) is zero, since the product is only for export.

For this reason the net foreign exchange flow and the net foreign exchange effect are the same. The result of the evaluation is negative: by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to (-4,700,000\$).

Even considering an higher selling price the net foreign exchange effect is negative (1,692,000 \$).

**FINANCIAL EVALUATION**  
**(Two Alternatives)**



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BRONZE  
February 88  
Sale price at 1606 US \$/ton

3 year(s) of construction, 15 years of production  
currency conversion rates:  
foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US Dollars

---

**Total initial investment during construction phase**

fixed assets:	8906.00	80.84% foreign
current assets:	0.00	0.00% foreign
total assets:	8906.00	80.84% foreign

---

**Source of funds during construction phase**

equity & grants:	2786.00	0.00% foreign
foreign loans:	6120.00	
local loans:	0.00	
total funds:	8906.00	68.718% foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	1081.26	1549.20	1549.20
depreciation :	590.67	590.67	590.67
interest :	612.00	535.50	459.00
production costs	2283.94	2675.38	2598.88
thereof foreign	60.77 %	52.31 %	50.90 %
total sales :	642.40	1043.90	1043.90
gross income :	-1641.54	-1631.47	-1554.97
net income :	-1641.54	-1631.47	-1554.97
cash balance :	-2220.63	-2022.02	-1729.30
net cashflow :	-343.63	-721.52	-505.30

Net Present Value at: 10.00 % = -11207.08  
Internal Rate of Return: -21.85 %  
Return on equity1: not found  
Return on equity2: -24.71 %

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**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US Dollars**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1
<b>Fixed investment costs</b>					
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00
Buildings and civil works .....	200.00	300.00	400.00	100.00	47.00
Auxiliary and service facilities .	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment ...	360.00	1180.00	2313.00	2360.00	1940.00
<b>Total fixed investment costs ....</b>	<b>560.00</b>	<b>1480.00</b>	<b>2713.00</b>	<b>2460.00</b>	<b>1587.00</b>
Pre-production capital expenditures.	5.00	15.00	15.00	30.00	41.00
Net working capital .....	0.00	0.00	0.00	0.00	0.00
<b>Total initial investment costs ...</b>	<b>565.00</b>	<b>1495.00</b>	<b>2728.00</b>	<b>2490.00</b>	<b>1628.00</b>
<b>Of it foreign, in % .....</b>	<b>63.72</b>	<b>72.24</b>	<b>79.18</b>	<b>86.75</b>	<b>88.45</b>

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Current Investment in 1000 US Dollars**

Year .....	1990	1991
<b>Fixed investment costs</b>		
Land, site preparation, development	0.00	0.00
Buildings and civil works .....	0.00	0.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>
Working capital .....	404.77	216.22
<b>Total current investment costs . . .</b>	<b>404.77</b>	<b>216.22</b>
<b>Of it foreign, % .....</b>	<b>68.55</b>	<b>71.16</b>

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COMFAR 2.1 - BALDI & CO. S.R.L., MILANO

**Total Production Costs in 1000 US Dollars**

Year .....	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	20.00	32.50	32.50	32.50	32.50	32.50
Raw material 1 .....	567.68	922.48	922.48	922.48	922.48	922.48
Other raw materials .....	0.00	0.00	0.00	0.30	0.00	0.00
Utilities .....	1.60	2.60	2.60	2.60	2.60	2.60
Energy .....	59.30	96.44	96.44	96.44	96.44	96.44
Labour, direct .....	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance .....	41.16	41.16	41.16	41.16	41.16	41.16
Spares .....	215.00	350.00	350.00	350.00	350.00	350.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1021.26</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>
Administrative overheads .....	60.00	60.00	60.00	60.00	60.00	60.00
Indir. costs, sales and distribution	3.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	590.68	590.68	590.68	590.68	590.68	569.48
Financial costs .....	612.00	535.50	459.00	382.50	306.00	229.50
<b>Total production costs .....</b>	<b>2283.94</b>	<b>2675.38</b>	<b>2598.88</b>	<b>2522.38</b>	<b>2445.88</b>	<b>2348.18</b>
<b>Costs per unit ( single product ) .</b>	<b>5.71</b>	<b>4.12</b>	<b>4.00</b>	<b>3.88</b>	<b>3.76</b>	<b>3.61</b>
Of it foreign, % .....	60.77	52.31	50.90	49.41	47.83	46.56
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	136.52	136.52	136.52	136.52	136.52	136.52



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US Dollars**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	32.50	32.50	32.50	32.50	32.50	32.50
Raw material 1 . . . . .	922.48	922.48	922.48	922.48	922.48	922.48
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	2.60	2.60	2.60	2.60	2.60	2.60
Energy . . . . .	96.44	96.44	96.44	96.44	96.44	96.44
Labour, direct . . . . .	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance . . . . .	41.16	41.16	41.16	41.16	41.16	41.16
Spares . . . . .	350.00	350.00	350.00	350.00	350.00	350.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>
Administrative overheads . . . . .	60.00	60.00	60.00	60.00	60.00	60.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	569.48	569.48	569.48	517.13	255.07	0.00
Financial costs . . . . .	153.00	76.50	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>2271.66</b>	<b>2195.18</b>	<b>2118.68</b>	<b>2066.32</b>	<b>1804.27</b>	<b>1549.20</b>
<b>Costs per unit ( single product ) .</b>	<b>3.49</b>	<b>3.38</b>	<b>3.26</b>	<b>3.18</b>	<b>2.78</b>	<b>2.38</b>
Of it foreign, % . . . . .	44.76	42.84	40.77	41.81	34.39	24.76
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	136.52	136.52	136.52	136.52	136.52	136.52



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COMFAR 2.1 - BALDO & C. S.R.L., MILANO

**Net Working Capital in 1000 US Dollars**

Year .....		1990	1991	1992-2004
Coverage .....	ndc coto			
<b>Current assets &amp;</b>				
Accounts receivable . . .	30 12.0	90.10	129.10	129.10
Inventory and materials .	30 12.0	47.31	76.88	76.88
Energy .....	11 32.4	1.83	2.98	2.98
Spares .....	360 1.0	215.00	350.00	350.00
Work in progress .....	1 360.0	2.84	4.14	4.14
Finished products . . .	30 12.0	90.10	129.10	129.10
Cash in hand .....	15 24.0	18.86	21.99	21.99
Total current assets .....		466.05	714.18	714.18
<b>Current liabilities and</b>				
Accounts payable .....	12 16.0	61.28	93.20	93.20
Net working capital .....		404.77	620.99	620.99
Increase in working capital .....		404.77	216.22	0.00
Net working capital, local .....		127.30	189.66	189.66
Net working capital, foreign .....		277.47	431.33	431.33

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US Dollars

Year .....	1987.1
Equity, ordinary ..	2786.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	6120.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	6120.00
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	8906.00

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**COMFAR**  
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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US Dollars

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total loan .....	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00
Current liabilities	61.28	31.91	0.00	0.00	0.00	0.00	0.00
Bank overdraft ....	2220.63	2022.02	1729.30	1652.80	1576.30	1499.80	1423.30
Total funds .....	1516.91	1288.93	964.30	887.80	811.30	734.80	656.30

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US Dollars

Year .....	1997	1998-2004
Equity, ordinary ..	0.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	-765.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	-765.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	1346.80	505.30
Total funds .....	581.80	505.30

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US Dollars

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	8906.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	8906.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Total assets . . . .	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	8341.00	-1495.00	-2728.00	-2490.00	-1628.00	0.00
Cumulated cash balance	8341.00	6846.00	4118.00	1628.00	0.00	0.00
Inflow, local . . . .	2786.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	205.00	415.00	568.00	330.00	188.00	0.00
Surplus ( deficit ) .	2581.00	-415.00	-568.00	-330.00	-188.00	0.00
Inflow, foreign . . .	6120.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	360.00	1080.00	2160.00	2160.00	1440.00	0.00
Surplus ( deficit ) .	5760.00	-1080.00	-2160.00	-2160.00	-1440.00	0.00
Net cashflow . . . . .	-565.00	-1495.00	-2728.00	-2490.00	-1628.00	0.00
Cumulated net cashflow	-565.00	-2090.00	-4788.00	-7278.00	-8906.00	-8906.00

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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	703.68	1075.81	1043.90	1043.90	1043.90	1043.90
Financial resources .	61.28	31.91	0.00	0.00	0.00	0.00
Sales, net of tax . .	642.40	1043.90	1043.90	1043.90	1043.90	1043.90
Total cash outflow . .	2924.31	3097.83	2773.20	2696.70	2620.20	2543.70
Total assets . . . .	466.05	248.13	0.00	0.00	0.00	0.00
Operating costs . . .	1081.26	1549.20	1549.20	1549.20	1549.20	1549.20
Cost of finance . . .	612.00	535.50	459.00	382.50	306.00	229.50
Repayment . . . . .	765.00	765.00	765.00	765.00	765.00	765.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2220.63	-2022.02	-1729.30	-1652.80	-1576.30	-1499.80
Cumulated cash balance	-2220.63	-4242.65	-5971.95	-7624.75	-9201.05	-10700.85
Inflow, local . . . . .	60.46	31.67	0.00	0.00	0.00	0.00
Outflow, local . . . .	973.32	1259.59	1165.56	1165.56	1165.56	1165.56
Surplus ( deficit ) .	-912.86	-1227.92	-1165.56	-1165.56	-1165.56	-1165.56
Inflow, foreign . . . .	643.22	1044.14	1043.90	1043.90	1043.90	1043.90
Outflow, foreign . . .	1950.99	1833.24	1607.64	1531.14	1454.64	1378.14
Surplus ( deficit ) .	-1307.77	-794.10	-563.74	-487.24	-410.74	-334.24
Net cashflow . . . . .	-843.63	-721.52	-505.30	-505.30	-505.30	-505.30
Cumulated net cashflow	-9749.63	-10471.15	-10976.45	-11481.75	-11987.04	-12492.34



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90
Total cash outflow . .	2467.20	2390.70	1549.20	1549.20	1549.20	1549.20
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1549.20	1549.20	1549.20	1549.20	1549.20	1549.20
Cost of finance . . .	153.00	76.50	0.00	0.00	0.00	0.00
Repayment . . . . .	765.00	765.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-1423.30	-1346.80	-505.30	-505.30	-505.30	-505.30
Cumulated cash balance	-12124.15	-13470.95	-13776.25	-14481.54	-14986.84	-15492.14
Inflow, local . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	1165.56	1165.56	1165.56	1165.56	1165.56	1165.56
Surplus ( deficit ) .	-1165.56	-1165.56	-1165.56	-1165.56	-1165.56	-1165.56
Inflow, foreign . . . .	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90
Outflow, foreign . . .	1301.64	1225.14	383.64	383.64	383.64	383.64
Surplus ( deficit ) .	-257.74	-181.24	660.26	660.26	660.26	660.26
Net cashflow . . . . .	-505.30	-505.30	-505.30	-505.30	-505.30	-505.30
Cumulated net cashflow	-12997.64	-13502.94	-14008.24	-14513.54	-15018.84	-15524.14



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	2002	2003	2004
Total cash inflow . .	1043.90	1043.90	1043.90
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	1043.90	1043.90	1043.90
Total cash outflow . .	1549.20	1549.20	1549.20
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1549.20	1549.20	1549.20
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	-505.30	-505.30	-505.30
Cumulated cash balance	-15997.44	-16502.74	-17008.04
Inflow, local . . . . .	0.00	0.00	0.00
Outflow, local . . . . .	1165.56	1165.56	1165.56
Surplus ( deficit ) .	-1165.56	-1165.56	-1165.56
Inflow, foreign . . . .	1043.90	1043.90	1043.90
Outflow, foreign . . . .	383.64	383.64	383.64
Surplus ( deficit ) .	660.26	660.26	660.26
Net cashflow . . . . .	-505.30	-505.30	-505.30
Cumulated net cashflow	-16029.44	-16534.74	-17040.04



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### Cashflow Discounting:

a) Equity paid versus Net income flow:		
Net present value .....	-11020.92 at	10.00 %
Internal Rate of Return (IRRE1) ..	not found	
b) Net Worth versus Net cash return:		
Net present value .....	-11076.75 at	10.00 %
Internal Rate of Return (IRRE2) ..	-24.71 %	
c) Internal Rate of Return on total investment:		
Net present value .....	-11207.08 at	10.00 %
Internal Rate of Return ( IRR ) ..	-21.85 %	
Net Worth = Equity paid plus reserves		

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BRODINE — February 88



**Net Income Statement in 1000 US Dollars**

Year . . . . .	1970	1971	1972	1973	1974
Total sales, incl. sales tax . . . . .	642.40	1043.90	1043.90	1043.90	1043.90
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	642.40	1043.90	1043.90	1043.90	1043.90
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	1671.94	2139.88	2139.88	2139.88	2139.88
Operational margin . . . . .	-1029.54	-1095.97	-1095.97	-1095.97	-1095.97
As % of total sales . . . . .	-160.26	-104.99	-104.99	-104.99	-104.99
Cost of finance . . . . .	612.00	535.50	459.00	382.50	306.00
Gross profit . . . . .	-1641.54	-1631.47	-1554.97	-1478.47	-1401.97
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Tangible profit . . . . .	-1641.54	-1631.47	-1554.97	-1478.47	-1401.97
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1641.54	-1631.47	-1554.97	-1478.47	-1401.97
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1641.54	-1631.47	-1554.97	-1478.47	-1401.97
Accumulated undistributed profit . . . . .	-1641.54	-3273.01	-4827.99	-6306.46	-7708.44
Gross profit, % of total sales . . . . .	-255.53	-156.29	-148.96	-141.63	-134.30
Net profit, % of total sales . . . . .	-255.53	-156.29	-148.96	-141.63	-134.30
ROE, Net profit, % of equity . . . . .	-58.92	-58.56	-55.81	-53.07	-50.32
ROI, Net profit+interest, % of invest. . . . .	-11.06	-11.50	-11.50	-11.50	-11.50



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US Dollars**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	1043.90	1043.90	1043.90	1043.90	1043.90
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1043.90	1043.90	1043.90	1043.90	1043.90
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	2118.67	2118.67	2118.67	2118.67	2118.67
Operational margin . . . . .	-1074.77	-1074.77	-1074.77	-1074.77	-1074.77
As % of total sales . . . . .	-102.96	-102.96	-102.96	-102.96	-102.96
Cost of finance . . . . .	229.50	153.00	76.50	0.00	0.00
Gross profit . . . . .	-1304.28	-1227.78	-1151.28	-1074.78	-1074.78
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1304.28	-1227.78	-1151.28	-1074.78	-1074.78
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1304.28	-1227.78	-1151.28	-1074.78	-1074.78
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1304.28	-1227.78	-1151.28	-1074.78	-1074.78
Accumulated undistributed profit . . . . .	-9012.71	-10240.49	-11391.76	-12466.54	-13541.31
Gross profit, % of total sales . . . . .	-124.94	-117.61	-110.29	-102.96	-102.96
Net profit, % of total sales . . . . .	-124.94	-117.61	-110.29	-102.96	-102.96
ROE, Net profit, % of equity . . . . .	-46.82	-44.07	-41.32	-38.58	-38.58
ROI, Net profit+interest, % of invest. . . . .	-11.28	-11.28	-11.28	-11.28	-11.28



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US Dollars**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	1043.90	1043.90	1043.90	1043.90	1043.90
Less: variable costs, incl. sales tax . . . . .	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1043.90	1043.90	1043.90	1043.90	1043.90
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation . . . . .	2066.33	2066.33	2066.33	1804.27	1549.20
Operational margin . . . . .	-1022.43	-1022.43	-1022.43	-760.37	-505.30
As % of total sales . . . . .	-97.94	-97.94	-97.94	-72.84	-48.41
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	-1022.43	-1022.43	-1022.43	-760.37	-505.30
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1022.43	-1022.43	-1022.43	-760.37	-505.30
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1022.43	-1022.43	-1022.43	-760.37	-505.30
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1022.43	-1022.43	-1022.43	-760.37	-505.30
Accumulated undistributed profit . . . . .	-14563.74	-15586.16	-16608.59	-17368.96	-17874.26
Gross profit, % of total sales . . . . .	-97.94	-97.94	-97.94	-72.84	-48.41
Net profit, % of total sales . . . . .	-97.94	-97.94	-97.94	-72.84	-48.41
ROE, Net profit, % of equity . . . . .	-36.70	-36.70	-36.70	-27.29	-18.14
ROI, Net profit+interest, % of invest. . . . .	-10.73	-10.73	-10.73	-7.98	-5.30



COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US Dollars

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total assets .....	8906.00	8906.00	8906.00	8906.00	8906.00	8906.00
Fixed assets, net of depreciation	0.00	565.00	2060.00	4788.00	7278.00	8906.00
Construction in progress .....	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available .	8341.00	6846.00	4118.00	1628.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities .....	8906.00	8906.00	8906.00	8906.00	8906.00	8906.00
Equity capital .....	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	6120.00	6120.00	6120.00	6120.00	6120.00	6120.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt .....	6120.00	6120.00	6120.00	6120.00	6120.00	6120.00
Equity, % of liabilities .....	31.28	31.28	31.28	31.28	31.28	31.28





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US Dollars**

Year .....	1990	1991	1992	1993	1994	1995
Total assets .....	10422.91	11711.04	12676.14	13563.94	14375.24	15110.04
Fixed assets, net of depreciation	8315.33	7724.65	7133.98	6543.30	5952.63	5383.15
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	447.19	692.20	692.20	692.20	692.20	692.20
Cash, bank .....	18.86	21.99	21.99	21.99	21.99	21.99
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	0.00	1641.54	3273.01	4827.99	6306.46	7708.44
Loss .....	1641.54	1631.47	1554.97	1478.47	1401.97	1304.28
Total liabilities .....	10422.91	11711.04	12676.14	13563.94	14375.24	15110.04
Equity capital .....	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	5355.00	4590.00	3825.00	3060.00	2295.00	1530.00
Current liabilities .....	61.28	93.20	93.20	93.20	93.20	93.20
Bank overdraft, finance required ..	2220.63	4242.65	5971.95	7624.75	9201.05	10700.85
Total debt .....	7636.91	8925.84	9890.14	10777.94	11589.24	12324.04
Equity, % of liabilities .....	26.73	23.79	21.98	20.54	19.38	18.44

BRODINE — February 88

COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US Dollars**

Year .....	1996	1997	1998	1999	2000	2001
Total assets .....	15768.34	16350.14	16855.45	17360.74	17866.04	18371.35
Fixed assets, net of depreciation	4813.68	4244.20	3674.73	3105.25	2588.13	2071.00
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	692.20	692.20	692.20	692.20	692.20	692.20
Cash, bank .....	21.99	21.99	21.99	21.99	21.99	21.99
Cash surplus, finance available ..	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward .....	9012.71	10240.49	11391.76	12466.54	13541.31	14563.74
Loss .....	1227.78	1151.23	1074.78	1074.78	1022.43	1022.43
Total liabilities .....	15768.34	16350.14	16855.45	17360.74	17866.04	18371.35
Equity capital .....	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	765.00	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	93.20	93.20	93.20	93.20	93.20	93.20
Bank overdraft, finance required ..	12124.15	13470.95	13976.25	14481.55	14986.85	15492.15

Total debt . . . . .	12982.34	13564.14	14069.45	14574.74	15080.04	15585.35
Equity, % of liabilities . . . .	17.67	17.04	16.53	16.05	15.59	15.16

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BROMINE — February 88



**Projected Balance Sheets, Production in 1000 US Dollars**

Year .....	2002	2003	2004
<b>Total assets .....</b>	<b>18876.64</b>	<b>19381.94</b>	<b>19887.24</b>
Fixed assets, net of depreciation	1553.88	1298.80	1298.80
Construction in progress .....	0.00	0.00	0.00
Current assets .....	692.20	692.20	692.20
Cash, bank .....	21.99	21.99	21.99
Cash surplus, finance available .	0.00	0.00	0.00
Loss carried forward .....	15586.16	16608.59	17368.96
Loss .....	1022.43	760.37	505.30
<b>Total liabilities .....</b>	<b>18876.64</b>	<b>19381.94</b>	<b>19887.24</b>
Equity capital .....	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	93.20	93.20	93.20
Bank overdraft, finance required.	15997.45	16502.75	17008.05
<b>Total debt .....</b>	<b>16090.64</b>	<b>16595.94</b>	<b>17101.24</b>
<b>Equity, % of liabilities .....</b>	<b>14.76</b>	<b>14.37</b>	<b>14.01</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

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Basic Project

3 year(s) of construction, 15 years of production

currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US Dollars

**Total initial investment during construction phase**

fixed assets:	8906.00	80.844 % foreign
current assets:	0.00	0.000 % foreign
total assets:	8906.00	80.844 % foreign

**Source of funds during construction phase**

equity & grants:	2786.00	0.000 % foreign
foreign loans :	6120.00	
local loans :	0.00	
total funds :	8906.00	68.718 % foreign

**Cashflow from operations**

Years:	1	2	3
operating costs:	1081.26	1549.20	1549.20
depreciation :	590.67	590.67	590.67
interest :	612.00	535.50	459.00
production costs	2283.94	2675.38	2598.88
thereof foreign :	60.77 %	52.31 %	50.90 %
total sales :	296.00	481.00	481.00
gross income :	-1987.94	-2194.38	-2117.88
net income :	-1987.94	-2194.38	-2117.88
cash balance :	-2567.03	-2584.92	-2292.20
net cashflow :	-1190.03	-1284.42	-1068.20

Net Present Value at: 10.00 % = -14582.81  
Internal Rate of Return on total investments: not found  
Equity paid versus Net income flow (IRR): not found  
Net Worth versus Net Cash Return (IRR): not found

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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CONFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Initial Investment in 1000 US Dollars**

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1
<b>Fixed investment costs</b>					
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00
Buildings and civil works . . . . .	200.00	300.00	400.00	100.00	47.00
Auxiliary and service facilities . .	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00	0.00	0.00
Plant machinery and equipment . . .	360.00	1180.00	2313.00	2360.00	1540.00
<b>Total fixed investment costs . . . .</b>	<b>560.00</b>	<b>1480.00</b>	<b>2713.00</b>	<b>2460.00</b>	<b>1587.00</b>
<b>Pre-production capital expenditures.</b>	<b>5.00</b>	<b>15.00</b>	<b>15.00</b>	<b>30.00</b>	<b>41.00</b>
<b>Net working capital . . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Total initial investment costs . . .</b>	<b>565.00</b>	<b>1495.00</b>	<b>2728.00</b>	<b>2490.00</b>	<b>1628.00</b>
<b>Of it foreign, in Z . . . . .</b>	<b>63.72</b>	<b>72.24</b>	<b>79.18</b>	<b>86.75</b>	<b>88.45</b>

BRONINE --- February 88



COMFAR 2.0 - DALDO & CO. S.R.L., NILAND

**Total Current Investment in 1000 US Dollars**

Year . . . . .	1990	1991
<b>Fixed investment costs</b>		
Land, site preparation, development	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00
<b>Total fixed investment costs . . . . .</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	404.77	216.22
<b>Total current investment costs . . .</b>	<b>404.77</b>	<b>216.22</b>
<b>Of it foreign, Z . . . . .</b>	<b>68.55</b>	<b>71.16</b>

BRONINE --- February 88



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US Dollars**

Year .....	1990	1991	1992	1993	1994	1995
% of nom. capacity (single product).	20.00	32.50	32.50	32.50	32.50	32.50
Raw material 1 .....	567.68	922.48	922.48	922.48	922.48	922.48
Other raw materials .....	0.00	0.00	0.00	0.00	0.00	0.00
Utilities .....	1.60	2.60	2.60	2.60	2.60	2.60
Energy .....	59.30	96.44	96.44	96.44	96.44	96.44
Labour, direct .....	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance .....	41.16	41.16	41.16	41.16	41.16	41.16
Spares .....	215.00	350.00	350.00	350.00	350.00	350.00
Factory overheads .....	60.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1021.26</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>
Administrative overheads .....	60.00	60.00	60.00	60.00	60.00	60.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.06
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	590.68	590.68	590.68	590.68	590.68	569.48
Financial costs .....	612.00	535.50	459.00	382.50	306.00	229.50
<b>Total production costs .....</b>	<b>2283.94</b>	<b>2675.38</b>	<b>2598.88</b>	<b>2522.38</b>	<b>2445.88</b>	<b>2348.18</b>
<b>Costs per unit ( single product ) .</b>	<b>5.71</b>	<b>4.12</b>	<b>4.00</b>	<b>3.88</b>	<b>3.76</b>	<b>3.61</b>
Of it foreign, % .....	60.77	52.31	50.90	49.41	47.83	46.56
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	136.52	136.52	136.52	136.52	136.52	136.52

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COMFAR 2.0 - BALBO & CO. S.R.L., RILAND

**Total Production Costs in 1000 US Dollars**

Year . . . . .	1996	1997	1998-99	2000- 2	2003	2004
% of nom. capacity (single product).	32.50	32.50	32.50	32.50	32.50	32.50
Raw material 1 . . . . .	922.48	922.48	922.48	922.48	922.48	922.48
Other raw materials . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Utilities . . . . .	2.60	2.60	2.60	2.60	2.60	2.60
Energy . . . . .	96.44	96.44	96.44	96.44	96.44	96.44
Labour, direct . . . . .	76.52	76.52	76.52	76.52	76.52	76.52
Repair, maintenance . . . . .	41.16	41.16	41.16	41.16	41.16	41.16
Spares . . . . .	350.00	350.00	350.00	350.00	350.00	350.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>	<b>1489.20</b>
Administrative overheads . . . . .	60.00	60.00	60.00	60.00	60.00	60.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	569.48	569.48	569.48	517.13	255.07	0.00
Financial costs . . . . .	153.00	76.50	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>2271.68</b>	<b>2195.18</b>	<b>2118.68</b>	<b>2066.32</b>	<b>1804.27</b>	<b>1549.20</b>
<b>Costs per unit ( single product ) .</b>	<b>3.49</b>	<b>3.38</b>	<b>3.26</b>	<b>3.18</b>	<b>2.78</b>	<b>2.38</b>
Of it foreign, % . . . . .	44.76	42.84	40.77	41.81	34.39	24.76
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	136.52	136.52	136.52	136.52	136.52	136.52





**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Working Capital in 1000 US Dollars

Year	1990	1991	1992-2004
Coverage . . . . . ndc coto			
Current assets &			
Accounts receivable . . . 30 12.0	90.10	129.10	129.10
Inventory and materials . 30 12.0	47.31	76.88	76.88
Energy . . . . . 11 32.4	1.83	2.98	2.98
Spares . . . . . 360 1.0	215.00	350.00	350.00
Work in progress . . . . 1 360.0	2.84	4.14	4.14
Finished products . . . 30 12.0	90.10	129.10	129.10
Cash in hand . . . . . 15 24.0	18.86	21.99	21.99
Total current assets . . . . .	466.05	714.18	714.18
Current liabilities and			
Accounts payable . . . . . 22 16.0	61.28	93.20	93.20
Net working capital . . . . .	404.77	620.99	620.99
Increase in working capital . . . . .	404.77	216.22	0.00
Net working capital, local . . . . .	127.30	189.66	189.66
Net working capital, foreign . . . . .	277.47	431.33	431.33

Note: ndc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US Dollars

Year .....	1987.1
Equity, ordinary ..	2786.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	6120.00
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	6120.00
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	8906.00

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## Source of Finance, production in 1000 US Dollars

Year .....	1990	1991	1992	1993	1994	1995	1996
Equity, ordinary ..	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00	-765.00
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total loan .....</b>	<b>-765.00</b>	<b>-765.00</b>	<b>-765.00</b>	<b>-765.00</b>	<b>-765.00</b>	<b>-765.00</b>	<b>-765.00</b>
Current liabilities	61.28	31.91	0.00	0.00	0.00	0.00	0.00
Bank overdraft ....	2567.03	2584.92	2292.20	2215.70	2139.20	2062.70	1986.20
<b>Total funds .....</b>	<b>1863.31</b>	<b>1851.83</b>	<b>1527.20</b>	<b>1450.70</b>	<b>1374.20</b>	<b>1297.70</b>	<b>1221.20</b>

BROMINE --- February 83

## Source of Finance, production in 1000 US Dollars

Year .....	1997	1998-2004
Equity, ordinary ..	0.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	-765.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
<b>Total loan .....</b>	<b>-765.00</b>	<b>0.00</b>
Current liabilities	0.00	0.00
Bank overdraft ....	1909.70	1068.20
<b>Total funds .....</b>	<b>1144.70</b>	<b>1068.20</b>

