OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

RESTRICTED

15754

DP/ID/SER.A/ 728
16 June 1986

ENGLISH

STRENGTHENING OF GOVERNMENT SUPPORT SERVICES IN THE NON-METALLIC MINERALS SECTOR

DP/ZIM/83/006

ZIMBABWE

Technical report: Appraisal of project to establish a sheet-glass plant

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

Based on the work of Pierre Montagne,
expert in sheet-glass production

United Nations Industrial Development Organization
Vienna

356

V.86-57472
3072T

Explanatory notes

The monetary unit in Zimbabwe is the dollar ($ Zim).

The exchange rate used in this report for the conversion of Zimbabwean dollars into United States dollars ($US) is:

$US 1 = $ Zim 0.6026.

References to tonnes (t) are to metric tonnes.

Besides the common abbreviations, symbols and terms, the following have been used in this report:

CMT	Central Machinery Textile Corporation (Romania)
CSO	Central Statistical Office
IDC	Industrial Development Corporation (of Zimbabwe)
IPIU	Technological Engineering Institute for Light Industries (Romania)
LC	local cost
LPG	liquified petroleum gas
SPG	selling price to Government

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Development Programme (UNDP) or the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

Within the context of the large-scale project "Strengthening of government support services in the non-metallic minerals sector" (DP/ZIM/83/006) an expert in sheet-glass production was assigned to the project for a total of ten weeks, split into three missions, the purpose of which was to assist the national project team in the technical evaluation and appraisal of bids received for the establishment of a sheet-glass plant.

During his first mission the expert assessed the three offers, one of which was eliminated. During the second mission he accompanied a team of local experts on a visit to the remaining two potential suppliers in Romania and Turkey, in order to review the technologies on site. Following that evaluation exercise, a decision was taken in favour of the TISCEMA (CMI) consortium of Romania.

During his third mission the expert appraised and made recommendations on a feasibility study prepared by the Industrial Development Corporation (IDC) of Zimbabwe. He also participated in the preliminary contract negotiations with TISCEMA, after which that company was required to revise their documents according to the recommendations put forward by the reviewing team and to resubmit them to IDC for further negotiations.

CONTENTS

Tables

Page

Figures

INTRODUCTION

The Industrial Development Corporation of Zimbabwe Limited (IDC) is considering establishing a sheet-glass industry for domestic market and in the future for export market.

The main purpose of the project is to strengthen the performance of non-metallic mineral-based industries and to promote new user industries to create foreign exchange resources through import substitution.

The duties of the expert were specified in his job description as follows:

The expert will be attached to the Ministry of Industry and Technology and will be expected to:

(a) Assist the national project team in the technical evaluation and appraisal of three proposals made to the Government for a sheet-glass production plant project, by companies in France, Japan and Romania; provide technical guidance and recommendations to ensure the selection of a technically and economically viable technology;

(b) The expert may also assist the project team in presenting the conclusion of the technology evaluation exercise to the higher authorities;

(c) He will provide, whenever felt necessary, advice relevant to the raw-material technologies and manpower requirements of the same project.

In addition, IDC have established a "Memorandum of understanding" dated 31 January 1986, defining the mode of operation as follows:

(a) UNIDO expert P. Montagne to work closely with IDC staff and carry out open discussions with them about all aspects of the tender documents during the period of evaluation;

(b) UNIDO expert to assist in drawing up a contract to be incorporated into the project.

The expert's assistance has been split into three missions:

(a) The purpose of the first mission, from 30 January to 20 February 1986, was to assess the technology offered, to analyse the offers by comparison and to comment on the technical merit of the bids. A report entitled "Technology evaluation" and dated February 1986 has been submitted to UNIDO and IDC;

(b) The purpose of the second mission, from 8 to 25 March 1986, was to visit suppliers (the Nissho Iwai Corporation consortium and the TISCEMA consortium) in Istanbul and Bucharest. A report "Visit to suppliers", dated March 1986, prepared in collaboration with M. C. Goromonzi and L. M. Chiviya, has been submitted to UNIDO and IDC;

(c) During his third mission, from 14 April to 9 May 1986, the expert was expected to provide technical advice and recommendations on a feasibility study made by IDC, and to assist the national project team in the preliminary negotiations of the contract.

RECOMMENDATIONS

1. IDC should request the suppliers to confirm, in writing, the quantity, availability, quality, homogeneity and price of local raw materials (sand, dolomite, limestone and feldspar).

2. IDC should also have the availability, characteristics and price for utilities (electricity, fuel oil, LPG, water etc.) confirmed in writing, to ensure that all utilities will be available at the date required by TISCEMA.

3. The site should be investigated with regard to level of underground water and soil resistance, as this may affect the cost of the foundation. If possible, more land should be bought for future expansion.

4. Equipment and services available in Zimbabwe should be laid down in collaboration with TISCEMA, according to their specifications and under their full technical responsibility. Quotations concerning civil works, equipment, materials and services available in Zimbabwe should be solicited and evaluated with a view to minimizing the investment cost.

5. TISCEMA should redesign the layout according to the recommendations formulated during the meeting, so as to allow for an easy expansion.

6. The production plans are based on local sales forecasts and selling prices assumed by IDC. To ensure the feasibility of the project, several assumptions should be made to validate the manufacturing plan. Figures regarding the export market should be confirmed and the sensitivity of the economic rate of return of the project to a change in the expected growth, in the demand and in the price on the local and export markets need to be evaluated.

7. The contract negotiations, based on a turnkey project, should be continued according to the strategy recommended. The technical assistance agreement should be signed for an initial period of five years and TISCEMA will be responsible for arranging all technical assistance and training to enable the company to produce sheet glass of international quality level.

8. Responsibilities and obligations under the joint venture should be clearly specified.

9. Details of the barter deal should be worked out to guarantee the financial plan.

I. SUMMARY OF REPORTS COVERING THE FIRST AND SECOND MISSION OF THE EXPERT

A. Assessment of the technology offered and analysis of comparative offers

During his first mission the expert assessed the technology offered by the following three companies:

(a) Nissho Iwai Corporation of Japan, in collaboration with Tecoyama (Japan), Kakoki (Japan) and Turkish Glass (Istanbul, Turkey);

(b) TISCEMA (CMI) of Romania;

(c) SOMEVER of France.

