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INDUSTRIAL PROJECT DEVELOPMENT
AND PRE-INVESTMENT STUDIES
DP/BAH/85/007/11-51 & 11-52

STATE OF BAHRAIN

(R) BAHRAIN:

Technical report: Identification of potential industrial projects and services in the small and medium scale sectors*

Prepared for the Government of the State of Bahrain
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of B. Byskov, Economist/Market Analyst
and A.K. Bhatnagar, Industrial Engineer

Backstopping officer: Gabriel Rezek, Feasibility Studies Branch

United Nations Industrial Development Organization
Vienna

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ANNEXTURES

Introduction

Mr. Bertil Byskov (Market Analyst/Economist) and Mr. Autar K. Bhatnagar (Industrial Engineer) were retained by the United Nations Industrial Development Organization, Vienna, as Consultants for a three-month mission - DP/BAH/85/007/11-51 & 52 - for the Identification of Potential Industrial Projects and Services in the medium and small scale sectors in Bahrain. The consultants reported on July 1, 1986 in Vienna (Austria) for a pre-mission briefing, which was done by Mr. Gabriel Rezek, of the Feasibility Studies Section, Industrial Operations Division of UNIDO. The valuable guidance provided by Mr. Rezek during briefing was found extremely useful in the subsequent planning and implementation of the mission activities by the mission team.

The consultants arrived at the duty station, Manama - Bahrain, on July 2, 1986. Soon after arrival, they had discussions with the officials of the Ministry of Finance and National Economy, Government of the State of Bahrain, during which the background and objectives of the mission were explained to them by Ministry officials - which were to identify medium and small scale industrial investment opportunities in Bahrain. The consultants were advised to give particular attention to industries, products of which might have a captive market in Bahrain and also not to exclude from consideration any good industrial opportunities they may come across, even if they happen to be marginally beyond the medium scale range in terms of investment.

Based on the briefing in Vienna, and subsequent discussions with the Ministry of Finance and National Economy, Government of the State of Bahrain, a project work-plan was prepared by the consultants. This work-plan was further discussed with the Acting Resident Representative, UNDP, Bahrain, and thereafter finalised.

A preliminary report dated July 12, 1986, containing the work-plan has already been sent to UNIDO, Vienna. The details of the work-plan for the mission are stated below for purposes of convenient reference.

Project Work-Plan

- To make a preliminary indentification of industrial and service opportunities in the medium and small scale sectors of Industry in Bahrain, based on a quick check of the total market, availability of raw materials and services inputs and technological feasibility.

- To make a more detailed analysis of the industrial and service opportunities identified above, and to prepare project profiles on those which are indicative of being technically feasible and economically viable potential investment opportunities.

- The process of preliminary identification of industries, and a more detailed analysis for preparation of a project profile, to go hand in hand.

- The potentially feasible and economically viable industries to be listed on an order of merit basis, and priorities for carrying out detailed feasibility studies on them (or alternative action) to be recommended.

- A final report to be prepared by the mission team, stating their recommendations on :

  a) feasibility studies on the identified industries;

  b) studies on any specific industrial sectors offering great potential;

  c) any industrial policy measures considered necessary for promotion of Industry;

  d) special implementational strategies recommended for promotion of Industry.

Project Implementation Activities

The consultants, after finalising the work-plan, proceeded with project identification activities, as planned and programmed earlier. During the first one month (until the end of July 1986), the consultants worked in the Ministry of Finance and National Economy. During this period, after careful analysis of the markets of over a 100 medium and small scale industries and also considerations relating to their raw materials and technological aspects, about 20 different industries were identified and short-listed for the second stage to make more detailed analysis. The short-list of industries identified on the basis of a preliminary analysis, is attached at Annexture I of this report. The main constraint in the selection of industries was the small size of the market for their products, which was not large enough to justify setting up the minimum economic size production units.

After spending one month in the Ministry of Finance and National Economy, the consultants were asked to shift to the Ministry of Development and Industry, where the rest of the mission activities were carried out during the remaining two month period of the mission.

Adjustments in the Work-Plan

Soon after the consultants moved to the Ministry of Development and Industry, discussions were held in the Ministry with the Acting Director of Industry on the project work-plan. Subsequently, His Excellency the Minister of Development and Industry also had a meeting with the consultants and briefed them on the most suitable plan of action for achieving practical results during the limited time available to the mission team. It was suggested, both by His Excellency the Minister, and the Acting Director of Industries, that in the limited time of two months available to the mission, instead of attempting detailed studies on a large number of industries, it would be more fruitful if the mission undertook detailed analysis of a limited number of "promising" industries and prepared profiles on them after more in-depth study. Such profiles would be more realistic and rational and would be of more practical value from the point of further implementation of the identified industry. These practical suggestions and guidance given by His Excellency the Minister of Development and Industry, and the Acting Director of Industry, were highly appreciated by the mission team and the work-plan was accordingly adjusted to incorporate the suggested approach.

Detailed Analysis of Project Possibilities

Further detailed and in-depth analysis of the industrial possibilities identified earlier was undertaken by the consultants along the guidelines suggested by the officials in the Ministry of Development and Industry. The detailed analysis of the projects included an analysis of the total domestic and export markets for the products (present and projected), availability of raw materials and services, availability of suitable technologies to manufacture quality products and the economics of production to determine the return on investment. One of the major problems experienced by the mission during economic analysis was the lack of information regarding investment costs and prices of inputs, which sometimes left no alternative except using estimated figures. Particular attention was given to industries which were likely to meet the requirements of a captive market and those which would generate employment opportunities. In addition, during the analysis of different industrial possibilities, discussions were held with potential investors as well as potential users of products of these industries, to obtain their reactions to these project ideas. In this context the consultants took the opportunity to visit a number of medium and large scale industries in Bahrain. A list of the industries visited is attached at Annexture II of this report.

TABLE 1

INDUSTRY	CAPACITY RECOMMENDED	INVESTMENT US$(Million)	PRIORITY	RECOMMENDED FOLLOW UP ACTION
1. Synthetic Detergents	10,000 TPA	4.0	1	Feasibility study.
2. Refined Edible Oils (incl. plastic bottle making plant	7,200 TPA	9.0	1	Feasibility study.
3. Galvanised Iron Pipes	10,000 TPA	5.0	1	Feasibility study.
4. Rolled Steel Bars and Angle Irons	20,000 TPA	5.0	1	Feasibility study.
5. Mineral Water Bottling Plant	5,000 TPA	1.0	1	Feasibility study.
6. Forge Cast Aluminium Frying Pans	450,000 Units/Year	2.1	2	Marketing arrangements to be investigated first.
7. Anodes for Cathodic Protection	300 TPA	0.15	2	Technical matters and sales arrangements to be investigated first.
8. Insulation Panels	135,000 M^2	1.6	2	To be considered after changes in building regulations.
9. Pet-coke for Smelter Anodes	100,000 TPA	55.0	2	A larger plant based on GCC market to be considered.
10. Synthetic Cryolite and Aluminium Flouride	10,000 TPA	20.0	2	A larger plant based on GCC market to be considered.
11. Ferric Chloride	5,000 TPA	3.0	1	Feasibility study.
12. Regional Management Development Centre		0.5	2	negotiations to be started with a reputable company with a proven track record for joint venture participation.

TABLE 2

List of small scale industries which can be started with small investment

1. Hosiery for making knitwear.

2. Tyre retreading.

3. Garment manufacture.

4. Electrical appliances manufacture.

5. Leather tannery (small scale)

6. Office stationery.

7. Ceramic ware (decorative).

8. Cleaning and reclamation of motor oils.

9. Nuts and bolts.

Therefore after a detailed analysis and in-depth study of each industrial possibility, project profiles were prepared on twelve different industries. These industries are listed in Table 1 of this report, with an indication of the priority these industries should be given for further consideration. In addition, certain small scale industries are listed in Table 2 of this report which are considered suitable for a small market like Bahrain. These small scale industries can generally be started with smaller investments and have a good chance of being successful in small markets on account of lower fixed and overheads costs. A detailed study of these industries could not be undertaken because of non-availability of information and data regarding their market potential and also limitations of time available to the mission.

Policy measures and implementation strategy recommended for promotion of industry

The industrial scene in Bahrain shows a number of large industries like the refinery, the aluminium smelter, the methanol and ammonia plant. These industries have sufficient capacities to compete on a world wide basis and the investments involved are of a magnitude only possible for government level participation.

The small scale industries are, however, more sensitive to the constraints of a small domestic market, although some of them have still been successfully started as forward linkages of existing large scale industrial ventures.

In principle, everything can be produced i Bahrain. The work force is young and relatively well educated, but knowledge of production is still rather limited, as Bahrain, for centuries has been a trading nation and has no industrial tradition.

The problem now is to develop and create opportunities for new entrepreneurial ventures with initiative and drive to build up a diversified industry.

The most obvious group with existing managerial skills is today's importers/traders who now more than ever before will have to think in terms of the whole Gulf region. The new causeway to Saudi Arabia will add a new dimension to the markets and a lot of changes for the trading community. The causeway will definitely be an eyeopener for many importers, and it will give Bahrain the opportunity for considering at least the eastern part of Saudi Arabia as part of its 'home market'. At the same time this situation will give Bahrain a new interesting advantage of being a production centre for new small scale industries with easy access to a bigger market in which the Bahraini trading community can take an active part. To facilitate the development of small scale industries, it is recommended that the government provide appropriate industrial estates including complete industrial buildings and utility services for renting out to newly started industries for a nominal fee particularly during the first few years. In this way young people with initiative - but perhaps not with the necessary financial resources - will have the opportunity of starting their own industries.

Small scale industries seem to have greater difficulties for a successful start than the medium sized industries with more financial resources behind them, due to the fact that they are totally dependent on the small domestic market and possibly also because the Bahraini consumer/buyer has a preference for imported products.

One of the ways to overcome this will be to introduce import duties of 20-25% to protect local manufacture. Of course the risk is always there that protected industries tend to become inefficient in operation, but it seems a necessity to introduce import duties in the area where there is local production for at least the first few years of production, in order to give the industry the opportunity of standing on its feet.

This system cannot be applied for every industry as Bahrain is a member of the GCC where the internal customs duties are abolished.

Products from the other GCC member countries have free access to Bahrain and for a lot of industries it will be difficult to protect them with customs duties. But for a small country which is a member of a customs union, the benefits are actually greater as Bahraini products have free access to new larger markets. It is suggested that Bahrain should try to have a selective customs duties pattern so that raw materials are exempted from duty, whereas finished goods are obliged to pay import duties.

The production skills in Bahrain can, no doubt be further developed. but it is just as important to develop the marketing skills for export to the other GCC countries. Bahrain has the advantage of being centrally placed in the Gulf region and also having a more liberal policy which is an advantage in attracting business people to the island either for business visits or for involvement in industrial production.

In summary the following policy measures are recommended for the promotion of industry.

Feasibility Studies' Costs

The feasibility study is necessary for the investor and for the financial institutions to see whether the project idea is viable before any final decision is taken. In several other countries where the government also wants to help the industrialisation process, it has been seen that the investor/promoter of a new industrial enterprise pays about 25% of the costs of the feasibility study to show his serious interest, and the government subsidises it to the extent of the remaining 75%.

The investor/promoter has then the sole right to the report and to set up the industry within a limited period of time e.g. one year. The investor/promoter is still independent of further government participation if this is not forthcoming.

Investment

The government constructs appropriate industrial estates (including building and utility services), which are rented out at favourable rates to new industries.

The government might decide to enter into partnership with a private investor.

The government might consider soft-term loans for financing industrial enterprises beneficial to the country and these soft loans would be adjusted in accordance with the success of the company.

General Rules

The government should try to buy locally manufactured goods preferably when these are competitive with imported goods. This will also have a positive impact on the consumers in general.

New industries will need an import duty protection of 20-25% for at least the first five years of production, for protecting them from products imported from outside the Gulf region.

For the establishment of medium sized companies, the government can be helpful with international promotional efforts to attract multinational companies to produce in Bahrain on a joint-venture basis with private, local investors.

Prominent features of identified industries and services

In the identification process of the 12 selected profiles, the consultants had set themselves the objective that some of the following criteria had to be met.

a) The return on investment for each individual project has to be sufficiently attractive in the short run and in the long run.

b) The production quality has to meet good international standards to be able to compete with imported goods and also to be suitable for export.

c) The domestic market is big enough to justify setting up a production plant.

d) The production costs are competitive with imported goods and preferably have a comparative advantage for being produced in Bahrain.

e) The value added of new productions taken up in Bahrain based on imported raw materials is at least 60%.

f) The promotion of Bahrain as a service centre within the GCC region.

g) The generation of new employment possibilities on all levels directly in the projects or indirectly through related industries.

h) The new industries to be complementary to the existing industry rather than in competition with it.

Relating to these criteria the more prominent features of each individual project mentioned in Table 1 are given below :

1. Synthetic Detergents

- high profitability;
- consumer product with upward trend in sales;
- domestic market big enough to justify a plant based on imported dodecyl benzene sulphonic acid;
- export possibilities to Saudi Arabia.

Recommendations

- feasibility study;
- establish contact with well established detergent manufacturers to discuss possibilities for setting up a plant on a joint venture basis to ensure the quality and marketing skills, including use of brand name.

2. Refined Edible Oils

- high safety margin and profitability;
- consumer product with upward trend in sales;
- the domestic market big enough to justify a plant based on imported crude edible oil;
- easy to install supplementary soap and shampoo production as by-products;
- eligible for protection.

Recommendations

- feasibility study;
- possibility of joint venture approach with a multi-national to be explored and considered.

3. Galvanised Steel Pipes

- high profitability;
- domestic market big enough to justify a plant based on imported steel strips;
- labour intensive.

Recommendation

- feasibility study.

4. <u>Rolled Steel Bars and Angle Irons</u>

- high profitability;
- domestic market big enough to justify a plant based on imported steel billets;
- labour intensive.

<u>Recommendation</u>

- feasibility study.

5. <u>Bottled Mineral Water</u>

- import substitution;
- domestic market big enough to justify a small plant based on local water.

<u>Recommendations</u>

- analysis of water quality;
- feasibility study.

6. <u>Forge Cast Aluminium Frying Pans</u>

- comparative production advantage;
- export oriented project.

<u>Recommendations</u>

- establish contact with an international sales organisation to guarantee export sales. Preferable to establish the project on a joint venture basis;
- feasibility study.

7. Anodes for Cathodic Protection

- comparative production advantage;
- market within the GCC region;
- service related industry;
- small investment.

Recommendations

- establish contact with company people who can bring the production quality to international standards;
- investigate marketing arrangements before a small feasibility study is prepared.

8. Insulation Panels

- high profitability;
- energy saving;
- seen from a national point of view, this project can help delaying expansion of power plants;
- will need official building regulations to be changed to require inclusion of insulations.

Recommendations

- building regulations should be altered to include insulation;
- feasibility study to be undertaken.

9. Petroleum Coke for Smelter Anodes

- the project is based upon a "captive market" in Bahrain on account of the requirements of ALBA smelter;

- in addition there are export possibilities in view of the requirements of smelters in the U.A.E. and one planned in Saudi Arabia;

- the raw material "green coke" is likely to be available from a coking plant being set up at Mina Abdulla in Kuwait, which is expected to go into production in early 1987;

- availability of cheap natural gas for calcination is another important factor in favour of the project;

- the project however indicates a marginal (unattractive) rate of return on investment of about 9% (before interest), if a 100,000 tpa plant is considered based on the requirements of ALBA only;

- to improve the profitability of the venture, a 300,000 tpa plant should be considered based on the present and projected GCC market, and a lower price for green coke from Kuwait;

- a feasibility study on the basis of a larger plant (300,000 tpa) and a more favourable negotiated price for green coke is recommended for this project;

10. <u>Synthetic Cryolite and Aluminium Flouride</u>

- the project is based on the "captive market" requirements of ALBA smelter;

- there are possibilities of export to other GCC states in view of the requirements of the present and planned smelter in the U.A.E. and Saudi Arabia;

- the project however indicates only a marginal (unattractive) rate of return on investment of about 10% (before interest), for a 10,000 tpa plant based on ALBA's requirements only;

- if however a 30,000 tpa plant based on GCC market is considered, the profitability of the venture will improve and make it attractive enough as a financial proposition;

- therefore a feasibility study for a 30,000 tpa plant based on GCC requirements is recommended for this project.