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**COMFAR**<sup>®</sup>  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US Dollars

Year . . . . .	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
Total cash inflow . .	8906.00	0.00	0.00	0.00	0.00	0.00
Financial resources .	8906.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	0.00	0.00	0.00	0.00	0.00	0.00
Total cash outflow . .	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Total assets . . . .	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Operating costs . . .	0.00	0.00	0.00	0.00	0.00	0.00
Cost of finance . . .	0.00	0.00	0.00	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	8341.00	-1495.00	-2728.00	-2490.00	-1628.00	0.00
Cumulated cash balance	8341.00	6846.00	4118.00	1628.00	0.00	0.00
Inflow, local . . . .	2786.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . .	205.00	415.00	568.00	330.00	188.00	0.00
Surplus ( deficit ) .	2581.00	-415.00	-568.00	-330.00	-188.00	0.00
Inflow, foreign . . .	6120.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	368.00	1080.00	2160.00	2160.00	1440.00	0.00
Surplus ( deficit ) .	5760.00	-1080.00	-2160.00	-2160.00	-1440.00	0.00
Net cashflow . . . . .	-565.00	-1495.00	-2728.00	-2490.00	-1628.00	0.00
Cumulated net cashflow	-565.00	-2060.00	-4788.00	-7278.00	-8906.00	-8906.00



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	1990	1991	1992	1993	1994	1995
Total cash inflow . .	357.28	512.91	481.00	481.00	481.00	481.00
Financial resources .	61.28	31.91	0.00	0.00	0.00	0.00
Sales, net of tax . .	296.00	481.00	481.00	481.00	481.00	481.00
Total cash outflow . .	2924.31	3097.83	2773.20	2696.70	2620.20	2543.70
Total assets . . . .	466.05	248.13	0.00	0.00	0.00	0.00
Operating costs . . .	1081.26	1549.20	1549.20	1549.20	1549.20	1549.20
Cost of finance . . .	612.00	535.50	459.00	382.50	306.00	229.50
Repayment . . . . .	765.00	765.00	765.00	765.00	765.00	765.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-2367.03	-2584.92	-2292.20	-2215.70	-2139.20	-2062.70
Cumulated cash balance	-2567.03	-5151.95	-7444.15	-9659.85	-11799.05	-13861.75
Inflow, local . . . .	60.46	31.67	9.00	0.00	0.00	0.00
Outflow, local . . . .	973.32	1259.59	1165.56	1165.56	1165.56	1165.56
Surplus ( deficit ) .	-912.86	-1227.92	-1165.56	-1165.56	-1165.56	-1165.56
Inflow, foreign . . .	296.02	481.24	481.00	481.00	481.00	481.00
Outflow, foreign . . .	1950.99	1838.24	1607.64	1531.14	1454.64	1378.14
Surplus ( deficit ) .	-1654.17	-1357.00	-1126.64	-1050.14	-973.64	-897.14
Net cashflow . . . . .	-1190.03	-1284.42	-1068.20	-1068.20	-1068.20	-1068.20
Cumulated net cashflow	-10096.03	-11380.45	-12448.65	-13516.85	-14585.05	-15653.25



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COMFAR 2.0 - DALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	1996	1997	1998	1999	2000	2001
Total cash inflow . .	481.00	481.00	481.00	481.00	481.00	481.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	481.00	481.00	481.00	481.00	481.00	481.00
Total cash outflow . .	2467.20	2390.70	1549.20	1549.20	1549.20	1549.20
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1549.20	1549.20	1549.20	1549.20	1549.20	1549.20
Cost of finance . . .	153.00	76.50	0.00	0.00	0.00	0.00
Repayment . . . . .	765.00	765.00	0.00	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) . .	-1986.20	-1909.70	-1068.20	-1068.20	-1068.20	-1068.20
Cumulated cash balance	-15647.95	-17757.65	-18825.85	-19894.04	-20962.24	-22030.44
Inflow, local . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, local . . . . .	1165.56	1165.56	1165.56	1165.56	1165.56	1165.56
Surplus ( deficit ) . .	-1165.56	-1165.56	-1165.56	-1165.56	-1165.56	-1165.56
Inflow, foreign . . . .	481.00	481.00	481.00	481.00	481.00	481.00
Outflow, foreign . . . .	1301.64	1225.14	383.64	383.64	383.64	383.64
Surplus ( deficit ) . .	-820.64	-744.14	97.36	97.36	97.36	97.36
Net cashflow . . . . .	-1068.20	-1068.20	-1068.20	-1068.20	-1068.20	-1068.20
Cumulated net cashflow	-16721.45	-17789.65	-18857.85	-19926.04	-20994.24	-22062.44



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US Dollars

Year . . . . .	2002	2003	2004
Total cash inflow . .	481.00	481.00	481.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	481.00	481.00	481.00
Total cash outflow . .	1549.20	1549.20	1549.20
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1549.20	1549.20	1549.20
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	0.00	0.00	0.00
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	-1068.20	-1068.20	-1068.20
Cumulated cash balance	-23098.64	-24166.84	-25235.04
Inflow, local . . . . .	0.00	0.00	0.00
Outflow, local . . . .	1165.56	1165.56	1165.56
Surplus ( deficit ) .	-1165.56	-1165.56	-1165.56
Inflow, foreign . . . .	481.00	481.00	481.00
Outflow, foreign . . .	383.64	383.64	383.64
Surplus ( deficit ) .	97.36	97.36	97.36
Net cashflow . . . . .	-1068.20	-1068.20	-1068.20
Cumulated net cashflow	-23130.64	-24198.04	-25267.04



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	-14396.66	at 10.00 %
Internal Rate of Return (IRRE1) ..	not found	
b) Net Worth versus Net cash return:		
Net present value .....	-14452.49	at 10.00 %
Internal Rate of Return (IRRE2) ..	not found	
c) Internal Rate of Return on total investment:		
Net present value .....	-14582.81	at 10.00 %
Internal Rate of Return (IRR) ..	not found	

Net Worth = Equity paid plus reserves

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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US Dollars**

Year . . . . .	1990	1991	1992	1993	1994
Total sales, incl. sales tax . . . . .	296.00	481.00	481.00	481.00	481.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	296.00	481.00	481.00	481.00	481.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1671.94	2139.88	2139.88	2139.88	2139.88
Operational margin . . . . .	-1375.94	-1658.88	-1658.88	-1658.88	-1658.88
As % of total sales . . . . .	-464.84	-344.88	-344.88	-344.88	-344.88
Cost of finance . . . . .	612.00	535.50	459.00	382.50	306.00
Gross profit . . . . .	-1987.94	-2194.38	-2117.88	-2041.38	-1964.88
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1987.94	-2194.38	-2117.88	-2041.38	-1964.88
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1987.94	-2194.38	-2117.88	-2041.38	-1964.88
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1987.94	-2194.38	-2117.88	-2041.38	-1964.88
Accumulated undistributed profit . . .	-1987.94	-4182.31	-6300.19	-8341.56	-10306.44
Gross profit, % of total sales . . . . .	-671.60	-456.21	-440.31	-424.40	-408.50
Net profit, % of total sales . . . . .	-671.60	-456.21	-440.31	-424.40	-408.50
ROE, Net profit, % of equity . . . . .	-71.35	-78.76	-76.02	-73.27	-70.53
ROI, Net profit+interest, % of invest.	-14.78	-17.41	-17.41	-17.41	-17.41



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US Dollars**

Year . . . . .	1995	1996	1997	1998	1999
Total sales, incl. sales tax . . . . .	481.00	481.00	481.00	481.00	481.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	481.00	481.00	481.00	481.00	481.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2118.67	2118.67	2118.67	2118.67	2118.67
Operational margin . . . . .	-1637.67	-1637.67	-1637.67	-1637.67	-1637.67
As % of total sales . . . . .	-340.47	-340.47	-340.47	-340.47	-340.47
Cost of finance . . . . .	229.50	153.00	76.50	0.00	0.00
Gross profit . . . . .	-1867.18	-1790.68	-1714.18	-1637.68	-1637.68
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1867.18	-1790.68	-1714.18	-1637.68	-1637.68
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1867.18	-1790.68	-1714.18	-1637.68	-1637.68
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1867.18	-1790.68	-1714.18	-1637.68	-1637.68
Accumulated undistributed profit . . .	-12173.61	-13964.29	-15678.46	-17316.13	-18953.81
Gross profit, % of total sales . . . .	-388.19	-372.28	-356.38	-340.47	-340.47
Net profit, % of total sales . . . .	-388.19	-372.28	-356.38	-340.47	-340.47
ROE, Net profit, % of equity . . . .	-67.02	-64.27	-61.53	-58.78	-58.78
ROI, Net profit+interest, % of invest.	-17.19	-17.19	-17.19	-17.19	-17.19



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US Dollars**

Year . . . . .	2000	2001	2002	2003	2004
Total sales, incl. sales tax . . . . .	481.00	481.00	481.00	481.00	481.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	481.00	481.00	481.00	481.00	481.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	2066.33	2066.33	2066.33	1804.27	1549.20
Operational margin . . . . .	-1585.33	-1585.33	-1585.33	-1323.27	-1068.20
As % of total sales . . . . .	-329.59	-329.59	-329.59	-275.11	-222.08
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	-1585.33	-1585.33	-1585.33	1323.27	-1068.20
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-1585.33	-1585.33	-1585.33	-1323.27	-1068.20
Tax . . . . .	0.00	0.00	0.00	0.00	0.00
Net profit . . . . .	-1585.33	-1585.33	-1585.33	-1323.27	-1068.20
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-1585.33	-1585.33	-1585.33	-1323.27	-1068.20
Accumulated undistributed profit . . .	-20539.14	-22124.46	-23709.79	-25033.06	-26101.26
Gross profit, % of total sales . . . .	-329.59	-329.59	-329.59	-275.11	-222.08
Net profit, % of total sales . . . .	-329.59	-329.59	-329.59	-275.11	-222.08
ROE, Net profit, % of equity . . . . .	-56.90	-56.90	-56.90	-47.50	-38.34
ROI, Net profit+interest, % of invest.	-16.64	-16.64	-16.64	-13.89	-11.21



**COMFAR**<sup>G</sup>  
2.0 UNIDO

COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US Dollars**

Year .....	1987.1	1987.2	1988.1	1988.2	1989.1	1989.2
<b>Total assets .....</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>
Fixed assets, net of depreciation	0.00	565.00	2060.00	4788.00	7278.00	8906.00
Construction in progress .....	565.00	1495.00	2728.00	2490.00	1628.00	0.00
Current assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash, bank .....	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available .	8341.00	6846.00	4118.00	1628.00	0.00	0.00
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>	<b>8906.00</b>
Equity capital .....	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	6120.00	6120.00	6120.00	6120.00	6120.00	6120.00
Current liabilities .....	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>6120.00</b>	<b>6120.00</b>	<b>6120.00</b>	<b>6120.00</b>	<b>6120.00</b>	<b>6120.00</b>
<b>Equity, % of liabilities .....</b>	<b>31.28</b>	<b>31.28</b>	<b>31.28</b>	<b>31.28</b>	<b>31.28</b>	<b>31.28</b>

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**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US Dollars**

Year .....	1990	1991	1992	1993	1994	1995
<b>Total assets .....</b>	<b>10769.31</b>	<b>12621.14</b>	<b>14148.34</b>	<b>15599.04</b>	<b>16973.24</b>	<b>18270.94</b>
Fixed assets, net of depreciation	8315.33	7724.65	7133.98	6543.30	5952.63	5383.15
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	447.19	692.20	692.20	692.20	692.20	692.20
Cash, bank .....	18.86	21.99	21.99	21.99	21.99	21.99
Cash surplus, finance available	0.00	0.00	0.00	0.00	0.00	0.00
Less carried forward .....	0.00	1987.94	4182.31	6300.19	8341.56	10306.44
Loss .....	1987.94	2194.38	2117.88	2041.38	1964.88	1867.18
<b>Total liabilities .....</b>	<b>10769.31</b>	<b>12621.14</b>	<b>14148.34</b>	<b>15599.04</b>	<b>16973.24</b>	<b>18270.94</b>
Equity capital .....	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Profit .....	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt .....	5355.00	4590.00	3825.00	3060.00	2295.00	1530.00
Current liabilities .....	61.28	93.20	93.20	93.20	93.20	93.20
Bank overdraft, finance required.	2567.03	5151.95	7444.15	9659.85	11799.05	13861.75
<b>Total debt .....</b>	<b>7983.31</b>	<b>9835.14</b>	<b>11362.34</b>	<b>12813.04</b>	<b>14187.24</b>	<b>15484.94</b>
<b>Equity, % of liabilities .....</b>	<b>25.87</b>	<b>22.07</b>	<b>19.69</b>	<b>17.86</b>	<b>16.41</b>	<b>15.25</b>



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COMFAR 2.0 - MALMO & CO. S.P.A., MILANO

**Projected Balance Sheets, Production in 1000 US Dollars**

Year . . . . .	1996	1997	1998	1999	2000	2001
<b>Total assets . . . . .</b>	<b>19492.14</b>	<b>20636.84</b>	<b>21705.04</b>	<b>22773.24</b>	<b>23841.44</b>	<b>24909.64</b>
Fixed assets, net of depreciation	4813.68	4244.20	3674.73	3105.25	2588.13	2071.00
Construction in progress . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Current assets . . . . .	692.20	692.20	692.20	692.20	692.20	692.20
Cash, bank . . . . .	21.99	21.99	21.99	21.99	21.99	21.99
Cash surplus, finance available .	0.00	0.00	0.00	0.00	0.00	0.00
Loss carried forward . . . . .	12173.61	13964.29	15678.46	17316.13	18953.81	20539.14
Loss . . . . .	1790.68	1714.18	1637.68	1637.68	1585.33	1585.33
<b>Total liabilities . . . . .</b>	<b>19492.14</b>	<b>20636.84</b>	<b>21705.04</b>	<b>22773.24</b>	<b>23841.44</b>	<b>24909.64</b>
Equity capital . . . . .	2786.00	2786.00	2786.00	2786.00	2786.00	2786.00
Reserves, retained profit . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Profit . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Long and medium term debt . . . .	765.00	0.00	0.00	0.00	0.00	0.00
Current liabilities . . . . .	93.20	93.20	93.20	93.20	93.20	93.20
Bank overdraft, finance required.	15847.95	17757.65	18825.85	19894.05	20962.25	22030.45
<b>Total debt . . . . .</b>	<b>16706.14</b>	<b>17850.84</b>	<b>18919.04</b>	<b>19987.24</b>	<b>21055.44</b>	<b>22123.64</b>
<b>Equity, % of liabilities . . . .</b>	<b>14.29</b>	<b>13.50</b>	<b>12.84</b>	<b>12.23</b>	<b>11.69</b>	<b>11.18</b>



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US Dollars

Year	2002	2003	2004
<b>Total assets</b>	<b>25977.84</b>	<b>27046.04</b>	<b>28114.24</b>
Fixed assets, net of depreciation	1553.88	1298.00	1298.80
Construction in progress	0.00	0.00	0.00
Current assets	692.20	692.20	692.20
Cash, bank	21.99	21.99	21.99
Cash surplus, finance available	0.00	0.00	0.00
Loss carried forward	22124.46	23709.79	25033.06
Loss	1585.33	1323.27	1068.20
<b>Total liabilities</b>	<b>25977.84</b>	<b>27046.04</b>	<b>28114.24</b>
Equity capital	2786.00	2786.00	2786.00
Reserves, retained profit	0.00	0.00	0.00
Profit	0.00	0.00	0.00
Long and medium term debt	0.00	0.00	0.00
Current liabilities	93.20	93.20	93.20
Bank overdraft, finance required	23098.65	24166.85	25235.04
<b>Total debt</b>	<b>23191.84</b>	<b>24260.04</b>	<b>25328.24</b>
Equity, % of liabilities	10.72	10.30	9.91

**Production of Bromine**

**ANNEXE 2**

**BEP EVALUATION**



**BEP EVALUATION**

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT THE PRESENT POSSIBLE CAPACITY (2ND YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

1) TOTAL REVENUES	HYP. B	<u>1043.9</u>
	HYP. A	<u>481</u>
2) VARIABLE COSTS:		<u>1098.04</u>
. RAW MATERIALS		922.48
. UTILITIES		2.60
. ENERGY		96.44
. LABOUR		76.52
3) FIXED COSTS		<u>1577.34</u>
. REPAIR-MAINTENANCE		41.16
. SPARES		350
. ADMINISTRATION		60
. DEPRECIATION		590.68
. FINANCIAL COSTS		535.50
4) TOTAL PRODUCTION COSTS		<u>2675.38</u>

$$\begin{array}{r} \text{BEP} \quad 1577.34 \\ \text{(HYP.A)} \quad \text{-----} \times 100 = \text{negative} \\ 481 - 1098.04 \end{array}$$

$$\begin{array}{r} \text{BEP} \quad 1577.34 \\ \text{(HYP.B)} \quad \text{-----} \times 100 = \text{negative} \\ 1043.9 - 1098.04 \end{array}$$

**FOREIGN EXCHANGE EFFECT EVALUATION**



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow . .	13151.07	6120.00	7031.07	6120.00	0.00	0.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	6121.07	6120.00	1.07	6120.00	0.00	0.00	0.00
exports . . . . .	7030.00	0.00	7030.00	0.00	0.00	0.00	0.00
indirect effects . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	19797.72	7200.00	12597.72	360.00	1080.00	2160.00	2160.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	5256.00	7200.00	-1944.00	360.00	1080.00	2160.00	2160.00
imported materials . . .	5666.66	0.00	5666.66	0.00	0.00	0.00	0.00
repayment loans & overd.	6121.07	0.00	6121.07	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	2754.00	0.00	2754.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-6646.66	-1080.00	-5566.66	5760.00	-1080.00	-2160.00	-2160.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-6646.66	-1080.00	-5566.66	5760.00	-1080.00	-2160.00	-2160.00
present values at 10.00 %							
foreign exchange flow .	-4700.81						
net foreign exchange effect	-4700.81						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		1992	1993	production		
	1988.1	1989.2			1994	1995	1996
total foreign inflow . .	0.00	0.00	296.82	481.24	481.00	481.00	481.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.82	0.24	0.00	0.00	0.00
exports . . . . .	0.00	0.00	296.00	481.00	481.00	481.00	481.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1440.00	0.00	1950.99	1838.24	1607.64	1531.14	1454.64
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1440.00	0.00	278.29	154.10	0.00	0.00	0.00
imported materials . . .	0.00	0.00	295.70	383.64	383.64	383.64	383.64
repayment loans & overd.	0.00	0.00	765.00	765.00	765.00	765.00	765.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	612.00	535.50	459.00	382.50	306.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1440.00	0.00	-1654.17	-1357.00	-1126.64	-1050.14	-973.64
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-1440.00	0.00	-1654.17	-1357.00	-1126.64	-1050.14	-973.64
present values at 10.00 %							
foreign exchange flow .	-4700.81						
net foreign exchange effect	-4700.81						



**Foreign Exchange Effect in 1000 US Dollars**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	481.00	481.00	481.00	481.00	481.00	481.00	481.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	481.00	481.00	481.00	481.00	481.00	481.00	481.00
indirect effects . . . . .							
total foreign outflow .	1378.14	1301.64	1225.14	383.64	383.64	383.64	383.64
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	383.64	383.64	383.64	383.64	383.64	383.64	383.64
repayment loans & overd.	765.00	765.00	765.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	229.50	153.00	76.50	0.00	0.00	0.00	0.00
indirect costs . . . . .							
net foreign exchange flow	-897.14	-820.64	-744.14	97.36	97.36	97.36	97.36
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-897.14	-820.64	-744.14	97.36	97.36	97.36	97.36
present values at 10.00 %							
foreign exchange flow .	-4700.81						
net foreign exchange effect	-4700.81						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	2004	production 2005	2006	2007
total foreign inflow . .	481.00	481.00	481.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00
exports . . . . .	481.00	481.00	481.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow .	383.64	383.64	383.64	-2375.33
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-2376.39
imported materials . . .	383.64	383.64	383.64	0.00
repayment loans & overd.	0.00	0.00	0.00	1.07
other repayments . . . .	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	97.36	97.36	97.36	2375.33
import substit'n effect	0.00	0.00	0.00	0.00
net foreign exchange effect	97.36	97.36	97.36	2375.33
present values at 10.00 %				
foreign exchange flow .	-4700.81			
net foreign exchange effect	-4700.81			



**Foreign Exchange Effect in 1000 US Dollars**  
 Economic Analysis excluding indirect effects  
 100 units foreign CU = 100.00 units local CU

	grand total	total constr.	total produc.	.....construction.....			
				1986.1	1987.2	1987.1	1988.2
total foreign inflow ..	20668.27	6120.00	14548.27	6120.00	0.00	0.00	0.00
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	6121.07	6120.00	1.07	6120.00	0.00	0.00	0.00
exports .....	14547.20	0.00	14547.20	0.00	0.00	0.00	0.00
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	21021.72	7200.00	13821.72	360.00	1080.00	2160.00	2160.00
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	6480.00	7200.00	-720.00	360.00	1080.00	2160.00	2160.00
imported materials ...	5666.66	0.00	5666.66	0.00	0.00	0.00	0.00
repayment loans & overd.	6121.07	0.00	6121.07	0.00	0.00	0.00	0.00
other repayments ....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	2794.00	0.00	2794.00	0.00	0.00	0.00	0.00
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-353.46	-1080.00	726.54	5760.00	-1080.00	-2160.00	-2160.00
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-353.46	-1080.00	726.54	5760.00	-1080.00	-2160.00	-2160.00
present values at 10.00 %							
foreign exchange flow .	-1692.67						
net foreign exchange effect	-1692.67						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	.....construction.....		1992	1993	production		
	1988.1	1989.2			1994	1995	1996
total foreign inflow ..	0.00	0.00	643.22	1044.14	1043.90	1043.90	1043.90
equity capital .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft ...	0.00	0.00	0.82	0.24	0.00	0.00	0.00
exports .....	0.00	0.00	642.40	1043.90	1043.90	1043.90	1043.90
indirect effects .....	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1440.00	0.00	1950.99	1838.24	1607.64	1531.14	1464.64
royalties .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment .....	1440.00	0.00	278.29	154.10	0.00	0.00	0.00
imported materials ...	0.00	0.00	295.70	383.64	383.64	383.64	383.64
repayment loans & overd.	0.00	0.00	765.00	765.00	765.00	765.00	765.00
other repayments ....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages ...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid .....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests .....	0.00	0.00	612.00	535.50	459.00	382.50	306.00
indirect costs .....	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-1440.00	0.00	-1307.77	-794.10	-563.74	-487.24	-410.74
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	-1440.00	0.00	-1307.77	-794.10	-563.74	-487.24	-410.74
present values at 10.00 %							
foreign exchange flow .	-1692.67						
net foreign exchange effect	-1692.67						





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1997	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90	1043.90
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	1378.14	1301.64	1225.14	383.64	383.64	383.64	383.64
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	383.64	383.64	383.64	383.64	383.64	383.64	383.64
repayment loans & overd.	765.00	765.00	765.00	0.00	0.00	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	229.50	153.00	76.50	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	-334.24	-257.74	-181.24	660.26	660.26	660.26	660.26
import substit'n effect	0.00	0.00	0.00	-0.00	0.00	0.00	0.00
net foreign exchange effect	-334.24	-257.74	-181.24	660.26	660.26	660.26	660.26
present values at 10.00 %							
foreign exchange flow .	-1692.67						
net foreign exchange effect	-1692.67						



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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

**Foreign Exchange Effect in 1000 US Dollars**  
Economic Analysis excluding indirect effects  
100 units foreign CI = 100.00 units local CI

	2004	production 2005	2006	2007
total foreign inflow . . .	1043.90	689.00	689.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00
subsidies, grants . . . .	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.00	0.00	0.00	0.00
exports . . . . .	1043.90	689.00	689.00	0.00
indirect effects . . . . .	.....	.....	.....	.....
total foreign outflow . . .	383.64	383.64	383.64	-1151.33
royalties . . . . .	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	-1152.39
imported materials . . . .	383.64	383.64	383.64	0.00
repayment loans & overd.	0.00	0.00	0.00	1.07
other repayments . . . . .	0.00	0.00	0.00	0.00
repatriated wages . . . . .	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....
net foreign exchange flow	660.26	305.36	305.36	1151.33
import substit'n effect	0.00	0.00	0.00	0.00
net foreign exchange effect	660.26	305.36	305.36	1151.33
present values at 10.00 %				
foreign exchange flow . . .	-1692.67			
net foreign exchange effect	-1692.67			