An analysis of the offers, detailed technical information, conclusions and recommendations are contained in the expert's report dated February 1986. The report also includes an annex entitled "Basic rules", in which the expert, based on information provided by IDC, elaborated his opinion and suggestion with regard to the general tender document, the sales forecast, the site, raw materials, utilities and investment in Zimbabwe. A second annex contains additional information on the supply of technology, including the turnkey contract, the technical assistance contract and the responsibility of the supplier of technology.

While it was relatively easy to reject the SOMEVER's offer for technical, economical and financial insufficiency, it was more difficult to appreciate and compare the merit of the proposals by Nissho Iwai Corporation and TISCEMA.

When the expert's conclusions and recommendations were presented to and discussed with the competent personnel of IDC, it became clear that both offers needed to be improved and supplemented and that this could best be achieved by visiting those suppliers of technology.

B. Visits to the selected suppliers

The visits to and discussions with suppliers (the expert's second mission) were made in close collaboration with M. C. Goromonzi and L. M. Chiviya.

From 9 to 15 March 1986 the team visited Turkiye Sise ve Cam Fabrikalari AS (Turkish Glass Works) at Istanbul with the participation of NIC - Tecoyama/Toledo Engineering, Yamabishi and Kakoki Koji Kaisha. From 16 to 22 March 1986 it visited TISCEMA at Bucharest and the Romanian Consortium.

The visits had the following main objectives:

(a) To establish personal contacts essential for further negotiations;

(b) To verify the competence and experience of the supplier of technology, especially of the glass producers by means of:

(i) Visiting the offices and factories of glass producers and suppliers of equipment;

(ii) Evaluating the standards of production;

(iii) Studying and collecting as much documentary evidence as possible with regard to technical, economic and financial aspects;

(c) To complete the offers, especially by discussing such major aspects as are referred to under the annexes "Basic rules" and "Additional information on the supply of technology".

The essential aim was to be able to compare:

(a) The technical competence in each criterion for the production of sheet glass;

(b) The policy of the suppliers of technology vis-à-vis the project, especially the responsibility they would take and their intention concerning the equity participation and the financing offered.

The main results have been summarized in the expert's report submitted in March 1986 and included the following documents for each supplier:

(a) Assessment of the capability of the suppliers of technology;

(b) Minutes of meetings (signed by both parties, the supplier of technology and IDC).

Based on the conclusions of the team, the IDC Board and the Tender Board has decided to continue the negotiation with the TISCEMA (CMI) consortium of Romania.

II. APPRAISAL OF THE FEASIBILITY STUDY

The feasibility study which has been prepared by IDC, is based on their own basic data. This study has been reviewed by the expert, and during the appraisal he collaborated with TISCEMA, the supplier of technology and partner in the joint venture, especially concerning the technical data.

A. Concept of the project

The aim of the project is to establish a sheet-glass industry which should in the first place cater for the domestic market and in the future for the export market. It will be based essentially on local raw materials: 80 per cent in tonnage of the total raw materials to be used will be local. The project will also take advantage of the electric potential of Zimbabwe: 30 per cent of the total energy requirement for glass melting will be electricity.

B. Market

At present sheet glass and plate glass are imported mainly from Belgium, Romania and South Africa and sometimes from Asia.

South Africa has a sheet-glass processing plant which has been constructed with the assistance of the Pilkington Glass Company, the world's leading manufacturer. The company supplies float-glass products of very high quality.

Imported glass products are mainly used in extensive applications such as building, housing, show windows, car windows etc. Sheet glass from the project will be sold to flat glass merchants and glaziers in Zimbabwe as well as to local importers.

Demand

The demand has been established according to data supplied by IDC. According to the Central Statistical Office (CSO) the market figures for the last five years were as follows:

Year	1980	1981	1982	1983	1984
Tonnage	4,688	5,880	4,616	6,776	10,000 (estimate)

The product mix (different uses) is approximately the following:

Building industry	84%
Automotive industry	12%
Prestige buildings/shop fronts	4%

The thickness of the glass is 2 to 12 mm, its width up to 2.5 metres, and its quality corresponds to international standards.

The market figures for the next 10 years have been arrived at using 1984 actuals as a base. The figures from CSO for the past five years show an average growth in demand of 25 per cent per year.

After consultations with importers of flat glass and with other senior members of the project department, a 10 per cent annual growth rate seems realistic. However, considering the recent trends in the economy, a somewhat pessimistic annual growth rate of only 5 per cent was assumed for the present feasibility study.

In 1984, the major importers of flat glass sold about 6,262 tonnes. IDC therefore assumes that the total demand for 1984 lies between 6,262 and 10,000 tonnes, and 8,150 tonnes would seem to be a realistic figure. Since it is also assumed that the share of the project in the total market will be about 80 per cent, the required supply would have been 6,520 tonnes for 1984.

Prices

The prices of imported sheet glass with a thickness of 3 mm are at present:

Local cost ($Zim/m^2)	7.19
Selling price to Government ($Zim/m^2)	26.69
SPG/LC ratio	370

IDC has considered a selling price for sheet glass which is the mean value of SPG and LC, i.e. $Zim 16.94/m^2 or $Zim 2.26/kg.

Sales projections

Table 1 is a summary of the sales projections for the local market, based on the above-mentioned assumptions and an expected commissioning of the plant in December 1988.

Table 1. Sales projections and estimate of sales revenues

Year	Expected sales (tonnes)	Estimated sales revenues a/ ($Zim)
1st (1989)	8 321	18 805 460
2nd (1990)	8 737	19 745 620
3rd (1991)	9 174	20 733 240
4th (1992)	9 633	21 770 580
5th (1993)	10 114	22 857 640
6th (1994)	10 620	24 001 200
7th (1995)	11 151	25 201 260
8th (1996)	11 708	26 460 080
9th (1997)	12 294	27 784 440
10th (1998)	12 909	29 174 340

a/ Based on 1986 sales price.

Production programme

The maximum melting capacity of the tank proposed by TISCEMA is 61.82 t/day with two PPG drawing machines.

The production plan for the first ten years (table 2) is based on the following assumptions:

(a) The production line will attain an efficiency of 65 per cent in the first and second year, and will reach 70 per cent in the third year and after;

(b) A one-month stock of finished product will be required;

(c) About 35 days/year will be needed for skimming, breakdown and maintenance;

(d) The furnace will have to be rebuilt after five years. Furnace rebuilding is expected to take 80 days.

The machines will therefore be working 330 days in a normal year and 250 days in the year of furnace rebuilding. The output will be 40t/day with an efficiency of 65 per cent, and 43.27 t/day with an efficiency of 70 per cent.