11. Ferric Chloride

- the profitability is good;
- the market is in the Gulf region.

Recommendation

- feasibility study.

12. Regional Management Development Centre

- high profitability;
- fits well into the idea of Bahrain being a service centre for the Gulf region;
- improves the managerial skills of the region;
- creates increasing business for hotels and indirect employment.

Recommendations

- make contact with a reputable international company with proven success in running management courses for the establishment of a joint venture.

Other Industrial Sectors/Industries Recommended for Studies

During the course of the mission's studies on industries in the medium and small scale sectors of industry in Bahrain, the mission team came across a number of good industrial possibilities in the large scale industrial sector, which could not be studied partly because of limitations of time and partly because they were outside the terms of reference of the present mission's scope of activities. However, as some of these large scale industrial possibilities might turn out, upon a technoeconomic analysis, to be excellent investment propositions which could contribute significantly to the national economy, they are being mentioned below, for the purpose of being studied in the future, at an appropriate time.

(1) Nitrogenous Fertilizers

As Bahrain is already producing ammonia in its petrochemicals complex (GPIC), and ammonia production being based on natural gas feedstock, is likely to be very competitive in price in comparison to world prices, this affords an excellent opportunity for Bahrain to go into the downstream products of ammonia - nitrogenous fertilizers - for the world market. Therefore techno-economic studies on the production of the following nitrogenous fertilizers are recommended :

(a) Urea
(b) Di-ammonium phosphate
(c) Ammonium sulphate.

(2) Phosphate Fertilizers

Bahrain has a good potential opportunity in the manufacture of triple superphosphate fertiliser, based upon imported rock phosphate from Jordan, and sulphuric acid from by-product sulphur of the BAPCO Refinery. This project, besides manufacturing triple superphosphate for the world market, would also produce as by-products, cement and aluminium flouride for the Bahrain market and being a multi-product venture is likely to be an economically attractive investment possibility. It is therefore recommended that a techno-eocnomic study be done on :

(a) The manufacture of triple superphosphate
(b) Cement (by-product)
(c) Aluminium flouride (by-product).

(3) <u>Methanol - downstream products</u>

Methanol being another one of the products which is currently being manufactured by the petrochemical plant (GPIC), offers good opportunities for being upgraded into more profitable chemical and bio-chemical products for the world markets. On account of its current production at competitive costs, its downstream products are also likely to prove very competitive in the world markets. It is therefore recommended that the following industrial projects based on methanol feedstock be considered and techno-economic evaluation studies conducted on them :

(a) Single cell protein manufacture
(b) Acetic acid manufacture
(c) Formaldehyde manufacture
(d) Methyl methacrylate manufacture.

(4) <u>Aluminium - downstream products</u>

According to current reports, a proposal for the manufacture of automobiles in collaboration with Japanese car manufacturers is presently under the consideration of the U.A.E. Government. If this project is approved and implemented by the U.A.E., it will open up excellent opportunities for Bahrain to go into engine block aluminium castings and manufacture of aluminium wheels for the cars. These opportunities for additional aluminium product lines should be kept in view, and necessary follow-up maintained in the context of the likely developments in the U.A.E.. in this field.

Recommendations regarding follow-up action

As a result of the project identification studies carried out under the present mission, a number of industries have been identified and listed in their order of priority in Table 1. Out of the industries listed, feasibility studies have been recommended in the immediate future for six industries. It is therefore recommended that, as follow-up action, detailed feasibility studies may be commissioned on the following six industries which are listed below serially in the order of preference, as indicated by their overall prospects of success from techno-economic considerations :

(i) Synthetic detergents manufacture

(ii) Refined edible oils manufacture

(iii) Galvanised steel pipe manufacture

(iv) Mineral water bottling plant

(v) Rolled steel bars and angle irons manufacture

(vi) Ferric chloride manufacture.

In respect of other industries listed in Table 1, it is recommended that action should be taken as mentioned against each industry, at the appropriate time.

Acknowledgements

The consultants would like to take this opportunity to express their thanks and grateful appreciation to all the officials and staff of the Ministry of Finance and National Economy, and the Ministry of Development and Industry for their valuable suggestions and assistance during the course of the mission's activities.

Thanks are also due to UNDP officials and staff for their assistance in enabling the consultants to achieve the objectives of the mission.

The consultants would also like to place on record their appreciation of the excellent secretarial assistance which they received from the secretary to the Economic Adviser, Ministry of Finance and National Economy, in the preparation of industrial project profiles and the final report.

Bertil Byskov

Autar K. Bhatnagar

Manama, State of Bahrain

Dated: September 24, 1986

ANNEXTURE I

Preliminary list of project possibilities selected for further analysis

1. Aluminium flouride and Synthetic Cryolite.
2. Synthetic detergents.
3. Edible oil, including margarine unit.
4. Car tyre retreading.
5. Textile garments manufacture.
6. Screws, nuts and bolts.
7. Forge cast aluminium frying pans.
8. Anodes for cathodic protection.
9. Leather tannery.
10. Hosiery for knitwear manufacture.
11. Calcined petroleum coke for smelter anodes.
12. Galvanised steel pipe manufacture.
13. Steel bars and angle iron manufacture.
14. Triple superphosphate fertilizer manufacture.
15. Plastic bottles for mineral water bottling.
16. Insulation panels for buildings.
17. Acetic acid.
18. Electrical appliances - irons, room heaters etc.
19. Single cell protein.
20. Aluminium sulphate.

ANNEXTURE II

Industries and commercial establishments visited by the Project Mission Team in Bahrain

1. Aluminium Bahrain (ALBA)
2. Bahrain Petroleum Company (BAPCO)
3. Bahrain Aluminium Rolling Mill Company (GARMCO)
4. Gulf Petrochemicals Industries Company (GPIC)
5. Arab Ship Repair Yard (ASRY)
6. Hempel Marine Paints
7. B R C Weldmesh (Gulf)
8. Bahrain Precast Concrete
9. Maskati Brothers
10. Cowi Consult

ANNEXTURE III

List of officials with whom discussions were held

Ministry of Finance and National Economy, Government of the State of Bahrain

1. Mr. Isa A. Borshaid
   Undersecretary of Finance and National Economy

2. Mr. Rashid Al Meer
   Assistant Undersecretary for Economic Affairs

3. Mr. Rasheed Al Maraj
   Director of Evaluation and Economic Research

4. Dr. John H. Rickard
   Economic Adviser

5. Mr. Zakaria Hejres
   Chief of Economic Planning

6. Mr. Abdul Aziz Al Kaabi
   Financial Analyst

7. Mr. Abdul Karime Al Motawa
   Economic Analyst

8. Ms. Maryanne Manikoth
   Secretary to the Economic Adviser

Ministry of Development and Industry, Government of the State of Bahrain

1. His Excellency, Yousif Ahmad Al Shirawi
   Minister of Development and Industry

2. Shaikh Isa Bin Abdullah Al Khalifa
   Undersecretary of Development and Industry

3. Mr. Khalid Ashoor
   Acting Director of Industries

4. Mr. Emood Khalifa Al Khalifa
   Senior Economist

5. Ms. Fatima Al Hassan
   Senior Economist

ANNEXTURE IV

List of UNDP officials with whom discussions were held

1. Mr. Robert Borthwick
   Acting Resident Representative, UNDP, Bahrain.

2. Mr. Saleh Osman
   Former Acting Resident Representative UNDP, Bahrain.

3. Mr. Zuheir Amin
   Deputy Resident Representative, UNDP, Bahrain.

P R O J E C T   P R O F I L E - for the production of SYNTHETIC DETERGENTS

Introduction

Synthetic detergents, on account of their superior washing properties, have been finding ever increasing use as household washing powders and their requirement has been going up throughout the world. Synthetic detergents are manufactured from petroleum hydrocarbon base stock as against soap powders which are manufactured from vegetable oil sources. Besides, their better washing properties, they also possess the advantage of better adaptation to different types of washing conditions (hard water, soft water etc.) on account of the possibility of change in their formulations, to suit different conditions.

Domestic Markets

According to available import statistics, the requirement of detergent powder in Bahrain during the last few years has been as follows :

Year	Imports (tons)	Value (B.D.m.)
1982	3,908	1,879
1983	4,528	2,150
1984	5,337	2,614
1985	6,036	2,741

At the present rate of expansion around 13%, the total domestic market for detergent powder is expected to grow as seen in alternative I. Alternative II shows the situation if the market growth slows down to 5% on account of any unforeseen economic changes.

	Market (tons)	
Year	Alternative I	Alternative II
1986	6,800	6,340
1987	7,680	6,600
1988	8,680	6,930
1989	9,800	7,280
1990	11,000	7,650

Export market and competitive activity

The export possibilities for detergent powder manufactured in Bahrain would seem to be rather limited, as the neighbouring states in the GCC region - Kuwait, Saudi Arabia, Oman and Qatar have detergent plants of their own to meet the requirements of their domestic markets. At present, the requirements of Bahrain are being supplied by the production in Saudi Arabia plus imports from the UK.

The production from the Saudi Arabian plant may in fact constitute the main source of competition for detergent powders produced in Bahrain, and the local production will have to compete successfully with imported products both in terms of price and quality, in order to be able to hold the market.

However, in setting up production in Bahrain, it is recommended to arrange a joint-venture with one of the international well known detergent manufacturers which is not already involved in production in Saudi Arabia. The Saudi Arabian market with an estimated detergent consumption of 150,000 tpa is just as open for Bahrain products as the Bahraini market is open for Saudi Arabia's. Only a very small percentage of the Saudi Arabian detergent market could consume an appreciable proportion of the production of the Bahrain plant and thereby improve its economies. (See Appendix IV).

Plant size

Based on the requirements of the domestic market in Bahrain, it is suggested that a 10 ton per shift plant be set up. This plant with a 2 shift production will produce about 6,600 tons of detergent, which will meet the present needs of the Bahrain market. Later, as the market demand goes up, a third shift can be added, thereby producing upto 10,000 tons/year of detergent, which would be adequate to take care of the Bahrain market upto 1989, after which additional production capacity could be planned.

Raw materials

The main raw materials required for the manufacture of powder detergents are Dodecyl Benzene/Alkyl Benzene, Sodium Tripoly phosphate, Sodium Sulphate, Sodium Silicate, Caustic Soda/Soda Ash. All these chemicals will have to be imported. The basic ingredient of detergent powders - Alkyl Benzene, would shortly become available from a plant being set up in Saudi Arabia, but the Sulphonation plant to convert Alkyl Benzene to the Sulphonic acid will have to be set up here along with the detergent plant. It would however be preferable to import Dodecyl Benzene Sulphonic acid as the starting raw material, as in this case, the suphonation plant will not be necessary and only the blending and spray drying plant will have to be set up to manufacture the detergent.

Technology

The technology for the manufacture of powder detergents, starting from the intermediate Alkyl Benzene, comprises of the following two stages :

1. Sulphonation

   Alkyl Benzene is treated with sulphur trioxide to obtain Alkyl Benzene Sulphonic acid, which is further reacted with caustic soda to get Sodium Alkyl Benzene Sulphonate, which is the main active ingredient in the formulation of detergent powder.

2. Blending and Spray drying

   Sodium Alkyl Benzene Sulphonate is blended with other chemicals such as Sodium Tripoly Phosphate, Sodium Sulphate, Sodium Silicate, Sodium Carbonate/Sodium Hydroxide, and optical whiteners and made into a slurry which with the help of high pressure pumps is sprayed at the top (inside) a drying tower counter current to a stream of hot air blown from below. The dry detergent powder is then transfered from the bottom of the tower by a conveyor belt to the filling machine, where it is filled into cartons and sent to the market. A detailed process flow diagram is attached at Appendix V of this profile.

Plant Location

A suitable location for the detergent plant would be in the Mina Sulman area of Manama (Bahrain) where other similar industrial units (soaps, paints etc.) are located and dock facilities are also available for import of raw materials.

Product Formulation

A typical formulation for detergent powders is attached at Appendix I of this profile.

Investment

In view of the comparatively large investment involved in the sulphonation plant, which would be of the order of US$ 15 million, it is suggested that initially only the blending and spray drying plant should be installed in Bahrain with a total investment of US$ 4 million (including working capital) and the sulphonation plant should be set up at a later stage, after the production and marketing of detergents has been well organized and well established.

Total cost of Blending & Spraying plant	:	US$ 3 million
+ Working capital	:	US$ 1 million
Total investment	:	US$ 4 million

Sales forecast

It is estimated that the total production capacity of a 2-shift operation would be sold. Last year's import price of detergent was US$ 1.30 per kg. which has been taken as the ex-factory price:

6,600 tons x US$ 1,300 = US$ 8,580,000

Cost of production

Output of detergent powder : 1 ton

Inputs		Tons
Dodecyl Benzene Sulphonic Acid	:	0.240
Sodium Tripoly phosphate	:	0.300
Sodium Sulphate	:	0.180
Sodium Silicate	:	0.220
Caustic Soda	:	0.040
Other Chemicals	:	0.020
		1.000

Total raw materials (average price of chemicals at US$ 300/ton)	=	US$ 300
Packaging	=	US$ 100

Utilities

Electric power	:	50 Kwh	x	0.04	=	2.90
Water	:	10 tons	x	0.09	=	9.00
Fuel	:	8 litres	x	0.065	=	0.50
Steam	:	0.2 tons	x	1.00	=	0.20
Total Utilities	:					US$ 12

Labour

Skilled labour man-hours/tons	: 2.4 x US$ 7.0 = US$ 17.00	
Unskilled labour	: 8 x US$ 2.5 = US$ 20.00	
Clerical	: 0.8 x US$ 5.0 = US$ 4.00	
Supervision & Overheads	: 1.2 x US$15.0 = US$ 18.00	
Total wages	:	US$ 59
Maintenance 2.5%		US$ 100
Total variable cost of production/ton	:	US$ 571

Profit and Loss Account

Sales revenue	:	8,580,000
- Cost of production 6,600 x 571	:	3,768,600
	:	4,811,400
- Marketing costs	:	811,400
	:	4,000,000
- Fixed salaries & Administration	:	300,000
	:	3,700,000
- Depreciation over 15 years linear	:	200,000
	:	3,500,000
- 10% interest on total investment	:	400,000
Profit net	:	3,100,000
Net return on investment	:	77.5%

Conclusion and Recommendations

In order to gain the local market it is of course necessary to have a first class quality product. But this often is not enough. It is also necessary to have the required marketing back up for the sale of detergents.

It is therefore recommended that a collaboration agreement with one of the established manufacturers of detergents be entered into in order to get access to the production and marketing know-how in this field, and also, if possible, to be able to use their product brand name.

The project is highly profitable when production and sales/marketing go hand in hand. It is recommended that a detailed feasibility study on this project be undertaken after which the final investment decision may be taken.

APPENDIX I

Typical Detergent Formulation :

Production : 1 metric ton detergent powder.

Raw material inputs		Tons
Dodecyl Benzene Sulphonic Acid	:	0.240
Sodium Tripoly Phosphate	:	0.300
Sodium Sulphate	:	0.180
Sodium Silicate	:	0.220
Caustic Soda/Soda Ash	:	0.040
Optical whitening agents (optional)	:	small amount

APPENDIX II

Equipment

The following equipment will be required for the synthetic detergents plant :

Sulphonation Plant

- Raw material and product storage tanks.
- Sulphonation Reactor, heat exchangers, demisters.
- Neutralization vessels.
- Equipment for production of sulphur trioxide.

Blending and Spray drying plant

- Mixing vessels.
- Booster vessels.
- High pressure pumps.
- Air heating equipment.
- Air blowers.
- Spray drying tower.
- Cyclone separator.
- Sieves.
- Packing Machines.

Plant Area

Land area required for a plant of this size will be approximately 5000 meters.