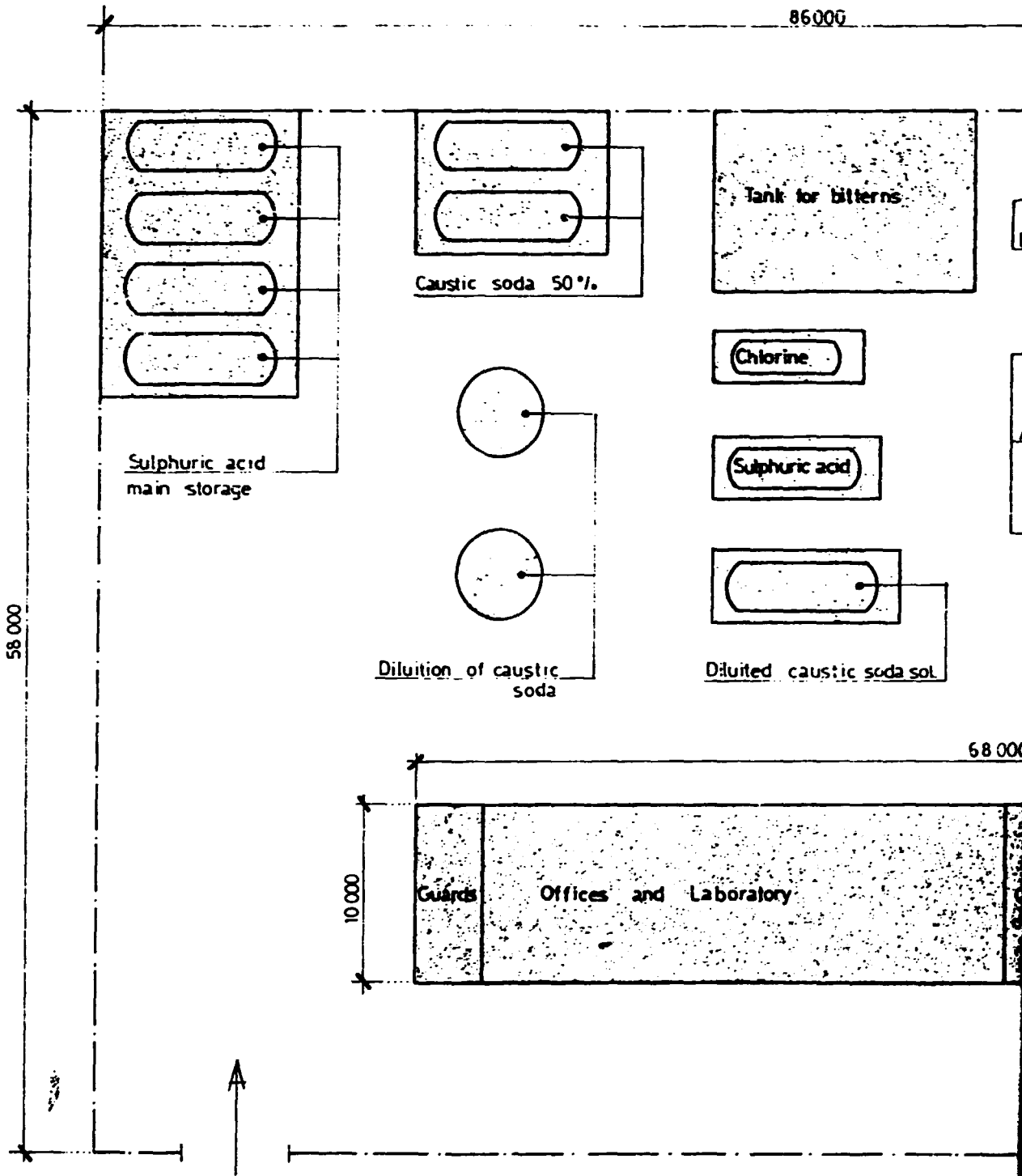
DRW. B162 - 9 - 1

LAY OUT

DRW. B162 - 9 - 2

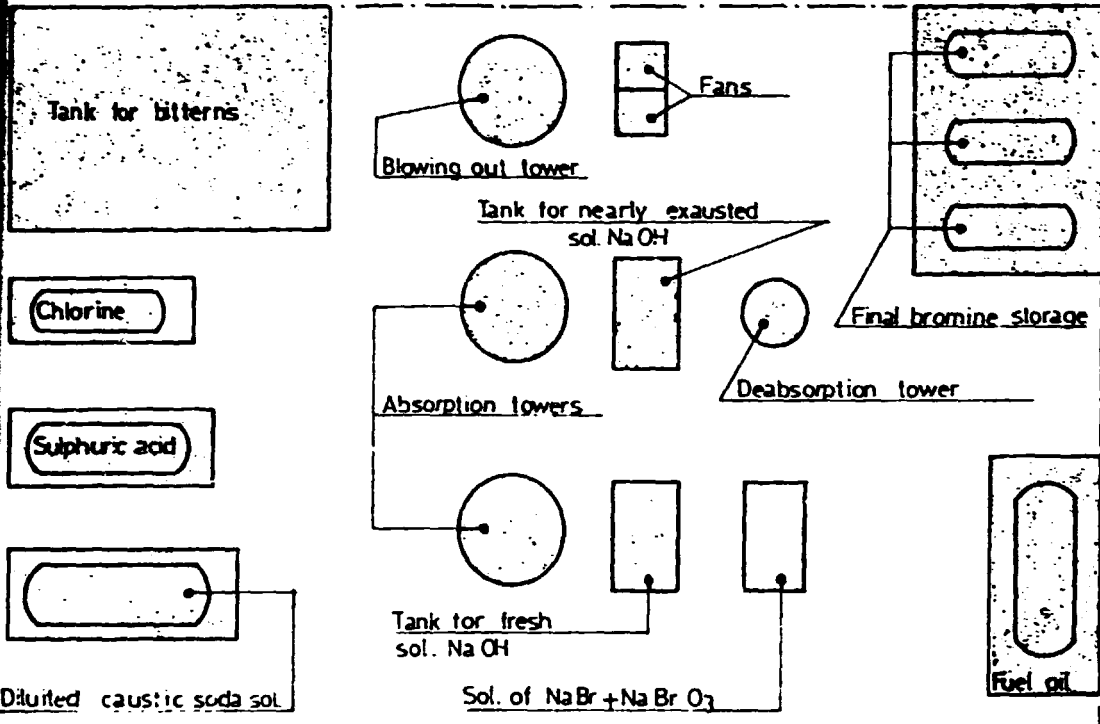
PROCESS FLOW DIAGRAM

86000



SECTION 1

86000

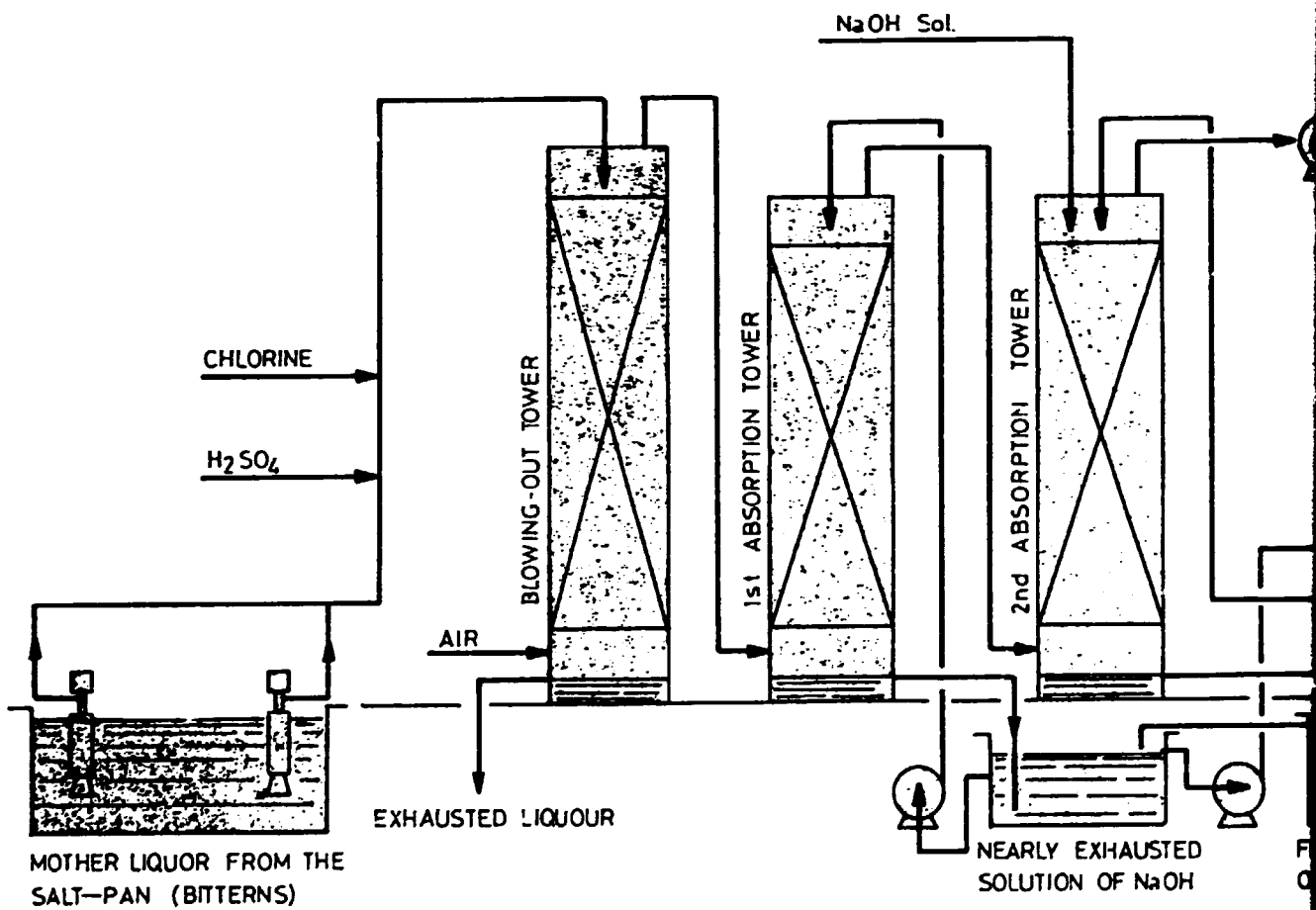


68000

Laboratory	Canteen and dressing facilities	Workshop and store	Steam generator	TRANSFORMER ROOM
------------	---------------------------------	--------------------	-----------------	------------------

### SECTION 2

<p align="center"><b>BROMINE PRODUCTION UNIT</b> LAY - OUT</p>		<p>DIS. N° DWG N° <b>B.162 - 9 - 1</b></p>					
<p><b>baldo &amp; c.</b> CONSULTING ENGINEERS</p>	<p>Via Stillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229</p>	<p>REV. <table border="1" style="display: inline-table;"><tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr></table></p>					



SECTION 1



U.N.I.D.O.  
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

D.P.S.A.  
DEVELOPMENT PROJECT STUDY AGENCY

OPPORTUNITY STUDY FOR THE  
PRODUCTION OF ESSENTIAL OILS  
IN ETHIOPIA

PROJECT DP/ETH/85/004

**baldo & ě.**  
CONSULTING ENGINEERS



I N D E X

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION**

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**ANNEXE 4 - DRW. B162-15-1 - ESSENTIAL OIL DISTILLATOR**

**ANNEXE 5 - ESSENTIAL OIL AMERICAN ASS. SPECIFICATIONS**

0. SUMMARY AND CONCLUSIONS

The possibility of producing essential oils by means of a mobile distilling unit is discussed in this opportunity study.

The growing of aromatic plants and extraction of essential oils has already been carried out in Ethiopia and a plant is now under rehabilitation.

The international market for raw (not refined) oil is increasing, however, and additional possibilities, in various regions of the Country, could be explored.

This is the main reason for the mobile distilling unit proposed.

It would travel from area to area depending upon the harvesting time and would allow the collection of many operational data, more comprehensive and real than those that could be obtained by laboratory scale processing.

The distillating unit operator could formulate appropriate agreements with the State Farms or producers associations in order to select the areas where essential oils bearing plants will be grown.

The unit has been optimized for operation with lemon grass, geranium and eucalyptus but, of course, other species suitable for Ethiopian climatic/agronomic condition could be processed.

It is recommended that a detailed feasibility study be carried out for the following main reasons:

- the unit would allow the collection of very valuable data on future exploitation of these interesting resources
- the fixed investment is quite low (200,000 \$ approx.) and can be recovered by selling the essential oils (IRR = 13.62%)

The feasibility study should be completed with a detailed agronomic study in order to select the areas most suitable to start the tests.

1. INTRODUCTION

An essential oil is commonly defined as a more or less volatile material isolated from an odorous plant of a single botanical species by a physical process.

The most commonly used physical processes for oil separation are:

- steam
- distillation
- enfleurage maceration
- extraction
- expression

According to Mc Nair (Am. Journal of Botany 19, 255 - 1922) out of 295 families of plants, eighty seven (29,5%) produce essential oils. Of these thirty-eight (44%) grow in the tropics, eight (9%) in tropical as well as in temperate climates, seventeen (19%) in temperate climates, and twenty-four (28%) in all climates.

Apart from the flowers, all parts of an odorous plant generally contain the same type of essential oil.

Real progress of the knowledge of essential oils was possible by the eighteenth century and it was also in this period that the first corporation was founded in France, producing alcoholic solutions of odorous plant material under the name of "quintessence".

Since then the demand for the commercial product has been in constant increase. This fact has also given rise to the production of synthetic oils.

The present opportunity study will be limited to consideration of the production of essential oils from geranium, lemon grass and eucalyptus, not because these plants are the only ones exploitable in Ethiopia, but

because these species have already been exploited in the country and their essential oils can be extracted by the same process and, consequently, by the same or similar equipment.

2. MARKET AND PLANT CAPACITY

2.1 Products and their uses

As stated above the species taken into consideration are:

lemon grass

geranium

eucalyptus

Their characteristics are as follows:

a) lemon grass: this is one of the most important essential oils; world production is estimated at around 1,700 t/y. The most important constituent of oil of lemongrass is citral occurring to the extent of 75%-85% (minimum commercially required 70%)

A lemon grass plantation has a lifecycle of 6-8 years; the oil yield reaches its maximum around the third or fourth year; its annual average value ranges between 15 and 20 Kg/ha with three crops per year. The ratio of oil to leaves is equal to 0.385%

Lemon grass plants grow well in soils not suitable for richer production: plants from sandy and rather dry soils yield relatively more oil, and oil of higher citral content, than plants from very fertile soils; this fact must be borne in mind if its profitability is to be appreciated.

Lemon grass is a very important oil in the manufacturing of soaps, bath salts, and other toiletry products; it is also used for the extraction of citral which in turn, is employed in artificial lemon flavourings and in the manufacture of ionones, which are very important for the production of

artificial flavours, perfumes and soaps and as raw material for vitamin A manufacturing.

- b) geranium: the world production of geranium oil is about 200 t/y; the main constituents are geraniol and l-citronellol, these two accounting for about 70% of oil: the minimum commercially acceptable content of geraniol is 40%.

A plantation of geranium has a lifecycle of 5 years and its annual yield ranges between 25 and 30 Kg/ha with two crops per year. The ratio of oil to leaves is around 0.2%.

Formerly the oil served as the only starting material for the separation of the two alcohols, geraniol and l-citronellol; but now large amount of geranium oil is produced synthetically, since the cheap pinene can be converted to the two alcohols. Geranium oil is used extensively in soaps and perfumes and for the manufacture of rhodinol (chiefly a mixture of l-citronellol and geraniol)

- c) eucalyptus: eucalyptus oil is obtained by steam distillation from the leaves of several species of eucalyptus. The world production is over 2,000 t/y. The eucalyptus trees are cut when five years old; at this age the plantation yields about 70,000 Kg/ha of leaves and at least 140 m<sup>3</sup> of wood (solid) without bark; the same plantation can yield 4-5 cuts. The ratio of oil to leaves (Eucalyptus globulus) is in the range of 2.5-2.7% (by weight); consequently the oil yield is around 1,800 kg/ha. The main constituent is cineole; the minimum acceptable cineole content is 70%.



Eucalyptus oil is very useful in the pharmaceutical industry for the preparation of cough drops, mouthwashes, gargles, dental formulations, inhalants, room sprays and medicated soaps; it is an important disinfectant and is also used as an ingredient in certain officinal preparations, and may also be used for the separation of the drug cineole.

## 2.2 Forecast demand and plant capacity

There was in the past a production of essential oils in Ethiopia from lemongrass, geranium, eucalyptus, etc. Some exports are said to have taken place up to a few years ago. An existing plant is presently installed at Wendo Genet, but is closed due to lack of raw material, the adjacent area meant to supply the factory having been taken over by a local peasants' association after nationalization. A project is said to be under consideration for the rehabilitation of this existing plant. The following table shows the imports of essential oils in the last eleven years.

Year (G.C.)	Tonnes	Thousand birr (a)	Birr/kg (b)
1975	658,1	3,180	4,83
1976	859,7	3,300	3,84
1977	151,6	2,528	16,67
1978	135,7	2,111	15,55
1979	414,5	4,241	10,23
1980	133,6	2,620	19,61
1981	126,7	1,425	11,25
1982	176,0	1,178	6,70
1983	170,7	1,719	10,07
1984	60,6	773	12,75
1985	94,0	682	7,26

(a) CIF Ethiopian border or Djibouti

(b) calculated on unrounded figures.

Source: Ministry of Finance - Customs and Excise Administration  
- Annual External Trade Statistics.

The considerable variation in unit prices reflects presumably different composition mixes, and possibly also international price fluctuations.

The present domestic demand of essential oils is in the range of 125 tons/year (1); types and qualities of the imported oils is not known; but the larger part of the imported product is presumed to consist of refined oils or essences. The preparation of these products, that is the refining of the essential oils or the extraction of the components to be used in the various industries (pharmaceutical, perfumery, soap, food, beverages, etc) requires rather sophisticated technology and skills, not yet developed in the country. Its establishment in Ethiopia is not advisable for the time being due to the complexity of requirements: availability of many raw-materials from the domestic or foreign market, availability of suitable technology and of well experienced staff, good introduction in the specific market, etc.

For these reasons, the major part of the essential oils produced in the world is commercialized as crude products and at present as far as crude oil are concerned, no constraints, apart from the correspondence to the minimum requirements for the main components, seem to hinder their export possibilities.

(1) Source: import statistics, 1981-1985

The essential oils market is, in fact, becoming more and more promising, giving good opportunities to the developing countries which have climatic conditions suitable for this type of cultivation. Evidence of this fact is provided by the cultivation in tropical and subtropical regions of Africa and South-America of plants whose origin was Asiatic; lemon grass, in particular is also cultivated in the United States (Florida) in spite of the high cost of local manpower. There is no doubt that the market is in continuous expansion, holding the prices of essential oils at profitable levels, and the type of cultivation, which requires a large amount of labour, make this activity interesting for the developing countries. The international competition has, on the other hand, raised the quality standard of the products. An essential oil of poor quality has little chance of being sold and the price level would, in any case, be very low.

In many countries the sale of essential oils is generally carried out through associations of local producers, under the control of the government who also guarantees the quality of the product, by carrying out the analysis of each lot before releasing the export licence, since the essential oils are subjected to many kinds of adulteration.

On the basis of these experiences, the best solution for Ethiopia seems to be the cooperation between NCC and the peasant associations, with NCC acting as the team leader.

A mobile extraction plant could be used in the first phase of the exploitation. The basis of the programme would, in any case, be the agronomic study that should consist in the following two main steps:

- the selection of the species to be cultivated
- the selection of the most suitable areas for cultivation on the basis of the soil characteristic and labour availability.

For these reasons in the first phase the plantations to be exploited could be rather spread out over a large area.

The proposed plant also takes into account the existence of a fixed extraction plant in the area of Wendo Genet, for whose rehabilitation a project seems to be already in the pipeline.

The capacity of the proposed plant is limited by its necessity of being transportable; it is therefore sized for distilling 150 kg of leaves per hour; this capacity (on the assumption of 250 working days per year, three shifts per day and the yields quoted in the preceding paragraph), corresponds to the production of the following amounts of the essential oils:

- lemon grass: 3,000 kg/y of oil (12 kg/d) which corresponds to a cultivated area of 150 to 200 hectares
- geranium: 1,750 kg/y of oil (7 kg/d) which corresponds to a cultivated area of 70-60 hectares
- eucalyptus: 21,250 kg/y of oil (85 kg/d) which corresponds to a harvested area of 12 hectares or, since the cutting occurs in a five years rotation, a planted area of 60 hectares.

### 2.3 Sale prices and total revenues

The current prices on the international market fluctuate within the following ranges:

- essential oil from lemon grass from 8 to 12 \$/kg and even more for the best qualities (as from India)
- essential oil from geranium from 80 to 110 \$/kg
- essential oil from eucalyptus from 7.5 to 8 \$/kg

As previously stated these figures are valid only if the content of the main components is not less than the prefixed minimum standard (1).

The total annual revenues, therefore, can amount from an average of 30,000 \$/y (exploitation of lemon grass only) to an average of 165,000 \$/y (exploitation of geranium or eucalyptus or a mix of the two) not taking into account the revenues from the sale of the wood of eucalyptus, as the leaves are a by-product of wood production, and not vice versa.

For financial evaluation, then, the production and sale of a mix of the last two products has been considered, that is 11,250 kg/y of oil (10500 from Eucalyptus and 750 from geranium) at a weighted average price of 13.56 \$/kg, corresponding to an annual revenue of 152,550 \$/y

(1) See attached Essential oil American Ass. specifications.

3. MATERIAL AND INPUTS

3.1 Chemistry

The process taken into consideration in this opportunity study foresees the extraction of essential oils from lemon grass, geranium and eucalyptus by means of steam distillation.

The only required raw materials therefore are the leaves of the three plants. The cost of this raw material is obviously quite difficult to assess, at this stage because it depends on variables such as climate, extension of cultivation, nature of soil, yield per hectare, etc. For the time being we can only apply the experience of other important producer of essential oils, those of India for instance, where the cost of raw material for the three plants taken into consideration is close to 3/5 of the selling price of the resulting oil.

The following table provides the basis for the calculation of the cost of the leaves.

SPECIES	OIL PRICE \$/kg	YIELD RATIO (oil to leaves) kg/kg	AMOUNTS OF LEAVES kg of leaves for 1 kg of oil	3/5 OIL PRICE	MAX PRICE PAYABLE FOR LEAVES \$/kg
Lemmon grass	8-12	0.00348	287	4.8-7.2	0.025
Geranium	80-110	0.002	500	48-66	0.13
Eucalyptus	7.5-8	2.5	40	4.5-4.8	0.12



3.2 Materials and utilities requirements and costs

The complete list of raw materials and utilities (amounts and costs) to be supplied annually to the plant at full capacity (900 t of leaves) is as follows:

	LC	FC	Total
	\$/y	\$/y	\$/y
leaves			
900,000 kgx0.015 \$/Kg=	13,500	-	13,500
 fuel oil			
90,000 kgx0.225 \$/Kg=		20,250	20,250
 water			
18,000 m <sup>3</sup> x0.024 \$/m <sup>3</sup> =	360	-	360
	-----	-----	-----
Total	17,910	16,200	34,110

This value must be increased of the cost of the packaging indicated at para 5.2

3.3 Raw material purchasing programme and storage volume

Due to the type of plant (transportable) and the necessity of working fresh raw material, no stock should be considered.

4. LOCATION

Any region with enough plantations to satisfy the capacity of the plant without requiring excessively long displacements. The operating site should be near a source of water and not far from lodging possibilities for the operating personnel.

5. PROJECT ENGINEERING

5.1 Process and main equipment description

The selected process, as already stated, is the steam distillation, which is the preferred method for all essential oils produced in large quantities. The steam, produced in a boiler is introduced into a vessel which contains the leaves and water; the leaves are located on a grid placed at a certain distance above the level of the water which fills the bottom of the vessel; the water is vaporized indirectly, by steam flowing in a pipe coil submerged by the water. The water vapor, plus the distilled oil coming from the evaporator vessel is recovered in a separate water cooled condenser.

This mixture flowing out of the condenser is separated by decantation in a Florentine flask: the distilled water is separated by the upper oil layer and, as it still contains some soluble parts of the oil, - sent back to the evaporator vessel to recover there soluble alchools by means of a second distillation.

A very important point is the handling of the leaves before the distillation. The leaves must be harvested at the right moment and stored in the open-air, possibly under a shelter; in this way the leaves are allowed to lose some moisture to the advantage of the distillation process. However the time elapsed from the harvest to the distillation time must not be longer than a few days in order to avoid product losses and quality deterioration due to the starting of fermentation and autoxidation processes.

The proposed mobile extraction unit will include the following main items:

- two evaporator vessels, 1 cu.mt volume each, complete in the interior with a grid for supporting the leaves and a heating coil. The vessels are completely constructed in stainless steel and thermally insulated.

The cover is mobile, closed with wingnuts. The vessels are loaded manually from the upper side and unloaded by turning them down through a suitable mechanism.

Each vessel can be loaded with 300 Kg of leaves; the time required for distillation is, on average, two hours, loading and unloading included. When one of the two is in the distilling phase the other is in the loading or unloading phase.

- one water cooled condenser consisting of a refrigerating coil put inside a casing. The distillate mixture flow inside the coil and the cooling water outside. The coil is of stainless steel, while the external case is of carbon steel.
- one Florentine flask, of stainless steel, for the separation of oil.
- one steam boiler, fed with fuel oil having a capacity of 200 kg/h
- one hand pump to transfer the condensed vapour back to the boiler
- one diesel pump for the circulation of the refrigerating water
- one truck (tractor plus trailer) for the transportation of the distillation plant. All the machinery and equipment is completely mounted, piping included, on the trailer and can be operated on it.

5.2 Packaging

The essential oils can be temporarily stored in glass containers; but for shipment tin-plate drums of 12 Kg capacity must be used. For the oil production of 11250 kg indicated in para 2.3, about 940 drums are required at an estimated total cost of 4000 \$.

5.3 Investment cost, depreciation and maintenance

The cost of the complete package (machinery plus truck) ready to operate is estimated as follows:

	FC	LC	Total
	\$	\$	\$
Distillation plant, trailer-mounted, fob European port	77,000	-	77,000
Tractor	-	80,000	80,000
Transportation	7,700	7,700	15,400
Spare parts	7,000	8,000	15,000
	-----	-----	-----
	91,700	95,700	187,400
Contingencies	4,800	4,300	9,100
	-----	-----	-----
Grand total	96,500	100,000	196,500

The life cycle of this plant can be estimated as 15 years

The annual expense for maintenance are assumed as being equivalent to 4% of machinery considered.

In the financial evaluation the investment costs (contingencies included) are shown as follow:

Machinery	FC	96,500 \$
Machinery	LC	100,000 \$
		-----
TOTAL		196,500 \$

6. PLANT ORGANIZATION

The plant will operate within the organizational framework of the National Chemical Corporation, as a mobile unit dependent on Wendo Genet Essential oil plant.

7. MANPOWER

7.1 Mobile unit

Production manager	1	1,000	
Shift operators	8	2,800	
Mechanic	1	400	
Driver	1	400	
Unskilled workers	6	1,200	
	--	-----	-----
	17	5,800	69,600
			(33,623 \$/y)

This total cost can presumably be subdivided into two parts:

- 26663 \$/y as production costs
- 6960 \$/y as maintenance cost

Being the unit an integral part of the Wendo Genet plant, the operating personnel only has been considered in the present paragraph and, consequently in the financial evaluation.



8. IMPLEMENTATION SCHEDULING

Delivery time, to Ethiopian port, of 1 year is required starting from the awarding of order for the main equipment

9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1. Such evaluation has been based on the data indicated in the foreword and in the study and on the followings:

- working capital input table: mdc

	FC	LC
raw materials (leaves)	1	1
other raw mat. (packaging)	1	30
	FC	LC
inventory utilities	1	1
work in progress	1	1

- the assistance of one foreign expert for the first operation period (six months) has been taken into account and indicated as "foreign factory overheads"
- packaging costs have been included in "other raw materials"
- the production programme has been assumed as follows:
  - 1st year: 4.5t (about 40% capacity) of oil from eucalyptus and geranium
  - 2nd year: 7.8t (about 70% capacity) of oil as above
  - from 3rd year to 15th year: 11.25 t (100% capacity) of oil as above
- Selling price: (av.weighted) : 13,560 \$/t

As a result, the evaluation yields an IRR equal to 13.25% and a BEP equal to 0.65.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) is zero, since the product is only for export

For this reason both the net foreign exchange flow and the net foreign exchange effect are the same. The result of the evaluation is favourable: by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 759,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan and using imported materials, there would still be a surplus which in terms of present value would amount to 759,000 \$

Essential Oils

ANNEXE 1

FINANCIAL EVALUATION



**COMFAR**<sup>®</sup>  
2.0 UNIDU

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

ESSENTIAL OILS  
February 88  
Mix of Geran. & Eucal.-Integrat.Unit

1 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

---

**Total initial investment during construction phase**

fixed assets:	211.50	45.62% foreign
current assets:	0.00	0.00% foreign
total assets:	211.50	45.62% foreign

---

**Source of funds during construction phase**

equity & grants:	130.00	0.00% foreign
foreign loans :	82.03	
local loans :	0.00	
total funds :	212.02	38.68% foreign

---

**Cashflow from operations**

Year:	1	2	3
operating costs:	80.75	63.60	76.44
depreciation :	16.11	16.11	16.11
interest :	8.20	7.18	6.15
production costs	105.06	86.88	98.70
thereof foreign	51.08 %	33.84 %	35.61 %
total sales :	61.02	106.85	152.55
gross income :	-44.04	19.97	53.85
net income :	-44.04	9.99	28.92
cash balance :	-53.71	18.35	29.03
net cashflow :	-35.26	35.78	45.43

Net Present Value at: 10.00 % = 60.60  
Internal Rate of Return on total investment: 13.62 %  
Equity paid versus Net income flow (IRR%): 11.31 %  
Net Worth versus Net Cash Return (IRR%): 14.36 %

---

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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---

**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987
Fixed investment costs	
Land, site preparation, development	0.00
Buildings and civil works .....	0.00
Auxiliary and service facilities .	0.00
Incorporated fixed assets .....	0.00
Plant machinery and equipment ...	196.50
<hr/>	
Total fixed investment costs .....	196.50
Pre-production capital expenditures.	15.00
Net working capital .....	0.00
<hr/>	
Total initial investment costs ...	211.50
Of it foreign, in % .....	45.63



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**Total Current Investment in 1000 US DOLLARS**

Year .....	1988	1989	1990
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment ..	0.00	0.00	0.00
<b>Total fixed investment costs .....</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital .....	15.53	-2.51	3.75
<b>Total current investment costs ...</b>	<b>15.53</b>	<b>-2.51</b>	<b>3.75</b>
<b>Of it foreign, % .....</b>	<b>60.44</b>	<b>0.00</b>	<b>63.05</b>



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**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1988	1989	1990	1991	1992	1993
% of nom. capacity (single product)	40.00	70.04	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	5.40	9.45	13.50	13.50	13.50	13.50
Other raw materials . . . . .	1.60	2.80	4.00	4.00	4.00	4.00
Utilities . . . . .	0.14	0.25	0.36	0.36	0.36	0.36
Energy . . . . .	8.10	14.18	20.25	20.25	20.25	20.25
Labour, direct . . . . .	26.66	26.66	26.66	26.66	26.66	26.66
Repair, maintenance . . . . .	6.96	6.96	6.96	6.96	6.96	6.96
Spares . . . . .	1.88	3.29	4.71	4.71	4.71	4.71
Factory overheads . . . . .	30.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>80.75</b>	<b>63.60</b>	<b>76.44</b>	<b>76.44</b>	<b>76.44</b>	<b>76.44</b>
Administrative overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	16.11	16.11	16.11	16.11	16.11	13.11
Financial costs . . . . .	8.20	7.18	6.15	5.13	4.10	3.08
<b>Total production costs . . . . .</b>	<b>105.06</b>	<b>86.88</b>	<b>98.70</b>	<b>97.68</b>	<b>96.65</b>	<b>92.63</b>
<b>Costs per unit (single product) .</b>	<b>23.35</b>	<b>11.03</b>	<b>8.77</b>	<b>8.68</b>	<b>8.59</b>	<b>8.23</b>
Of it foreign, % . . . . .	51.08	33.84	35.61	34.94	34.25	34.63
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	26.66	26.66	26.66	26.66	26.66	26.66