Table 2. Production plan

Year	Efficiency	Net production (tonnes)	Operating days		
			Total	Machine no. 1	Machine No. 2
1st (1989)	65	8 321 + stock 693	225	330	120
2nd (1990)	65	8 737	218.5	330	107
3rd (1991)	70	9 174	212	330	94
4th (1992)	70	9 633	223	330	116
5th (1993)	70	10 114	234	330	138
6th (1994) Furnace rebuilding	70	10 620	245	250	240
7th (1995)	70	11 151	258	330	186
8th (1996)	70	[illegible]	271	330	212
9th (1997)	70	12 [illegible]4	284	330	238
10th (1998)	70	12 909	298	330	266

C. Raw materials and utilities

Raw materials

The basic materials used in the production of sheet glass are sand, soda ash, dolomite, limestone and feldspar. With the exception of soda ash, all are available locally and represent 80 per cent in tonnage. The quality of limestone, especially concerning the high iron content, has to be confirmed. Small quantities of salt cake and carbon which are added, will have to be imported.

The chemical analysis of the local raw materials and the results of melting tests have been described in detail in the expert's reports of February and March 1986.

The required quantity and cost of each of these raw materials per tonne of melted glass are shown in table 3, and the raw material cost per year in table 4.

Table 3. Quantity and cost of raw materials per tonne of melted glass

Raw material	Composition (percentage)	Quantity per batch (tonnes)	Cost of one tonne of raw material ($Zim)	Cost per tonne of glass ($Zim)
Sand	57.4	0.748	32	23.94
Soda ash	20.0	0.261	324	84.56
Dolomite	14.2	0.185	126	23.31
Limestone	4.1	0.054	55	2.97
Feldspar	3.0	0.039	100	3.9
Salt cake	1.2	0.016	3.160	50.56
Carbon	0.1	0.0013	570	0.74
Total	100.0	1.3043 a/		189.98

a/ According to TISCEMA, 1.3014 t of batch will give 1 t of melted glass.

Table 4. Raw material cost per year

Year	Net production (tonnes)	Raw material cost ($Zim)
1st (1989)	8 321 + stock 693	1 580 823 131 656
2nd (1990)	8 737	1 659 855
3rd (1991)	9 174	1 742 876
4th (1992)	9 633	1 830 077
5th (1993)	10 114	1 921 458
6th (1994)	10 620	2 017 588
7th (1995)	11 151	2 118 467
8th (1996)	11 708	2 224 286
9th (1997)	12 294	2 335 614
10th (1998)	12 909	2 452 452

Utilities

Details on utilities consumption supplied by TISCEMA are summarized in table 5.

Table 5. Utilities consumption for the production of 45, 40 and 32 tonnes of glass

Utility	Net production		
	45 t	40 t	32 t
Fuel oil (tank firing)	10 530 t/day	9 660 t/day	8 400 t/day
Electricity	33 750 kWh/day	30 300 kWh/day	26 290 kWh/day
LPG	432 t/year	396 t/year	332 t/year
Sulphur dioxide	0.2 kg/h	0.18 kg/h	0.14 kg/h
Water	Average of 140 m^3/day		

By extrapolation the utilities consumption for each year has been calculated (table 6). The fuel oil consumption for the sand drier is 145 t/year and is constant.

The unit price of those utilities is as follows:

Fuel oil, diesel oil	67.4 cts/litre or 81.35 cts/kg
Electricity	3.5 cts/kWh
LPG	118.8 cts/kg
Water	3 cts/m^3
Sulphur dioxide	2,213.97 cts/t

The cost of utilities per year is summarized in table 7.

Packing materials

Imported sheet glass products are wrapped in paper and packed in wooden boxes to prevent breakage during transportation. A rate of breakage of about 5 per cent is assumed.

According to the unit prices given by IDC for wooden boxes, paper, woodchips and nails, the cost per tonne for packing materials is estimated at $Zim 57.11.

D. Site

The project will be located in the Kadoma industrial zone, 144 km from Harare. The population of Kadoma is about 77,000.

The location is satisfactory with respect to access, energy and water supply, manpower availability, and communication links with the main market areas. It is also reasonably close to the local deposit of raw materials.

The existing property which is almost flat, has a surface of approximately 20,000 m^2 as compared to an estimated 40,000 m^2 needed for the project's covered and uncovered areas, including roads.

The layout of the plant is now being prepared, and due consideration should be given to the possibility of extending this project in the future by other glass-production facilities.

Table 6. Utilities consumption per year

Utility	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fuel oil (t)										
Tank	2 523	2 524	2 600	2 678	2 758	2 841	2 926	3 014	3 104	3 197
Sand driers	145	145	145	145	145	145	145	145	145	145
Total	2 668	2 669	2 745	2 823	3 903	2 986	3 071	3 159	3 249	3 342
LPG (t)	283	293	303	315	326	338	350	363	376	390
Electricity (kWh)	8 000 000	7 836 648	8 079 019	8 328 886	8 586 480	8 852 042	9 125 817	9 408 059	9 699 030	9 999 000
Water (m^3)	46 200	46 200	46 200	46 200	46 200	46 200	46 200	46 200	46 200	46 200
Sulphur dioxide (kg)	850	792	871	950	1 029	1 118	1 187	1 266	1 345	1 424

Table 7. Utilities cost per year
(In Zimbabwean dollars)

Utility	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Fuel oil	2 170 418	2 171 231	2 233 057	2 296 510	2 361 590	2 429 111	2 498 258	2 549 846	2 643 061	2 718 717
LPG	336 204	348 084	359 964	374 220	387 288	401 544	415 800	431 244	446 688	463 320
Electricity	280 000	274 282	282 765	291 511	300 526	309 821	319 403	329 282	339 466	349 965
Water	1 386	1 386	1 386	1 386	1 386	1 386	1 386	1 386	1 386	1 386
Sulphur dioxide	1 882	1 753	1 928	2 103	2 278	2 475	2 628	2 803	2 978	3 153
Total	2 791 786	2 796 736	2 879 100	2 965 730	3 053 068	3 144 337	3 237 475	3 334 561	3 433 579	3 536 547

The following investment will be needed:

	$Zim
Land	2 000
Infrastructure:	250,000
Electrical substation ($Zim 151 000)	
Utilities connection up to the limit of the property	
Telex and telephone	
Railway connection	
Total	252,000

This corresponds to an amount of $US 152,855.