APPENDIX III

Manpower requirements for the plant

The manpower requirements of the plant are expected to be as follows:

-	Manager/Chemist	:	1
-	Sales force	:	2
-	Engineers	:	2
-	Skilled workers	:	6
-	Unskilled workers	:	20
-	Clerical workers	:	2
	Total	:	33

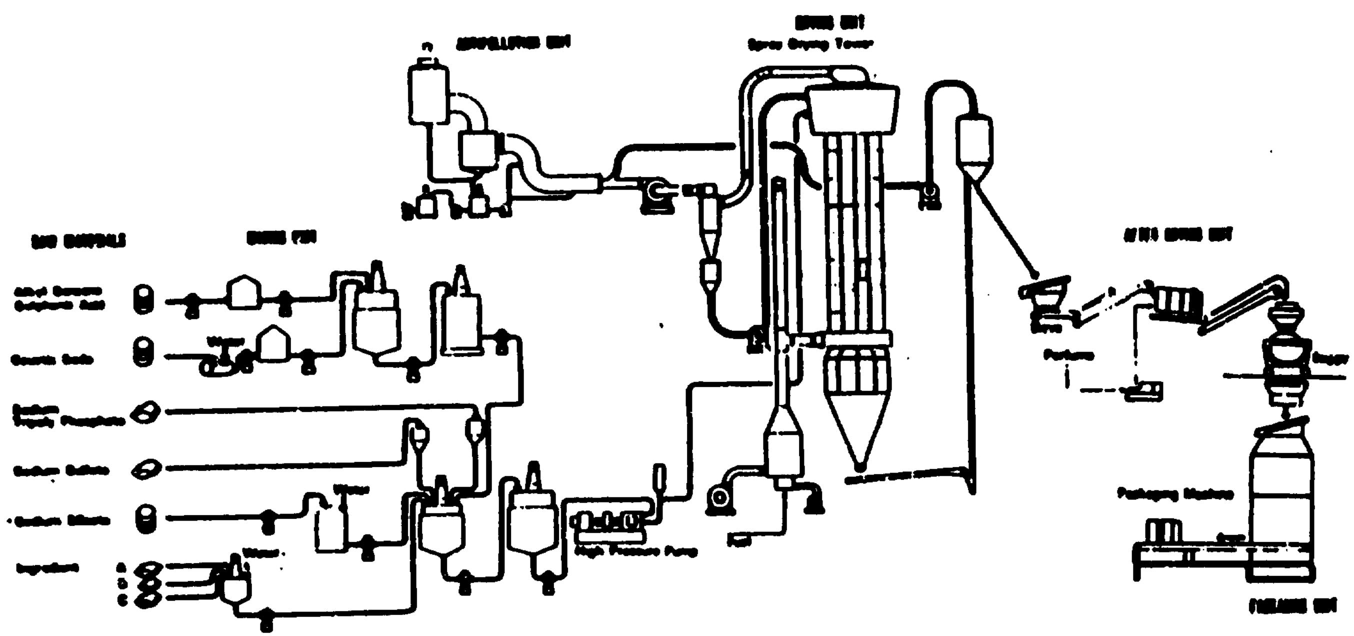
APPENDIX IV

Note :

- Value is stated in U.S. Dollars (f.o.b.).
- Covers only OECD exports to the GCC countries.
- Intertrade among the GCC countries is not stated.

APPENDIX V

Process Flow Diagram for Detergent Plant



APPENDIX VI

OECDPA24

O E C D T R A D E D A T A

SUMMARY REPORT ON OECD EXPORTS TO GCC

PAGE : 1

DATE : 27/08/86

PRODUCT CODE (5 DIGITS) : 5541 DETERGENTS

TOTAL FOR	1980 QNTY	1980 UNIT	1980 VALUE	1981 QNTY	1981 UNIT	1981 VALUE	1982 QNTY	1982 UNIT	1982 VALUE	1983 QNTY	1983 UNIT	1983 VALUE	1984 QNTY	1984 UNIT	1984 VALUE
SAUDI ARABIA	9,293	T	15,900	9,029	T	17,237	10,738	T	17,123	12,807	T	19,021	11,720	T	17,066
KUWAIT	3,356	T	7,149	5,620	T	10,304	2,709	T	4,027	3,030	T	5,320	4,008	T	5,780
BAHRAIN	663	T	1,372	1,051	T	2,527	725	T	1,464	510	T	967	591	T	1,201
UNITED ARAB EMIRATS	3,126	T	7,964	3,957	T	8,694	4,594	T	9,199	3,400	T	5,920	3,560	T	5,910
QATAR	352	T	936	937	T	1,974	748	T	1,536	677	T	1,236	740	T	1,194
OMAN	283	T	872	464	T	1,273	717	T	1,510	901	T	1,560	959	T	1,062
GCC TOTAL IMPORTS :	17,073		34,393	21,978		42,009	20,311		35,659	22,221		34,032	21,586		33,2[illegible]

NOTE : *3='000' OF UNITS, *3=DOZ/THOUSAND OF UNITS : UNITS: T=TON, [illegible],C=C.METER, K='000'KWH, L='000' LITERS, M='000' METERS P='000' PAIRS, S='000' SQ.METER, U/Z=UNIT NOT AVAILABLE. FOR VALUE IN '000' OF U S $, * : UNIT MISMATCH TOTAL NOT POSSIBLE

P R O J E C T   P R O F I L E - for the production of REFINED EDIBLE OIL

Introduction

Edible oil products, e.g. cooking oil and margarine, are items of daily human consumption, and constitute an essential requirement of normal households. Cooking oils, in particular, form a basic human need from the point of health and nutrition.

Market

According to import statistics the consumption of Edible oils for cooking purposes, and margarine, in Bahrain has been as follows :

	Year	Tons		Value B.D. (millions)
Corn oil imports (for cooking purposes)				
	1982	3,637	:	1.69
	1983	4,355	:	1.86
	1984	4,272	:	1.91
	1985	4,788	:	2.17
Margarine				
	1982	1,651	:	0.58
	1983	1,198	:	0.49
	1984	1,719	:	0.68
	1985	1,686	:	0.65

An analysis of the figures given above indicates an average annual increase in the market demand for cooking oils at 8%, whereas the demand for margarine over this period has been more or less stable.

Based on the 8% annual average increase of the cooking oil market, the future cooking oil demand projections are expected to be as follows:

Year	Cooking oils (tons)	Margarine (tons)	Total (tons) Edible oils
1986	5,174	1,700	6,874
1987	5,584	1,700	7,284
1988	6,030	1,700	7,730
1989	6,512	1,700	8,212
1990	7,032	1,700	8,732
1991	7,594	1,700	9,234
1992	8,200	1,700	9,900

Assuming that the margarine market will stay at the same figure of about 1,700 tons/year, the total market for edible fats in Bahrain would be as indicated under total edible fats above, and by 1990 would increase to 8,700 tons and by 1992 to about 10,000 tons/year. Besides the domestic market, there may be some marginal export possibilities to meet the requirements of the neighbouring countries in the G.C.C. region. Saudi Arabia, Oman, and U.A.E., already have edible oil plants of their own but they do not fully meet the requirements of their domestic markets. As such, exports to these countries from Bahrain could be possible.

Plant capacity

Based on the domestic market for edible oils as identified above, it is suggested that an edible oil refining plant with a capacity to process 8 tons of raw oil per shift, or 7,200 tons of raw oil per year, may be installed to meet the present requirements of the Bahrain market. Initially, a 2-shift operation of the plant will give production of about 5000 tons/year which will enable the locally manufactured product to meet a substantial part of the present market demand, and as the demand builds up, a third shift can be started to further increase the production to 7,200 tons/year. At the design stage of the plant, provision should be kept for further increase in capacity in the future.

As at the moment, the main demand in the market is for cooking oils, it would be advisable initially to organize production of cooking oils only. After the production of cooking oils has been established and the marketing well organized, then additional product lines, such as margarine can be added (additional investment is approximately US$ 750,000). Similarly, certain by-product lines, such as shampoo and soap, which have possibilities based on utilization of free fatty acid soaps produced during the refining of oils, should be considered at a subsequent stage (additional investment approximately US$ 350,000).

Plant location

The most suitable location for edible oil refining plant in Bahrain would be in the Mina Sulman industrial area of Manama, where other similar industries, such as soap, paints etc. are located. The Port facilities in this area, will be quite adequate for receiving supplies of imported raw materials for the plant and the finished product (refined oil) can also be transported to the market quite conveniently.

Raw materials

For the manufacture of refined cooking oil, the main raw materials required would be : raw edible oil (palm oil/ground nut oil/corn oil or cotton seed oil), phosphoric acid and bleaching earth. In addition, some filtration aid materials and certain other chemicals in minor quantities may be required. As none of the materials are locally available, all raw materials and processing chemicals will have to be imported.

Technology

The technology for the production of refined edible oils consists of a number of processing steps aimed at removal of sludge, free fatty acids, colouring matter and odour-giving compounds from the raw oil, in order to make it suitable for human consumption.

First, the raw oil is treated with phosphoric acid to separate the sludge and sediment from it. The oil is then washed and filtered. Next the oil is heated and bleaching earth added to it for removal of its colour. The oil is then cooled and filtered. The filtered oil is de-aerated and heated again and pumped to the distillation/deodorisation unit where its temperature is raised to 250-300°C to distill the free fatty acids which are condensed and collected in a separate tank. Having been freed of free fatty acids, the oil is deodorised, cooled, finally filtered and sent to refined oil storage tanks. From the tanks the oil is sent to the packing machines, where it is filled in plastic P.V.C. bottles or metal containers, and sent to the finished product warehouse.

During the refining process, oil samples are taken and tested at the different stages of processing, and ultimately at the final stage, to ensure proper quality standards for the finished product.

Investment

	U.S. $
Total cost of 8 tons/shift (7,200 tpa) Edible oil refining plant (C.I.F.) including packaging unit	6,500,000
Installation cost	1,000,000
	7,500,000
Working capital	1,500,000
Total investment	9,000,000

Sales Budget

It is estimated that local sales and export sales for the first year will be equivalent to the production of a 2 shift operation (4,800 tons) and in the second year and onwards, the full production capacity of 7,200 tons will be sold.

	Year 1	Year 2	Year 3
Sales in tons	4,800	7,200	7,200
*Ex-factory sales price (US$/tons)	1,300	1,300	1,300
Total sales revenue (US$)	6,240,000	9,360,000	9,360,000

* corresponds to the average import C.I.F. price in 1985 of corn oil.

Cost of production

Raw materials

	Tons x US$/Ton		US$
Crude edible oil	1.10 x 200 =	220	
Phosphoric acid	0.02 x 400 =	8	
Bleaching earth	0.02 x 100 =	2	
Packing materials		50	
	Total cost of raw materials	:	280.00

Utilities

	Units x US$		
Electricity	39 kwh x 0.04 = 1.56		
Water	0.800 tons x 0.90 = 0.72		
Fuel	0.005 tons x 70.00 = 0.35		
Dry steam	0.235 tons x 1.00 = 0.23		
	Total cost of utilities	:	3.00

		US $
Labour		
	Manhours/ton x US$	
Skilled	4.0 x 7.0 = 28.00	
Unskilled	4.0 x 2.5 = 10.00	
Supervision & overheads	3.0 x 15.0 = 45.00	
	Total labour costs :	83.00
Maintenance	:	40.00
Variable cost of production/ton	:	406.00

The labour costs are based upon the assumption that Bahraini labour will be employed.

Profit and Loss Budget (US$ '000)

	Year 1	Year 2	Year 3
Sales revenue	6,240	9,360	9,360
- variable costs	1,949	2,923	2,923
	4,291	6,437	6,437
- fixed salaries, administration and marketing	250	250	250
	4,041	6,187	6,187
- depreciation 5% linear	375	375	375
Profit before interest	3,666	5,812	5,812
- 10% interest on total investment	900	850	800
	2,766	4,962	5,012
Return on investment after depreciation and interest	30.7%	55.1%	55.7%

Note: The results shown above will be obtained during the first, second and third production year after installation has taken place. The figures are not discounted to present value.

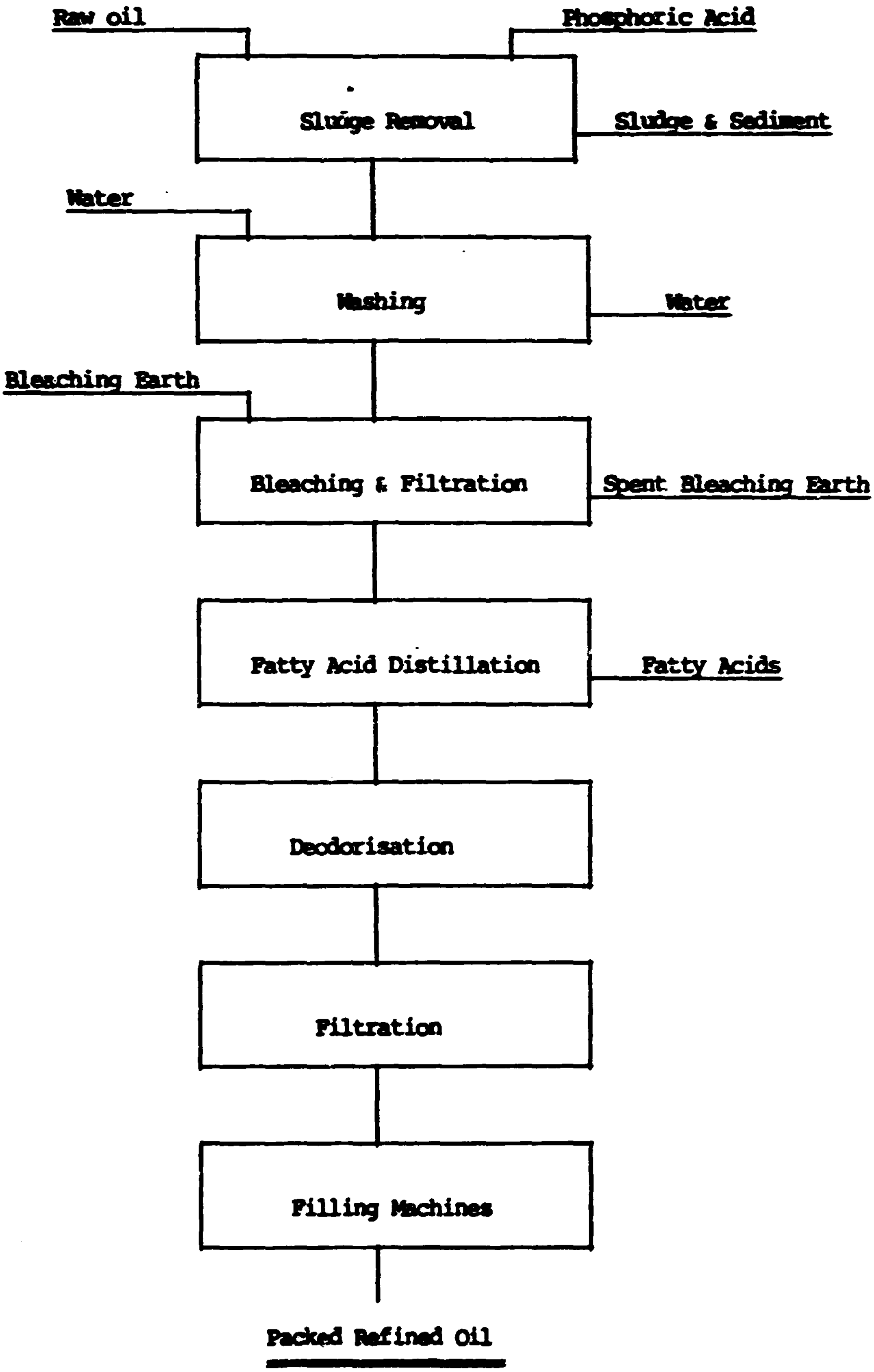
Conclusions and Recommendations

This project is technically feasible and economically viable. The return on investment is quite attractive and the safety margin is high. This industry would have a stable and progressively increasing market, as it is in the basic consumer product area. With the addition of margarine and shampoos (co-products), the profitability of the venture will further improve. This plant will generate employment for about 30 to 40 persons, including factory and marketing personnel.

It is therefore recommended that a detailed feasibility study on this project should be prepared, and based on the recommendations of the feasibility study the investment decision should be taken.