**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1994	1995	1996-2000	2001	2002
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00
Raw material 1 . . . . .	13.50	13.50	13.50	13.50	13.50
Other raw materials . . . . .	4.00	4.00	4.00	4.00	4.00
Utilities . . . . .	0.36	0.36	0.36	0.36	0.36
Energy . . . . .	20.25	20.25	20.25	20.25	20.25
Labour, direct . . . . .	26.66	26.66	26.66	26.66	26.66
Repair, maintenance . . . . .	6.96	6.96	6.96	6.96	6.96
Spares . . . . .	4.71	4.71	4.71	4.71	4.71
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>76.44</b>	<b>76.44</b>	<b>76.44</b>	<b>76.44</b>	<b>76.44</b>
Administrative overheads . . . . .	0.00	0.00	0.00	0.00	0.00
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	13.11	13.11	13.11	6.46	0.00
Financial costs . . . . .	2.05	1.03	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>91.60</b>	<b>90.58</b>	<b>89.55</b>	<b>82.90</b>	<b>76.44</b>
<b>Costs per unit ( single product ) .</b>	<b>8.14</b>	<b>8.05</b>	<b>7.96</b>	<b>7.37</b>	<b>6.79</b>
Of it foreign, % . . . . .	33.89	33.15	32.38	31.04	29.51
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	26.66	26.66	26.66	26.66	26.66



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Working Capital in 1000 US DOLLARS

Year .....		1988	1989	1990	1991-2002
Coverage .....	mdc coto				
Current assets &					
Accounts receivable . . .	30 12.0	6.73	5.30	6.37	6.37
Inventory and materials .	7 48.0	0.15	0.26	0.37	0.37
Energy .....	30 12.0	0.68	1.18	1.69	1.69
Spares .....	360 1.0	1.88	3.29	4.71	4.71
Work in progress .....	1 360.0	0.22	0.18	0.21	0.21
Finished products . . .	30 12.0	6.73	5.30	6.37	6.37
Cash in hand .....	15 24.0	2.73	1.54	1.60	1.60
Total current assets .....		19.12	17.05	21.32	21.32
Current liabilities and					
Accounts payable .....	21 17.0	3.59	4.03	4.55	4.55
Net working capital .....		15.53	13.02	16.77	16.77
Increase in working capital .....		15.53	-2.51	3.75	0.00
Net working capital, local .....		6.14	7.53	8.91	8.91
Net working capital, foreign .....		9.39	5.49	7.85	7.85

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987
Equity, ordinary ..	130.00
Equity, preference.	0.00
Subsidies, grants .	0.00
Loan A, foreign .	82.03
Loan B, foreign..	0.00
Loan C, foreign .	0.00
Loan A, local....	0.00
Loan B, local....	0.00
Loan C, local....	0.00
Total loan .....	82.03
Current liabilities	0.00
Bank overdraft ....	0.00
Total funds .....	212.02



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1988	1989	1990	1991	1992-95
Equity, ordinary ..	0.00	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00	0.00
Loan A, foreign .	-10.25	-10.25	-10.25	-10.25	-10.25
Loan B, foreign..	0.00	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00	0.00
Total loan .....	-10.25	-10.25	-10.25	-10.25	-10.25
Current liabilities	3.59	0.44	0.53	0.00	0.00
Bank overdraft ....	53.19	-18.35	-29.03	-5.81	0.00
Total funds .....	46.52	-28.16	-38.76	-16.06	-10.25

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year .....	1987
Total cash inflow ..	212.02
Financial resources .	212.02
Sales, net of tax ..	0.00
Total cash outflow ..	211.50
Total assets .....	211.50
Operating costs ...	0.00
Cost of finance ...	0.00
Repayment .....	0.00
Corporate tax ...	0.00
Dividends paid ...	0.00
Surplus ( deficit ) .	0.52
Cumulated cash balance	0.52
Inflow, local .....	130.00
Outflow, local .....	115.00
Surplus ( deficit ) .	15.00
Inflow, foreign ...	82.03
Outflow, foreign ...	96.50
Surplus ( deficit ) .	-14.47
Net cashflow .....	-211.50
Cumulated net cashflow	-211.50



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COMFAR 2.0 - SALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1988	1989	1990	1991	1992	1993
Total cash inflow . .	64.61	107.36	153.08	152.55	152.55	152.55
Financial resources .	3.59	0.51	0.53	0.00	0.00	0.00
Sales, net of tax . .	61.02	106.85	152.55	152.55	152.55	152.55
Total cash outflow . .	118.32	89.01	124.05	119.26	118.75	119.73
Total assets . . . . .	19.12	-2.07	4.27	0.00	0.00	0.00
Operating costs . . .	80.75	63.60	76.44	76.44	76.44	76.44
Cost of finance . . .	8.20	7.18	6.15	5.13	4.10	3.08
Repayment . . . . .	10.25	10.32	10.25	10.25	10.25	10.25
Corporate tax . . . .	0.00	9.99	26.92	27.44	27.95	29.96
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	-53.71	18.35	29.03	33.29	33.80	32.82
Cumulated cash balance	-53.19	-34.84	-5.81	27.49	61.29	94.10
Inflow, local . . . . .	3.48	0.51	0.51	0.00	0.00	0.00
Outflow, local . . . . .	51.35	59.68	82.70	81.32	81.83	83.85
Surplus ( deficit ) .	-47.87	-59.18	-82.19	-81.32	-81.83	-83.85
Inflow, foreign . . . .	61.13	106.85	152.57	152.55	152.55	152.55
Outflow, foreign . . . .	66.97	29.32	41.35	37.94	36.91	35.89
Surplus ( deficit ) .	-5.84	77.53	111.22	114.61	115.64	116.66
Net cashflow . . . . .	-35.26	35.78	45.43	48.67	48.16	46.14
Cumulated net cashflow	-246.76	-210.97	-165.54	-116.87	-68.71	-22.57



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1994	1995	1996	1997	1998	1999
Total cash inflow ..	152.55	152.55	152.55	152.55	152.55	152.55
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	152.55	152.55	152.55	152.55	152.55	152.55
Total cash outflow ..	119.22	118.71	107.94	107.94	107.94	107.94
Total assets .....	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs ...	76.44	76.44	76.44	76.44	76.44	76.44
Cost of finance ...	2.05	1.03	0.00	0.00	0.00	0.00
Repayment .....	10.25	10.25	0.00	0.00	0.00	0.00
Corporate tax ...	30.47	30.99	31.50	31.50	31.50	31.50
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	33.33	33.84	44.61	44.61	44.61	44.61
Cumulated cash balance	127.43	161.27	205.88	250.49	295.10	339.70
Inflow, local .....	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, local .....	84.36	84.87	85.38	85.38	85.38	85.38
Surplus ( deficit ) .	-84.36	-84.87	-85.38	-85.38	-85.38	-85.38
Inflow, foreign ...	152.55	152.55	152.55	152.55	152.55	152.55
Outflow, foreign ...	34.86	33.84	22.56	22.56	22.56	22.56
Surplus ( deficit ) .	117.69	118.71	129.99	129.99	129.99	129.99
Net cashflow .....	45.63	45.12	44.61	44.61	44.61	44.61
Cumulated net cashflow	23.07	68.19	112.79	157.40	202.01	246.61



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2000	2001	2002
Total cash inflow . .	152.55	152.55	152.55
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	152.55	152.55	152.55
Total cash outflow . .	107.94	111.27	114.50
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	76.44	76.44	76.44
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	31.50	34.82	38.05
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	44.61	41.28	38.05
Cumulated cash balance	364.31	425.59	463.65
Inflow, local . . . . .	0.00	0.00	0.00
Outflow, local . . . .	85.38	88.71	91.94
Surplus ( deficit ) .	-85.38	-88.71	-91.94
Inflow, foreign . . . .	152.55	152.55	152.55
Outflow, foreign . . .	22.56	22.56	22.56
Surplus ( deficit ) .	129.99	129.99	129.99
Net cashflow . . . . .	44.61	41.28	38.05
Cumulated net cashflow	291.22	332.50	370.56





**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	15.54	at 10.00 %
Internal Rate of Return (IRRE1) ..	11.31	%
b) Net Worth versus Net cash return:		
Net present value .....	60.08	at 10.00 %
Internal Rate of Return (IRRE2) ..	14.36	%
c) Internal Rate of Return on total investment:		
Net present value .....	60.60	at 10.00 %
Internal Rate of Return ( IRR ) ..	13.62	%
Net Worth = Equity paid plus reserves		



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1988	1989	1990	1991	1992
Total sales, incl. sales tax . . . . .	61.02	106.85	152.55	152.55	152.55
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	61.02	106.85	152.55	152.55	152.55
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	96.35	79.70	92.55	92.55	92.55
Operational margin . . . . .	-35.83	27.15	60.00	60.00	60.00
As % of total sales . . . . .	-58.73	25.41	39.33	39.33	39.33
Cost of finance . . . . .	8.20	7.18	6.15	5.13	4.10
Gross profit . . . . .	-44.04	19.97	53.85	54.87	55.90
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	-44.04	19.97	53.85	54.87	55.90
Tax . . . . .	0.00	9.99	26.92	27.44	27.95
Net profit . . . . .	-44.04	9.99	26.92	27.44	27.95
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	-44.04	9.99	26.92	27.44	27.95
Accumulated undistributed profit . . .	-44.04	-34.05	-7.13	20.31	48.26
Gross profit, % of total sales . . . . .	-72.17	18.69	35.30	35.97	36.64
Net profit, % of total sales . . . . .	-72.17	9.35	17.65	17.99	18.32
ROE, Net profit, % of equity . . . . .	-33.87	7.68	20.71	21.11	21.50
ROI, Net profit+interest, % of invest.	-15.78	7.64	14.49	14.27	14.04



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**Net Income Statement in 1000 US DOLLARS**

Year .....	1993	1994	1995	1996	1997
Total sales, incl. sales tax .....	152.55	152.55	152.55	152.55	152.55
Less: variable costs, incl. sales tax .....	0.00	0.00	0.00	0.00	0.00
Variable margin .....	152.55	152.55	152.55	152.55	152.55
As % of total sales .....	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation .....	89.55	89.55	89.55	89.55	89.55
Operational margin .....	63.00	63.00	63.00	63.00	63.00
As % of total sales .....	41.30	41.30	41.30	41.30	41.30
Cost of finance .....	3.08	2.05	1.03	0.00	0.00
Gross profit .....	59.92	60.95	61.97	63.00	63.00
Allowances .....	0.00	0.00	0.00	0.00	0.00
Taxable profit .....	59.92	60.95	61.97	63.00	63.00
Tax .....	29.9%	30.47	30.99	31.50	31.50
Net profit .....	29.9%	30.47	30.99	31.50	31.50
Dividends paid .....	0.00	0.00	0.00	0.00	0.00
Undistributed profit .....	29.9%	30.47	30.99	31.50	31.50
Accumulated undistributed profit .....	78.22	108.70	139.68	171.18	202.68
Gross profit, % of total sales .....	39.28	39.95	40.63	41.30	41.30
Net profit, % of total sales .....	19.64	19.98	20.31	20.65	20.65
RDE, Net profit, % of equity .....	23.05	23.44	23.84	24.23	24.23
ROI, Net profit+interest, % of invest. ....	14.47	14.25	14.02	13.80	13.80



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1998	1999	2000	2001	2002
Total sales, incl. sales tax . . . . .	152.55	152.55	152.55	152.55	152.55
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	152.55	152.55	152.55	152.55	152.55
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	89.55	89.55	89.55	82.90	76.44
Operational margin . . . . .	63.00	63.00	63.00	69.65	76.11
As % of total sales . . . . .	41.30	41.30	41.30	45.66	49.89
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	63.00	63.00	63.00	69.65	76.11
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	63.00	63.00	63.00	69.65	76.11
Tax . . . . .	31.50	31.50	31.50	34.82	38.05
Net profit . . . . .	31.50	31.50	31.50	34.82	38.05
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	31.50	31.50	31.50	34.82	38.05
Accumulated undistributed profit . . .	234.18	265.68	297.18	332.01	370.06
Gross profit, % of total sales . . . . .	41.30	41.30	41.30	45.66	49.89
Net profit, % of total sales . . . . .	20.65	20.65	20.65	22.83	24.94
RDE, Net profit, % of equity . . . . .	24.23	24.23	24.23	26.79	29.27
ROI, Net profit+interest, % of invest.	13.80	13.80	13.80	15.26	16.67



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, construction in 1000 US DOLLARS**

Year .....	1987
Total assets .....	212.02
Fixed assets, net of depreciation	0.00
Construction in progress .....	211.50
Current assets .....	0.00
Cash, bank .....	0.00
Cash surplus, finance available	0.52
Loss carried forward .....	0.00
Loss .....	0.00
Total liabilities .....	212.02
Equity capital .....	130.00
Reserves, retained profit .....	0.00
Profit .....	0.00
Long and medium term debt .....	82.03
Current liabilities .....	0.00
Bank overdraft, finance required	0.00
Total debt .....	82.03
Equity, % of liabilities .....	61.31



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1988	1989	1990	1991	1992	1993
<b>Total assets .....</b>	<b>258.54</b>	<b>240.37</b>	<b>218.55</b>	<b>203.00</b>	<b>213.57</b>	<b>233.28</b>
Fixed assets, net of depreciation	195.39	179.29	163.18	147.07	130.97	117.86
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	16.39	15.51	19.72	19.72	19.72	19.72
Cash, bank .....	2.73	1.54	1.60	1.60	1.60	1.60
Cash surplus, finance available .	0.00	0.00	0.00	27.49	61.29	94.10
Loss carried forward .....	0.00	44.04	34.05	7.13	0.00	0.00
Loss .....	44.04	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>258.54</b>	<b>240.37</b>	<b>218.55</b>	<b>203.00</b>	<b>213.57</b>	<b>233.28</b>
Equity capital .....	130.00	130.00	130.00	130.00	130.00	130.00
Reserves, retained profit .....	0.00	0.00	0.00	0.00	20.31	48.26
Profit .....	0.00	9.99	26.92	27.44	27.95	29.96
Long and medium term debt .....	71.77	61.52	51.27	41.01	30.76	20.51
Current liabilities .....	3.59	4.03	4.55	4.55	4.55	4.55
Bank overdraft, finance required.	53.19	34.84	5.81	0.00	0.00	0.00
<b>Total debt .....</b>	<b>128.54</b>	<b>100.38</b>	<b>61.62</b>	<b>45.57</b>	<b>35.31</b>	<b>25.06</b>
<b>Equity, % of liabilities .....</b>	<b>50.28</b>	<b>54.08</b>	<b>59.48</b>	<b>64.04</b>	<b>60.87</b>	<b>55.73</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1994	1995	1996	1997	1998	1999
<b>Total assets .....</b>	<b>253.50</b>	<b>274.24</b>	<b>305.74</b>	<b>337.24</b>	<b>368.74</b>	<b>400.24</b>
Fixed assets, net of depreciation	104.75	91.64	78.54	65.43	52.32	39.22
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	19.72	19.72	19.72	19.72	19.72	19.72
Cash, bank .....	1.60	1.60	1.60	1.60	1.60	1.60
Cash surplus, finance available .	127.43	161.27	205.88	250.49	295.10	339.70
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>253.50</b>	<b>274.24</b>	<b>305.74</b>	<b>337.24</b>	<b>368.74</b>	<b>400.24</b>
Equity capital .....	130.00	130.00	130.00	130.00	130.00	130.00
Reserves, retained profit .....	78.22	108.70	139.68	171.18	202.68	234.18
Profit .....	30.47	30.99	31.50	31.50	31.50	31.50
Long and medium term debt .....	10.25	-0.00	-0.00	-0.00	-0.00	-0.00
Current liabilities .....	4.55	4.55	4.55	4.55	4.55	4.55
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>14.81</b>	<b>4.55</b>	<b>4.55</b>	<b>4.55</b>	<b>4.55</b>	<b>4.55</b>
<b>Equity, % of liabilities .....</b>	<b>51.28</b>	<b>47.40</b>	<b>42.52</b>	<b>38.55</b>	<b>35.26</b>	<b>32.48</b>



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2000	2001	2002
Total assets .....	431.74	466.56	504.61
Fixed assets, net of depreciation	26.11	19.65	19.65
Construction in progress .....	0.00	0.00	0.00
Current assets .....	19.72	19.72	19.72
Cash, bank .....	1.60	1.60	1.60
Cash surplus, finance available .	384.31	425.59	463.65
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
Total liabilities .....	431.74	466.56	504.61
Equity capital .....	130.00	130.00	130.00
Reserves, retained profit .....	265.68	297.18	332.01
Profit .....	31.50	34.82	38.05
Long and medium term debt .....	-0.00	-0.00	-0.00
Current liabilities .....	4.55	4.55	4.55
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt .....	4.55	4.55	4.55
Equity, % of liabilities .....	30.11	27.86	25.76



**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1 US \$:

1) TOTAL REVENUES	<u>152,550</u>
2) VARIABLE COSTS:	<u>64,773</u>
. RAW MATERIALS	17,500
. UTILITIES	360
. ENERGY	20,250
. LABOUR	26,663
3) FIXED COSTS	<u>33,930</u>
. REPAIR-MAINTENANCE	6,960
. SPARES	4,700
. ADMINISTRATION	-
. DEPRECIATION	16,110
. FINANCIAL COSTS	6,150
4) TOTAL PRODUCTION COSTS	<u>98,703</u>

$$\text{BEP} \frac{33,930}{152,550 - 64,773} \times 100 = 38,3\%$$

Essential Oils

ANNEXE 3

FOREIGN EXCHANGE EFFECT EVALUATION

18 d 13


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**Foreign Exchange Effect in 1000 US DOLLARS**  
 Economic Analysis excluding indirect effects  
 100 units foreign CU = 100.00 units local CU

	grand total	total constr.	.construction.		production		1990
			total produc.	1987	1988	1989	
total foreign inflow . .	2233.18	82.03	2151.15	82.02	61.13	106.85	152.57
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	82.15	82.03	0.13	82.03	0.11	0.00	0.02
exports . . . . .	2151.02	0.00	2151.02	0.00	61.02	106.85	152.55
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	554.00	96.50	457.50	96.50	66.97	29.32	41.35
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	86.85	96.50	-9.65	96.50	9.50	-3.96	2.38
imported materials . . .	348.09	0.00	348.09	0.00	39.02	15.79	22.56
repayment loans & overd.	62.15	0.00	62.15	0.00	10.25	10.32	10.25
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	36.91	0.00	36.91	0.00	8.20	7.18	6.15
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	1679.17	-14.47	1693.65	-14.47	-5.84	77.53	111.22
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchge effect	1679.17	-14.47	1693.65	-14.47	-5.84	77.53	111.22
present values at 10.00 %							
foreign exchange flow .	758.59						
net foreign exchge effect	758.59						



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### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	152.55	152.55	152.55	152.55	152.55	152.55	152.55
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	152.55	152.55	152.55	152.55	152.55	152.55	152.55
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	37.94	36.91	35.89	34.86	33.84	22.56	22.56
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . .	22.56	22.56	22.56	22.56	22.56	22.56	22.56
repayment loans & overd.	10.25	10.25	10.25	10.25	10.25	0.00	0.00
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	5.13	4.10	3.08	2.05	1.07	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchge flow	114.61	115.64	116.66	117.69	118.71	129.99	129.99
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00
net forgn exchge effect	114.61	115.64	116.66	117.69	118.71	129.99	129.99
present values at	10.00 %						
foreign exchange flow .	758.59						
net forgn exchge effect	758.59						



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**Foreign Exchange Effect in 1000 US DOLLARS**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1998	1999	production 2000	2001	2002	2003
total foreign inflow . .	152.55	152.55	152.55	152.55	152.55	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
subsides, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	152.55	152.55	152.55	152.55	152.55	0.00
indirect effects . . . . .						
total foreign outflow .	22.56	22.56	22.56	22.56	22.56	-17.50
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	-17.57
imported materials . . .	22.56	22.56	22.56	22.56	22.56	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.06
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .						
net foreign exchange flow	129.99	129.99	129.99	129.99	129.99	17.50
import substit'n effect	0.00	0.00	0.00	0.00	0.00	0.00
net foreign exchange effect	129.99	129.99	129.99	129.99	129.99	17.50
present values at 10.00 %						
foreign exchange flow .	758.59					
net foreign exchange effect	758.59					

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Essential Oils

ANNEXE 4

DRW. B162 - 15 - 1  
ESSENTIAL OIL DISTILLATOR





**Essential Oils**

**ANNEXE 5**

**ESSENTIAL OIL AMERICAN ASS. SPECIFICATIONS**



Oil Lemongrass is the volatile oil obtained by steam distillation of the *Cymbopogon* grasses indigenous to tropical and semi-tropical areas. The oil is widely

used as an aromatic for its intense lemon-like odor and as a raw material for the manufacture of isolates, ionones, and other aromatic products.

**SPECIFICATIONS**

<p>Other General Names . . . . .</p>	<p>There are basically two types of Lemongrass Oil commercially available: The East Indian and "West Indian" type oil.</p> <p>The East Indian Oil is also known as Cochin, Native and British Indian Lemongrass Oil.</p> <p>The "West Indian" type oil appears on the market designated according to geographic origin as Madagascar, Guatemala, Honduras or Florida Lemongrass Oil, etc.</p>
<p>Botanical Nomenclature . . . . .</p>	<p>East Indian Oil: <i>Cymbopogon flexuosus</i> (Stapf) <i>Andropogon Nardus</i> var. <i>flexuosus</i> (Hack)</p> <p>"West Indian" type Oil: <i>Cymbopogon citratus</i> (Stapf) <i>Andropogon nardus</i> var. <i>ceriferus</i> (Hack)</p>
<p>Preparation . . . . .</p>	<p>By steam distillation of the freshly cut and partially dried grasses.</p>
<p>Physical and Chemical Constants . . . . .</p>	<p>East Indian Oil: Appearance and Odor: The East Indian Oil is generally dark yellow to light brown red in color and has a pronounced heavy lemon-like odor. Specific Gravity at 25°/25°C: 0.894 to 0.904. (Temperature correction factor from n°/n°C: 0.00062 per °C). Optical Rotation: -3° to +1. Refractive Index at 20°C: 1.4830 to 1.4890. Residue: 8% maximum. Method: Proceed as directed for determination of vacuum distillation residue (See EOA Determinations # 1-P). Carry on distillation until the vapor temperature reaches 90° to 105°C. Citral Content: A. Acid Sulfite Method - Not less than 75%. Solubility in Alcohol at 25°C: Soluble in 2 to 3 volumes of 70% alcohol, often with slight turbidity.</p> <p>"West Indian" type Oil: Appearance and Odor: The "West Indian" type oil varies from light yellow to light brown or orange. Its odor is lemon-like but of lighter character than the East Indian. Specific Gravity at 25°/25°C: 0.869 to 0.894. (Temperature correction factor from n°/n°C: 0.00062 per °C). Optical Rotation: -3° to +1°.</p>

E.O.A. STANDARD for: OIL LEMONGRASS (Continued)

Refractive Index at 20°C: 1.4830 to 1.4890.

Residue: 7% maximum.

Method: (See EOA Determinations #1-P).

Citral Content: A. Acid Sulfite Method: Not less than 75%.

Solubility in Alcohol at 25°C: Yields cloudy solutions in 70, 80, 90 and 95% Alcohol.

Assay: A. Remove any metallic impurities from a sample of the lemon-grass oil by shaking the oil for five minutes with about 1% of dry, powdered tartaric acid. Filter the oil and dry, if necessary with the aid of anhydrous sodium sulfate. Pipette 10cc of this treated, clear oil into a 150cc E.O.A. cassia flask (See EOA Specification apparatus #1) and 75cc of a prepared 30% (W/V) aqueous solution of sodium bisulfite. Stopper the flask and shake thoroughly until the normal bisulfite addition product is formed. (This is indicated by the formation of a white semi-solid to solid mass which renders further shaking difficult.) Permit the flask to stand at room temperature for five minutes. Then place the loosely-stoppered flask in a water bath, maintained at 85° to 90°C; occasionally shaking the flask, until the solid addition compound has gone completely into the solution. Continue the heating for an additional 30 minutes with intermittent shaking to assure complete reaction. Add sufficient bisulfite solution to raise the meniscus within the graduated portion of the flask. Any droplets of oil adhering to the sides of the flask are made to rise into the neck by gently tapping the flask and by rotating it rapidly between the palms of the hands. On cooling, the volume of the unreacted oil is measured and the citral content is calculated.

Percentage of Citral:

(By volume) =  $10X$  (10 = no. of cc of unreacted oil).

NOTE: The sodium bisulfite used for the preparation of the solution should be of reagent grade sodium bisulfite (NaHSO<sub>3</sub>). Assaying not less than 95% NaHSO<sub>3</sub>. It should be stored in tightly stoppered bottles.

Descriptive Characteristics . . . . .

Solubility:

- Benzyl Benzoate: Soluble in all proportions.
- Diethyl Phthalate: Soluble in all proportions.
- Fixed Oils: Soluble in all proportions in most fixed oils.
- Glycerine: Relatively insoluble.
- Mineral Oil: Relatively soluble.
- Propylene Glycol: Soluble in all proportions.

Stability:

- Alkali: Lemongrass oils slowly decompose in the presence of alkalis.
- Acids: Strong inorganic acids tend to polymerize the oil. Weak acids have less effect.

Containers . . . . .

Ship preferably in glass, aluminum, tin-lined or other suitably lined containers. Good quality galvanized or black iron containers are also suitable if long storage is not contemplated.

Storage . . . . .

Store in tight, full containers in a cool place protected from light.

**SAMPLE:** Lemongrass Oil (All Types) E.O.A.

**COLUMN:**

Material: Copper Length: 8 ft. O.D. 1/4" I.D. 3/16"  
Stationary Phase: Carbowax 20M, 10%  
Solid Support: Chromosorb W, pH 7.4, 60-80 mesh

**CARRIER GAS:** Helium

**CONDITIONS:**

Column Temperature — Isothermal: 150°C  
Inlet Temperature: 250°C  
Inlet Pressure: 25 PSIG Column Flow Rate 80 ml/min.  
Sample Size: 1.0  $\mu$

**DETECTOR:**

Type: Thermal Conductivity — Hot Wire Temp. 275°C

**RECORDER:**

Span: 1 mv. Chart Speed: 60 inches/hr.

**CHROMATOGRAM:**

Principal Components	Rel. Retent. Time	Attenuation
1. Neral	0.47	4
2. Geranial	0.57	4
3. Phenyl Ethyl Propionate	1.00	4

Retention time of last component: 9 min. (Phenyl Ethyl Propionate)

Typical Curve (The conditions given above refer specifically to the curve attached.)

**METHOD OF CALCULATION:**

Internal Standard (See E.O.A. Instrumental Determination 1D-3) (Gas Chromatography) (Section II-D) using Phenyl Ethyl Propionate in 30% mixture with sample. A factor of 0.918 was obtained using the procedure described herein.