E. Project engineering

All details concerning the process, equipment and facilities of the plant, economics, as well as financial and commercial data are detailed in the following TISCEMA documents:

(a) Letter reference Dept. 1-1, dated 7 January 1986.
Commercial proposal No. 11110631, January 1986;

(b) Technical offer - Sheet glass plant, new unit, January 1986;

(c) Additional information, dated 4 April 1986.

The glass plant will use a Pittsburgh process. The main components of the glass plant are the batch plant, the furnace, and the drawing machine. These components are designed for an easy expansion.

The batch plant includes a receiving and storage area, a conveyor system, and weighing and mixing equipment. This plant will be semi-automatic.

The glass plant will have a combination furnace that uses both fuel oil (70%) and electricity (30%). Furnace operation is a continuous process. The normal period of operation is expected to be at least five years, at the end of which time the factory will be shut down for approximately 80 days to allow for furnace rebuilding.

The PPG drawing machine has a net ribbon length of 2.2 m and the drawing speeds for glass sheet of different thickness given by TISCEMA are shown in figure I.

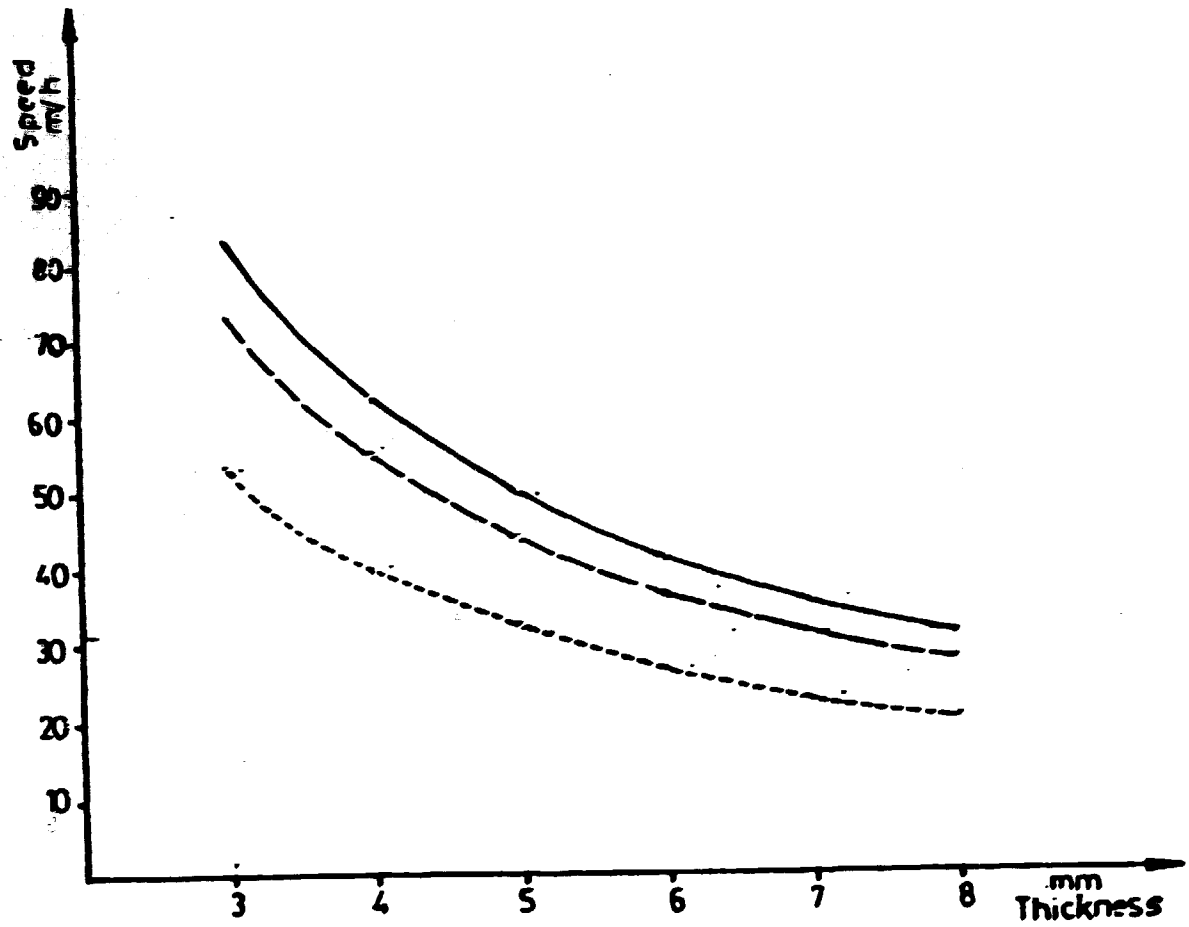
Equipment for cutting-off, cutting, packing and shipping is included.

The project will also include a stand-by generator, a workshop, a laboratory, and all auxiliary equipment for production and warehousing, as well as for the administrative and recreational facilities.

The cost of project engineering is shown in table 8. In that connection it should be noted that:

(a) The contract will cover all equipment (production, auxiliaries, administration, transportation etc.) necessary for the production of sheet glass according to international standards of output and quality, including engineering services and training of Zimbabwean personnel;

Figure I. Speed of drawing machine for glass sheet of different thickness



Key:

— —Average speed

- - - - - Minimal speed

——— Maximal speed

(b) The prices are fixed prices for the foreign-currency component. For the part to be paid in local currency a contingency of 10 per cent has been added;

(c) The cost for site preparation, civil works, installation and erection have been estimated according to IDC experience. The calculation of building costs is based on $US 450 per square metre;

(d) An allowance for training 23 staff for a period of 90 man-months has been added;

(e) An allowance for technical assistance, accommodation, air tickets etc. has been added.

Table 8. Cost of project engineering
(In United States dollars)

Item	Local currency	Foreign currency	Total
Equipment and services offered by TISCEMA			
Equipment and spare parts for two years			
From Romania		5 210 270	5 210 270
From local suppliers	1 114 749	171 000	1 285 749
From suppliers in a third country		1 038 115	1 038 115
Technical assistance, 6 workers (12 m/m)	21 000	19 727	40 727
Training of 23 local staff in Romania (90 m/m)	203 500	215 050	418 550
Engineering and know-how		640 306	640 306
Technical assistance, supervision of construction and erection of plant, taking-over tests, 17 workers (12 m/m)	124 750	264 777	389 527
Subtotal	1 463 999	7 559 245	9 023 244
Contingency (10%)	146 399		146 399
Additional equipment			
Telex, telephone, cafeteria, first aid etc.	100 000		100 000
Preparation of site			
Civil works, road installations etc.	4 500 000	500 000	5 000 000
Insurance during construction	30 000		30 000
Total	6 240 398	8 059 245	14 299 643

F. Plant organization and overhead costs

TISCEMA (CMT) of Romania will have the overall responsibility for supervising and managing the erection of the plant, and for providing all equipment and services on a turn-key basis. The organigramme of the consortium is given in figure II.