APPENDIX I

FLOW SHEET SHOWING REFINED EDIBLE OIL MANUFACTURE



P R O J E C T P R O F I L E - on the manufacture of GALVANISED IRON PIPES

Introduction

Galvanised iron pipes of sizes ½ inch to 4 inches diameter, are generally used quite extensively in buildings for the supply of drinking water and also water for other domestic purposes. They are also used in industrial and office establishments for a similar purpose. As such, they constitute an appreciable part of the overall demand for pipes in every country.

Market

The total imports of iron and steel pipes in Bahrain over the period 1982 - 1985 were as follows :

Year	Imports of steel pipes (tons)		Value B.D.(million)
1982	22,002	:	7.8
1983	31,282	:	10.8
1984	22,702	:	16.8
1985	25,856	:	8.0

As the import figures given above relate to all different sizes and types of pipes and the variation of tonnages imported seems also to include special requirements during particular years (1983), it is therefore not possible to establish a definite trend in the demand pattern. However, considering the level of building activity in Bahrain over these years, it is perhaps safe to assume, that out of an average yearly demand of 22,000 tons, about 50% (11,000 tons) would easily be for galvanised pipes (sizes ½ inch to 4 inches) mainly used for water supply requirements of both residential and commercial buildings.

Plant capacity

In view of the market for galvanised pipes estimated above, it is suggested that initially a pipe manufacturing plant, with a production capacity of 10,000 tons/year be set up in Bahrain to manufacture galvanised pipe of sizes ½ inch to 4 inches in diameter. As the locally manufactured product gradually establishes itself in the market and the market demand increases, the production of the plant can be increased. A somewhat cautious approach in setting up initial plant capacity is considered advisable in order to avoid subsequent problems due to low plant load factors and uneconomical production.

Plant location

It is suggested that this plant be set up either in the Mina Sulman or Ma'ameer area of Bahrain where dock facilities for importing the raw materials i.e. steel strips would be available as also distribution of the finished products (pipes) to the market could be conveniently done.

Raw materials

The raw materials required for steel pipe manufacture are steel strips of suitable width for different pipe sizes and zinc for galvanising the pipe. Both these materials will have to be imported. The smaller quantities of sulphuric acid required for pickling would be available from local sources.

Manufacturing process

The manufacturing process for galvanised iron pipes is fairly simple. The steel strip is first bent on a drawing bench and then rolled on a rolling mill. The rolled pipe is then seam welded, pickled and hot dip galvanised. The galvanised pipes are finally threaded at the ends and thereafter sent to the finished products warehouse.

Investment		**U.S. $ (million)**
Capital cost of a 10,000 tpa galvanised pipe manufacturing plant	=	4.0
+ Working capital	=	1.0
Total investment	=	5.0

Cost of Production

Basis : 1 Ton of Galvanised pipe

Materials	**Tons x U.S.$**						**U.S.$**
Skelp	0.95	x 430	=	408.50			
Zinc	0.05	x 1000	=	50.00			
Electricity	50 kwh	x 0.04	=	2.00			
Water	20 M^3	x 0.10	=	2.00			
Fuel	0.5 MMBTUS		=	0.12			
Acid	(for pickling)		=	3.00			
	Total materials		=	465.62		=	465.00

Labour	**Manhours/Ton x U.S.$**						
Skilled labour	8	x 5.00	=	40			
Unskilled labour	10	x 1.50	=	15			
Supervision	2	x 8.00	=	16			
				Total labour		=	71.00

(Labour rates taken above are based on a mixed labour force [Bahraini and Expatriate] being employed).

Maintenance	=	16.00
Total Variable Cost U.S.$/Ton	=	552.00

Profit and Loss Budget		**U.S.$**
Annual sales return 10,000 x 830 (at US$ 830 per ton)	=	8,300,000
Variable cost 10,000 tons x US$ 552	=	5,520,000
		2,780,000
Sales and Administration	=	100,000
		2,680,000
Depreciation 5%	=	200,000
		2,480,000
Interest at 10% on total investment	=	500,000
		1,980,000

Return on investment (after interest) = $\frac{1,980,000}{5,000,000}$ = 39.6%

Conclusion and Recommendations

This project is technically feasible and economically viable. The rate of return on investment (after interest) of approximately 40% is considered quite attractive.

As this is a labour intensive industry, this project is likely to generate employment for about 90 people of all different categories. Besides it will also save foreign exchange to the extent of the value of imports of steel pipe currently being incurred. In fact, it may even prove to be an exchange earner on account of the export possibilities of steel pipes to some of the neighbouring GCC countries.

It is therefore recommended that a detailed feasibility study be prepared on this industry and based on the findings and recommendations of the feasibility study, an investment decision be taken.

APPENDIX I

Machinery and Equipment

Typical machinery and equipment required in a steel pipe manufacturing plant is listed below :

1. Draw bench 30 feet long with all accessories.
2. Rolling mill with motor and accessories.
3. Oxy-acetylene gas welding equipment.
4. Pipe threading lathe.
5. Acid pickling and washing tanks.
6. Hot dip galvanising equipment.
7. Rotary shearing machine.
8. Pipe straightening machine.
9. Arc welding set.
10. Pipe cutter pedestal grinder.
11. Hydraulic testing equipment.
12. Weighing scale.

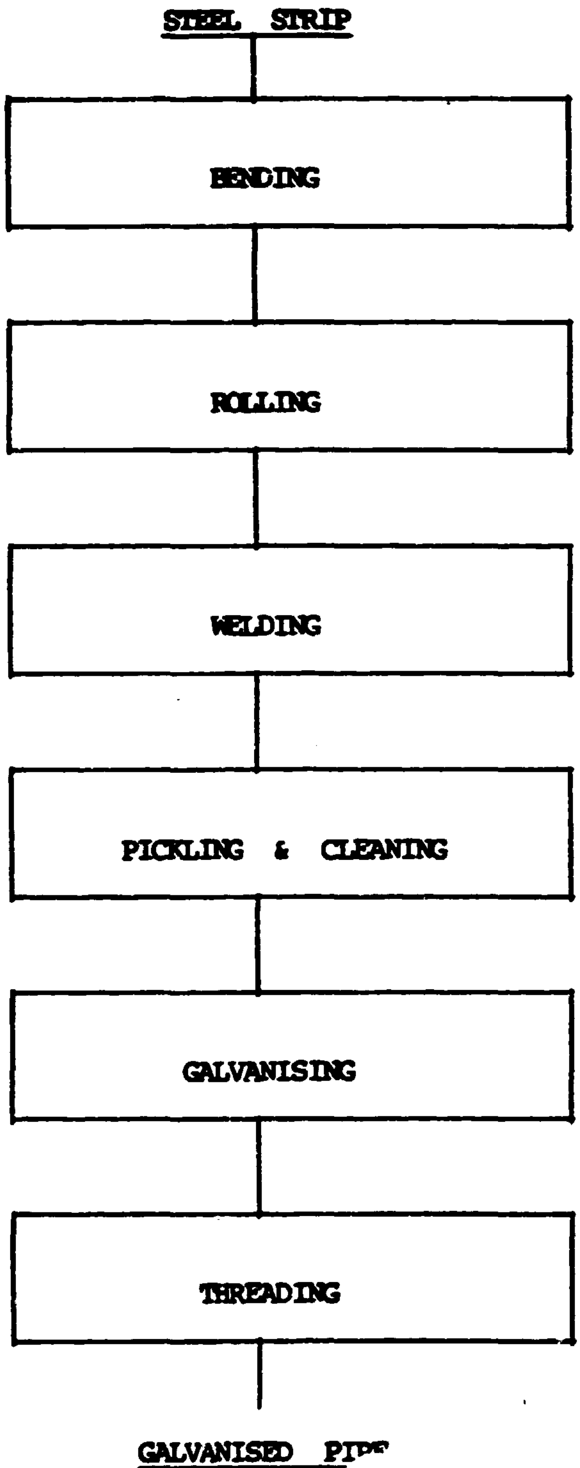
APPENDIX II

Staff and Labour Requirements

1.	Manager	1
2.	Accountant	1
3.	Supervisors	2
4.	Skilled workers	32
5.	Unskilled workers	38
6.	Watchman	1
7.	Driver	1
8.	Sales personnel	5
9.	Clerical/Administration personnel	5

APPENDIX III

FLOW SHEET SHOWING MANUFACTURING OPERATIONS IN A STEEL PIPE MANUFACTURING PLANT



PROJECT PROFILE - on IRON AND STEEL RE-ROLLING MILL

Introduction

Iron and steel bars, angles and other sections, produced by re-rolling of iron billets, are extensively used in the building industry as re-inforcements in concrete work, and also in various other industries for structural or fabrication work.

Market

At present there is a substantial market in Bahrain for steel re-rolled products as indicated by the following import figures for steel bars and angle irons :

Steel Bars

Year	Imports (tons)	Value (B.D. millions)
1982	44,089	5.11
1983	57,888	6.37
1984	60,406	6.86
1985	52,007	5.27

Angle Irons

Year	Imports (tons)	Value (B.D. millions)
1982	5,583	1.27
1983	4,599	0.80
1984	4,278	0.73
1985	4,122	0.64

The requirement of these products - particularly the iron bars - is closely linked with the building and civil works activity in Bahrain, in which it has its major application. It is therefore quite understandable that with the decline of the building activity in

Bahrain in 1985, the consumption of iron bars has decreased (by about 13%). As the future of the building industry in Bahrain is, at the moment, somewhat uncertain and difficult to predict, it is therefore difficult under the circumstances to make any definite forecast regarding the future consumption of iron and steel re-rolled products. Therefore any plans for the production of these products should be based upon the minimum economic size production facility which would meet a minimum steady demand of the market.

Plant capacity

In view of the present situation about the market for iron bars and angles and other re-rolled products in Bahrain, it is felt that initially a re-rolling plant with a capacity of 20,000 tons/year of steel bars and angles should be set up, with provision for further expansion in the future. The capacity of the factory can be increased as the requirements go up, by installation of additional rolling equipment.

Plant location

It is suggested that this plant be located in either the Mina Sulman area of Manama (Bahrain) or alternatively in the Maa'meer area. Port facilities will be necessary for importing iron billets for re-rolling , and re-rolled products will have to be transported to the market. These facilities are likely to be available in the industrial areas suggested above.

Raw material

The main raw material used for rolled products is steel billets (50-ton weight) which will have to be imported. Besides the billets the other consumables are fuel oil or gas for heating the billets in the furnace and other spare parts for the re-rolling equipment. The fuel or gas would, of course, be locally available, whereas spare rolls and machinery spares will need to be imported.

Technology

The technology employed for the production of rolled steel products is relatively simple. The billets are heated in a furnace to 1200° - 1250° C and when they are white hot, they are put through the rolling mill to be rolled to the desired size and dimension. After rolling the products are transferred to the stockyard, where after cooling they are ready for despatch to the market.

The products are tested physically and chemically through random sampling to check their conformity to quality standards as part of quality control procedures.

Specifications

Generally the following standard specifications are followed for various rolled steel products :

B.SS-EN-1, 8, 9, 16, 18, 19, 24, 31, 36, 44, 45A.

Investment

		US$ (million)
Installed cost of 20,000 tpa steel re-rolling mill	:	4.0
+ Working capital		1.0
		5.0

Sales

	U.S. $
Annual sales return on angles (assuming 25% of product mix at US$ 450/ton) : 5,500 x 450 =	2,250,000
Annual sales return on bars (assuming 75% of product mix at US$ 260/ton) : 15,000 x 260 =	3,900,000
Annual sales revenue from scrap sale : 2,000 x 40 =	80,000
Total =	6,230,000

Cost of Production

Basis : 1 Ton of Rolled Products

Inputs:

Raw material	Consumption/ton x US$			U.S.$
Steel billets	: 1.1 tons x 145	= 159.00		
Fuel oil/gas and other utilities	: 2.5m.btus	= 1.00		
			Total :	160.00

Labour	Manhours x US$			
Skilled labour	: 5 x 5.00	= 25.00		
Unskilled labour	: 6 x 1.50	= 9.00		
Supervision	: 1 x 8.00	= 8.00		
			Total :	42.00

Note : labour rates taken above are based upon the assumption that a mixed labour force (Bahraini and expatriates) will be employed in the industry

Maintenance	: 4.00
Variable Production Cost	: 206.00

Profit and Loss Budget	U.S. $
Sales	6,230,000
- Variable costs	4,120,000
	2,110,000
- Sales and admininstration expenses	100,000
	2,010,000
- Depreciation (5% linear)	200,000
	1,810,000
- 10% interest on total investment	500,000
Profit	1,310,000
Return on investment (after 10% interest) :	26.2%

Conclusions and Recommendations

This project is technically feasible and economically viable. The rate of return on investment after interest is 26.2% which is considered quite attractive. The present project plan is based upon meeting only about one third of the present (1985) market requirements, on account of the somewhat uncertain future of the building activity at the moment. However, as the building constructions activity picks up and stabilizes in the future, there would be greater demand for the steel rolled products and consequently for increase in production capacity of such a plant. This industry being labour intensive, will generate employment for about 120 people.

It is therefore recommended that a detailed feasibility study be prepared on this industry and thereafter the investment decision be taken.

APPENDIX I

Typical Machinery and Equipment required in a Steel Re-rolling Mill

1. Complete re-rolling mill 10" diameter rolls; flywheel 10 tons - complete with gearbox, couplings, cotter pins and bushes, spindles, bed plates and accessories; channels for passing the finished products.

2. Preheating oil or gas fired furnace with burners, chimney 14" x 35", hearth area 5M. x 2.5M. capacity 20 tons/shift. In case of oil fired furnace, an oil tank pump motor and strainer will be required.

3. 500 KVA transformer; complete with two OCBS, PVC cable and switch board.

4. Billet shearing machine with 20 HP motor and starter.

6. Other workshop machinery : lathe, drilling machine, shaping machine, grinding machine etc. for a maintenance workshop.

Note : The actual number of rolling mills (item 1) and preheating furnaces (item 2) to be employed would depend upon the production capacity of the re-rolling factory.

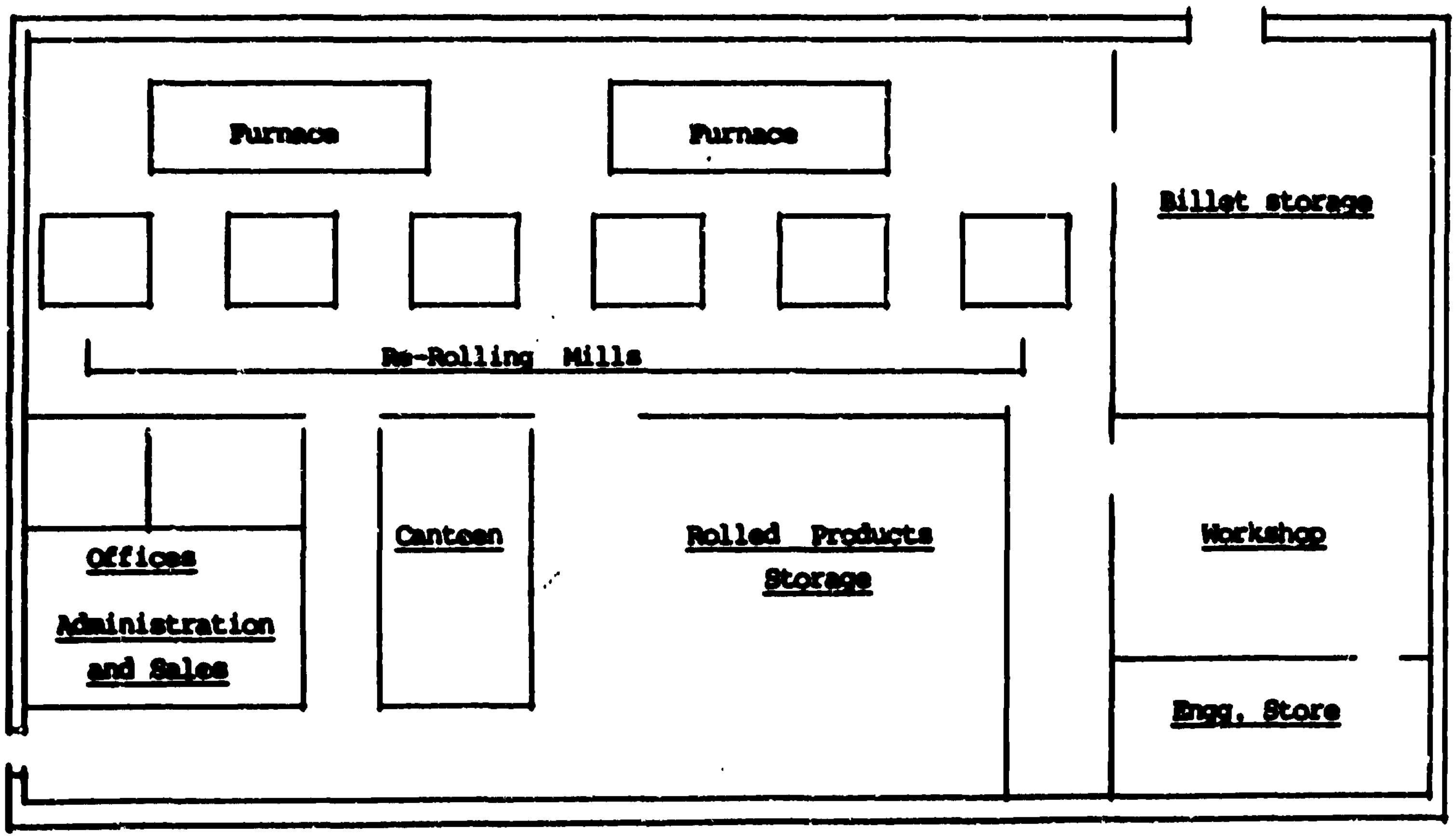
APPENDIX II

Manpower Requirements of a Re-rolling Mill

Works Manager	:	1
Sales Manager	:	1
Mill Foreman	:	1
Maintenance Foreman	:	1
Skilled Operators	:	16 per shift
Unskilled Labour	:	15 per shift
Electrician	:	1
Maintenance Fitters	:	3
Accountant	:	1
Storekeeper	:	1

APPENDIX III

Layout Plan for a Steel Re-rolling Mill



P R O J E C T   P R O F I L E - for the production of BOTTLED MINERAL WATER

Introduction

Drinking water is the single most important neccessity for human consumption and its quality is essential for the w l being of a population.