THIS ANALYSIS MAY ALSO BE ACCOMPLISHED WITH COLUMNS CONTAINING:  
DEGS

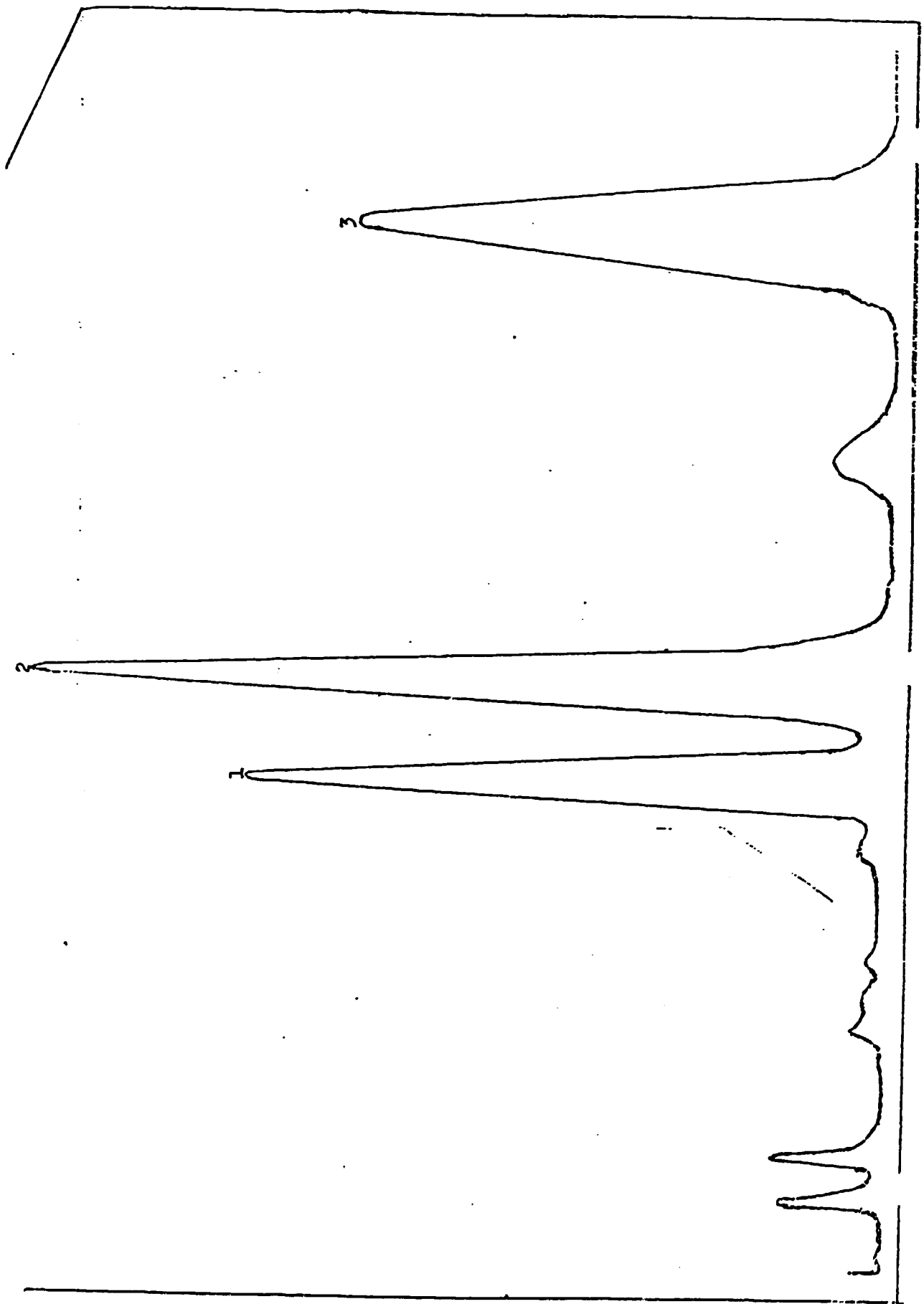
THE CONDITIONS GIVEN ABOVE ARE PROVIDED FOR GUIDANCE ONLY.

**NOTE:**

The analyst is cautioned to purify the knowns used in the determination just prior to use, by distillation and/or preparative GC followed by GC analysis for percent purity. Citral is unstable, and purification procedures require care. Decomposition, if it takes place, is usually noted as a rise in the base line, just prior to the Neral peak. The use of the neutralized support and recommended temperatures eliminates decomposition.

A determination of the factor for each series of analyses is advisable.

**ESSENTIAL OIL ASSOCIATION OF U. S. A., Inc.**



## EUCALYPTUS CITRIODORA

Eucalyptus Citriodora is primarily grown in Brazil with some being grown in Guatemala and Australia.  
It is used as a source of citrocetl and in perfumery.

## SPECIFICATIONS

Botanical Nomenclature . . . . .	Eucalyptus Citriodora. Hoo'. (Family:— Myrtaceae).
Preparation . . . . .	Eucalyptus Citriodora is prepared by the steam-distillation of the leaves.
Physical & Chemical Constants . . . . .	Appearance and Odor: Eucalyptus Citriodora is a light yellow to greenish yellow oil with a characteristic odor of Citronellal. Specific Gravity at 25°/25°C: 0.860 to 0.875. (Temperature correction factor from n°/n°C: 0.0006 per °C.) Optical Rotation: —0.5° to +2.0°. Refractive Index at 20°C: 1.4510 to 1.4640. Aldehyde Content: 65% to 85% as Citronellal. Assay: Proceed as directed for the determination of aldehydes by the Hydroxylamine method (See Determinations EOA #1-D) using approximately 2.0 gram sample accurately weighed. The difference in the ml. of N/2 HCl required for both titrations multiplied by 0.07712 indicates the weight in grams of total aldehydes calculated as citronellal in the sample taken for assay. Solubility in Alcohol: Soluble in 3 vol. of 70% alcohol.
Descriptive Characteristics . . . . .	Solubility: Benzyl Benzoate: Soluble in all proportions. Diethyl Phthalate: Soluble in all proportions. Fixed Oils: Soluble in most fixed oils. Glycerine: Insoluble. Mineral Oil: Soluble in all proportions. Propylene Glycol: Relatively soluble.  Stability: Alkali: Relatively unstable. Acids: Unstable.
Containers . . . . .	Should be shipped preferably in glass, tin-lined or aluminum containers. Good quality galvanized iron containers are suitable provided long storage is not contemplated.
Storage . . . . .	Store in tight, full containers in a cool place protected from light.

## OIL GERANIUM ALGERIAN

Oil Geranium Algerian is produced in Algeria and Tripoli and the nearby regions by steam distillation of the leaves of *Pelargonium graveolens* (*P. terbinthaceum*). The leaves are harvested three times a

year, shortly before blossoming, when the leaves begin to turn yellow. Plantings in somewhat dry locations produce slightly less oil but of superior quality compared to oil from irrigated sections.

## SPECIFICATIONS

Other General Names . . . . .	Oil Rose Geranium Algerian.
Botanical Nomenclature . . . . .	<i>Pelargonium graveolens</i> . Family Geraniaceae.
Preparation . . . . .	Steam distillation of the leaves.
Physical & Chemical Constants . . . . .	Color & Appearance: Light yellow to deep yellow liquid with characteristic odor resembling rose and geraniol. Specific Gravity @ 25°/25°C: 0.886 to 0.898. (Correction factor from n°/n°C: 0.00058 per °C.) Optical Rotation: -7° to -13°. Refractive Index @ 20°C: 1.4640 to 1.4720. Acid Value: 1.5 to 9.5. Proceed as directed for the determination of Acid Value (See Determination E.O.A. #1-E) using approximately 5 gms. of the sample accurately weighed, and 15-cc of water as diluent instead of alcohol. It will be necessary to agitate the mixture thoroughly during the titration to keep the oil in suspension. Ester Value: 31 to 70 (indicating a 13% to 29.5% ester calculated as Geranyl Tiglate). The Percentage of Geranyl Tiglate can be calculated by the following formulae: $\text{Ester Value} \times 0.422 = \% \text{ of Geranyl Tiglate}$ Proceed as directed for the determination of esters (See Determination E.O.A. #1-A) using approximately 6 gms. of the oil accurately weighed. Calculate the Saponification Value by the following formulae: $\text{S.V.} = \frac{28.05 \times a}{s}$ where a = the number of cc of 0.5N alcoholic potassium hydroxide solution consumed in the saponification and s = weight of the oil, in grams. Determine the Ester Value as follows: $\text{E.V.} = \text{S.V.} - \text{A.V.}$ Ester Value after Acetylation: 203 to 234. (Indicating 66% to 78% of total alcohol calculated as geraniol not corrected for ester).

**SPECIFICATIONS (Continued)**

Proceed as directed for the determination of Total Alcohols (See Determinations E.O.A. #1-B) using approximately 1.9 gms. of the acetylated oil accurately weighed for the subsequent saponification. Calculate the Ester Value after Acetylation by the following formulae.

$$\text{E.V.A.A.} = \frac{28.05 \times a}{s}$$

where *a* = the number of cc of 0.5N alcohol potassium hydroxide consumed in the subsequent saponification and *s* = the weight in gms of the acetylated oil used.

Percent total geraniol may be calculated by the following formulae:

$$\text{E.V.A.A.} = \frac{7.712 \times a}{s - (a \times 0.021)}$$

This gives the total geraniol not corrected for ester.

**Solubility in Alcohol:** Soluble in 2 to 3 volumes of 70% alcohol. On further addition of 70% alcohol opalescence sometimes occurs which may be followed by separation of paraffin particles.

Descriptive Characteristics . . . . .

**Solubility:**

- Benzyl Benzoate:** Soluble in all proportions.
- Fixed Oils:** Soluble in all proportions in most fixed oils.
- Glycerine:** Practically insoluble.
- Mineral Oil:** Soluble in all proportions with opalescence after about 3 volumes.
- Propylene Glycol:** Soluble in all proportions, with opalescence after about 4 volumes.

**Stability:**

- Alkali:** Unstable in alkalis due to hydrolysis of some of the esters.
- Acid:** Exposure to anything more than mild organic acids risk deterioration of quality.

Containers . . . . .

Should be shipped preferably in glass, tin-lined or aluminum containers. Good quality galvanized containers are suitable when long storage is not contemplated.

Storage . . . . .

Store preferably in tight, full containers in a cool place, protected from light.



**U.N.I.D.O.**  
**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**D.P.S.A.**  
**DEVELOPMENT PROJECT STUDY AGENCY**

**OPPORTUNITY STUDY FOR THE**  
**PRODUCTION OF CANNED FISH**  
**IN ETHIOPIA**

**PROJECT DP/ETH/85/004**

**baldo & c.**  
CONSULTING ENGINEERS

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**ANNEXES**

**ANNEXE 1 - FINANCIAL EVALUATION - HYPOTHESIS 1**

**ANNEXE 2 - FINANCIAL EVALUATION - HYPOTHESIS 2**

**ANNEXE 3 - BEP EVALUATION**

**ANNEXE 4 - FOREIGN EXCHANGE EFFECT EVALUATION**

**ANNEXE 5 - DRW. B162-18-1 - FREEZING UNIT FOR STORES AND ICE  
MAKING PROCESS SCHEME**

**DRW. B162-18-2 - BLAST AIR TUNNEL**

**DRW. B162-18-3 - PRODUCTION OF FISH MEAL AND OIL**

**DRW. B162-18-4 - GENERAL LAY OUT**

0. SUMMARY AND CONCLUSIONS

The industrial exploitation of the aleutic resources of the Red Sea can provide a number of very valuable final products:

- canned fish, a good protein source, easy to store and distribute;
- fish meal, an excellent integrator for animal feed, produced from fish canning wastes processing;
- fish oil, again produced from fish canning-wastes processing and used in a variety of industrial applications;

The Red Sea, according to FAO, has a good fishing potential but the project discussed in this opportunity study is not too ambitious (5 tons/day processing) for the following main reasons:

- fish is not a very popular food in Ethiopia except in the period of Lent;
- an industrial fishing fleet does not yet exist.

In any case the proposed processing plant will produce good quality canned fish and by-products, will allow the training of personnel, a better use of the existing resources and may be considered therefore the first part of a larger programme for the exploitation of Red Sea potential.

The fixed investment has been estimated at 2,700,000 US \$ (1,550,000 \$ the foreign exchange portion).

The staff will be 69.

The internal rate of return results 33.33 % and is still 25.2% even drastically reducing the sale price of canned fish on the domestic market to a value as low as 2 \$/kg. The foreign exchange effect is also very favourable. Consequently it is recommended that a detailed feasibility study be carried out.

1. INTRODUCTION

In the countries rich in fish and where large catches of particular species in limited periods of the year are carried out, the fish is obviously subjected to preservation treatments utilizing various available methods such as drying (stock-fish), salting (cod, herring), smoking (herring, salmon), plain boiling (salmon), preservation in oil after a sterilizing process (sardines, tuna) and pickling (herring, eels); all these procedures are well known and allow the food processing industry to supply the international market with large quantities of fish. This type of industry is however also interesting for Eritrea, since one of the constraints on the fishing activities in this region is the high ambient temperature which causes a very rapid deterioration of the product.

The present study deals with fish processing and canning in the Red Sea region, with specific emphasis on the small pelagic species (sardines, anchovies) that are among the most abundant species in this area.

2. MARKET AND PLANT CAPACITY

2.1 Uses

Consumption of fish is not popular in Ethiopia, except during the period of Lent among the Coptic population. Eating habits may change, but slowly and, obviously, quality and price must be convincing; the low level of income of the greater part of the Ethiopian population combined with traditional dietary customs are not presently very favourable to a project of fish marketing on a large scale; but the availability of the raw material and the necessity of matching the surge of demand during Lent, suggest the consideration of a project for the production of an adequate amount of canned fish which, suitable for storage for a long time, is the ideal product for satisfying a peak demand. Thus it may also be useful in drought periods as well as in several other cases. It should also be pointed out that, from the nutritional point of view, fish (and in particular fish such as sardines) can compete well with meat and other foods, so that, if the price is competitive, it could always represent a good alternative meal, as in fact is the case in many industrialized and developing countries.

In addition the processing of the fish to be canned offers the possibility of recovering the wastes, transforming them into two useful by-products, namely:

- a) fish meal, an excellent integrator of animal feeds, being very rich in protein; it can be added to the fodder in a proportion of 10-20%, if poor in nitrogenous substances, of livestock (horses, cattle, sheep, pigs and poultry);

- b) fish oil, which may have many varied industrial uses such as:
- a base for a product largely used in the tanning industry
  - an antifoam agent in distilleries and sugar factories
  - a hydrogenated, sulphonated or polymerized oil to be directly used in soap production
  - an ingredient for paint preparation, due to the particular characteristics possessed by its film, such as ductility, flexibility, high resistance to oxidation, impermeability and good resistance to brackish water
  - ingredient for the preparation of water-proof canvas, linoleum, jute mats and ropes
  - a cooling agent in steel tempering
  - an ingredient for the preparation of printing ink
  - a lube oil for special mechanisms.

## 2.2 Forecast demand and plant capacity

It is not easy to define a forecast demand, as statistics on the subject are scarce and incomplete; what can be stated is:

- according to FAO statistics, the average annual production of fish in the period 1980-1982 was 3695 t/y which, taking into account the imports, became 3736 t/y as food supply for the population (no non-food use has been recorded)
- the consumption pro-capita in the above mentioned period was 0.1 kg/y, one of the lowest consumptions in the World as well as in Africa itself, where against a

- value of 0.1-0.2 kg/y for Ethiopia, Swaziland and Rwanda, there are consumptions of 1.1 - 2.3 kg/y for Botswana, Niger, Zimbabwe, Somalia and Burkina Faso and much higher values for all the other countries;
- imports of fish have always been recorded in the last ten years, even if in quantities lower than 10% of the local production;
  - fishing in Lake Zwai was suspended in the years 1984-85, to avoid the risk of tilapia depletion, as its breeding season coincides with Lent, when the consumption of fish reaches the maximum value. In previous years the production of the lake has been around 1300 t/y.

These considerations lead to the conclusion that, apart from the necessity to satisfy better the peak demand of the Lent period, the potential demand is large and even if it is impossible to identify a trend, demand is sufficient to look with confidence to a project regarding the processing of 1000-2000 t/y of fish. On the other hand, even if the estimated potential yield of the Red Sea is quite high, (25÷50000 t/y of small pelagic fishes) (1), there are other considerations that lead to a consideration of a not over ambitious project:

- the existing fishing fleet is not adequate for such a yield;
- information on the dynamics of these pelagic fish is not available.

(1) Source: FAO, Rome



For all these reasons the capacity of the plant has been fixed at 5 t/d, that is, on the supposition of one shift a day for 264 days per year; an annual processing capacity of 1320 t/y of various fish, a capacity that can well be satisfied by the current fishing fleet; the corresponding average outputs are estimated as follows:

- 460 t/y of frozen fish (include the best qualities such as lobsters, shrimps, bass fillets, etc), mainly for export
- 460 t/y of canned fish (include anchovies, sardines and similar small fish), mainly for the domestic market
- 200 t/y (corresponding to around 400 t/y of fresh wastes) of fish meal and oil to be used mainly in the domestic market.

The process equipment have been designed for the following max capacities:

550 t/y of frozen fish

600 t/y of canned fish

300 t/y of fish meal and oil

The plant will also produce 3t/d of ice flakes which will be used for the preservation of fish before processing.

2.3 Sales price and total revenues

The sale price of the frozen product, ex works, can be assumed as 5 \$/Kg, on the basis of the current wholesale price, CIF European port, of 6.2 \$/Kg. The canned product can be priced 3.4 \$/Kg (can net content) on the basis of the information collected by the Consultant in Addis Ababa (1)

Fish meal and oil can be priced at 0.17 \$/kg.

The total annual revenues therefore result as follows:

- canned product	
460,000 Kg/y x 3.4 \$/Kg =	1,564,000 \$/y
- frozen fish	
460,000 Kg/y x 5 \$/Kg =	2,300,000 \$/y
- fish meal and oil	
200,000 Kg/y x 0.17 \$/Kg =	34,000 \$/y
	-----
Total	3,898,000 \$/y

(1) The current retail price in Addis Ababa for the imported canned sardines is around 2 birr for a tin of 125 gr (this is the net weight of the canned fish); this means a price of 16 birr per kg of canned fish or 7.7 dollars; this is the retail price that includes, inland transportation, customs duty and distribution costs plus profit; all these components have been evaluated in the range of 55% of the retail price. The local ex-works selling price can therefore be fixed at 3.4 \$/kg.

3. MATERIALS AND INPUTS

3.1 Technology

The catch is selected and the better qualities of fish are frozen; then the remaining fishes are dressed and canned. All the wastes (heads, tails, spoiled fish, etc) are minced and dehydrated.

Consequently as well as the fish, the inputs include the tins, the steam for the dehydration and evaporation and the electric power for the freezing process and for the driving of all the auxiliary machines.

The price to be paid to the fishermen, including the transportation to the factory store, has been assumed, on the basis of the information available on the subject, as 0.48 \$/Kg.

3.2 Raw material requirements and costs

The following calculations include all the costs for the raw materials as well as for the utilities referred to the processing of 1320 t/y of fish as stated in para. 2.2:

	LC	FC	Total
	\$/y	\$/y	\$/y
- Purchasing of fish			
1,320,000 kg x 0.48 \$/Kg	637,680	-	637,680
- Power for fish freezing			
460,000 kg x 0.175 kWh/each Kg of fish x 0.096 \$/kW	7,728	-	7,728

- Edible oil for canned fish 0.26 kg oil/each kg of canned fish = 460,000 kg fish x 0.26 kg oil x 2.0 \$/Kg (1)	239,200	-	239,200
- Steam needed for fish cooking 460,000 kg fish per 0.3 kg steam at 0.0175 \$/kg steam (cost of fuel to produce 1 kg steam)	-	2,484	2,484
- Fuel needed for fish meal and fish oil preparation 400,000 kg x 0.07 kg fuel per each kg of raw material at 0.22 \$/kg.	-	6,054	6,054
- Power needed for fish meal and oil preparation 400,000 kg x 0.035 kWh per kg raw material x 0.096 \$/kg	1,334	-	1,334
	-----		
	885,942	8,538	894,480
- Other utilities and unaccounted consumptions (10% of the total)	83,058	7,462	90,520
	-----		
	969,000	16,000	985,000
- Packaging (see para 5.2)	417,000	-	417,000
	-----		
	1,386,000	16,000	1,402,000

(1) Central Bureau of statistics and Consultant's survey

For the financial evaluation these costs are grouped as follows:

Raw material (fish + oil)	LC	876,880
Other raw material (packaging)	LC	417,000
Energy (fuel)	FC	16,000
Utilities (electricity+unacc. cons.)	LC	92,120
		-----
		1,402,000

**3.3 Raw material purchasing programme and storage volumes**

The raw materials to keep in stock are the edible oil and the fuel oil; an amount equivalent to 30 days of work at full capacity as storage capacity is reasonable. Thus the stock is equal to 4450 kg of fuel oil (equivalent to 980 \$) plus 10,000 kg of edible oil, (20,000 \$ approximately).

4. LOCATION

Bearing in mind the use of the present fishing fleet,  
the location should be in the vicinity of Assab.

5. PROJECT ENGINEERING

5.1 Description of process and main equipment

Fish processing is carried out through the following steps:

- selection
- freezing of the fish for the export market
- canning and sterilizing of the fish for the local market
- processing of the waste

The plant must be adequate to allow the performing of all the processing steps according to the "Recommended international code of practice for canned fish" by FAO

a) Selection

The fish, supplied daily by the fishermen, is stored in a cold room (-2°C) separating the different qualities, according to the processing programme: fish to be frozen and exported, fish to be canned, fish to be sold fresh on the local market, if required, and fish of very poor quality to be processed together with the wastes.

b) Freezing

This process is reserved for the fish more appreciated on the international market, such as lobster, shrimps, bass, etc. No dressing is foreseen except for the fish of large size that are prepared as fillets.

The fish are manually packaged and frozen in a blast tunnel and immediately stored in cold room at -20°C.

c) Canning

All the small fish (sardines and anchovies and mackerel in particular) are processed in this section: they are dressed (beheaded, degutted, tails removed; the large mackerel cut into fillets), and put into the cans with oil; the cans are then closed and sterilized.

All the operations are carried out by hand except for the can closing and sterilizing.

The net weight of the canned product is 95g; the gross weight (fish+oil), 125g.

d) Fish meal plus oil

In this section all the wastes of the previous treatment are processed as well as all the fish of very poor quality.

All this process is mechanized; first these refuses are minced; then they are cooked; coming out of the cooker the flow is separated into two streams: one, solid, is sent to the dryer; the other one, liquid, to a separator. From the dryer the output is milled a second time and after that the meal is ready to be bagged. From the separator, the fish oil is sent to the packaging section while the water is pumped to the concentrates (two stages evaporators); the vapours are vented to the atmosphere after having been deodorized.



The equipment and machinery necessary for accomplishing all these process steps include the following main items:

- one prefabricated 100 cu.mt cold store and one prefabricated (150 cu.mt) chilled room
- one complete freezing equipment (compressor, surge drum, air coolers, evaporative condenser, pumps piping, stand-by compressor) for the cold store (-20°C), the chilled store (-2°C) and 3 t/d flake ice generator complete of 3t ice storing compartment. The volume of each of the two rooms is 65 cu.mt.
- one complete freezing machine for 1 air blast tunnel.
- one set of belt conveyors for the transport of the fish through the various steps of the process
- four preparation tables for fish dressing and packaging
- one automatic machine for can filling with oil and closing
- one complete sterilizing tunnel
- one air conditioning unit
- one complete plant for fish meal and oil production including:
  - . one mince
  - . one rotating drum cooker, with jacket heated by the flue gas produced by hot air generator
  - . one centrifuge for separating the solid from the liquid phase
  - . one separator for separating the liquid phase into three streams, oil, stickwater and solids: solids are recovered back into the minced fish stream, stickwater are brought to the evaporators and oil to the tank storage

- . one rotating drum dryer, jacket heated by flue gases as for the cooker
- . one hammer mill; at its outlet the meal is bagged
- . one evaporator unit, double effect type, for concentrating the stickwater; the concentrate can be mixed into the feed of the dryer, thus permitting whole meal to be produced
- . one hot air generator for heating of cooker and dryer, complete of fuel oil burner, fuel oil heater and pump, and instrumentation
- . one deodorizing equipment for the abatement of the vapours from the dryer through a scrubber tower
- . one fish oil 100 cu.mt tank
- one steam boiler for supplying steam to the evaporators, to the sterilizing system and to cleaning hose system
- one complete set of pumps, fans and screw conveyors as well as all other ancillaries equipment as required by the regular operation of the plant (total installed power 250 kVA)

## 5.2 Packaging

The frozen fish will be packaged in small plastic bags put into cardboard boxes filled by hand. The cost of this packaging is estimated at 0.15 \$/kg of fish, that is 70,000 \$.

Eight cans (each weighing 40÷45 gr) are required for every kilogram of fish; the cost of these cans is in the range of 0.7 \$, that is 322,000 \$ for 460,000 kg of fish. It is worth noting that a project for the production of cans in Ethiopia is now under consideration. It can, in future, provide this input to

the fish canning plant. The fish meal is shipped in 25 kg paper bags, whose cost can be estimated at 0.5 \$/piece that is 25,000 \$.

The oil is shipped in bulk.

On this basis the cost of packaging amounts to 417,000\$ that must be added to the cost of raw materials (see para 3.2)

### 5.3 Layout

The factory covers an area of about 4500 sq.mt. Inside this area are the process building and the administrative building. The process building consists of two adjacent parts, each measuring 15 x 30m, 5m high, one mainly devoted to fish processing and the other to fish meal production. These two parts are constructed of reinforced concrete as supporting structure; external and partition walls are of brickwork; the roof is covered with asbestos cement, insulated with mineral wool lagging; the floor of the building is covered with tiles in order to be easily washable and free of dust.

The administrative building including also the workshop and the warehouse, is a two-storey construction measuring 15 x 30m; the supporting structure is of reinforced concrete; external and partition walls are of brickwork; the roof is covered with asbestos cement, insulated with mineral wool lagging.

The courtyard all around the factory is tamped, covered with gravel and rolled; a wire-netting fence encloses all the factory; a bridge-scale is located near the main gate.

5.4 Investment cost

The estimate of the investment costs for the complete factory as above described, all utilities and facilities included, as well as two lorries for the fish transport, is as follows:

	LC	FC	TOTAL
Machinery and equipment			
FOB European port		1,134,492	1,134,492
Transport	113,450	113,450	226,900
Erection	155,200	71,700	226,900
Civil work	700,000	-	700,000
Site development	70,000	-	70,000
Spare parts		100,000	100,000
	-----	-----	-----
	1,038,650	1,419,642	2,458,292
Contingencies	111,350	130,358	241,708
	-----	-----	-----
GRAND TOTAL	1,150,000	1,550,000	2,700,000

The life cycle of this plant can be estimated as 15 years. Annual maintenance cost has been evaluated in the range of 4% of the cost of machinery and equipment, i.e. approximately 50,000 \$/y.

In the financial evaluation the investment costs (contingencies included) are grouped as follows:

Machinery	FC 1.550 million dollars
Machinery	LC 0.269 million dollars
Site preparation	LC 0.070 million dollars
Civil works	LC 0.811 million dollars
	-----
	2.700 million dollars

6. PLANT ORGANIZATION

The plant organization is highlighted in para 7 and has been drafted assuming that the plant will operate as an autonomous unit operating within the organizational framework of the Fish Producing and Marketing Corp.

7. MANPOWER

No special skills are required for any of the positions listed below except for the production manager, the workshop engineer and the foremen who must have through training in the technology involved in the various processing operations, from the technical as well as from the sanitary and preservation points of view. The requirements for all the other positions are not different from those required in any other agro-industry factory.

7.1 Management

		Birr/m	Birr/y
General manager	1	1500	
Technical manager	1	<u>1200</u>	_____
	2	2700	32400

7.2 Administrative dept.

Senior accountant	1	800	
Purchasing dep.head	1	400	
Store dept.head	1	400	
Sale dept.head	1	400	
Clerks and secretaries	8	2800	
Guards	4	600	
Drivers	2	<u>700</u>	_____
	---	-----	-----
	18	6100	73200
			Total 105,600
			(50,014 \$/y)

7.3 Production and maintenance department

		birr/m	birr/y
<u>a) Production department</u>			
Production manager	1	1000	
Foremen	4	1600	
Skilled workers	8	2800	
Unskilled workers	20	4000	
Clerk	<u>1</u>	<u>300</u>	
	34	9700	116400
			(56,232 \$/y)
 <u>b) Maintenance department</u>			
Engineer	1	800	
Electricians	2	800	
Mechanics	3	1200	
Handymen	2	700	
Unskilled workers	<u>7</u>	<u>1400</u>	
	15	4900	58800
			(28,406 \$/y)

8. IMPLEMENTATION SCHEDULING

24 months are needed for the design and construction of the equipment.



9. FINANCIAL EVALUATION

The Comfar financial evaluation is attached as Annexe 1 and 2.

This evaluation is based on the data indicated in the foreword and in the study and on the following:

- working capital input table: mdc

	FC	LC
inventory utilities	1	1
work in hand	3	3

- the assistance of one foreign expert for the first operating period (six months) has been taken into account and indicated as "foreign factory overheads".

- packaging costs have been included in the "other raw materials"

- the production program has been assumed as follows:

1st year: 60% capacity (276t Frozen F.+276 t canned fish + 120 t Fish meal).

2nd year: 80% capacity (368t Frozen F.+ 368 t canned fish + 160 t Fish meal).

From the 3rd

to the 15th year : 100% capacity (460 t Frozen F. + 460 t canned F. + 200 t Fish meal).