During the operational phases CMT will provide all technical assistance on the basis of a five-year contract.

Administrative manpower costs proposed by TISCEMA include 28 people (1 general manager, 5 managers etc.). The manpower costs have been calculated by IDC based on Zimglass wages. The costs include the company contributions for medical insurance, pension etc.

Table 9. Overhead costs
(In Zimbabwean dollars)

Item	Local currency	Foreign currency	Total
Technical assistance (long-term contract signed with CMT)	286 400	96 569	382 969
Manpower cost (28 administrative officers)	678 730		678 730
Overhead materials and telephone (3% of manpower cost)	20 361		20 361
Overheads for administrative officers (insurance, taxes, pension fund, medical insurance etc.)	150 000		150 000
Total	1 135 491	96 569	1 232 060

Maintenance

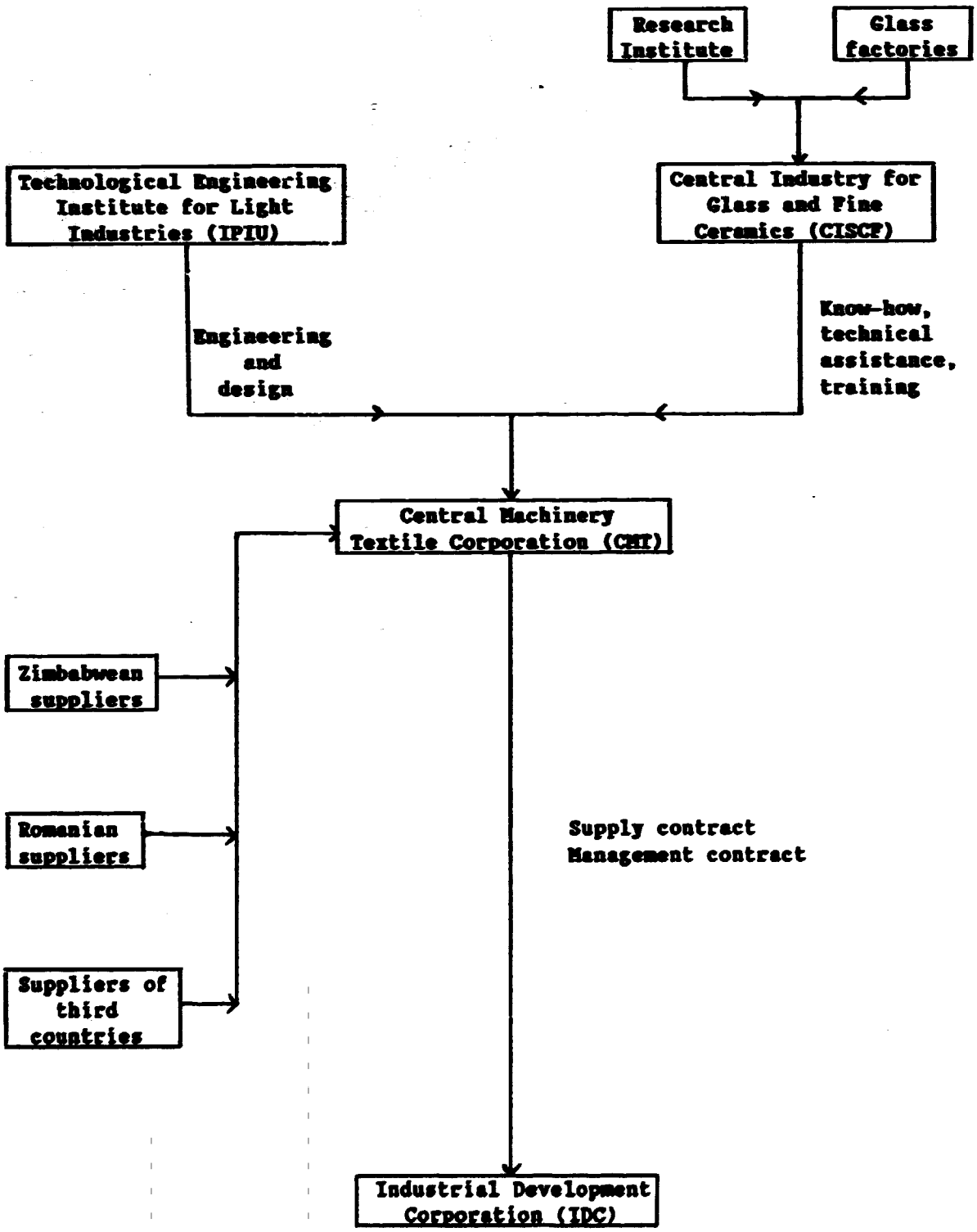
The furnace will be rebuilt after five years of service, for which 50 per cent of the material cost ($US 2,000,000) will have to be spent. The reserve per year was calculated as follows: $\frac{2\,000\,000 - 2}{5}$ = $US 200,000 or $Zim 331,895.

The general maintenance cost was assumed at 2 per cent of the equipment cost, i.e. $US 151,077 or $Zim 250,709.

G. Manpower

The project will create employment for 177 persons. Given the relative shortage of local staff having sufficient experience and background in the production of sheet glass, TISCEMA (CMT) will provide eight specialists for the first five years to fill key supervisory and production positions.

Figure II. Organigramme of the CMT consortium



A breakdown of administrative and production personnel appears below:

Administrative	28
Production	149
Total	177

The production manpower costs have been calculated by IDC on ZIMGLASS wages. The cost of the company contribution has been added to overheads.

Cost for 149 works $Zim 287 650/year

H. Implementation scheduling

Provided that the turn-key contract and technical-assistance contract will be signed in July 1986 and come into force in October 1986, the civil works on the site should commence towards the end of 1986. Plant commissioning is then expected to be completed in November 1988.

I. Financial and economic evaluation

Total project investment cost

(a) Pre-operation expenses

Pre-operation expenses include allowances for the test run, the services of a general manager and his secretary for the construction period of 25 months, and also for a UNIDO expert to assist the local team in the implementation of the project, in collaboration with the supplier of technology. Those expenses are summarized in table 10.