Bahrain has so far no manufacturing facility for bottled mineral water and its supply is entirely dependent on importation, even though Bahrain in the Gulf region is well known for its sweet water wells.

The Market

The import statistics for water into Bahrain for the last four years is as follows :

	Tons	B.D.	B.D./Litre
1982	3,678	497,855	0.135
1983	5,650	455,074	0.081
1984	6,028	530,897	0.088
1985	5,552	486,272	0.088

To give an idea of how all the neighbouring states have their own bottled water, the imports of water for 1985 came from :

	Tons	B.D.	B.D./Litre
U.A.E.	1,885	143,503	0.076
Jordan	106	5,634	0.053
Kuwait	49	2,949	0.060
Lebanon	298	24,021	0.081
Oman	233	16,057	0.069
Qatar	17	1,111	0.065

	Tons	B.D.	B.D./Litre
Saudi Arabia	530	38,177	0.072
Belgium	466	43,781	0.094
France	1,377	151,568	0.110
West Germany	28	4,009	0.143
Greece	32	2,731	0.085
Italy	84	6,352	0.076
Portugal	31	2,835	0.091
Switzerland	134	9,241	0.069
U.K.	281	34,303	0.122
	5,552	486,272	0.088

The only company in Bahrain which is providing mineral water is Agua Cool. This company delivers in big returnable 19 litres plastic bottles at a price of BD 1/- each, but with a deposit up front of BD 20/-.

A popular way of distributing water is the lorries driving around with water tanks, but this water tastes salty, lacks minerals and has to be supplemented with mineral water.

In the above mentioned two tables, the import price C.I.F. has been calculated per litre in order to see the comparison with an ex-factory price and also to see from where the competition is strongest.

The retail prices in Bahrain are :

		B.D./Litre
1½ litre bottles :	B.D. 0.200 - 0.250	0.133 - 0.166
½ litre bottles :	B.D. 0.100 - 0.150	0.200 - 0.300

It seems as if the mark-up from the imported value is approximately 100%.

The import of water into Saudi Arabia in 1985 was 19,695 tons at a total price of B.D. 1.44 million, which corresponds to an average import price per litre of B.D. 0.073.

Plant capacity

In order to meet the local requirement, a plant capacity of 5000 tons/year is suggested.

Investment

A mineral water plant will usually consist of :

- a basic filtration and bacteriological unit and
- a production unit for plastic bottles and
- a filling plant.

The plastic bottles are supposed to be bought from another company which also could supply the need for example, for edible oil production, suggested in a separate profile.

The total cost of filtration and bacteriological treatment plant with filling unit C&F Bahrain is	US$	650,000
In this price is included know-how, installation costs supervision, and laboratory equipment.		
+ building requirements	US$	200,000
+ working capital	US$	150,000
Total investment :	US$	1,000,000

Equivalent to B.D. 380,000

Sales Budget

It is estimated that the total production capacity of 5000 tons is sold in the following quantities :

2.0 mill. 1½ litre bottles at B.D. 0.110	=	B.D. 220,000
2.0 mill. 1 litre bottles at B.D. 0.080	=	B.D. 160,000
Total sales	=	B.D. 380,000

The prices are kept so low that they can compete with low costs imports from the neighbouring countries and also with the existing distribution of water in Bahrain in which case the market potential is much higher.

There would also be the possibility of selling ½ litre bottles where the contribution margin per litre of mineral water is higher.

Profit and Loss Budget		B.D.
Sales		380,000
- Variable costs :		
Spare parts	8.000	
Raw water	3.000	
Bottles and packing material	110.000	
Minerals	3.000	
Power	15.000	
Wages	50.000	
		189,000
		191,000
- Fixed costs		50,000
		141,000
- Depreciation (10% linear)		38,000
		103,000
- Interest (10% of total investment)		38,000
Profit		65,000
Return on investment after deduction of 10% interest :		17.1%

Conclusion

This project is based on buying the plastic bottles from another manufacturer, which reduces the investment and makes the project feasible even with the relatively low capacity and sales of 5.0 million litres.

The project is directly aimed at substituting part of the importation and with a minor potential for export earnings.

It is recommended to prepare a detailed feasibility study including a careful analysis of the water quality before any investment decision is taken.

P R O J E C T   P R O F I L E - for the production of FORGE CAST ALUMINIUM FRYING PANS

Introduction

The experience over the last years in the industrialised countries is that households, in general, are looking at better quality kitchen equipment. All consumer tests have shown that the forge cast aluminium frying pans are superior in quality to those drawn out of aluminium sheets due to better heat distribution, greater efficiency and longer life time.

The forge cast aluminium frying pan is a high price product which gradually is getting a bigger share (although still very small) of the market in Europe and the USA.

Market possibilities

Forge cast aluminium frying pans are today produced for the European and North American markets by three Scandinavian companies. One of these companies is today having capacity problems and wants to expand their production by either participating in production joint ventures or by entering sales agreements with producing companies else where in the world. This is an interesting possibility worth considering in the establishment of a new plant in Bahrain, as the marketing aspect is always a very important factor for a newly established factory.

The first years of production should be based on exports to European and North American markets but gradually it should be possible to introduce the products into the Middle Eastern households and possibly extend the production lines also to include forge cast aluminium cooking pots, which are extensively used in Arabic kitchens.

Looking at the market in Europe and North America, there are approximately 600 million people divided into approximately 150 million households. Each household buys on average a new frying pan at least every 3 years, which gives a total yearly market of 50 million frying pans.

Investment

- Land, building maximum 1800M² including offices, and office equipment	:	US$	700,000
- Machines and equipment	:	US$	1,000,000
- Feasibility study, running-in costs, training outside Bahrain, stock of spare parts	:	US$	100,000
- Working capital + cash reserve	:	US$	300,000
Total investment	:	US$	2,100,000

Equipment specification

Below are listed the main equipment specifications for optimal use of installed capacity.

- 4 melting pots

  The raw material of aluminium ingots is melted at a temperature of approximately 600°C. This investment (approximately US$ 50,000) is probably not necessary, as ALBA can provide the liquid aluminium, which is one of the attractions using Bahrain as the production place.

- 4 hydraulic presses (200 t)

  The liquid aluminium is poured into moulds in the press. The frying pan is produced under pressure from above and below and the cooling takes place while the pan is in the mould.

- 2 machines

  To trim the pans when they have left the mould.

- **1 polishing machine**

  The frying pans which are not going to be covered with a special surface will be sand blasted and polished to make them shiny.

- **2 grinding machines**

  All impurities in the surface will be cleaned and imperfect pans will be melted down again.

- **1 machine**

  For covering with stainless steel.

- **1 machine**

  For coating with two layers of Teflon. The transportline includes drying and cooling aggregates.

- **1 turning machine**

  For making sure the bottom of the pan is completely level.

Sales Budget

It is estimated that the total capacity will be sold through a sales agreement with an international company. The retail prices of a good quality frying pan is between US$ 20/- to 30/- which is the market segment this product is aiming at. With a retail price of e.g. US$ 25/- the ex-factory price will be approximately US$ 10/-. To get a conservative estimate the following calculation is based on an ex-factory price of US$ 8/- per frying pan. (Table on next page).

	Year 1	Year 2	Year 3	Year 4
Pans per year	246,400	308,000	462,000	618,000
Average price ex-factory	US$ 8/-	US$ 8/-	US$ 8/-	US$ 8/-
Total sales revenue US$	1,971,000	2,464,000	3,696,000	4,944,000

<u>Production Programme</u>

Years	Capacity Units	Efficiency	Nett Production	Consumption of Aluminium tons
<u>Year 1</u> 1 shift with 4 presses of 275 unit/day for 280 days	308,000	80%	246,400	296
<u>Year 2</u> 1 shift with 4 presses of 275 units/day for 280 days	308,000	100%	308,000	370
<u>Year 3</u> 1 full shift & 2nd shift with 2 presses	462,000	100%	462,000	555
<u>Year 4</u> 2 full shifts	618,000	100%	618,000	742

Production Costs

	Unit Price US$/Kg	Consumption per pan	Raw material per pan US$
Aluminium	1.25	1.2 kg	1.50
*Handles & screws	0.45	1 ps	0.45
Coating	25.00	45 g	1.12
Packaging	0.2	1 ps	0.20
Oil	0.5	12.5 g	0.06
Breakage - 5% of material costs			0.15
Energy			0.02
			3.50
Wages **275 pans per shift per press			0.60
Variable costs per unit			4.10

*The handles could also be produced in Bahrain.

**The total workforce in the first year will be 24 people (6 workers per press).

Profit and Loss Budget (US$ '000)

	Year 1	Year 2	Year 3	Year 4
Sales revenue	1,971	2,464	3,696	4,944
- Variable costs	1,010	1,263	1,849	2,534
- Freight (US$ 1 per pan)*	246	308	462	618
Contribution	715	893	1,340	1,792
- Fixed salaries	150	150	150	150
- Administration	50	50	50	50
	515	793	1,140	1,592
- Depreciation	150	150	150	150
Profit before interest	365	643	990	1,442
- 10% interest on total investment	210	190	170	150
Profit net	155	453	820	1,292

* approximately 118 pans per M^3.

Conclusion :

The possibility of obtaining aluminium from ALBA will decrease the investment and will also make the production easier.

The critical factor in this project is sales, so it would be advisable to enter a sales arrangement by which an international sales organisation is responsible for minimum sales and the overseas marketing.

PROJECT PROFILE - for the production of ALUMINIUM ANODES FOR CATHODIC PROTECTION

Introduction

Cathodic protection is used for corrosive protection of ships, water/and oil tanks, harbour installations, oil/gas/and water pipelines, oil drilling platforms; in general installations where steel is in contact with an electrolyte, such as soil and water.

In simple words, the anodes will be corroded (eaten up) instead of the protected steel, and the anodes will therefore have to be replaced regularly.

In the Gulf region, the anode is usually based on zinc, but the aluminium anode is, quality wise, just as good. With today's price competitiveness, the aluminium anodes are the most attractive commercially, as they can be produced at a cheaper price.

The Production of Anodes

The aluminium quality has to be 99.9% with an iron content of maximum 0.07%, and a copper content of maximum 0.06%. If the iron content is less than 0.07%, then an aluminium quality of 99.85% can be used.

The anode alloys are made in open moulds with reinforced iron. The method is easy and can be done manually for either single piece production or for small series.

The production can be arranged so:

1. The liquid raw aluminium with a satisfactory analysis is taken out of ALBA's running production. In general, ALBA is only guaranteeing 99.7%, but 99.85% and 99.9% is produced.

2. The melted raw aluminium is kept hot and is alloyed in a transport spoon (0.5 - 1.0 T) and is then moved to the anode casting house, which for practical reasons could be in a neighbouring building to ALBA or in a corner of ALBA itself.

3. The alloy is stirred and samples for analyses are taken to guarantee the chemical composition. ALBA has the necessary equipment to do the analysis.

4. If the analyses are correct, the casting according to customers specifications can be started.

5. The casting can be done with a hand spoon or for bigger anodes using the transport spoon.

6. After cooling, casting edges are removed and the back of the anodes is coated with paint. After quality control check the anode is ready for sale.

Total Investment

The project is based on a close co-operation with ALBA, in order:

- to get the liquid raw aluminium directly from the smelter (energy is saved and the investment cost is reduced considerably, at least US$ 80,000);
- to borrow ALBA's analytical equipment for a few minutes during production (the investment is then reduced by approximately US$ 90,000).

ALBA's interest will be helping a new near-by customer on its feet and at the same time ALBA will save costs on its own castings, internal transportation, stocks, packing and shipment.

The total costs for transport and holding spoon with transport equipment, the moulds for castings, tools, hydraulic press, welding machine and a stacker truck will not exceed US$ 100,000. If a building (approximately 300 M^2) is included, the investment will be increased by approximately US$ 50,000 to a total of US$ 150,000.

Sales

A Bahraini based international company was earlier the agent in the Gulf for an European anode manufacturer. The company knows the trade and is interested to discuss being the agent for a Bahraini anode producer, as they find that Bahrain should be able to produce at very competitive prices, and the company in principle, is willing to start a representative agreement for the Middle East which, at a later stage could be extended to other parts of the world. The company in question is represented throughout the world with 28 factories and 240 offices. The total sales is conservatively estimated at :

- 300,000 Kg - US$ 1.80 a kg = US$ 540,000

Production Costs

Aluminium represents 83% of the total anode weight and reinforced iron represents the remaining 17%.

The international price of aluminium (LME) is approximately US$ 1240 per ton and the price of reinforced iron is approximately US$ 500 per ton. The production price per kilogram anode is:

$$- \frac{(830 \times 1240) + (170 \times 500)}{1000} = \text{US\$ 1,11/kg anode}$$

Profitability

- **Total sales**			= US$ 540,000
- **Production costs**			
- raw materials	= US$ 333,000		
- wages (3 persons)	= US$ 36,000		= US$ 369,000
			US$ 171,000
- **Administration and salaries**			= US$ 30,000
- Know how fee (if necessary) estimated at 5% of sales in 5 years			= US$ 27,000
- **Depreciation** (10% on total inv.)			= US$ 15,000
Profit			= US$ 99,000

Conclusion

The project seems to be ideal for Bahrain as a small scale industry or possibly as an extension of ALBA's product range. The main raw materials is produced in the country so it should be possible to produce at a very competitive price, which is an important factor within cathodic protection. The interest already shown in being the sales representation office gives a clear indication of the market potentials.

PROJECT PROFILE - for the production of INSULATION PANELS FOR BUILDINGS

Introduction

Standardized sandwich Insulation Panels made from rigid polyurethane foams have two main advantages for the building industry.

- being a highly efficient modular construction system at low costs.
- having remarkable insulation qualities.

Product description

Polyurethane is a product of natural gas, and rigid foam is formed by a chemical reaction. The finished product has a high proportion of unconnected, closed cells, giving the insulation effects.

The mechanical properties of this type of foams vary with densities, but all are characterized by high strength-to-weight ratio. When sandwiched to other materials - like e.g. steel plates, aluminium, PVC sheets, glass fibres, gypsum, plywood, chipboard, cork - the strength of the foam may be further enhanced and can serve as a structural component.