Selling prices:

Frozen fish: 5 \$/kg

Canned fish:	3.40 \$/kg (hypothesis 1)
	2.00 \$/kg (hypothesis 2)
Fish meal :	0.17 \$/kg

The evaluation yields an IRR equal to 33.33% and a BEP equal to 17% in the hypothesis 1; in the hypothesis 2 the IRR is 25.52%.

10. FOREIGN EXCHANGE EFFECT

The evaluation of the foreign exchange effect is shown in Annexe 3.

All the figures used in this computation as "inflows" and "outflows" correspond to the inputs given to the COMFAR for the same items, while the import substitution effect (which measures the expected savings in foreign exchange due to the substitution of the imports of the items the production of which has been taken up by the project) has been calculated on the following assumptions:

- yearly imported quantity equal to the production programme;
- cost of import equal to 2.55 \$/kg CIF Assab.

Both the net foreign exchange flow and the net foreign exchange effect are favourable; by discounting the annual net foreign exchange effect at the rate of 10% the calculation arrives at a present value of the foreign exchange effect amounting to 18,848,000 \$.

Hence the amount of foreign exchange earned and saved by implementation of this project would be such that in spite of repaying the foreign loan, there would still be a surplus which in terms of present value would amount to 18,848,000 \$.

**Canned Fish**

**ANNEXE 1**

**FINANCIAL EVALUATION**

**HYPOTHESIS 1**



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CANNED FISH  
February 1988  
BASIC PROJECT - HYPOTHESIS 1

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	2911.70	57.757 % foreign
current assets:	0.00	0.000 % foreign
total assets:	2911.70	57.757 % foreign

**Source of funds during construction phase**

equity & grants:	1463.00	0.000 % foreign
foreign loans :	1317.00	
local loans :	0.00	
total funds :	2780.00	47.374 % foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1035.85	1296.25	1586.65
depreciation :	191.88	191.88	184.88
interest :	131.70	115.24	98.78
production costs	1359.43	1403.36	1870.30
thereof foreign	22.41 %	16.93 %	14.34 %
total sales :	2338.80	3118.40	3898.00
gross income :	979.37	1515.04	2027.70
net income :	489.69	757.52	1013.85
cash balance :	308.87	731.20	974.12
net cashflow :	605.20	1011.07	1237.52

Net Present Value at: 10.00 % = 5462.68  
Internal Rate of Return on total investment: 33.33 %  
Equity paid versus Net income flow (IRR%): 39.94 %  
Net Worth versus Net Cash Return (IRR%): 38.29 %

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance



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**Total Initial Investment in 1000 US DOLLARS**

Year .....	1987	1988
<b>Fixed investment costs</b>		
Land, site preparation, development	70.00	0.00
Buildings and civil works .....	487.00	324.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment ...	378.00	1441.00
<b>Total fixed investment costs .....</b>	<b>935.00</b>	<b>1765.00</b>
Pre-production capital expenditures.	20.00	191.70
Net working capital .....	0.00	0.00
<b>Total initial investment costs ...</b>	<b>955.00</b>	<b>1956.70</b>
Of it foreign, in % .....	32.46	70.10

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Total Current Investment in 1000 US DOLLARS

Year .....	1989	1990	1991
Fixed investment costs			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works .....	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets .....	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
Total fixed investment costs .....	0.00	0.00	0.00
Preproduction capitals expenditures.	0.00	0.00	0.00
Working capital .....	208.07	53.57	59.98
Total current investment costs ...	208.07	53.57	59.98
Of it foreign, % .....	21.77	12.21	21.60

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**Total Production Costs in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product)	0.00	0.00	0.00	0.00	0.00	0.00
Raw material 1 .....	526.13	701.50	876.88	876.88	876.88	876.88
Other raw materials .....	250.20	333.60	417.00	417.00	417.00	417.00
Utilities .....	55.27	73.70	92.12	92.12	92.12	92.12
Energy .....	9.60	12.80	16.00	16.00	16.00	16.00
Labour, direct .....	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance .....	28.41	28.41	28.41	28.41	28.41	28.41
Spares .....	30.00	40.00	50.00	50.00	50.00	50.00
Factory overheads .....	30.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>985.84</b>	<b>1246.24</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>
Administrative overheads .....	50.01	50.01	50.01	50.01	50.01	50.01
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	191.88	191.88	184.88	177.88	177.88	161.88
Financial costs .....	131.70	115.24	98.78	82.31	65.85	49.39
<b>Total production costs .....</b>	<b>1359.43</b>	<b>1603.36</b>	<b>1870.30</b>	<b>1846.84</b>	<b>1830.31</b>	<b>1797.91</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	22.41	16.93	14.34	13.63	12.85	12.17
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	106.24	106.24	106.24	106.24	106.24	106.24

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**Total Production Costs in 1000 US DOLLARS**

Year .....	1995	1996	1997-98	1999-2001	2002	2003
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I .....	876.88	876.88	876.88	876.88	876.88	876.88
Other raw materials .....	417.00	417.00	417.00	417.00	417.00	417.00
Utilities .....	92.12	92.12	92.12	92.12	92.12	92.12
Energy .....	16.00	16.00	16.00	16.00	16.00	16.00
Labour, direct .....	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance .....	28.41	28.41	28.41	28.41	28.41	28.41
Spares .....	50.00	50.00	50.00	50.00	50.00	50.00
Factory overheads .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs .....</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>
Administrative overheads .....	50.01	50.01	50.01	50.01	50.01	50.01
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation .....	161.88	161.88	161.88	121.33	59.85	0.00
Financial costs .....	32.92	16.46	0.00	0.00	0.00	0.00
<b>Total production costs .....</b>	<b>1781.45</b>	<b>1764.99</b>	<b>1748.53</b>	<b>1707.98</b>	<b>1646.50</b>	<b>1586.65</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % .....	11.36	10.53	9.69	9.92	7.11	4.16
Of it variable, % .....	0.00	0.00	0.00	0.00	0.00	0.00
Total labour .....	106.24	106.24	106.24	106.24	106.24	106.24

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US DOLLARS**

Year .....		1989	1990	1991	1992-2003
Coverage .....	ndc coto				
<b>Current assets &amp;</b>					
Accounts receivable . . .	30 12.0	86.32	108.02	132.22	132.22
Inventory and materials .	28 12.8	64.85	86.46	108.08	108.08
Energy .....	30 12.0	0.80	1.07	1.33	1.33
Spares .....	360 1.0	30.00	40.00	50.00	50.00
Work in progress .....	3 120.0	8.22	10.39	12.81	12.81
Finished products . . .	30 12.0	86.32	108.02	132.22	132.22
Cash in hand .....	15 24.0	8.11	7.28	7.69	7.69
Total current assets .....		284.62	361.23	444.35	444.35
<b>Current liabilities and</b>					
Accounts payable .....	29 12.5	76.55	99.60	122.74	122.74
Net working capital .....		208.07	261.63	321.62	321.62
Increase in working capital .....		208.07	53.57	59.98	0.00
Net working capital, local .....		162.78	209.81	256.83	256.83
Net working capital, foreign .....		45.29	51.83	64.78	64.78

Notes: ndc = minimum days of coverage ; coto = coefficient of turnover .



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Source of Finance, construction in 1000 US DOLLARS

Year .....	1987	1988
Equity, ordinary ..	1463.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1317.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1317.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	131.70
Total funds .....	2780.00	131.70

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992-96
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-164.63	-164.63	-164.63	-164.63
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-164.63	-164.63	-164.63	-164.63
Current liabilities	76.55	23.05	23.14	0.00
Bank overdraft ....	-131.70	0.00	0.00	0.00
Total funds .....	-219.78	-141.57	-141.49	-164.63

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987	1988
Total cash inflow . .	2780.00	0.00
Financial resources .	2780.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	955.00	1956.70
Total assets . . . .	955.00	1825.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	131.70
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	1825.00	-1956.70
Cumulated cash balance	1825.00	-131.70
Inflow, local . . . .	1463.00	0.00
Outflow, local . . . .	845.00	585.00
Surplus ( deficit ) .	818.00	-585.00
Inflow, foreign . . .	1317.00	0.00
Outflow, foreign . . .	310.00	1371.70
Surplus ( deficit ) .	1007.00	-1371.70
Net cashflow . . . . .	-955.00	-1825.00
Cumulated net cashflow	-955.00	-2780.00

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992	1993	1994
Total cash inflow ..	2415.35	3141.50	3921.14	3898.00	3898.00	3898.00
Financial resources .	76.55	23.10	23.14	0.00	0.00	0.00
Sales, net of tax ..	2338.80	3118.40	3898.00	3898.00	3898.00	3898.00
Total cash outflow ..	2106.48	2410.30	2947.02	2859.17	2850.94	2850.71
Total assets .....	284.62	76.62	83.12	0.00	0.00	0.00
Operating costs ...	1035.85	1296.25	1586.65	1586.65	1586.65	1586.65
Cost of finance ...	131.70	115.24	98.78	82.31	65.85	49.39
Repayment .....	164.63	164.67	164.63	164.63	164.63	164.63
Corporate tax ...	489.69	757.52	1013.85	1025.58	1033.81	1050.04
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	308.87	731.20	974.12	1038.83	1047.06	1047.29
Cumulated cash balance	177.17	908.37	1882.49	2921.33	3968.39	5015.68
Inflow, local .....	1035.15	1301.50	1621.10	1598.00	1598.00	1598.00
Outflow, local .....	1695.07	2071.09	2604.63	2546.23	2594.46	2570.69
Surplus ( deficit ) .	-659.92	-769.59	-983.53	-948.23	-956.46	-972.69
Inflow, foreign ...	1380.19	1840.00	2300.04	2300.00	2300.00	2300.00
Outflow, foreign ...	411.40	339.20	342.39	312.94	296.48	280.01
Surplus ( deficit ) .	968.79	1500.80	1957.64	1987.06	2003.53	2019.99
Net cashflow .....	605.20	1011.07	1237.52	1285.77	1277.54	1261.31
Cumulated net cashflow	-2174.80	-1163.74	73.78	1359.55	2637.09	3898.40



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	3898.00	3898.00	3898.00	3898.00	3898.00	3898.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	3898.00	3898.00	3898.00	3898.00	3898.00	3898.00
Total cash outflow . .	2842.47	2834.24	2661.37	2661.39	2681.66	2681.66
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1586.65	1586.65	1586.65	1586.65	1586.65	1586.65
Cost of finance . . .	32.92	16.46	0.00	0.00	0.00	0.00
Repayment . . . . .	164.63	164.63	0.00	0.00	0.00	0.00
Corporate tax . . . .	1058.27	1066.51	1074.74	1074.74	1095.01	1095.01
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	1055.53	1063.76	1236.61	1236.61	1216.34	1216.34
Cumulated cash balance	6071.21	7134.97	8371.58	9608.20	10824.53	12040.87
Inflow, local . . . . .	1598.00	1598.00	1598.00	1598.00	1598.00	1598.00
Outflow, local . . . .	2578.92	2587.16	2595.39	2595.39	2615.66	2615.66
Surplus ( deficit ) .	-980.92	-989.16	-997.39	-997.39	-1017.66	-1017.66
Inflow, foreign . . . .	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00
Outflow, foreign . . . .	263.55	247.09	66.00	66.00	66.00	66.00
Surplus ( deficit ) .	2036.45	2052.91	2234.00	2234.00	2234.00	2234.00
Net cashflow . . . . .	1253.08	1244.84	1236.61	1236.61	1216.34	1216.34
Cumulated net cashflow	5151.47	6396.32	7632.93	8869.54	10085.88	11302.22



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	3898.00	3898.00	3898.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	3898.00	3898.00	3898.00
Total cash outflow . .	2681.66	2712.40	2742.32
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1586.65	1586.65	1586.65
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	1075.01	1125.75	1155.68
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	1216.34	1185.60	1155.68
Cumulated cash balance	13257.21	14442.81	15598.49
Inflow, local . . . .	1598.00	1598.00	1598.00
Outflow, local . . . .	2615.66	2646.40	2676.32
Surplus ( deficit ) .	-1017.66	-1048.40	-1078.32
Inflow, foreign . . .	2300.00	2300.00	2300.00
Outflow, foreign . . .	66.00	66.00	66.00
Surplus ( deficit ) .	2234.00	2234.00	2234.00
Net cashflow . . . . .	1216.34	1185.60	1155.68
Cumulated net cashflow	12518.56	13704.16	14859.84





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Cashflow Discounting:**

a) Equity paid versus Net income flow:		
Net present value .....	5174.99 at	10.00 %
Internal Rate of Return (IRRE1) ..	39.94 %	
b) Net Worth versus Net cash return:		
Net present value .....	5416.50 at	10.00 %
Internal Rate of Return (IRRE2) ..	38.29 %	
c) Internal Rate of Return on total investment:		
Net present value .....	5462.68 at	10.00 %
Internal Rate of Return ( IRR ) ..	33.33 %	

Net Worth = Equity paid plus reserves

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	2338.80	3118.40	3898.00	3898.00	3898.60
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	2338.80	3118.40	3898.00	3898.00	3898.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1227.73	1488.13	1771.53	1764.53	1764.53
Operational margin . . . . .	1111.07	1630.27	2126.47	2133.47	2133.47
As % of total sales . . . . .	47.51	52.28	54.55	54.73	54.73
Cost of finance . . . . .	131.70	115.24	98.78	82.31	65.85
Gross profit . . . . .	979.37	1515.04	2027.70	2051.16	2067.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	979.37	1515.04	2027.70	2051.16	2067.62
Tax . . . . .	489.69	757.52	1013.85	1025.58	1033.81
Net profit . . . . .	489.69	757.52	1013.85	1025.58	1033.81
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	489.69	757.52	1013.85	1025.58	1033.81
Accumulated undistributed profit . . .	489.69	1247.20	2261.05	3286.63	4320.44
Gross profit, % of total sales . . . .	41.88	48.58	52.02	52.62	53.04
Net profit, % of total sales . . . .	20.94	24.29	26.01	26.31	26.52
ROE, Net profit, % of equity . . . .	33.47	51.78	69.30	70.10	70.66
ROI, Net profit+interest, % of invest.	20.80	28.69	35.87	35.72	35.45



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	3898.00	3898.00	3898.00	3898.00	3898.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3898.00	3898.00	3898.00	3898.00	3898.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1748.53	1748.53	1748.53	1748.53	1748.53
Operational margin . . . . .	2149.47	2149.47	2149.47	2149.47	2149.47
As % of total sales . . . . .	55.14	55.14	55.14	55.14	55.14
Cost of finance . . . . .	49.39	32.92	16.46	0.00	0.00
Gross profit . . . . .	2100.09	2116.55	2133.01	2149.47	2149.47
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2100.09	2116.55	2133.01	2149.47	2149.47
Tax . . . . .	1050.04	1058.27	1066.51	1074.74	1074.74
Net profit . . . . .	1050.04	1058.27	1066.51	1074.74	1074.74
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1050.04	1058.27	1066.51	1074.74	1074.74
Accumulated undistributed profit . . .	5370.49	6428.76	7495.27	8570.00	9644.74
Gross profit, % of total sales . . . .	53.88	54.30	54.72	55.14	55.14
Net profit, % of total sales . . . .	26.94	27.15	27.36	27.57	27.57
ROE, Net profit, % of equity . . . .	71.77	72.34	72.90	73.46	73.46
ROI, Net profit+interest, % of invest.	35.45	35.18	34.92	34.65	34.65



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	3898.00	3898.00	3898.00	3898.00	3898.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3898.00	3898.00	3898.00	3898.00	3898.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1707.98	1707.98	1707.98	1846.50	1586.65
Operational margin . . . . .	2190.02	2190.02	2190.02	2251.50	2311.35
As % of total sales . . . . .	56.18	56.18	56.18	57.76	59.30
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	2190.02	2190.02	2190.02	2251.50	2311.35
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	2190.02	2190.02	2190.02	2251.50	2311.35
Tax . . . . .	1095.01	1095.01	1095.01	1125.75	1155.68
Net profit . . . . .	1095.01	1095.01	1095.01	1125.75	1155.68
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	1095.01	1095.01	1095.01	1125.75	1155.68
Accumulated undistributed profit . . .	10739.75	11834.76	12929.77	14055.53	15211.20
Gross profit, % of total sales . . . .	56.18	56.18	56.18	57.76	59.30
Net profit, % of total sales . . . .	28.09	28.09	28.09	28.88	29.65
RDE, Net profit, % of equity . . . .	74.85	74.85	74.85	76.95	78.99
ROI, Net profit+interest, % of invest.	35.30	35.30	35.30	36.30	37.26



COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US DOLLARS

Year .....	1987	1988
Total assets .....	2780.00	2911.70
Fixed assets, net of depreciation	0.00	955.00
Construction in progress .....	955.00	1956.70
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	1825.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	2780.00	2911.70
Equity capital .....	1463.00	1463.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1317.00	1317.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	131.70
Total debt .....	1317.00	1448.70
Equity, % of liabilities .....	52.63	50.25



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1989	1990	1991	1992	1993	1994
<b>Total assets .....</b>	<b>3181.61</b>	<b>3797.55</b>	<b>4669.92</b>	<b>5530.87</b>	<b>6400.06</b>	<b>7285.47</b>
Fixed assets, net of depreciation	2719.82	2527.95	2343.07	2165.19	1987.32	1825.44
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	276.50	353.96	436.66	436.66	436.66	436.66
Cash, bank .....	8.11	7.28	7.69	7.69	7.69	7.69
Cash surplus, finance available .	177.17	908.37	1882.49	2721.32	3768.37	5015.68
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>3181.61</b>	<b>3797.55</b>	<b>4669.92</b>	<b>5530.87</b>	<b>6400.06</b>	<b>7285.47</b>
Equity capital .....	1463.00	1463.00	1463.00	1463.00	1463.00	1463.00
Reserves, retained profit .....	0.00	489.69	1247.20	2261.05	3286.63	4320.44
Profit .....	489.69	757.52	1013.85	1025.58	1033.81	1050.04
Long and medium term debt .....	1152.38	987.75	823.13	658.50	473.88	329.25
Current liabilities .....	76.55	99.60	122.74	122.74	122.74	122.74
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>1228.92</b>	<b>1087.35</b>	<b>945.86</b>	<b>781.24</b>	<b>616.61</b>	<b>451.99</b>
<b>Equity, % of liabilities .....</b>	<b>45.98</b>	<b>38.52</b>	<b>31.33</b>	<b>26.45</b>	<b>22.86</b>	<b>20.08</b>

DANNED FISH — February 1988



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	1995	1996	1997	1998	1999	2000
Total assets .....	8179.12	9081.00	10155.74	11230.47	12325.49	13420.50
Fixed assets, net of depreciation	1663.56	1501.68	1339.81	1177.93	1056.60	935.28
Construction in progress .....	0.00	0.00	0.00	0.00	0.00	0.00
Current assets .....	436.66	436.66	436.66	436.66	436.66	436.66
Cash, bank .....	7.69	7.69	7.69	7.69	7.69	7.69
Cash surplus, finance available .	6071.21	7134.97	8371.58	9608.19	10824.53	12040.87
Loss carried forward .....	0.00	0.00	0.00	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>8179.12</b>	<b>9081.00</b>	<b>10155.74</b>	<b>11230.48</b>	<b>12325.49</b>	<b>13420.50</b>
Equity capital .....	1463.00	1463.00	1463.00	1463.00	1463.00	1463.00
Reserves, retained profit .....	5370.49	6428.76	7495.27	8570.00	9644.74	10739.75
Profit .....	1058.27	1066.51	1074.74	1074.74	1075.01	1075.01
Long and medium term debt .....	144.63	0.00	0.00	0.00	0.00	0.00
Current liabilities .....	122.74	122.74	122.74	122.74	122.74	122.74
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total debt .....</b>	<b>287.36</b>	<b>122.74</b>	<b>122.74</b>	<b>122.74</b>	<b>122.74</b>	<b>122.74</b>
<b>Equity, % of liabilities .....</b>	<b>17.89</b>	<b>16.11</b>	<b>14.41</b>	<b>13.03</b>	<b>11.87</b>	<b>10.90</b>

CANNED FISH — February 1988



**COMFAR**<sup>®</sup>  
2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Projected Balance Sheets, Production in 1000 US DOLLARS**

Year .....	2001	2002	2003
<b>Total assets .....</b>	<b>14515.51</b>	<b>15641.26</b>	<b>16796.94</b>
Fixed assets, net of depreciation	813.95	754.10	754.10
Construction in progress .....	0.00	0.00	0.00
Current assets .....	436.66	436.66	436.66
Cash, bank .....	7.69	7.69	7.69
Cash surplus, finance available .	13257.21	14442.81	15598.48
Loss carried forward .....	0.00	0.00	0.00
Loss .....	0.00	0.00	0.00
<b>Total liabilities .....</b>	<b>14515.51</b>	<b>15641.26</b>	<b>16796.94</b>
Equity capital .....	1463.00	1463.00	1463.00
Reserves, retained profit .....	11834.76	12929.77	14055.53
Profit .....	1095.01	1125.75	1155.68
Long and medium term debt .....	0.00	0.00	0.00
Current liabilities .....	122.74	122.74	122.74
Bank overdraft, finance required.	0.00	0.00	0.00
<b>Total debt .....</b>	<b>122.74</b>	<b>122.74</b>	<b>122.74</b>
<b>Equity, % of liabilities .....</b>	<b>10.08</b>	<b>9.35</b>	<b>8.71</b>

CANNED FISH — February 1988



**Canned Fish**

**ANNEXE 2**

**FINANCIAL EVALUATION**

**HYPOTHESIS 2**



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

CANNED FISH  
February 1988  
Rev. Cann. Fish price\_HYPOTHESIS 2

2 year(s) of construction, 15 years of production  
currency conversion rates:

foreign currency 1 unit = 1.0000 units accounting currency  
local currency 1 unit = 1.0000 units accounting currency  
accounting currency: 1000 US DOLLARS

**Total initial investment during construction phase**

fixed assets:	2911.70	57.757 I foreign
current assets:	0.00	0.000 I foreign
total assets:	2911.70	57.757 I foreign

**Source of funds during construction phase**

equity & grants:	1463.00	0.000 I foreign
foreign loans :	1317.00	
local loans :	0.00	
total funds :	2780.00	47.374 I foreign

**Cashflow from operations**

Year:	1	2	3
operating costs:	1035.85	1296.25	1586.65
depreciation :	191.88	191.88	184.88
interest :	131.70	115.24	98.78
production costs	1359.43	1603.36	1870.30
thereof foreign	22.41 I	16.93 I	14.34 I
total sales :	1952.40	2603.20	3254.00
gross income :	592.97	999.84	1383.70
net income :	296.49	499.92	691.85
cash balance :	115.67	473.60	652.12
net cashflow :	412.00	753.47	915.52

Net Present Value at: 10.00 I = 3391.00  
Internal Rate of Return on total investment: 25.52 I  
Equity paid versus Net income flow (IRR): 29.98 I  
Net Worth versus Net Cash Return (IRR): 28.81 I

**Index of Schedules produced by COMFAR**

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet



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**Total Initial Investment in 1000 US DOLLARS**

Year .....	1967	1968
<b>Fixed investment costs</b>		
Land, site preparation, development	70.00	0.00
Buildings and civil works .....	487.00	324.00
Auxiliary and service facilities .	0.00	0.00
Incorporated fixed assets .....	0.00	0.00
Plant machinery and equipment . . .	378.00	1441.00
<b>Total fixed investment costs . . . .</b>	<b>935.00</b>	<b>1765.00</b>
<b>Pre-production capital expenditures.</b>	<b>20.00</b>	<b>191.70</b>
<b>Net working capital .....</b>	<b>0.00</b>	<b>0.00</b>
<b>Total initial investment costs . . .</b>	<b>955.00</b>	<b>1956.70</b>
<b>Of it foreign, in Z .....</b>	<b>32.46</b>	<b>70.10</b>

CARRIED FISH --- February 1968



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**Total Current Investment in 1000 US DOLLARS**

Year .....	1989	1990	1991
<b>Fixed investment costs</b>			
Land, site preparation, development	0.00	0.00	0.00
Buildings and civil works . . . . .	0.00	0.00	0.00
Auxiliary and service facilities .	0.00	0.00	0.00
Incorporated fixed assets . . . . .	0.00	0.00	0.00
Plant, machinery and equipment . .	0.00	0.00	0.00
<b>Total fixed investment costs . . . .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>Preproduction capitals expenditures.</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Working capital . . . . .	208.07	53.57	59.98
<b>Total current investment costs . . .</b>	<b>208.07</b>	<b>53.57</b>	<b>59.98</b>
<b>Of it foreign, Z . . . . .</b>	<b>21.77</b>	<b>12.21</b>	<b>21.60</b>

CANNED FISH --- February 1988



**COMFAR**  
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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993	1994
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	526.13	701.50	876.88	876.88	876.88	876.88
Other raw materials . . . . .	250.20	333.60	417.00	417.00	417.00	417.00
Utilities . . . . .	55.27	73.70	92.12	92.12	92.12	92.12
Energy . . . . .	9.60	12.80	16.00	16.00	16.00	16.00
Labour, direct . . . . .	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance . . . . .	28.41	28.41	28.41	28.41	28.41	28.41
Spares . . . . .	30.00	40.00	50.00	50.00	50.00	50.00
Factory overheads . . . . .	30.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>985.84</b>	<b>1246.24</b>	<b>1536.44</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>
Administrative overheads . . . . .	50.01	50.01	50.01	50.01	50.01	50.01
indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	191.88	191.88	184.88	177.88	177.88	161.88
Financial costs . . . . .	131.70	115.24	98.78	82.31	65.85	49.39
<b>Total production costs . . . . .</b>	<b>1319.43</b>	<b>1603.36</b>	<b>1870.30</b>	<b>1846.84</b>	<b>1830.38</b>	<b>1797.91</b>
<b>Costs per unit (single product) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, % . . . . .	22.41	16.93	14.34	13.63	12.85	12.17
Of it variable, % . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	106.24	106.24	106.24	106.24	106.24	106.24

CANNED FISH --- February 1988



**COMFAR**  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Total Production Costs in 1000 US DOLLARS**

Year . . . . .	1995	1996	1997-98	1999-2001	2002	2003
I of new capacity (single product).	0.00	0.00	0.00	0.00	0.00	0.00
Raw material I . . . . .	876.88	876.88	876.88	876.88	876.88	876.88
Other raw materials . . . . .	417.00	417.00	417.00	417.00	417.00	417.00
Utilities . . . . .	92.12	92.12	92.12	92.12	92.12	92.12
Energy . . . . .	16.00	16.00	16.00	16.00	16.00	16.00
Labour, direct . . . . .	56.23	56.23	56.23	56.23	56.23	56.23
Repair, maintenance . . . . .	28.41	28.41	28.41	28.41	28.41	28.41
Spares . . . . .	50.00	50.00	50.00	50.00	50.00	50.00
Factory overheads . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
<b>Factory costs . . . . .</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>	<b>1536.64</b>
Administrative overheads . . . . .	50.01	50.01	50.01	50.01	50.01	50.01
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation . . . . .	161.88	161.88	161.88	121.33	59.85	0.00
Financial costs . . . . .	32.92	16.46	0.00	0.00	0.00	0.00
<b>Total production costs . . . . .</b>	<b>1781.45</b>	<b>1764.99</b>	<b>1748.53</b>	<b>1707.98</b>	<b>1646.50</b>	<b>1586.65</b>
<b>Costs per unit ( single product ) .</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
Of it foreign, I . . . . .	11.36	10.53	9.69	9.92	7.11	4.16
Of it variable, I . . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Total labour . . . . .	106.24	106.24	106.24	106.24	106.24	106.24

CANNED FISH --- February 1968



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

**Net Working Capital in 1000 US DOLLARS**

Year . . . . .			1989	1990	1991	1992-2003
Coverage . . . . .	adc	coto				
<b>Current assets &amp;</b>						
Accounts receivable . . .	30	12.0	86.32	108.02	132.22	132.22
Inventory and materials .	28	12.8	64.85	86.46	108.08	108.08
Energy . . . . .	30	12.0	0.80	1.07	1.33	1.33
Spares . . . . .	360	1.0	30.00	40.00	50.00	50.00
Work in progress . . . .	3	120.0	8.22	10.39	12.81	12.81
Finished products . . . .	30	12.0	86.32	109.02	132.22	132.22
Cash in hand . . . . .	15	24.0	8.11	7.28	7.69	7.69
Total current assets . . . . .			284.62	361.23	444.35	444.35
<b>Current liabilities and</b>						
Accounts payable . . . . .	29	12.5	76.55	99.60	122.74	122.74
Net working capital . . . . .			208.07	261.63	321.62	321.62
Increase in working capital . . . . .			208.07	53.57	59.98	0.00
Net working capital, local . . . . .			162.78	209.81	256.83	256.83
Net working capital, foreign . . . . .			45.29	51.83	64.78	64.78

Note: adc = minimum days of coverage ; coto = coefficient of turnover .