Table 10. Pre-operation expenses
(In United States dollars)

Item	Local currency	Foreign currency	Total
Labour cost and overheads for test run (two months)	253 063		253 063
Utilities for test run (two months)	355 186		355 186
Local supervision (General manager and secretary (25 months)	75 000		75 000
General expenses (office, transportation, hospitality, travel)	50 000		50 000
UNIDO assistance	20 000	80 000	100 000
Total	753 249	80 000	833 249

(b) Working capital

(i) Raw materials

Of locally available raw materials a stock for a one-month's production will be kept, while of imported materials a quantity covering the production requirements of three months will be stored.

Raw material	Yearly consumption (t)	Storage (t)	Cost ($Zim)
Sand a/	6,224.19	518.68	16,597
Soda ash b/	2,169.20	542.30	175,705
Dolomite a/	1,569.67	130.81	16,481
Limestone b/	446.92	111.73	6,145
Feldspar a/	359.72	29.98	2,998
Salt cake b/	130.81	10.90	34,445
Carbon b/	10.90	2.73	1,553
Total			253,924 or $US 153,015

a/ One month's requirement.

b/ Three month's requirement.

(ii) Utilities

The capital tied up in storing utilities for one month's operation will be:

	$Zim
Oil	180,868
LPG	28,017
Sulphur dioxide	157
Total	209,042 or $US 125,969

(iii) Packing materials

For one month's full production:

	$Zim
Wood board	35,867
Paper	17,068
Wood chips and nails	3,211
Total	56,146 or $US 33,833

(iv) Accounts receivable (debtors)

Assumed at 10 per cent of the turnover (calculated on basis of a sales price for 3-mm thick glass of $Zim 15/$m^2$ or $Zim 2/kg):

$Zim 1,664,200 or $US 1,002,847.

(v) Finished product on stock

Assumed at the value of one month's sales of sheet glass (based on the above-mentioned sales price):

Table 11. Working capital
(In United States dollars, 1986 constant value)

Item	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Raw materials	153 015	160 665	168 699	177 134	185 991	195 290	205 055	215 307	226 073	237 376
Utilities	125 969	132 267	138 881	145 825	153 116	160 772	168 810	177 251	186 113	195 419
Packing materials	33 833	35 525	37 301	39 166	41 124	43 180	45 339	47 606	49 987	52 486
Accounts receivable (debtors)	1 002 847	1 052 989	1 105 638	1 160 921	1 218 967	1 279 915	1 343 910	1 411 106	1 481 662	1 555 745
Finished product on stock	835 203	835 203	835 203	835 203	835 203	835 203	835 203	835 203	835 203	835 203
Cash	126 531	126 531	126 531	126 531	126 531	126 531	126 531	126 531	126 531	126 531
Payments (creditors)	(226 186)	(219 261)	(232 100)	(240 832)	(249 804)	(259 215)	(268 957)	(279 147)	(289 709)	(300 747)
Total working capital	2 051 210	2 123 919	2 180 153	2 243 947	2 311 128	2 381 676	2 455 891	2 533 957	2 615 860	2 702 013
Contingency (base 1986)	-	72 709	56 234	63 794	67 181	70 548	74 215	77 966	81 903	86 153
Contingency (base 1989)	-	83 615	64 669	73 363	77 258	81 130	85 347	89 661	94 188	99 076

$Zim 1,386,000 or $US 835,203.

(vi) Cash

Assumed at the value of one month's personnel wages:

$Zim 209,976 or $US 126,531.

(vii) Payments to creditors

Assumed at one month's cost of raw materials and utilities:

$Zim 375,355 or $US 226,189.

The working capital required for the first ten years of operation is summarized in table 11.

(c) Total project cost

The overall cost of the project is summarized in table 12.

Table 12. Total project cost

Item	Local currency	Foreign currency	Total	
	$US		$US	$Zim
Aquisition of land and part of infrastructure	151 855		151 855	252 000
Site preparation, civil works (building and road) erection and installation of plant	4 500 000	500 000	5 000 000	8 297 378
Subtotal	4 651 855	500 000	5 151 855	8 549 378
Machines, equipment and services (training, engineering and know-how, technical assistance (including contingency))	1 710 398	7 559 245	9 269 643	15 382 746
Insurance	30 000		30 000	49 784
Subtotal	1 740 398	7 559 245	9 299 643	15 432 530
Pre-operation expenses	753 249	80 000	833 249	1 382 756
Interest during construction	500 000	500 000	1 000 000	1 659 475
Working capital	2 051 210		2 051 210	3 403 932
Contingencies (10%) (including increase of local expenses)	500 000	1 500 000	2 000 000	3 318 951
Total	10 196 712	10 139 245	20 335 957	33 747 024

Depreciation

The cost of the assets will be written off according to the following schedule:

(a) Site, building and civil works - 20 years (5%);

(b) Machines, equipment and services, installation and insurance - 10 years (10%);

(c) Pre-operation expenses and interest during construction - 5 years (20%).

A depreciation schedule for the first 10 years is given in table 13.

Financial plan

The proposed financial plan, in Zimbabwean dollars, is summarized below:

	Percentage	Foreign currency	Local currency	Total
Equity	35			11,811,458
of which:				
IDC	70		8,268,021	
TISCEMA	30	3,543,437		
Total equity	100	3,543,437	8,268,021	11,811,458
Loans	65			
TISCEMA (barter condition)		9,000,945		
Local banks			12,934,621	
Total long-term loans		9,000,945	12,934,621	21,935,566
Total project financing				33,747,024

TISCEMA is expected to supply a loan under a barter agreement. The interest rate will be 6 per cent per year and the projections assume that repayment will be over eight years with two years' grace.

The other loans are to be arranged by IDC with the Zimbabwe Development Bank and possibly with other local institutions. The terms are expected to be 13.25 per cent per year and repayment over 10 years with two years' grace. The dept service is detailed in table 14.