The sandwich panel behaves as "composites" whose combined strength is greater than that of their components.

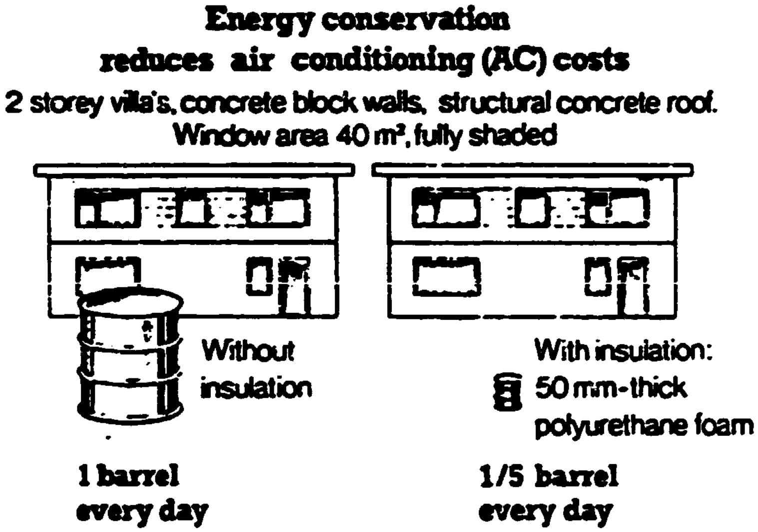
For construction purposes, the sandwich panels are rigid, strong and light-weight, and easy to install. The standard panel is 120cm. x 240cm., with a thickness from 5cm. to 20cm.

Sandwich panels are used for prefabricated houses, industrial buildings, complete building components (walls, roofs, ceilings, partitions, doors, floors), cold stores, chill rooms, portable cabins etc.

The Market

Bahrain has, during the years with abundant energy resources, not given high priority to insulation, but it is a fact that insulation can save a lot of energy otherwise used for air conditioning.

The picture below gives an idea about the proportions.



The power from the public owned power plants is mainly used for running the air conditioners, as the big industries have their own power plants.

The very distinct peak periods are around 2 p.m. and 12 p.m. and mostly during the summer. With the present increase in energy consumption, Bahrain will, within the next five years have to build new power stations or to expand the existing ones.

One of the ways to delay such an investment would be to concentrate more on insulation. Besides insulation panels, double-glazed windows should also be considered.

It can be mentioned that Kuwait has introduced insulation as a standard building requirement, and Bahrain will probably find it beneficial to introduce similar building regulations.

The Ministry of Housing has, in the latest constructions, e.g. Hamad Town, insulated roof with 50mm. polystyrene and 50mm. of stones.

By the end of 1985, there were a total of 64,635 houses in Bahrain. The construction of new houses over the last five years is as shown below :

Year	Private Houses	Houses built by the Ministry of Housing (Average)	Total
1981 :	1,802	800	2,602
1982 :	2.051	800	2,851
1983 :	2,124	800	2,924
1984 :	2,200	800	3,000
1985 :	2,075	800	2,875

The government-built houses have an average of 110 M^2 of constructed area, with an average estimation for the private-built houses at 200 M^2, the total constructed area per year is around 500,000 M^2.

Appendix 1 shows an easy and low cost way of using the rigid panels for housing construction.

Investment

For a production line similar to the one shown in Appendix 2, the machinery and equipment costs amount to approximately US$ 900,000. The capacity is 150 panels per shift, equal to 135,000 M^2 per year.

The investment would be :		U.S.$
Machinery and equipment	:	900,000
Building (1,600 M^2)	:	400,000
Working capital	:	300,000
Total investment	:	1,600,000

Sales

It is assumed that the total production of 135,000 M^2 would be sold. The price per M^2 is dependent on the facing (the material which the panel is sandwiched to). We calculate an average price of US$ 25 per M^2.

Total sales 135,000 x 25 = US$ 3,375,000

Production costs

Raw materials	US$/$M^2$			US$/Year
Rigid foam	4.0			
Glue (0.4kg per M^2)	1.0			
Facing	5.0			
	10.0		=	1,350,000

Labour

Skilled (7 persons)	:	84,000		
Supervisors (2 persons)	:	30,000	=	114,000
Maintenance and Miscellaneous			=	50,000
Variable costs			=	1,514,000

Profit and Loss Budget

		U.S. $
Sales	:	3,375,000
- Variable costs	:	1,514,000
		1,861,000
- Administration	:	100,000
		1,761,000
- Depreciation (10%)	:	90,000
		1,671,000
- Interest 10% on total investment	:	160,000
Profit	:	1,511,000

The project has a pay back period of approximately one year. The break - even production will be reached at approximately 30,000 M^2 per year or with a sales equivalent to 22% of installed capacity.

Conclusion

This project has several advantages :

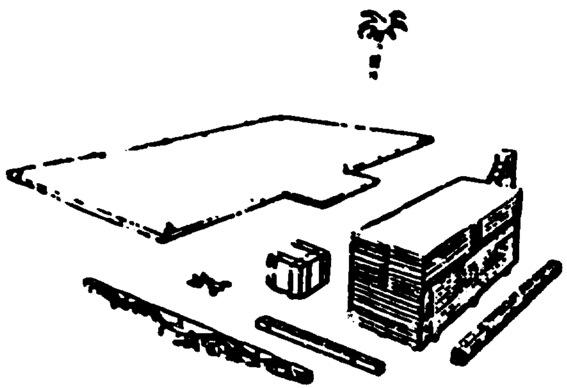
- for the investor, a highly profitable business;
- for the consumer/buyer who gets a better insulated house and savings on energy and construction;
- for the national economy, savings on energy in general and in particular savings on investment costs in a new power station.

The only obstacle is that people in Bahrain are not used to the idea of energy saving and therefore the idea of insulation is new.

The government could help in this respect by introducing a new legislation making insulation compulsory for new constructions and giving incentives also for the existing houses to install insulation.

In this profile, the purpose of the insulation aspect has been stressed, but it should not be forgotten that the rigid polyurethane panel also is an excellent building component in itself.

APPPENDIX I



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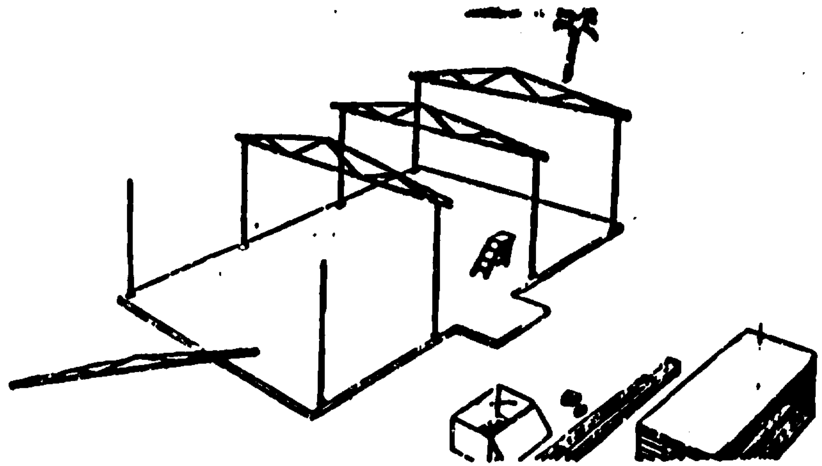

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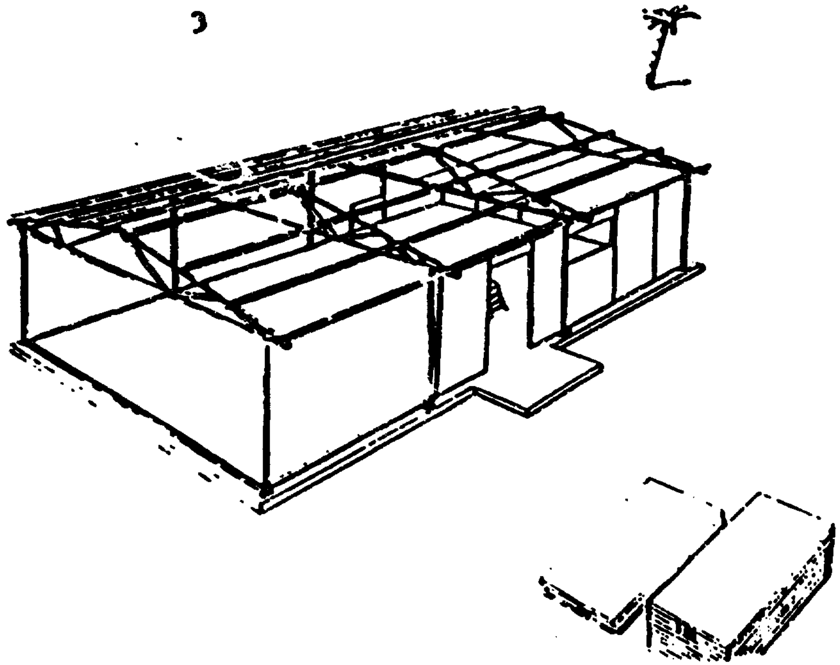

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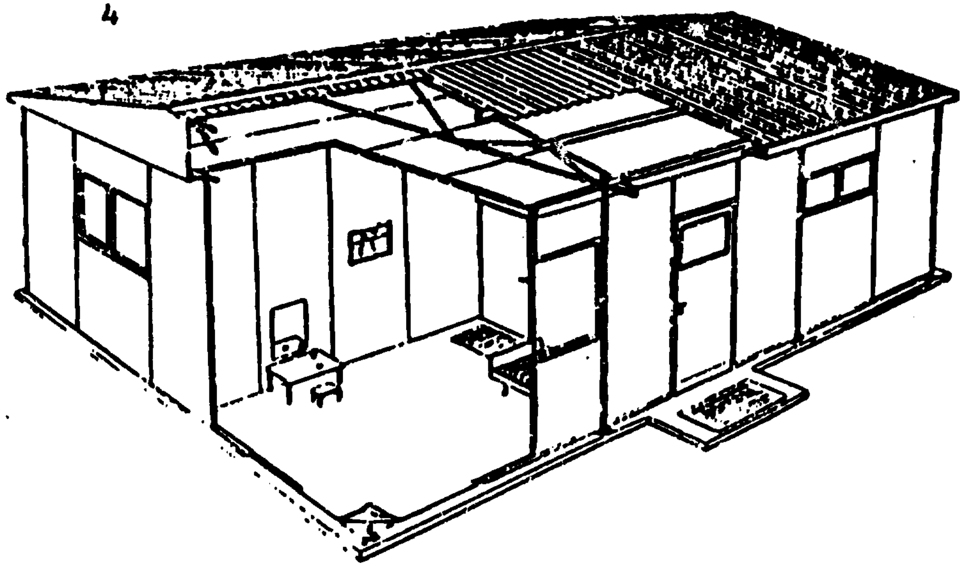

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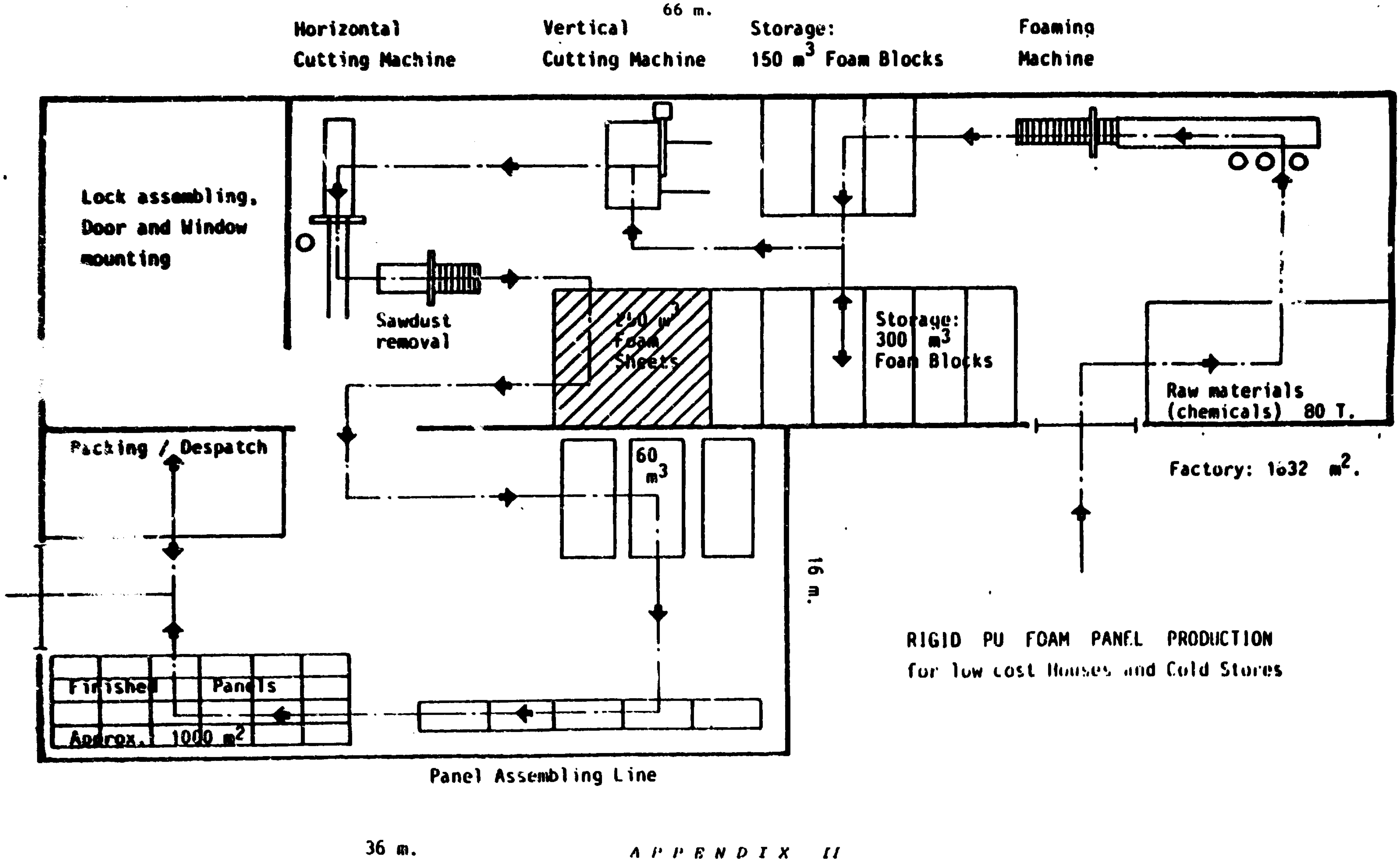


RIGID PU FOAM PANEL PRODUCTION
for low cost Houses and Cold Stores

APPENDIX II

P R O J E C T   P R O F I L E - for the production of CALCINED PETROLEUM COKE FROM GREEN COKE

Introduction

Petroleum coke (pet-coke) and pitch are used for the manufacture of carbon anodes, which are required in aluminium smelter operation for the electrolytic reduction of alumina to metallic aluminium. Generally, the consumption of pet-coke and pitch in smelter operations is 0.4 tons and 0.1 tons respectively per ton of aluminium produced.

Domestic Market

For the 1985 production of ALBA smelter in Bahrain at 176,731 tons of aluminium, ALBA's requirement of pet-coke and pitch were as follows:

1985

Petroleum coke	69,363 tons
Pitch	16,625 tons

Considering ALBA's future expansion plans of increasing its metal production to 220,000 tons by 1990, the requirement of pet-coke and pitch are expected to go up to the following figures:

1990

Petroleum coke	88,000 tons
Pitch	22,000 tons

Currently, the requirements of pet-coke and pitch are being met by importing pet-coke from U.S.A. and pitch from Australia/West Germany.