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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, construction in 1000 US DOLLARS

Year .....	1987	1988
Equity, ordinary ..	1463.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	1317.00	0.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	0.00	0.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan .....	1317.00	0.00
Current liabilities	0.00	0.00
Bank overdraft ....	0.00	131.70
Total funds .....	2780.00	131.70

CANNED FISH --- February 1988





COMFAR  
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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Source of Finance, production in 1000 US DOLLARS

Year .....	1989	1990	1991	1992-96
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	-164.63	-164.63	-164.63	-164.63
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan .....	-164.63	-164.63	-164.63	-164.63
Current liabilities	76.55	23.05	23.14	0.00
Bank overdraft ....	-115.67	-16.03	0.00	0.00
Total funds .....	-203.75	-157.60	-141.49	-164.63

CANNED FISH --- February 1988



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow Tables, construction in 1000 US DOLLARS

Year . . . . .	1987	1988
Total cash inflow . .	2780.00	0.00
Financial resources .	2780.00	0.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	955.00	1956.70
Total assets . . . .	955.00	1825.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	0.00	131.70
Repayment . . . . .	0.00	0.00
Corporate tax . . . .	0.00	0.00
Dividends paid . . . .	0.00	0.00
Surplus ( deficit ) .	1825.00	-1956.70
Cumulated cash balance	1825.00	-131.70
Inflow, local . . . . .	1463.00	0.00
Outflow, local . . . . .	645.00	585.00
Surplus ( deficit ) .	818.00	-585.00
Inflow, foreign . . . .	1317.00	0.00
Outflow, foreign . . . .	310.00	1371.70
Surplus ( deficit ) .	1007.00	-1371.70
Net cashflow . . . . .	-955.00	-1825.00
Cumulated net cashflow	-955.00	-2780.00

CANNED FISH --- February 1988



COMFAR 2.0 - R&LBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1989	1990	1991	1992	1993	1994
Total cash inflow . .	2028.95	2626.30	3277.14	3254.00	3254.00	3254.00
Financial resources .	76.55	23.10	23.14	0.00	0.00	0.00
Sales, net of tax . .	1952.40	2603.20	3254.00	3254.00	3254.00	3254.00
Total cash outflow . .	1913.28	2152.70	2625.02	2537.17	2528.94	2528.71
Total assets . . . .	284.52	76.62	83.12	0.00	0.00	0.00
Operating costs . . .	1035.85	1296.25	1586.65	1586.65	1586.65	1586.65
Cost of finance . . .	131.70	115.24	98.78	82.31	65.85	49.39
Repayment . . . . .	164.63	164.67	164.63	164.63	164.63	164.63
Corporate tax . . . .	296.49	499.92	691.85	703.58	711.81	728.04
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	115.67	473.60	652.12	716.83	725.06	725.29
Cumulated cash balance	-16.03	457.57	1109.69	1826.53	2551.59	3276.88
Inflow, local . . . . .	648.75	786.30	977.10	954.00	954.00	954.00
Outflow, local . . . .	1501.87	1813.49	2282.63	2224.23	2232.46	2249.69
Surplus ( deficit ) .	-853.12	-1027.19	-1305.53	-1270.23	-1278.46	-1294.69
Inflow, foreign . . . .	1380.19	1840.00	2300.04	2300.00	2300.00	2300.00
Outflow, foreign . . . .	411.40	339.20	342.39	312.94	296.48	280.01
Surplus ( deficit ) .	968.79	1500.80	1957.64	1987.06	2003.53	2019.99
Net cashflow . . . . .	412.00	753.47	915.52	963.77	955.54	939.31
Cumulated net cashflow	-2368.00	-1614.54	-699.02	264.75	1220.29	2159.60

CANNED FISH --- February 1988



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	1995	1996	1997	1998	1999	2000
Total cash inflow . .	3254.00	3254.00	3254.00	3254.00	3254.00	3254.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	3254.00	3254.00	3254.00	3254.00	3254.00	3254.00
Total cash outflow . .	2520.47	2512.24	2339.39	2339.39	2359.66	2359.66
Total assets . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	1586.65	1586.65	1586.65	1586.65	1586.65	1586.65
Cost of finance . . .	32.92	16.46	0.00	0.00	0.00	0.00
Repayment . . . . .	164.63	164.63	0.00	0.00	0.00	0.00
Corporate tax . . . .	736.27	744.51	752.74	752.74	773.01	773.01
Dividends paid . . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus ( deficit ) .	733.53	741.76	914.61	914.61	894.34	894.34
Cumulated cash balance	4010.41	4752.17	5666.78	6581.39	7475.73	8370.07
Inflow, local . . . . .	954.00	954.00	954.00	954.00	954.00	954.00
Outflow, local . . . .	2256.92	2265.16	2273.39	2273.39	2293.66	2293.66
Surplus ( deficit ) .	-1302.92	-1311.16	-1319.39	-1319.39	-1339.66	-1339.66
Inflow, foreign . . . .	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00
Outflow, foreign . . . .	263.55	247.09	66.00	66.00	66.00	66.00
Surplus ( deficit ) .	2036.45	2052.91	2234.00	2234.00	2234.00	2234.00
Net cashflow . . . . .	931.08	922.84	914.61	914.61	894.34	894.34
Cumulated net cashflow	3090.67	4013.52	4928.13	5842.74	6737.08	7631.42

CANNED FISH --- February 19E3



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Cashflow tables, production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total cash inflow . .	3254.00	3254.00	3254.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	3254.00	3254.00	3254.00
Total cash outflow . .	2359.66	2390.40	2420.32
Total assets . . . .	0.00	0.00	0.00
Operating costs . . .	1586.65	1586.65	1586.65
Cost of finance . . .	0.00	0.00	0.00
Repayment . . . . .	0.00	0.00	0.00
Corporate tax . . . .	773.01	803.75	833.67
Dividends paid . . . .	0.00	0.00	0.00
Surplus ( deficit ) .	894.34	863.60	833.68
Cumulated cash balance	9264.41	10128.01	10961.68
Inflow, local . . . . .	954.00	954.00	954.00
Outflow, local . . . .	2293.66	2324.40	2354.32
Surplus ( deficit ) .	-1339.66	-1370.40	-1400.32
Inflow, foreign . . . .	2300.00	2300.00	2300.00
Outflow, foreign . . . .	66.00	66.00	66.00
Surplus ( deficit ) .	2234.00	2234.00	2234.00
Net cashflow . . . . .	894.34	863.60	833.68
Cumulated net cashflow	8525.76	9389.36	10223.04

CANNED FISH --- February 1988



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**Cashflow Discounting:**

a) Equity paid versus Net income flow:			
Net present value .....	3103.32	at	10.00 %
Internal Rate of Return (IRRE1) ..	29.98	%	
b) Net Worth versus Net cash return:			
Net present value .....	3344.82	at	10.00 %
Internal Rate of Return (IRRE2) ..	28.81	%	
c) Internal Rate of Return on total investment:			
Net present value .....	3391.00	at	10.00 %
Internal Rate of Return (IRR) ..	25.52	%	
Net Worth = Equity paid plus reserves			

CANNED FISH — February 1988



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CONFAR 2.0 - BALBO & CO. S.R.L., MILANO

**Net Income Statement in 1000 US DOLLARS**

Year . . . . .	1989	1990	1991	1992	1993
Total sales, incl. sales tax . . . . .	1952.40	2603.20	3254.00	3254.00	3254.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	1952.40	2603.20	3254.00	3254.00	3254.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1227.73	1488.13	1771.53	1764.53	1764.53
Operational margin . . . . .	724.67	1115.07	1482.47	1489.47	1489.47
As % of total sales . . . . .	37.12	42.83	45.56	45.77	45.77
Cost of finance . . . . .	131.70	115.24	98.78	82.31	65.85
Gross profit . . . . .	592.97	999.84	1383.70	1407.16	1423.62
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	592.97	999.84	1383.70	1407.16	1423.62
Tax . . . . .	296.49	499.92	691.85	703.58	711.81
Net profit . . . . .	296.49	499.92	691.85	703.58	711.81
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	296.49	499.92	691.85	703.58	711.81
Accumulated undistributed profit . . . .	296.49	796.40	1488.25	2191.83	2903.64
Gross profit, % of total sales . . . . .	30.37	38.41	42.52	43.24	43.75
Net profit, % of total sales . . . . .	15.19	19.20	21.26	21.62	21.87
RDE, Net profit, % of equity . . . . .	20.27	34.17	47.29	48.09	48.65
ROI, Net profit+interest, % of invest.	14.33	20.22	25.49	25.34	25.07

CANNED FISH --- February 1988



COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1994	1995	1996	1997	1998
Total sales, incl. sales tax . . . . .	3254.00	3254.00	3254.00	3254.00	3254.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3254.00	3254.00	3254.00	3254.00	3254.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1748.53	1748.53	1748.53	1748.53	1748.53
Operational margin . . . . .	1505.47	1505.47	1505.47	1505.47	1505.47
As % of total sales . . . . .	46.27	46.27	46.27	46.27	46.27
Cost of finance . . . . .	49.39	32.92	16.46	0.00	0.00
Gross profit . . . . .	1456.09	1472.55	1489.01	1505.47	1505.47
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1456.09	1472.55	1489.01	1505.47	1505.47
Income tax . . . . .	728.04	736.27	744.51	752.74	752.74
Net profit . . . . .	728.04	736.27	744.51	752.74	752.74
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	728.04	736.27	744.51	752.74	752.74
Accumulated undistributed profit . . .	3631.69	4367.96	5112.47	5865.20	6617.94
Gross profit, % of total sales . . . . .	44.75	45.25	45.76	46.27	46.27
Net profit, % of total sales . . . . .	22.37	22.63	22.88	23.13	23.13
RDE, Net profit, % of equity . . . . .	49.76	50.33	50.67	51.45	51.45
RDI, Net profit+interest, % of invest.	25.07	24.90	24.53	24.27	24.27

CANNED FISH --- February 1998





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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US DOLLARS

Year . . . . .	1999	2000	2001	2002	2003
Total sales, incl. sales tax . . . . .	3254.00	3254.00	3254.00	3254.00	3254.00
Less: variable costs, incl. sales tax.	0.00	0.00	0.00	0.00	0.00
Variable margin . . . . .	3254.00	3254.00	3254.00	3254.00	3254.00
As % of total sales . . . . .	100.00	100.00	100.00	100.00	100.00
Non-variable costs, incl. depreciation	1707.98	1707.98	1707.98	1646.50	1586.65
Operational margin . . . . .	1546.02	1546.02	1546.02	1607.50	1667.35
As % of total sales . . . . .	47.51	47.51	47.51	49.40	51.24
Cost of finance . . . . .	0.00	0.00	0.00	0.00	0.00
Gross profit . . . . .	1546.02	1546.02	1546.02	1607.50	1667.35
Allowances . . . . .	0.00	0.00	0.00	0.00	0.00
Taxable profit . . . . .	1546.02	1546.02	1546.02	1607.50	1667.35
Tax . . . . .	773.01	773.01	773.01	803.75	833.67
Net profit . . . . .	773.01	773.01	773.01	803.75	833.67
Dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00
Undistributed profit . . . . .	773.01	773.01	773.01	803.75	833.67
Accumulated undistributed profit . . .	7390.95	8163.96	8936.97	9740.72	10574.40
Gross profit, % of total sales . . . . .	47.51	47.51	47.51	49.40	51.24
Net profit, % of total sales . . . . .	23.76	23.76	23.76	24.70	25.62
RDE, Net profit, % of equity . . . . .	52.84	52.84	52.84	54.94	56.98
ROI, Net profit+interest, % of invest.	24.92	24.92	24.92	25.91	26.88

CANNED FISH --- February 1988



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Projected Balance Sheets, construction in 1000 US DOLLARS

Year .....	1987	1988
Total assets .....	2780.00	2911.70
Fixed assets, net of depreciation	0.00	955.00
Construction in progress .....	955.00	1956.70
Current assets .....	0.00	0.00
Cash, bank .....	0.00	0.00
Cash surplus, finance available .	1825.00	0.00
Loss carried forward .....	0.00	0.00
Loss .....	0.00	0.00
Total liabilities .....	2780.00	2911.70
Equity capital .....	1463.00	1463.00
Reserves, retained profit .....	0.00	0.00
Profit .....	0.00	0.00
Long and medium term debt .....	1317.00	1317.00
Current liabilities .....	0.00	0.00
Bank overdraft, finance required.	0.00	131.70
Total debt .....	1317.00	1448.70
Equity, % of liabilities .....	52.63	50.25

CANNED FISH --- February 1988



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COMFAR 2.0 - BALBO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year	1989	1990	1991	1992	1993	1994
Total assets	3004.44	3346.75	3897.11	4436.07	4983.26	5546.67
Fixed assets, net of depreciation	2719.82	2527.95	2343.07	2165.19	1987.32	1825.44
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	276.50	353.96	436.66	436.66	436.66	436.66
Cash, bank	8.11	7.28	7.69	7.69	7.69	7.69
Cash surplus, finance available	0.00	457.57	1109.69	1826.52	2551.59	3276.80
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	3004.44	3346.75	3897.11	4436.07	4983.26	5546.67
Equity capital	1463.00	1463.00	1463.00	1465.00	1463.00	1463.00
Reserves, retained profit	0.00	296.49	796.40	1488.25	2191.83	2903.64
Profit	296.49	499.92	691.85	703.58	711.61	728.04
Long and medium term debt	1152.38	987.75	823.13	658.50	493.88	329.25
Current liabilities	76.55	99.60	122.74	122.74	122.74	122.74
Bank overdraft, finance required	16.03	0.00	0.00	0.00	0.00	0.00
Total debt	1244.95	1087.35	945.86	781.24	616.61	451.99
Equity, % of liabilities	48.69	43.71	37.54	32.98	29.36	26.38

CANNED FISH --- February 1988



COMFAR 2.0 - BALDO & CO. S.R.L. - MILANO

Projected Balance Sheets, Production in 1000 US DOLLARS

Year	1995	1996	1997	1998	1999	2000
Total assets	6118.32	6698.20	7450.94	8203.68	8976.69	9749.70
Fixed assets, net of depreciation	1463.56	1501.68	1339.81	1177.93	1056.60	935.28
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	436.66	436.66	436.66	436.66	436.66	436.66
Cash, bank	7.69	7.69	7.69	7.69	7.69	7.69
Cash surplus, finance available	4010.41	4752.17	5666.78	6581.39	7475.73	8370.07
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	6118.32	6698.20	7450.94	8203.68	8976.69	9749.70
Equity capital	1463.00	1463.00	1463.00	1463.00	1463.00	1463.00
Reserves, retained profit	3631.69	4367.96	5112.47	5865.20	6617.94	7390.95
Profit	736.27	744.51	752.74	752.74	773.01	773.01
Long and medium term debt	164.63	0.00	0.00	0.00	0.00	0.00
Current liabilities	122.74	122.74	122.74	122.74	122.74	122.74
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	287.36	122.74	122.74	122.74	122.74	122.74
Equity, % of liabilities	23.91	21.84	19.64	17.83	16.30	15.01



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Projected Balance Sheets, Production in 1000 US DOLLARS

Year . . . . .	2001	2002	2003
Total assets . . . . .	10522.71	11326.46	12160.13
Fixed assets, net of depreciation	813.95	754.10	754.10
Construction in progress . . . .	0.00	0.00	0.00
Current assets . . . . .	436.66	436.66	436.66
Cash, bank . . . . .	7.69	7.69	7.69
Cash surplus, finance available .	9264.41	10128.01	10961.68
Loss carried forward . . . . .	0.00	0.00	0.00
Loss . . . . .	0.00	0.00	0.00
Total liabilities . . . . .	10522.71	11326.46	12160.14
Equity capital . . . . .	1463.00	1463.00	1463.00
Reserves, retained profit . . . .	8163.96	8936.97	9740.72
Profit . . . . .	773.01	803.75	833.67
Long and medium term debt . . . .	0.60	0.00	0.00
Current liabilities . . . . .	122.74	122.74	122.74
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt . . . . .	122.74	122.74	122.74
Equity, % of liabilities . . . . .	13.90	12.92	12.03

CANNED FISH --- February 1988

**Canned Fish**

**ANNEXE 3**

**BEP EVALUATION**

BEP EVALUATION

ALL THE FOLLOWING DATA ARE RELEVANT TO THE 1ST YEAR OF PRODUCTION AT FULL CAPACITY (3RD YEAR OF PRODUCTION). ACCOUNTING CURRENCY: 1000 US \$:

	HYP. 1	HYP. 2
1) TOTAL REVENUES	<u>3898</u>	<u>3254</u>
2) VARIABLE COSTS:	<u>1456.23</u>	<u>1458.23</u>
. RAW MATERIALS	1293.88	1293.88
. UTILITIES	92.12	92.12
. ENERGY	16	16
. LABOUR	56.23	56.23
3) FIXED COSTS	<u>412.08</u>	<u>412.08</u>
. REPAIR-MAINTENANCE	28.41	28.41
. SPARES	50	50
. ADMINISTRATION	50.01	50.01
. DEPRECIATION	184.88	184.88
. FINANCIAL COSTS	98.78	98.78
4) TOTAL PRODUCTION COSTS	<u>1870.31</u>	<u>1870.31</u>

$$\text{(HYP.1) } \frac{\text{BEP } 412.08}{3898 - 1458.23} \times 100 = 16.9\%$$

$$\text{(HYP.2) } \frac{\text{BEP } 412.08}{3254 - 1458.23} \times 100 = 22.9\%$$

**Canned Fish**

**ANNEXE 4**

**FOREIGN EXCHANGE EFFECT EVALUATION**





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COMFAR 2.1 - BALDO & CO. S.R.L., MILANO

### Foreign Exchange Effect in 1000 US DOLLARS

Economic Analysis excluding indirect effects

100 units foreign CJ = 100.00 units local CJ

	grand total	total constr.	total produc.	.....construction.....		production	
				1987	1988	1989	1990
total foreign inflow ..	3437.23	1317.00	35120.23	1317.00	0.00	1380.19	1840.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsides, grants . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	1317.23	1317.00	0.23	1317.00	0.00	0.19	0.00
exports . . . . .	23120.00	0.00	33120.00	0.00	0.00	1380.00	1840.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	4255.28	1681.70	2603.58	310.00	1371.70	411.41	339.20
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	1263.30	1550.00	-286.70	310.00	1240.00	45.48	6.49
imported materials . . . .	980.40	0.00	980.40	0.00	0.00	69.60	52.90
repayment loans & overd.	1317.23	0.00	1317.23	0.00	0.00	164.63	164.67
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	724.35	131.70	592.65	0.00	131.70	131.70	115.24
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	50151.95	-364.70	30516.65	1007.00	-1371.70	968.79	1500.80
import substit'n effect	13248.00	0.00	13248.00	0.00	0.00	552.00	736.00
net forgn. exchange effect	43999.95	-364.70	43764.65	1007.00	-1371.70	1520.79	2236.80
present values at 10.00 %							
foreign exchange flow . .	12929.33						
net forgn exchange effect	16848.41						



**Foreign Exchange Effect in 1000 US DOLLARS**  
Economic Analysis excluding indirect effects  
100 units foreign CU = 100.00 units local CU

	1991	1992	1993	production 1994	1995	1996	1997
total foreign inflow . .	2300.04	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidiaries, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . . .	0.04	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow . .	342.39	312.94	296.48	280.01	263.55	247.09	66.00
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	12.99	0.00	0.00	0.00	0.00	0.00	0.00
imported materials . . . .	66.00	66.00	66.00	66.00	66.00	66.00	66.00
repayment loans & overd.	164.63	164.63	164.63	164.63	164.63	164.63	0.00
other repayments . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	98.78	82.31	65.85	49.39	32.92	16.46	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	1957.64	1987.06	2003.53	2019.99	2036.45	2052.91	2234.00
import substit'n effect	920.00	920.00	920.00	920.00	920.00	920.00	920.00
net foreign exchange effect	2877.64	2907.06	2923.52	2939.99	2956.45	2972.91	3154.00
present values at foreign exchange flow . .	10.00 %	12929.33					
net foreign exchange effect		18848.41					



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**Foreign Exchange Effect in 1000 US DOLLARS**

Economic Analysis excluding indirect effects

100 units foreign CU = 100.00 units local CU

	1998	1999	2000	production 2001	2002	2003	2004
total foreign inflow . .	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00	0.00
equity capital . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
subsidies, grants . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loans & overdraft . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
exports . . . . .	2300.00	2300.00	2300.00	2300.00	2300.00	2300.00	0.00
indirect effects . . . . .	.....	.....	.....	.....	.....	.....	.....
total foreign outflow .	66.00	66.00	66.00	66.00	66.00	66.00	-351.48
royalties . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
equipment . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	-351.67
imported materials . . .	66.00	66.00	66.00	66.00	66.00	66.00	0.00
repayment loans & overd.	0.00	0.00	0.00	0.00	0.00	0.00	0.18
other repayments . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
repatriated wages . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
dividends paid . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
interests . . . . .	0.00	0.00	0.00	0.00	0.00	0.00	0.00
indirect costs . . . . .	.....	.....	.....	.....	.....	.....	.....
net foreign exchange flow	2234.00	2234.00	2234.00	2234.00	2234.00	2234.00	351.48
import substit'n effect	920.00	920.00	920.00	920.00	920.00	920.00	0.00
net foreign exchange effect	3154.00	3154.00	3154.00	3154.00	3154.00	3154.00	351.48

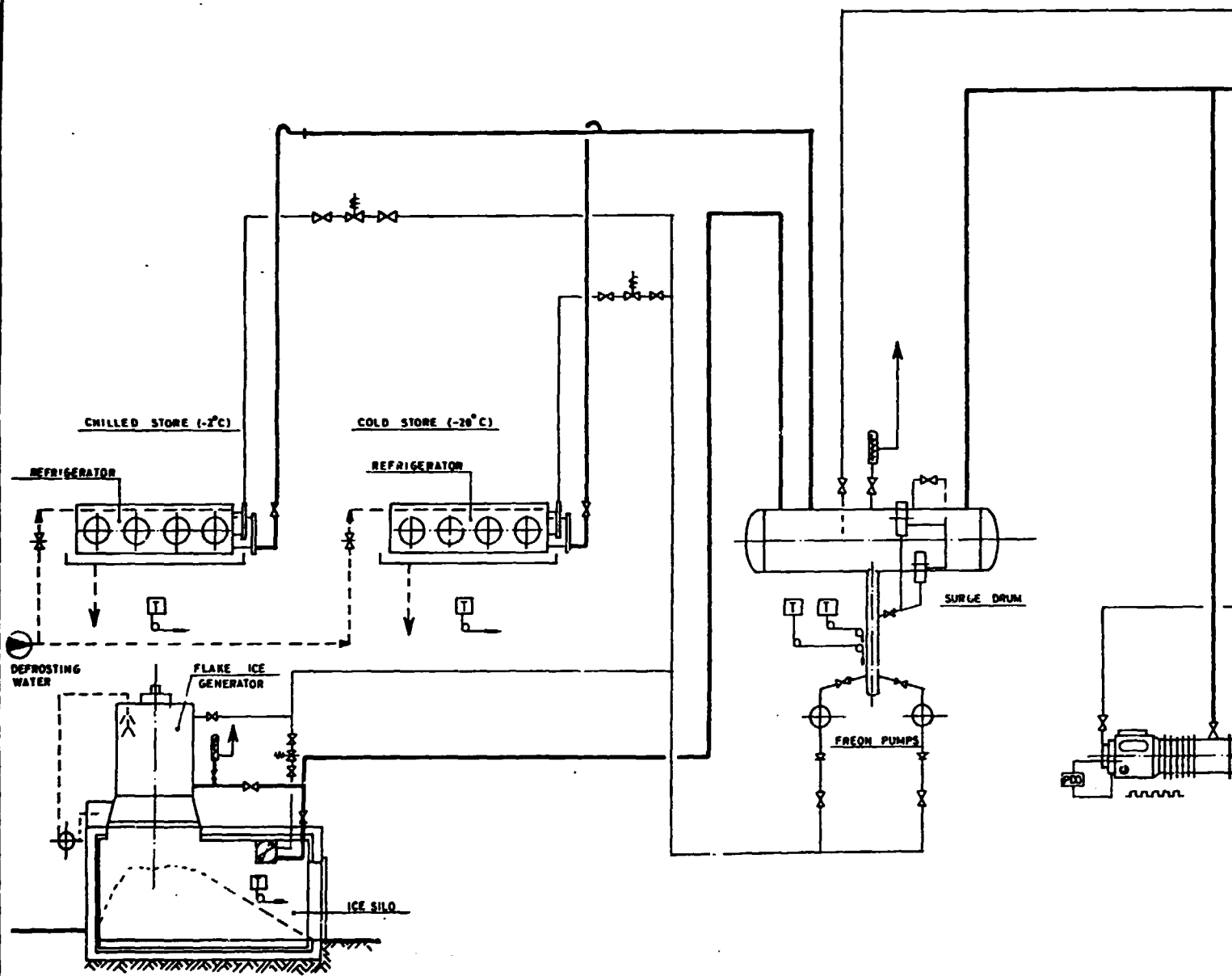
present value at 10.00 %	
foreign exchange flow .	12929.33
net foreign exchange effect	18848.41