Projected income

The projected income for the first 10 years of operation is shown in table 15. The costs are based on 1986 prices; for 1989 the following contingency for price increases has been added:

Sales price	10%
Raw materials	
Packing materials	
Utilities	
Personnel cost	15%
Maintenance and furnace rebuilding	
Overhead expenses	

Table 13. Depreciation
(In Zimbabwean dollars)

et and e of preciation	Investment $US	Investment $Zim	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
e. building nd civil orks (5%)	5 151 855	8 549 378	427 469	427 469	427 469	427 469	427 469	427 469	427 469	427 469	427 469	427 469
chines, equipment nd services (10%)	11 299 643	18 751 481	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148	1 875 148
-operation xpenses nd interest uring con- truction (20%)	1 833 249	3 042 231	608 446	608 446	608 446	608 446	608 446					
Total	18 284 747	30 343 090	2 911 063	2 911 063	2 911 063	2 911 063	2 911 063	2 302 617	2 302 617	2 302 617	2 302 617	2 302 617

Table 14. Debt service
(In Zimbabwean dollars)

Loan	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
TISCEMA (6% over 8 years, 2 years' grace)										
Interest	540 056	540 056	540 056	450 047	360 037.8	270 028.35	180 018.9	90 009.45	-	-
Total payment	540 056	540 056	2 040 217	1 950 204	1 860 196	1 770 186	1 680 177	1 590 166	-	-
Amount of loan	9 000 945	9 000 945	7 500 787.5	6 000 630	4 500 472.5	3 000 315	1 900 157.5	-	-	-
Local banks (13.25% over 10 years, 2 years' grace)										
Interest	1 713 837	1 713 837	1 713 837	1 499 608	1 285 378	1 071 148	856 919	642 689	428 460	214 230
Total payment	1 713 837	1 713 837	3 330 665	3 116 436	2 902 206	2 687 976	2 473 747	2 259 517	2 045 288	1 831 058
Amount of loan	12 934 621	12 934 621	11 317 794	9 700 967	8 084 139	6 467 312	4 850 484	3 233 657	1 616 828	-
Total										
Interest	2 253 893	2 253 893	2 253 893	1 949 655	1 645 416	1 341 176	1 036 988	732 698	428 460	214 230
Total payment	2 253 893	2 253 893	3 370 882	5 066 640	4 762 402	4 458 162	4 153 924	3 849 683	2 045 288	1 831 058
Amount of loan	21 935 566	21 935 566	18 818 582	15 701 597	12 584 612	9 467 627	6 350 642	3 233 657	616 828	-

Table 15. Projected income
(In Zimbabwean dollars)

Item	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total sales	20 686 006	21 720 180	22 806 564	23 947 638	25 143 404	26 401 320	27 721 386	29 106 088	30 562 884	32 091 774
Production costs										
Raw materials	1 969 351	1 908 833	2 004 307	2 104 588	2 209 676	2 320 226	2 436 237	2 557 929	2 685 956	2 820 320
Packing materials	592 007	573 815	602 516	632 662	664 252	697 484	732 359	768 940	807 527	847 818
Utilities	3 210 553	3 204 746	3 310 965	3 410 647	3 511 029	3 615 987	3 723 096	3 834 745	3 948 516	4 067 022
Personnel	1 480 797	1 480 797	1 480 497	1 480 497	1 480 497	1 480 497	1 480 497	1 480 497	1 480 497	1 480 497
Furnace rebuilding	381 679	381 679	381 697	381 697	481 697	481 697	481 697	381 697	381 697	381 697
Maintenance	288 315	288 315	288 315	288 315	288 315	288 315	288 315	288 315	288 315	288 315
Inventory	(283 430)	-	-	-	-	-	-	-	-	-
Total production costs	7 639 272	7 838 185	8 068 297	8 208 406	8 535 466	8 784 206	9 042 201	9 312 123	9 592 408	9 885 669
Gross profit	13 046 734	13 881 995	14 738 267	15 649 232	16 607 938	17 617 114	18 679 185	19 793 965	20 970 476	22 206 105
Overhead expenses										
Technical assistance, salaries, general expenses	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869	1 416 869
Operating profit	11 629 865	12 465 126	13 321 399	14 232 363	15 191 069	16 200 245	17 262 316	18 377 096	19 553 607	20 789 236
Other expenses										
Depreciation	2 911 063	2 911 063	2 911 063	2 911 063	2 911 063	2 302 617	2 302 617	2 302 617	2 302 617	2 302 617
Net interest	2 253 893	2 253 893	2 253 893	1 949 655	1 645 416	1 341 176	1 036 938	732 698	428 460	214 230
Total other expenses	5 164 956	5 164 956	5 164 956	4 860 718	4 556 479	3 647 793	3 339 555	3 035 315	2 731 077	2 516 847
Net income (profit) before tax	6 464 909	7 300 170	8 156 443	9 371 645	10 634 590	12 556 452	13 922 761	15 341 781	16 822 530	18 272 389
Tax (52.8%)	3 413 471	3 854 489	4 306 601	4 948 228	5 615 063	6 629 806	7 351 218	8 100 460	8 882 296	9 647 821

continued

Table 15. (continued)

Item	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Net income (profit) after tax	3 051 437	3 445 680	3 849 841	4 423 417	5 019 526	5 926 645	6 571 543	7 241 321	7 940 234	8 624 568
Net profit before tax as percentage of sales	31	34	36	39	42	48	50	53	55	57
Net profit after tax as percentage of sales	15	16	17	18	20	22	24	25	26	27
Net profit after tax as percentage of equity	26	29	33	37	42	50	56	61	67	73

Return on investment, pay-back and cash flow

Table 16 gives details on pay-back and the return on investment. According to those calculations, the rate of return on investment is 20.74 per cent and the pay-back period 4 1/2 years.

The cash flow during the construction period is shown in table 17.

Table 16. Return on investment and pay-back
(In Zimbabwean dollars)

Year	Investment	Net profit after tax	Depreciation	Pay-back per year	Accumulated pay-back	Balance at end of year	Return			
							At 20%	R(1.20)	At 21%	R(1.21)
1989	30 343 090	3 051 437	2 911 063	5 962 500	5 962 500	24 380 590	0.83	4 968 750	0.83	4 927 685
1990		3 445 680	2 911 063	6 356 743	12 319 243	18 023 847	0.69	4 414 404	0.68	4 341 741
1991		3 849 841	2 911 063	6 760 904	19 080 147	11 262 943	0.58	3 912 560	0.56	3 816 298
1992		4 423 417	2 911 063	7 334 480	26 414 627	3 928 463	0.48	3 537 075	0.47	3 421 589
1993		5 019 526	2 911 063	7 930 589	34 345 216		0.40	3 127 125	0.39	3 057 585
1994		5 926 645	2 302 617	8 229 262			0.33	2 755 963	0.32	2 622 096
1995		6 571 543	2 302 617	8 874 160			0.28	2 476 615	0.26	2 334 914
1996		7 241 321	2 302 617	9 543 938			0.23	2 219 615	0.22	2 077 039
1997		7 940 234	2 302 617	10 242 851			0.19	1 952 590	0.18	1 842 267
1998		8 624 568	2 302 617	10 927 185			0.16	1 764 801	0.15	1 624 256
	30 343 090							31 129 498		30 065 470
								+(786 408)		-(270 620)