Export Market

Besides the domestic market for pet-coke identified above, there is a sizeable present and potential export market in the Gulf region on account of the requirements of a smelter in Dubai (150,000 tpa), and another one being constructed in the U.A.E. (150,000 tpa). A third smelter of a comparable size is also presently being planned in Saudi Arabia. The pet-coke requirements of these th[illegible] smelters would very well be of the order of about 200,000 tpa. T[illegible]e total market for pet-coke in the region is expected to be as follows:

	1985 (tpa)	1990 (tpa)
Bahrain market for pet-coke	70,000	88,000
Export market for pet-coke	70,000	200,000
TOTAL market for pet-coke	140,000	288,000

Plant Size

In view of the market for pet-coke as identified above, it is suggested that initially a 100,000 tpa plant mainly based on the domestic market, with a marginal capacity for export, may be considered. This capacity could later be increased in two successive stages to 300,000 tpa, as the export market for pet-coke increases in the future. The provision for future plant expansion may be kept in view at the initial design stage of the plant, in order to avoid later extension difficulties. A somewhat cautious approach in setting up plant capacities is suggested, in order to avoid subsequent problems resulting from low plant load factors and consequent uneconomical production.

An alternative approach, would of course be, to set up a pet-coke plant with financial participation of U.A.E. and Saudi Arabia, based on the total requirements of the region. In this case, a plant size of 300,000 tpa can be considered, which would also improve the overall economics of the project.

Product Specification

For the specifications of calcined coke required by the ALBA smelter, see appendix '1'.

Technology and Production Planning

The technology for the production of calcined pet-coke from refinery residues is well established and consists of a two stage conversion process:

a) In the first stage, the refinery residues are converted to 'green coke' by thermal cracking in a coking plant, as a result of which the refinery residues decompose into products like gasoline, LPG, naphtha, gasoil and 'green coke' (approx. 20% of the refinery residues). Of the different processes used, the 'delayed coking' process is generally favoured by the majority of plants in the world.

b) In the second stage the 'green coke' produced by the thermal coker, is fed to the calcination kiln, where it is heated to 1100-1300 C to remove the volatile matter, and thus converted to calcined coke suitable for use in the manufacture of electrodes (anodes) in a smelter.

Usually the first stage in the manufacture of pet-coke i.e. conversion of reduced crude to 'green coke' is more capital intensive and requires about 75% of the total investment, the second stage (calcination) accounting for the remaining 25%.

Therefore, if a satisfactory source of suitable quality 'green coke' is available, it would be preferable to set up only the second stage calcination plant which would involve much lower investment for producing calcined pet-coke.

Another important consideration in the production of pet-coke is the suplhur content of the calcined coke, which, in order for it to be suitable for anode manufacture, must be within 2½% specification limits. Therefore the 'green coke' selected for calcination must conform to these specifications.

In view of the fact that the Kuwait oil refinery at Mina Abdulla is reportedly setting up a petroleum coking plant (2 units of 30,000 barrels a day) which is likely to go into production by early 1987 and the sulphur content of this 'green coke' is also expected to be low (about 1%), it would seem to be a satisfactory source of 'green coke' which could be processed into calcined coke in a calcination plant, if one is set up in Bahrain.

Therefore in view of the prospects of the availability of 'green coke' from the Kuwait refinery at Mina Abdulla, it would be logical for Bahrain to plan the production of calcined coke by setting up only a coke calcination plant. Normally, for calcination purposes, the rotary horizontal kilns are commonly being used in other plants in the world.

It is also worth mentioning here, that currently, the BAPCO Refinery in Bahrain is manufacturing heavy fuel oils and does not have a coke manufacturing unit. The sulphur content of the BAPCO fuel oil is about 3.5%. However, in view of the future changes likely to come about in the world market for petroleum products, BAPCO feels that within the next ten years the demand for fuel oil is likely to go down and BAPCO is currently engaged in future planning for a different product pattern. It is therefore possible that BAPCO, considering the rising demand for 'green coke' in this region, might set up a coking unit sometime in the future. If this happens and 'green coke' of a suitable quality becomes available from the BAPCO refinery, the calcining plant in Bahrain can always consider using the locally produced 'green coke' from BAPCO, provided it is satisfactory in quality and competitive in price with 'green coke' from alternative sources.

Plant Location

The coke calcination plant should be located in the ALBA smelter complex. The 'green coke' will be brought in through the aerial rope and the calcined coke directly used in the anode plant.

Competitive Activity

According to available information, there is, at present, no other plant in the G.C.C. region manufacturing calcined petroleum coke. The nearest plant in the region is in Egypt at Naga Hammadi (100,000 tpa), which meets the requirement of the aluminium smelter there.

Other Products

Besides anodes for aluminium smelting, calcined pet-coke is also used for the manufacture of electrodes for other electro-metallurgical industries for the manufacture of ferro-alloys, calcium carbide and phosphorus. In a further modified form as graphite, its use can be further extended for the manufacture of graphite electrodes for industries such as iron and steel (direct reduction process), caustic soda, phosphoric acid and magnesium.

Investment

		U.S. $ (million)
The calcination plant costs approximately	:	50.0
+ working capital	:	2.0
+ pre-project expenses	:	3.0
TOTAL investment	:	55.0

Note : Working capital based on one month raw material stock cover, fifteen days finished products stock cover, payroll and miscellaneous administrative expenses.

Sales per year:

- ALBA : 88,000 tpa - US$ 190 = US$ 16,720,000
- Export : 12,000 tpa - US$ 180 = US$ 2,160,000

TOTAL sales revenue = UC$ 18,880,000

Costs

- Imported 'green coke' from Kuwait 120,000 tpa US$ 40 (CIF) =	US$ 4,800,000	US$ 4,800,000
		US$ 14,080,000
- Utilities	: US$ 600,000	
- Manpower (20 25 persons)	: US$ 480,000	
- Maintenance	: US$ 1,000,000	US$ 2,080,000
		US$ 12,000,000

Depreciation

- Over 20 years, 5% linear	: US$ 2,500,000	US$ 2,500,000
Profit before interest	:	US$ 9,500,000

Note :

- It is a condition for the project that the sales price to ALBA is competitive with import prices CIF. The American company, M. W. Kellogg Limited, made a feasibility study for GOIC in 1981 and based the pet-coke price on US$ 200/- The indicated price in this profile of US$ 190/- seems to be a realistic price on a long term basis, although it has to be mentioned that ALBA in July 1986 imported pet-coke at a 25% lower price at a time when the oil prices in general were in an extremely depressed situation. Even with this low price of US$ 143/- taken into consideration the profitability of the project before interest would be 9.1% of the total investment and the projet would still be worth considering.

- the export is mainly thought to be to Dubai and the export sales price delivered in Dubai has to be competitive with the world market prices.

- the coking plant in Kuwait has been planned and is viable because of getting gasoline, LPG, naphtha and gasoline. According to information obtained by BAPCO, the production cost of 'green coke' is considered to be zero. There should be good possibilities of negotiating a favourable price. The stated US$ 40/- is therefore at the moment, arbitrary. It is very important to know Kuwait's position on the green coke.

- the main utility is natural gas which has been calculated at a cost.

- the profit before interest is calculated to be US$ 9.5m. which corresponds to 17.3% of the total investment If the production is increased to 200,000 tpa or more, the economics will naturally improve.

Conclusions and Recommendations

On the basis of the observations made above, there appears to be a strong case for further consideration of a project for the manufacture of pet-coke in Bahrain, based on 'green coke' as the feed stock. The attractive features of this project obviously are:

1. There is a captive market for the product - calcined coke - in the ALBA smelter.

2. A good export potential on account of the requirements of other smelters in the G.C.C.

3. Easy raw material (green coke) availability from Kuwait.

4. Availability of cheap natural gas for calcination.

The project is likely to be technically feasible and economically viable. It is therefore recommended that a detailed feasibility study on this project be undertaken to examine in greater depth and detail the different technical and economic aspects of this project and thereafter an investment decision be taken.

The content of this profile has been discussed with the managements of ALBA and BAPCO and they consider the production of pet-coke in Bahrain a step forward in the industrialization process of Bahrain, and are inclined very favourably towards this project.

APPENDIX 1

SPECIFICATION OF CALCINED COKE REQUIRED BY ALBA SMELTER

Physical:

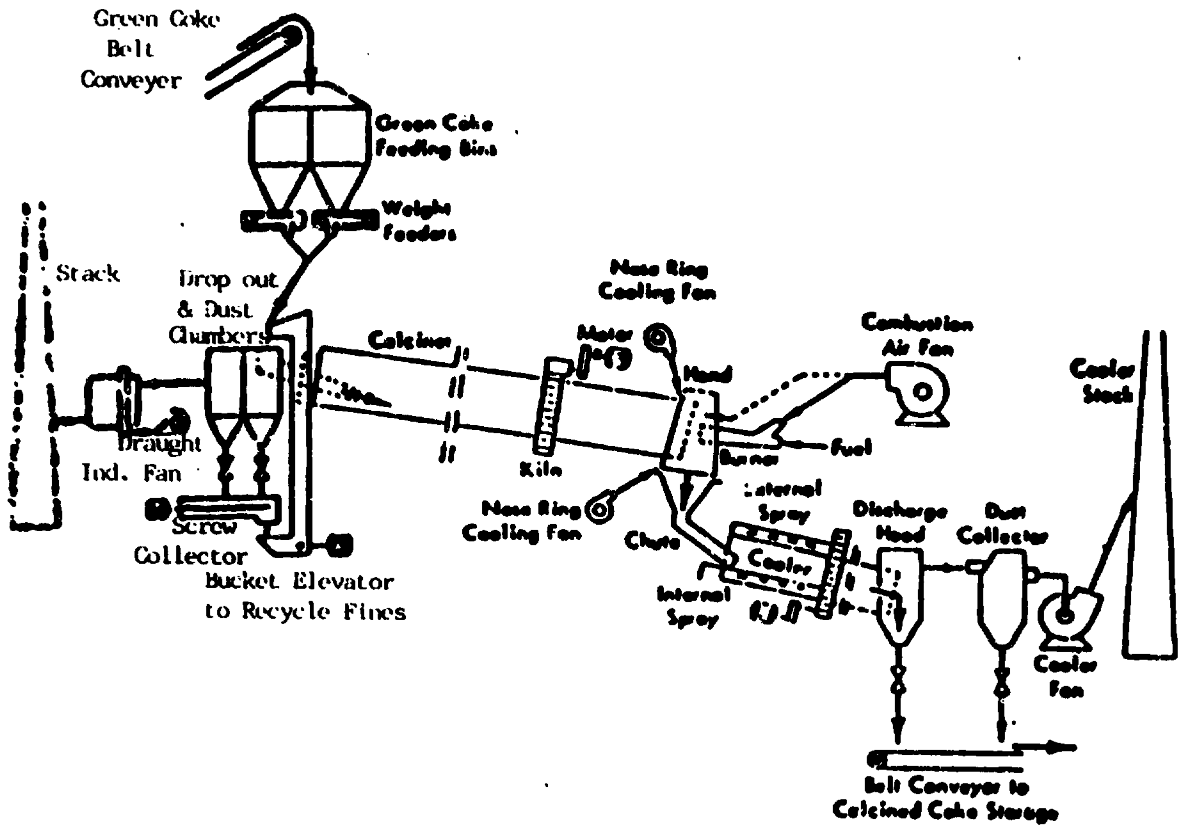
	Dimension	Value Min/Max	Determination
Particles	+ 50 mm	0% Max	
	- 50 mm + 4 Mesh	30% Min	ASTM D293
	- 4 Mesh + 14 Mesh	30% Min	ASTM D293
	- 14 Mesh	25% Max	ASTM D293
	-100 Mesh	1.5% Max	ASTM D293
	Screens sized according to		ASTM E 11-70
Hardgrove grindability index		32 - 40	ASTM D409
Vibrated bulk density.	grams/cm^3	0.86 Min	-20 + 48 Mesh
Real density	grams/cm^3	2.06 Min	Alba Std. Method 3.1.4
Resistivity	ohm-mm	1.040 Max	Alba Std. Method 3.1.17
Dedusting oil	%	0.5 Max	Alba Std. Method 3.1.15
Moisture	%	0.50 Max	Alba Std. Method 3.1.2A
Volatile Matter	%	0.50 Max	Alba Std. Method 3.1.3A
Ash	%	0.30 Max	Alba Std. Method 3.1.6
Fixed Carbon	%	99.4 Min	ASTM D3172

CHEMICAL:

	Dimension	Value Min/Max	Determination
Vanadium	%	0.025 Max	Alba Std. Method 3.1.8
Titanium	%	0.002 Max	Alba Std. Method 3.1.8
Iron	%	0.030 Max	Alba Std. Method 3.1.7
Nickel	%	0.015 Max	Alba Std. Method 3.1.14
Calcium	%	0.020 Max	Alba Std. Method 3.1.13
All other metals	%	0.020 Max	
Silicon	%	0.030 Max	Alba Std. Method 3.1.7
Sulphur	%	2.5 Max	Alba Std. Method 3.1.16
Air reactivity	%	3.0 mg/mint Max	Alba Std. Method 3.4.7
Co-efficient of thermal expansion	C.T.E. X 10^{-6}/°C	2.0 Max	
Calcination Tempt.		1150°C Min	

APPENDIX 2

HORIZONTAL ROTARY KILN CALCINER



PROJECT PROFILE - for the production of SYNTHETIC CRYOLITE & ALUMINIUM FLOURIDE

Introduction

Cryolite and Aluminium Flouride are two important chemicals which are used in the smelting of Alumina to Aluminium metal. Usually the consumption of these chemicals together is approximately 4% of aluminium produced.

Domestic market

The current market in Bahrain is of the order of 8000 tons per year of cryolite and aluminium flouride which are required to meet the processing needs of the Aluminium smelter operated by ALBA. ALBA produced 177,000 tons of aluminium in 1985 and expects to increase its production to 220,000 tons by 1990. While this would indicate an increase in the requirement for cryolite and aluminium flouride in the future, but in view of the cryolite recovery system currently being installed in the smelter and the economies in consumption likely to result from it, the future increase in cryolite and aluminium flouride consumption may not be in the same proportion as the increase in metal production. Therefore it would be safe to estimate the domestic requirement of these chemicals at present at about 8000 tons by the year 1990.

Export market

In addition to the captive domestic market for cryolite and aluminium flouride identified above, these chemicals are also required by the aluminium smelter in Dubai (150,000 tpa) and another one being planned in the U.A.E. (150,000 tpa). Yet another smelter of a comparable size is also presently being planned in Saudi Arabia. The total requirement of cryolite and aluminium flouride for these three smelters may well be of the order of 18,000 to 20,000 tons per year.

Therefore, the position regarding the total market for cryolite and aluminium flouride is as indicated below :

	1985 (tons/year)	1990 (tons/year)
Domestic market (Bahrain)	8,000	8,000
Export market	6,000	18,000
	14,000	26,000

Plant size

It is felt that in order to meet the requirement of th[illegible] [illegible]rket as indicated above, a 10,000 tpa plant mainly based o[illegible] the captive domestic market and with a marginal capacity for the [illegible] market may initially be planned. However, at the design stage, a p[illegible]ion for a further 2-stage expansion of the plant to 30,000 tpa m[illegible] [illegible]e kept in view to meet the requirements of the export market, a[illegible] [illegible]t develops in the future. It may be mentioned, that it would not be wise to set up too high a capacity (based on export market) right [illegible] the beginning, as this could result in low plant load factor and consequent uneconomical production.

Technology

Cryolite and aluminium flouride can be manufactured either from hydroflouric acid (an intermediate) by reacting it with alumina and sodium hydroxide or by starting from the basic raw material flourspar by reacting it with sulphuric acid to manufacture hydroflouric acid which can then be treated with alumina and sodium chloride to produce aluminium flouride/cryolite.

The decision regarding whether to start from the intermediate (hydroflouric acid) or the basic raw material flourspar, would essentially depend upon the economics of both the process routes which must be studied at the time of making a detailed analysis in a feasibility study. However, in the context of the situation in Bahrain, where sulphuric acid is available from local production (based on sulphur from petroleum refinery), it may be more profitable to import flourspar and start from the basic raw material. This process route, besides other economic advantages will also boost up the production of sulphuric acid plant (which is currently operating very much below design capacity) and also find usage for refinery by-product sulphur. A process flow-sheet of cryolite and aluminium flouride manufacture is attached at Appendix 2, showing the manufacture from flourspar.

Product specification

The specification of cryolite and aluminium flouride currently being used by ALBA smelter are attached at Appendix 1 of this profile.