DRW. B162 - 18 - 1  
FREEZING UNIT FOR STORES  
AND ICE MAKING PROCESS SCHEME

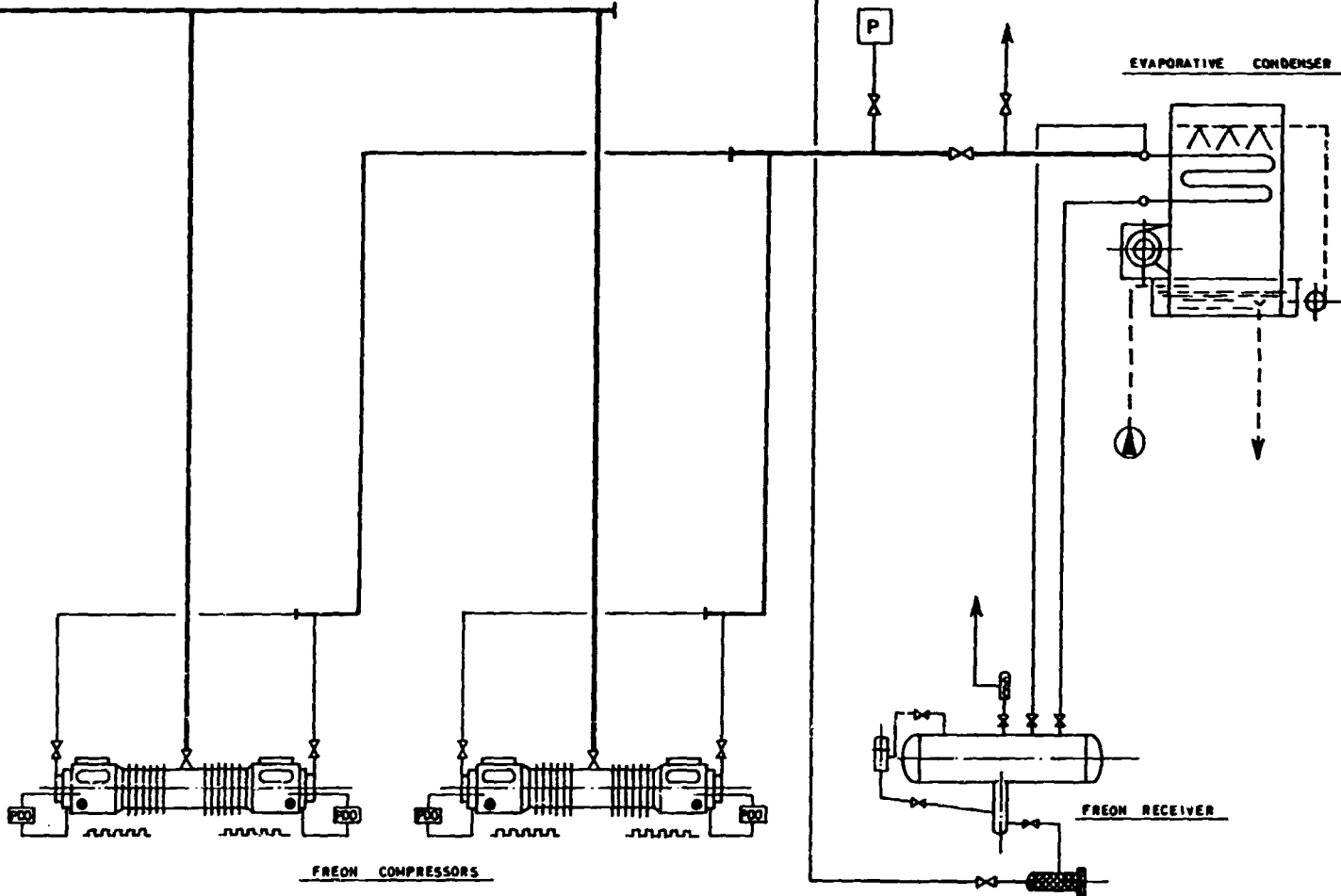
DRW. B162 - 18 - 2  
BLAST AIR TUNNEL

DRW. B162 - 18 - 3  
PRODUCTION OF FISH MEAL & OPII

DRW. B162 - 18 - 4  
GENERAL LAY OUT

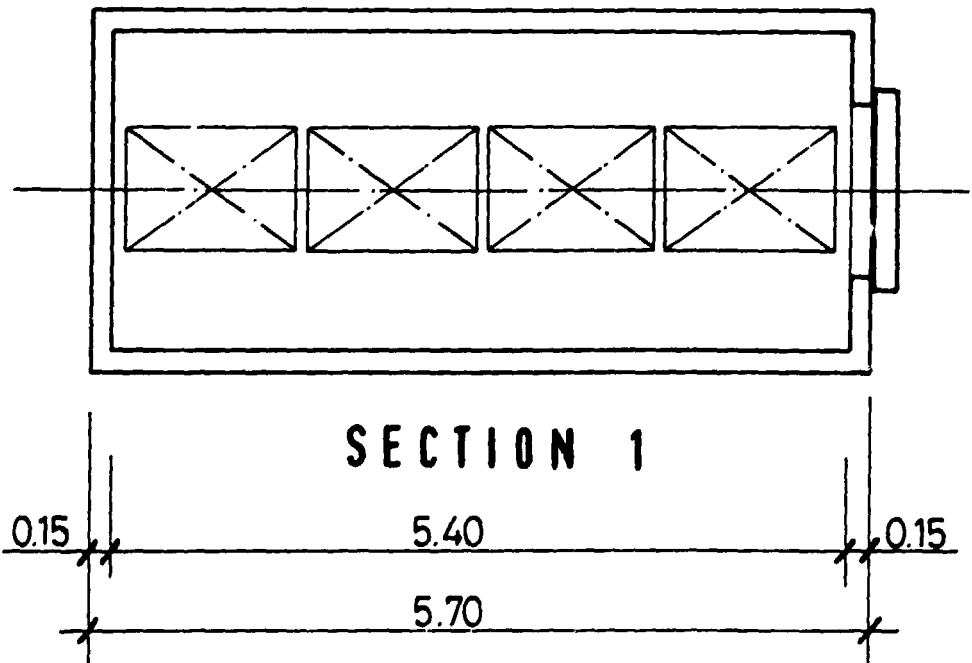
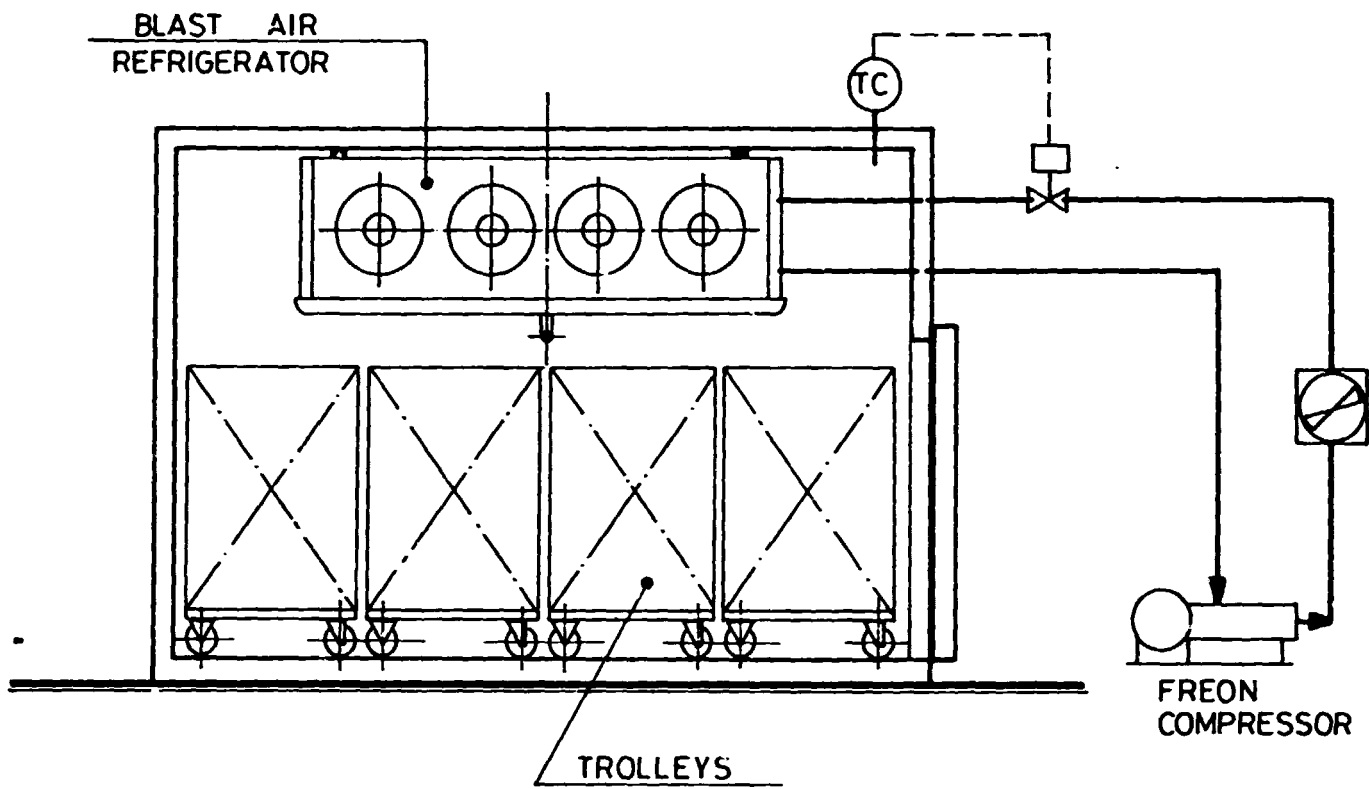


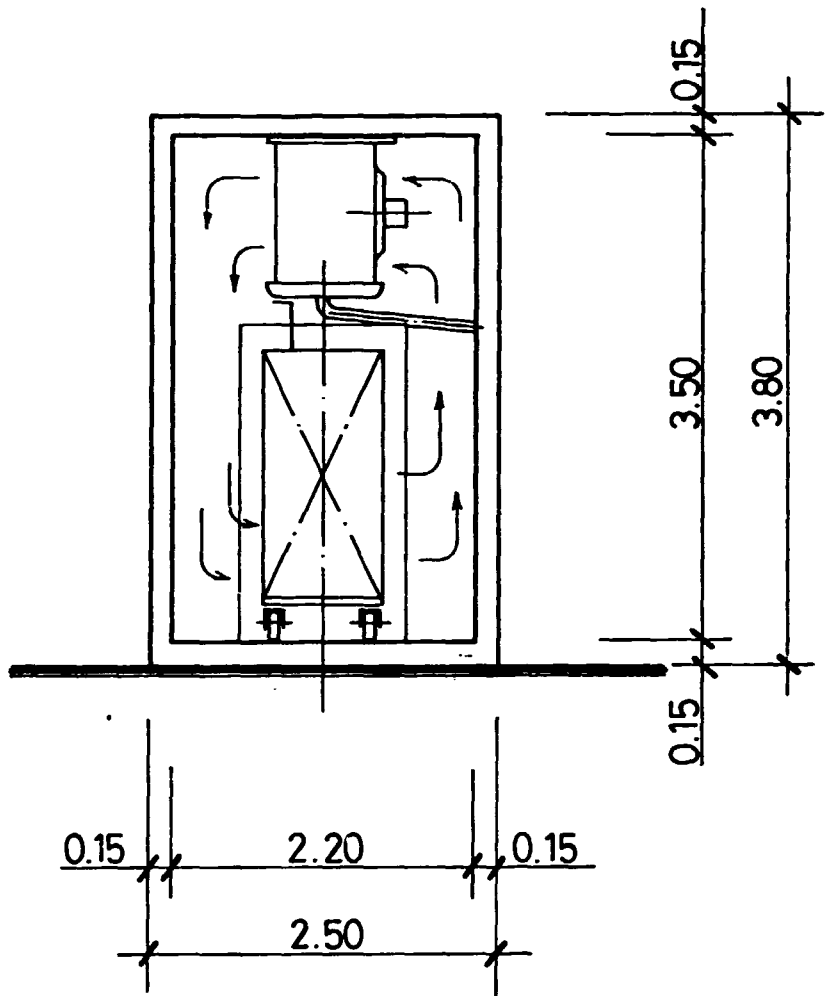
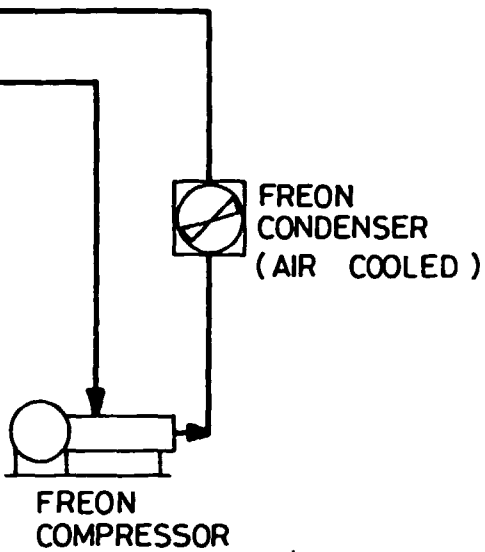
SECTION 1



## SECTION .2

CLIENTE CUSTOMER	COMMESSA N° JOB N°	B-162	
CANNED FISH PLANT FREEZING UNIT FOR STORES AND ICE MAKING PROCESS SCHEME		CONTROLLATO APPROVED	DATA DATE
		DISEGNATO DRAWN	DATA DATE /14.88
		SCALA SCALE	//
<b>baldo &amp; c.</b> CONSULTING ENGINEERS		Via Sillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	
		DIS. N° DWS N° <b>B.162-18-1</b>	
		REV	

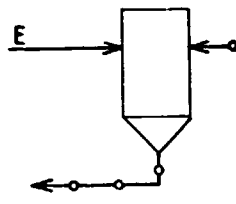




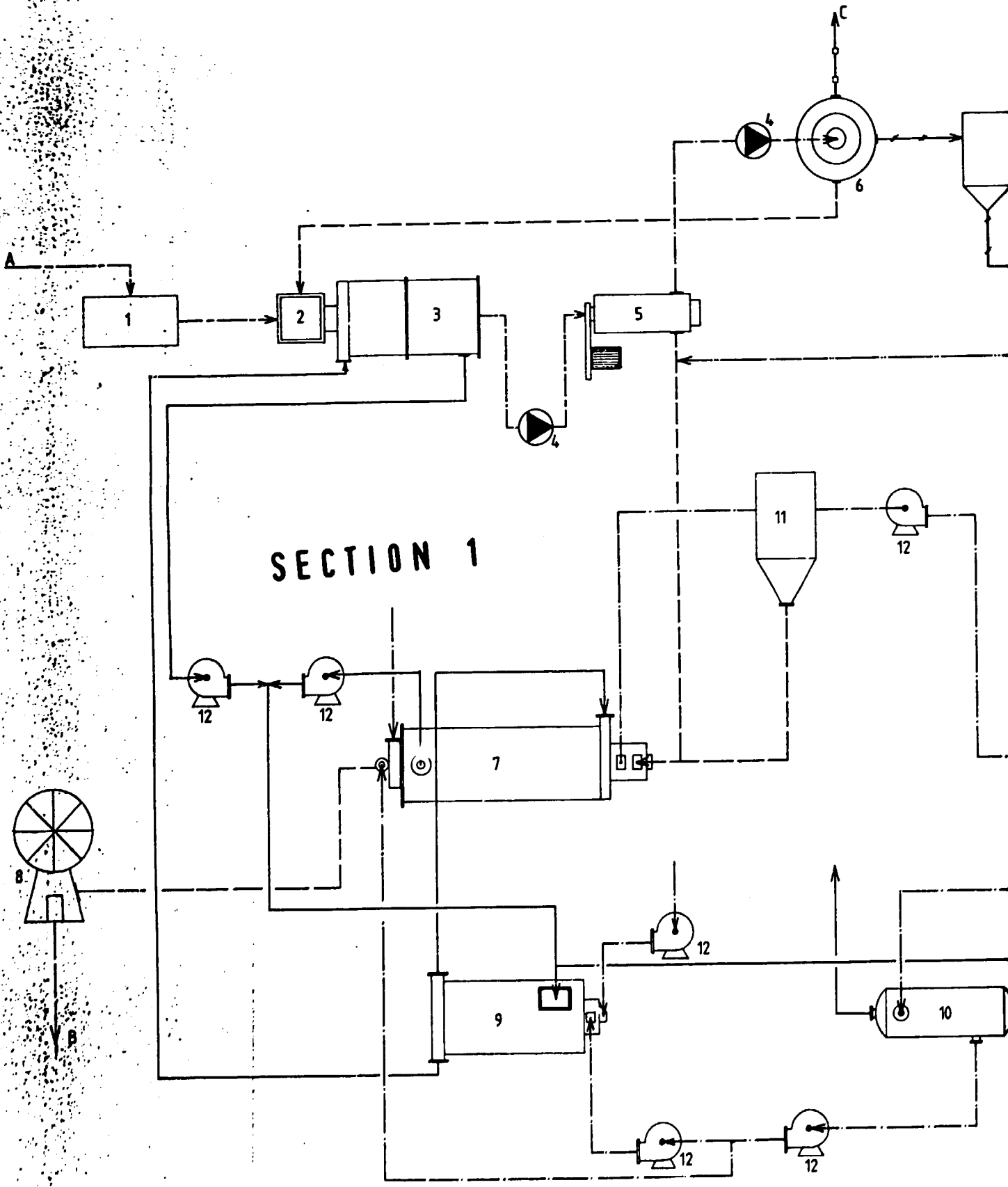
SECTION .2

CLIENTE CUSTOMER	COMMESSA N° JOB N° B-162	
CANNED FISH PLANT BLAST AIR TUNNEL	CONTROLLATO APPROVED	DATA DATE
	DISEGNATO DRAWN <i>A. P.</i>	DATA DATE
	SCALA SCALE <i>1/1</i>	
	DIS. N° DWG N° B 162 - 18 - 2	
	Via Stillocone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229	
REV.		





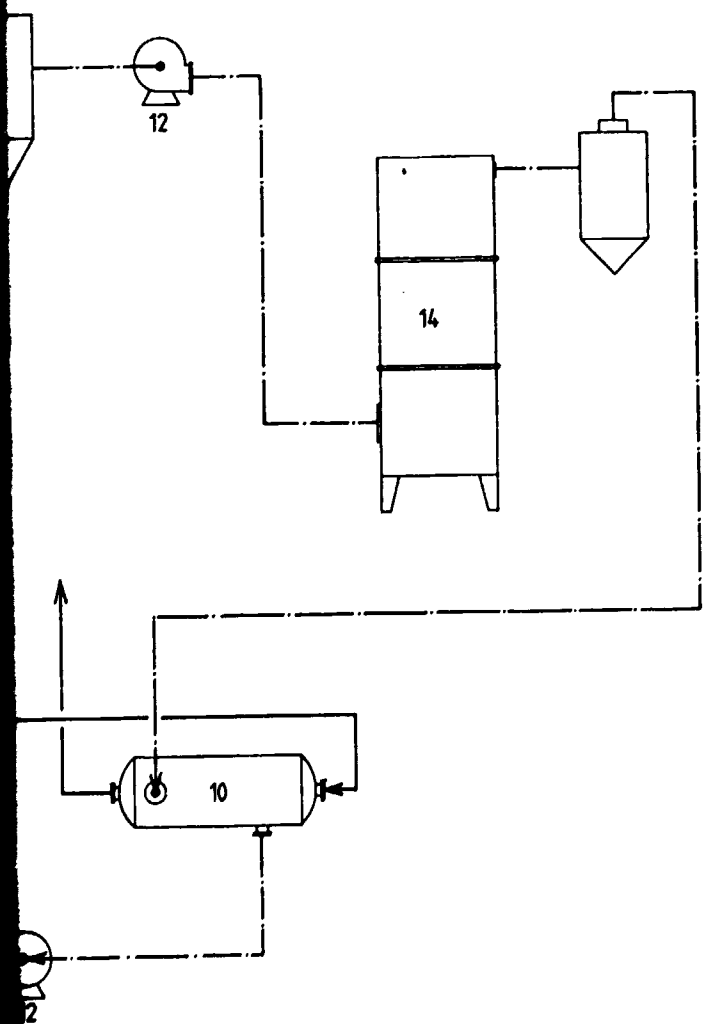
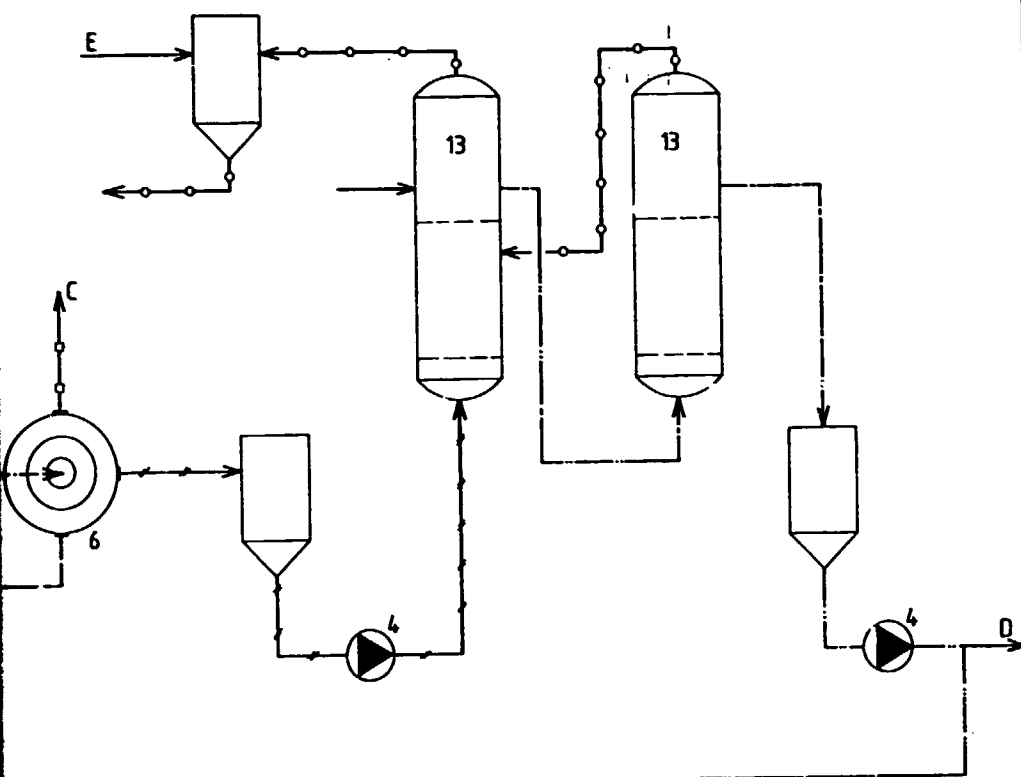
C




LEGENDA

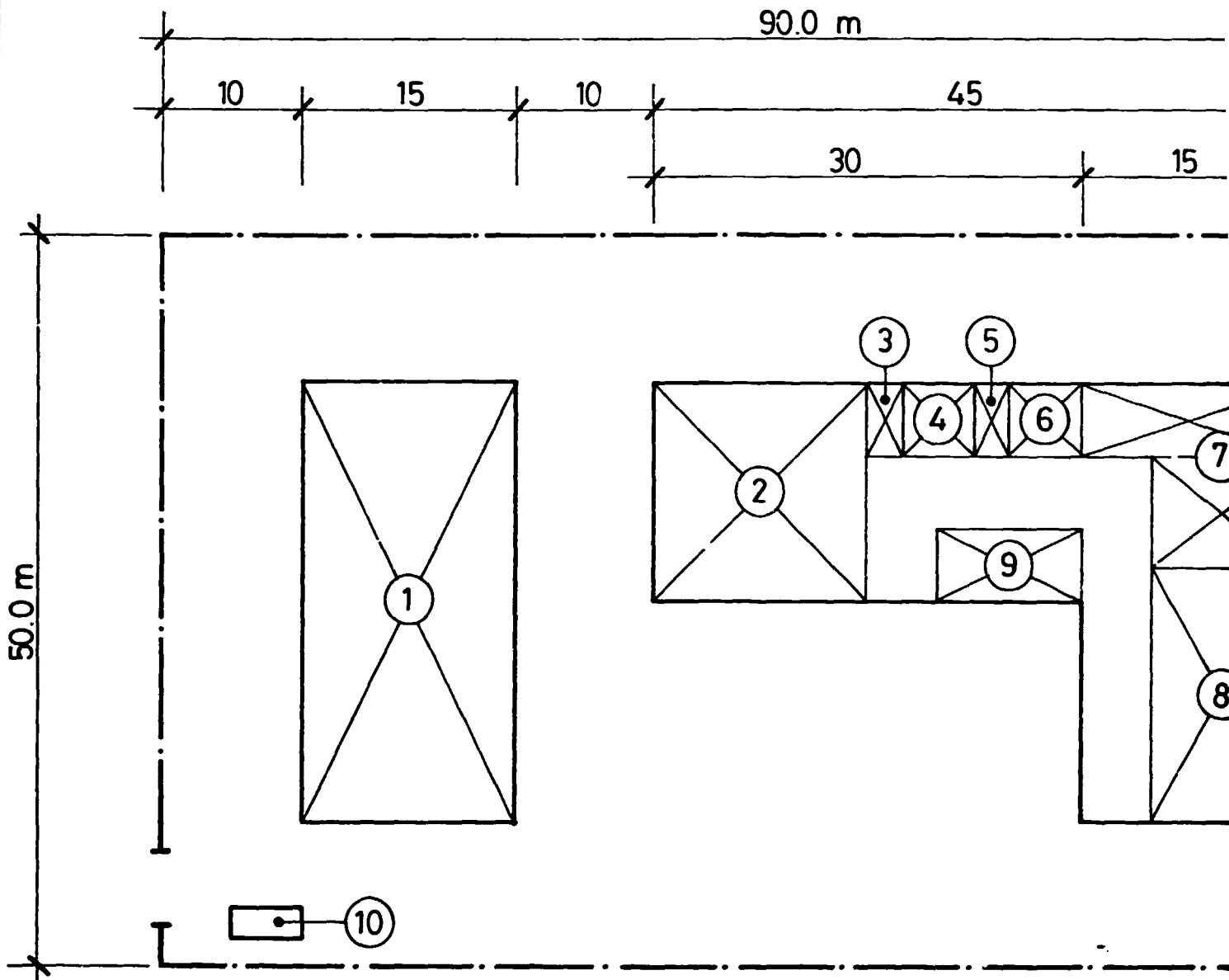
- 1- MINCER
- 2- INLET TANK
- 3- COOKER
- 4- PUMP
- 5- DECANTER
- 6- SOLIDS EJECTING HIGH SPEED SEPARATOR
- 7- DRYER
- 8- MEAL MILL
- 9- FLUE GAS GENERATOR
- 10- ECONOMIZER
- 11- CYCLONE
- 12- VENTILATORS
- 13- EVAPORATORS
- 14- DEODORIZING UNIT

- RAW MATERIAL -----
- SOLIDS PHASE AND MEAL -----
- VENTILATION AIR -----
- FLUE GAS -----
- STICK WATER CONCENTRATE -----
- STICK WATER ----- // // //
- LIQUID PHASE -----
- SECONDARY STEAM CONDENSATE ----- ○ ----- ○ -----
- FISH OIL ----- □ ----- ○ ----- □ -----
- A- RAW MATERIAL
- B- FISH MEAL
- C- PURIFIED FISH OIL
- D- STICK WATER CONCENTRATE

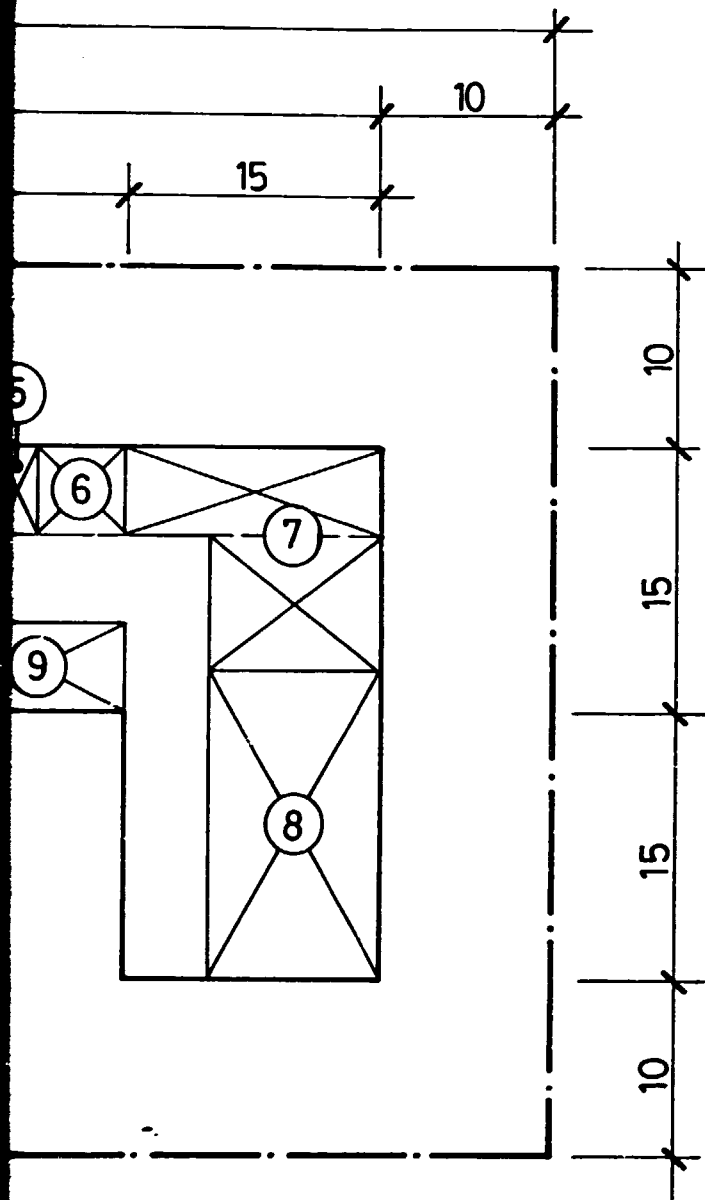


SECTION .2

CLIENTE SUTROR	COMMESSA N° JOB N°	
CANNED FISH PLANT		CONTROLLATO APPROVATO DATA
PRODUCTION OF FISH MEAL & OIL		DISEGNATO DATA
PROCESS SCHEME		SCALA SCALE
		DISE N° DATA
Via Sulfone 26, 20154 MILANO Ph. N. 2108 Tel. N. 200226		B162_18_3



SECTION 1



**LEGENDA**

- 1- OFFICES, LAB., WAREHOUSE, WORKSHOP
- 2- FISH PROCESSING
- 3- ICE MAKING
- 4- CHILLED STORE
- 5- BLAST AIR TUNNEL
- 6- COLD STORE
- 7- UTILITIES AND FACILITIES
- 8- FISH MEAL
- 9- CANNING
- 10- SCALE

**SECTION .2**

CLIENTE CUSTOMER	COMMESSA N° JOB N°	
<u>CANNED FISH PLANT</u>  <u>GENERAL LAY-OUT</u>	CONTROLLATO APPROVED	DATA DATE
	DISEGNATO DRAWN	DATA DATE
	SCALA SCALE	
	DIS. N° DWG N°	
	<p style="font-size: 24pt; font-weight: bold;">B 162 .. 18 _ 4</p>	
Via Sillicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229		REV.