Table 17. Cash flow for the construction period
(In Zimbabwean dollars)

Item	1987 First semester	1987 Second semester	1988 First semester	1988 Second semester	Total	
Cash inflow						
Equity:						
TISCEMA	1 543 253		2 000 184		3 543 437)	2 474 079
IDC	500 000	7 768 021			8 268 021)	
Loan		2 000 000	2 000 000	8 934 621	12 934 621)	(9 000 945 barter)
Cash outflow						
Site preparation, civil works, building, installations and erection of plant	85 494	8 378 390	85 494		8 549 378	
Machines, equipment, services, training, engineering and know-how, technical assistance, insurance	1 543 253		2 444 166	2 444 166	6 431 585 +9 000 945 barter	24 746 079 (9 000 945 barter)
Pre-operation expenses	345 689	345 689	345 689	345 689	1 382 756)	
Interest during construction				1 659 475	1 659 475)	
Working capital				3 403 932	3 403 932)	
Contingencies		1 106 317	1 106 317	1 106 317	3 318 951)	
Surplus/deficit	68 817	-62 375	18 518	-24 960		
Cumulative cash balance	68 817	6 442	24 960	0		

III. PRELIMINARY CONTRACT NEGOTIATIONS

The expert participated in the preliminary contract negotiations which took place between 28 April and 6 May 1986. The meetings were attended by:

Mr Paul Popescu, counsellor, CHI, Bucharest
Mr. Mircea Nestor, director, Central Industry for Glass and Fine Ceramics, Bucharest
Mr. Alexandru Patrescu, project manager, Technological Engineering Institute for the Light Industries, Bucharest
Mr. Marin, economist, Bucharest
Mr. Dobran, commercial counsellor, Romanian Embassy, Harare
Mr. M. C. Goromonzi, projects controller, IDC, Harare
Mr. L. M. Chiviya, senior chemical engineer, IDC, Harare

The discussions were based on the following draft documents submitted by TISCHMA:

Contract

Article 1 - Subject matter and scope of contract
Article 2 - Delivery obligations and services to be rendered by the seller
Article 3 - Supplies and services to be provided by the buyer
Article 4 - Price
Article 5 - Terms of payment
Article 6 - Delivery of equipment, machinery and materials, rendering of services, delivery of the subject matter (terms, place and conditions)
Article 7 - Packing
Article 8 - Insurance
Article 9 - Transportation and dispatch
Article 10 - Test before shipment
Article 11 - Provisions concerning the seller's personnel necessary for erection, starting up, test in view of accepting, and training of the Romanian operating personnel
Article 12 - Test in view of completion of erection and acceptance of the plant
Article 13 - Guarantees
Article 14 - Penalties and other sanctions
Article 15 - Force majeure
Article 16 - Arbitration
Article 17 - Miscellaneous
Article 18 - Final dispositions
Article 19 - Coming into force

Technical appendix

Description of the plant - its technical characteristics, the technology and the guarantee performance
Specifications of seller's delivery
Specifications of buyer's delivery
Specifications of the documentation to be delivered by the seller
The schedule of the contract's execution, delivery, erection, test in view of acceptance
Conditions for the seller's specialists sent for erection work and test in view of acceptance

Technical assistance agreement

Article 1 - Subject matter and scope of the contract
Article 2 - The period of technical assistance and validity of the contract
Article 3 - Fees and work programme
Article 4 - Overtime
Article 5 - Leave
Article 6 - Payment of technical assistance
Article 7 - Obligations of the buyer
Article 8 - Obligations of the seller
Article 9 - Medical assistance and replacements in case of disease, accident or death
Article 10 - Insurance
Article 11 - General conditions
Article 12 - Arbitration
Article 13 - Cancellation
Article 14 - Correspondence and language
Article 15 - Coming into force

After the preliminary negotiations, the team concluded that TISCEMA will have to revise their document according to the recommendations put forward and to resubmit it to INC for further negotiations.

IV. CONCLUSIONS

During his first mission the expert assisted the national project team in the evaluation of three proposals made to the Government by a French, a Japanese and a Romanian company. An assessment of the technology offered and a comparative analysis of the offers made apparent the need to improve the proposal from Japan and Romania.

Visits to and discussions with both suppliers of technology were held in close collaboration with the national project team (M. C. Goromanzi and L. M. Chiviya). Based on the conclusions of that team, the IDC Board and the Tender Board decided to continue the negotiations with the TISCEMA (CMI) consortium of Romania.

TISCEMA seem to have the necessary expertise and experience to provide the technology, to build the plant and to manage the construction of a sheet-glass factory using the PPG process.

In addition, TISCEMA will become a partner of IDC in a joint-venture agreement and will provide supervision and technical assistance during both the project implementation period and the operational phase. A technical assistance agreement will be signed for an initial period of five years between the joint-venture company and TISCEMA, which will be responsible for providing all technical knowledge, know-how and training to enable the company to produce sheet glass of an acceptable quality, to operate the plant efficiently and to maintain it in good condition.

The feasibility study prepared by IDC in collaboration with the supplier of technology has confirmed the profitability of the project. Besides providing an acceptable return and pay-back, the project will also contribute to the development of linked activities like mining and transportation of sand, limestone, dolomite and feldspar (80 per cent in tonnage of the required raw materials are local). The project will also take advantage of the electric potential of Zimbabwe, as 30 per cent of the total energy requirement for melting glass will be derived from electricity.

The project will generate employment for 177 local people.

In addition, because sheet glass which has so far been imported will be produced domestically, the project will help to save foreign currency and thus contribute toward the improvement of the trade balance of Zimbabwe. This goal can be reached on the condition that the Government of Zimbabwe will stop all importation of sheet glass and give assurance that domestic glass prices will be set in such a way as to allow the project to earn reasonable returns on capital employed and to service its debts, and to reflect inflationary increase in costs.

The contract documents presented by TISCEMA during the last part of the expert's mission made apparent the need for TISCEMA to revise the turnkey contract and the technical assistance agreement and to resubmit those documents to IDC for further negotiations. In the redrafting of the documents it should also be ensured that they conform to the contract laws of Zimbabwe.

The contract-negotiations strategy recommended by the expert is displayed in figure III.

Figure III. Recommended strategy for contract negotiations