Plant location

It is suggested that the cryolite plant be located in the Sitra region of Bahrain. If the plant is set up by ALBA, then it will of course be located within the ALBA complex. Alternatively, the plant should be located close to the ALBA smelter, to facilitate transport of the product to the point of use. The imported raw materials for the plant (flourspar, alumina and caustic soda) can be easily transported from the docks, whereas sulphuric acid can be supplied from the sulphuric acid plant in Manama.

Raw materials

The raw materials required for the synthetic cryolite and aluminium flouride plant are : flourspar, sulphuric acid, alumina and caustic soda or sodium chloride. Except for sulphuric acid, which is currently being produced in Bahrain, all other chemicals will have to be imported. Alumina is already being imported in large quantitites by ALBA for the production of aluminium metal and perhaps the quantities required for aluminium flouride and cryolite production, could be conveniently supplied by ALBA.

Investment for a 10,000 tons/year cryolite and aluminium flouride plant

		US$ (million)
Cost of hydroflouric acid plant	:	7
Cost of synthetic cryolite and aluminium flouride plant	:	10
Total capital cost of plant	:	17
Working capital	:	3

Investment alterratives

a) Total investment starting from flourspar as raw material	:	20
b) Total investment starting from hydroflouric acid as raw material	:	12

Cost of production

A. Hydroflouric acid (100%)

Raw materials

	Tons x US$		US$/Tons
Flourspar	2.4 x 30.00 = 72.00		
Sulphuric acid	3.0 x 60.00 = 180.00		
	Total cost of raw materials	:	252.00

Utilities

	Units x US$		
Fuel oil (160 kg)	0.160 x 65.00 = 10.40		
Steam (750kg)	0. 75 x 1.00 = 0.75		
Electricity (120 kwh)	120 x 0.04 = 4.80		
Process water (190 kg)	0. 19 x 0.90 = 0.17		
Cooling water (30 M^3)	30 x 0.05 = 1.50		
	Total cost of utilities	:	18.00

Labour

	Manhours/ton x US$		
Skilled labour	3.0 x 7.0 = 21.00		
Unskilled labour	1.5 x 2.5 = 3.75		
Supervision & overheads	1.0 x 15.0 = 15.00		
	Total labour costs	:	40.00
Maintenance		:	30.00
Estimated cost of production for one ton of hydroflouric acid		:	340.00

Cost of production

B. Synthetic Cryolite

Raw materials

	Tons x US$	US$/Tons
Hydroflouric acid (45%)	1.350 x 153 = 207	
Alumina	0.400 x 120 = 48	
Sodium chloride	3.450 x 10 = 34	
	Total cost of raw materials :	289.00

Utilities

	Units x US$	
Steam (3000 kg)	3.0 x 1.00 = 3.00	
Electricity (230 kwh)	230 x 0.04 = 9.10	
Fuel oil (160 kg)	0.160 x 65.00 = 10.40	
Process water ($45M^3$)	4.5 x 1.00 = 4.50	
	Total cost of utilities :	27.00

Labour

	Man-hours/ton x US$	
Skilled labour	2.5 x 7.0 = 17.50	
Unskilled labour	1.5 x 2.5 = 3.50	
Supervision & overheads	1.0 x 15.0 = 15.00	
	Total cost of labour :	36.00
Maintenance	:	25.00

Estimated cost of production of cryolite 377.00

Note : The cost of production of Aluminium Flouride is a little less but in this case we consider cryolite and aluminium flouride to have the same cost of production.

The total amount of manpower required is around 45 people.

Profit and Loss Account

		US$
Sales 10,000 tons x US$ 700	:	7,000,000
- Variable cost of production 10,000 tons x US$ 377	:	3,770,000
		3,330,000
- Fixed costs (administration etc.)	:	230,000
		3,100,000
- Depreciation over 20 years	:	850,000
Profit before interest	:	2,250,000
- With an interest rate of 10% of the total		2,000,000
investment, the profit will be reduced to	:	250,000

Conclusions

This project had been selected for study mainly because there was a captive market in Bahrain for Cryolite and Aluminium Flouride in ALBA smelter operations. However, though the project is technically feasible, its economics does not appear to be very attractive. Therefore a decision regarding future action may be taken considering both these aspects, which have been evaluated on the basis of data and information so far available.

APPENDIX I (A)

Specification of Synthetic Cryolite

Chemical Analysis

		Percentage
Na_3ALF_6	:	98 minimum
F	:	53 minimum
AL	:	12.5 - 13.5
Na	:	32.5 - 33.5
Excess ALF_3	:	0 - 5
AL_2O_3	:	2 maximum
CaF_2	:	1 maximum
SiO_2	:	0.3 maximum
Fe_2O_3	:	0.1 maximum
P_2O_5	:	0.05 maximum
SO_3	:	0.2 maximum
L.O.1 @ 550°C - 1 hour	:	0.5 maximum

Sieve Analysis

Bigger than 5mm	:	1 - 5
1mm - 5mm	:	80 - 95
Smaller than 1mm	:	15 - 20

Packing

The cryolite shall be packed in Multi Ply paper bags of 50 kilos each net, on non-returnable pallets each containing 20 bags, shrink wrapped and steel banded.

APPENDIX I (B)

Specification of Aluminium Flouride

Chemical Analysis

		Percentage
ALF_3	:	96 minimum
SiO_2	:	0.2 maximum
P_2O_5	:	0.02 maximum
Fe_2O_3	:	0.03 maximum
SO_3	:	0.03 maximum
Free water	:	0.2 maximum
Ca	:	0.2 maximum
Na	:	0.5 maximum
AL_2O_3	:	2.6 maximum
Pb	:	100 ppm
L.O.1 at 450° C	:	0.5 maximum
L.O.1 at 600° C	:	0.8 maximum

Size Distribution

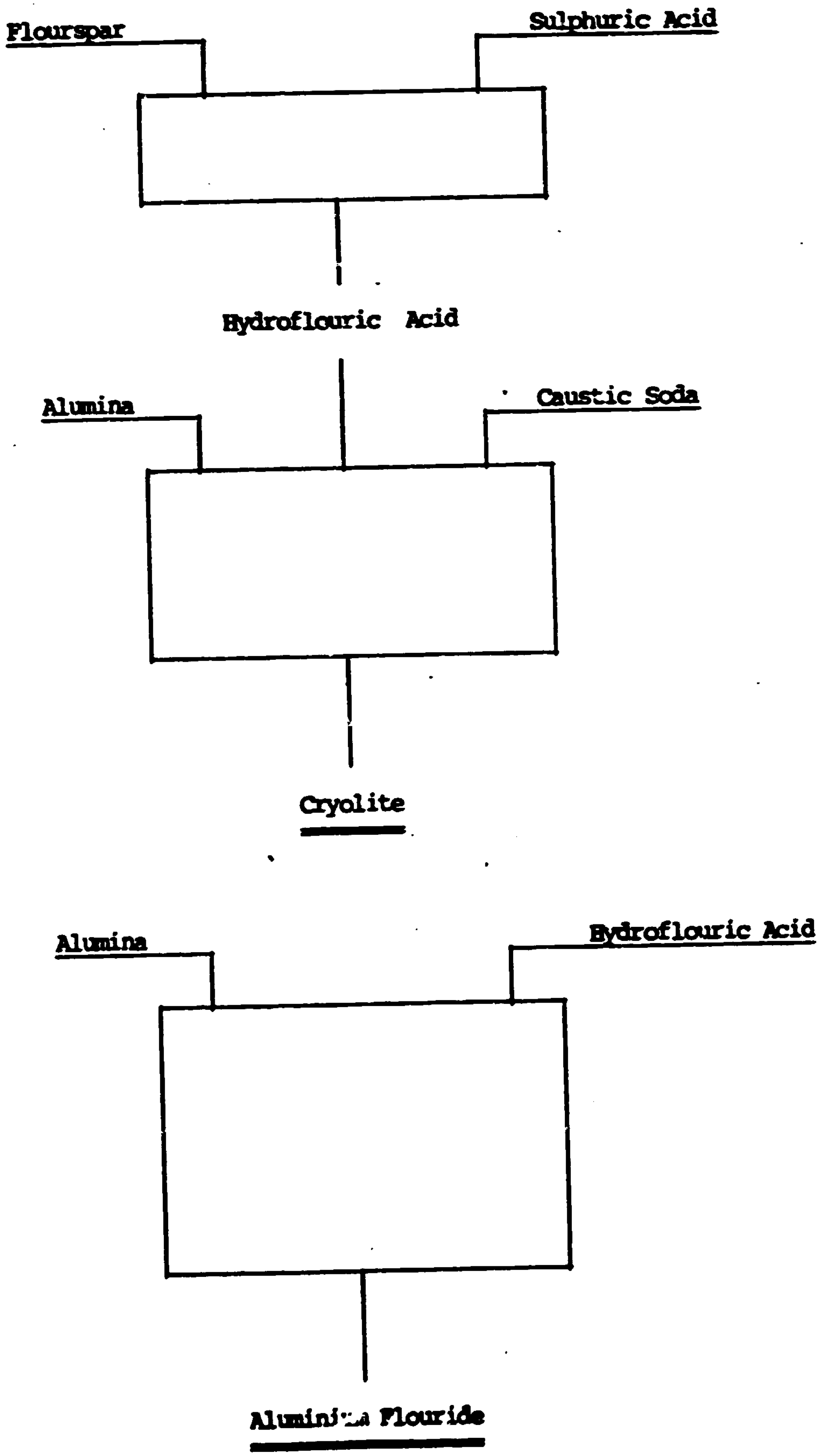
50 - 60% plus 90 microns

80 - 90% plus 63 microns

90 - 95% plus 45 microns

5 - 10% plus 45 microns

APPENDIX II


Flourspar
Sulphuric Acid
Hydroflouric Acid
Alumina
Caustic Soda
Cryolite
Alumina
Hydroflouric Acid
Alumini a Flouride

Introduction

Ferric Chloride is a metallic salt which can be obtained from a chemical reaction between iron and hydrochloric acid.

Ferric chloride is a normally traded commodity mainly used as a coagulant in the water purification process of saline water such as sea water.

Market

In the GCC countries the most obvious market is water purification, especially the desalination plants using sea water, like e.g. the new desalination plant Adur in Bahrain, which is under construction and will be ready by the end of 1987. A new desalination plant similar to Adur is scheduled to start in 1989/1990, but this project has not yet been finally decided upon.

By the end of 1985, the desalination plants in the GCC countries had the following capacities :

		Million gallons per year
Bahrain	:	12.775
Kuwait	:	86.029
Oman	:	4.380
Qatar	:	19.903
Saudi Arabia	:	131.527
U.A.E.	:	16.790

The above capacities also include plants which are based on the evaporation process, and these plants will need no chemicals.

However, the new tendency in the GCC countries is to transform sea water into drinkable water using the reverse osmosis process and here chemicals are needed.

The project should be able to benefit from the free market availability among the GCC states and the protection provided by the common GCC customs duties tariffs against imports from outside.

Capacity

It is suggested that the Ferric chloride plant should have an annual operating capacity of 5000 tpa to meet the requirements of the expanding GCC market.

Raw Materials

There are basically only two raw materials required for this plant. Both the raw materials, iron and hydrochloric acid will have to be imported.

Investment		U.S.$ (million)
Capital cost of 5000 tpa Ferric chloride plant	:	2.5
+ Working capital	:	0.5
Total investment	:	3.0

Sales

The market aimed at in this profile is the desalination plants within the GCC countries, but export potential outside the area is also possible.

The total production of 5000 tpa which is rather small, is supposed to be sold at a price of U.S.$ 300/-.

Yearly turnover 5000 x 300 = U.S.$ 1,500,000

Production costs

Raw Materials	U.S.$		U.S.$
1000 tons of iron scrap at U.S.$ 50/- per ton	50,000		
4000 tons of hydrochloric acid at U.S.$ 82 per ton	328,000	:	378,000
Labour			
Cost at U.S.$ 20/- per ton		:	100,000
Maintenance		:	50,000
	Total variable costs	:	520,000

Profit and Loss Budget		U.S.$
Annual sales return	:	1,500,000
- Annual variable costs	:	520,000
		980,000
- Sales and Administration	:	80,000
		900,000
- Depreciation at 5%	:	125,000
- Interest at 10%	:	300,000
		475,000

Return on investment (after interest) $= \frac{475{,}000}{3{,}000{,}000} \times 100$

$= 15.8\%$

Conclusion and Recommendations

This project is technically feasible and economically viable. The rate of return on investment of 15.8% after interest is considered reasonably good. In view of the chemical being required in the desalination plants, the market for this product is going to increase with time, which would call for increase in capacity for the manufacturing units with a promise for higher return on investment.

It is recommended that a feasibility study on this industry be done and after that an investment decision taken.

PROJECT PROFILE - on the establishment of a REGIONAL MANAGEMENT DEVELOPMENT CENTRE

Introduction

Bahrain is centrally placed in the Gulf region. With an international airport and a new causeway to Saudi Arabia, the access to visit Bahrain is easy. The new 7 days visa rule has also made the entry easier. The communication network is excellent and the hotels are of good international standards. The society is more open and liberated than its neighbouring countries. Its cultural heritage and traditional past is well cared for and will be exhibited even more favourably with the opening of the new museum.

Bahrain has things to offer to visitors which are not found to the same extent in the neighbouring countries.

What they all have had in common is a tremendous expansion of their economies over the last 10-12 years followed by development of industry, government departments and new service sectors. The need for development and improvement of management skills is now becoming more apparent.

As Bahrain has the opportunity to serve the Gulf region as a service centre within certain well defined areas, this profile presents the idea of the establishment of a Regional Management Development Centre in Bahrain.

The project idea

The Centre has to be run as a company on a commercial basis. The business activity should start out with running short term management courses at regular intervals in Bahrain. The hotels can provide facilities for presentation of the courses and also accomodate foreign participants.

The Centre should be a joint venture with a reputable international management company which can show a proven track record in successfully running management courses. The foreign joint venture partner will have to provide the most modern and up-to-date course material and also provide professional specialists for conducting the courses. After a while, Arabic speaking course conductors can be trained.

In Europe and North America today, it is a highly profitable business, running management courses and it is this experience which is now proposed to be transferred to Bahrain.

The Market

The management courses should be held for staff at all levels. As Bahrain wants to be a service centre in the Gulf region, courses could for example be held stressing the need for improvement in service standards, especially in :

Airlines;
Communicational Networks;
Hotels;
Trade and Business Centres;
Banks;
Insurance Companies;
Travel Agencies;
Government Departments.

The courses should aim at improving existing services and also encouraging new initiatives like conferences for product promotions.

In the Dubai International Trade Centre, several well attended management courses have already been held and at the moment it seems that Dubai has taken the lead within the Gulf region.

Investment

One of the European companies already running management courses in the Dubai International Trade Centre has expressed its interest in participating as a joint venture partner in a permanent Centre in Bahrain.

The initial investment for such a venture using existing facilities need not be very high, but the above mentioned European Company foresees that B.D. 200,000/- would be the necessary capital required to make a serious effort which would have the proper impact. in the Gulf region.

Profit and Loss Budget

Each course runs for two days with approximately 60 participants on each course. The fee per participant is approximately BD 200/-. It is estimated as a start that at least 4 courses per month will be held (10 months per year).

Yearly turnover 60 x 200 x 4 x 10 = B.D. 480,000

- Costs :

room for presentation, course conductors fee,
office, marketing efforts : B.D. 240,000

The return on investment is much higher than what is seen in industry, but it is essential that the courses are of a very high standard so companies continue to nominate people for such courses.

Conclusion and Recommendation

The project would provide an important service to industry and commerce and fits well into the idea of Bahrain being a service centre for the Gulf region. The profitability is high as long as the courses maintain a high standard. It is necessary to base the project on a joint venture model with an experienced foreign company with a proven track record. Furthermore, an interesting possibility would be if the project could have the participation of other GCC governments. The idea is to cater to people at all levels which would give it the potential for attracting a lot of participants for improvements in general management standards.

The hotels in Bahrain would be the big winners as a lot of new guests would be coming to the island, so the project would also create indirect employment.

It is recommended to establish contact with a reputable company and negotiate the terms for setting up a joint venture with its participation.