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cdt-afrique

bp 1805, douala-bonanjo

telephone/fax: (237) 42 47 43

cameroun

africa

FAEM S.A.

Douala, CAMEROUN

PHASING OUT OF CFCs

A FINANCIAL ANALYSIS

**Douala July 22, 1996
(FINAL REPORT)**

12

REPUBLIC OF CAMEROON
FAEM CFCs PHASEOUT

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ABBREVIATIONS AND ACRONYMS

CBD	Convention on Biological Diversity
CFC	Chlorofluorocarbons
CIF	Cost, Insurance, Freight
FAEM	Société Anonyme de Fabrication d'Appareils Electro-Ménagers
FRR	Financial rate of Return
FOB	Free on Board
GEF	Global Environment Facility
GOC	Government of Cameroon
GNP	Gross National Product
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IMFIM	Interim Multilateral Fund for the Implementation of the Montreal Protocol
MEF	Ministry of Environment and Forestry
MFMP	Multilateral Fund for the Implementation of the Montreal Protocol
MP	Montreal Protocol
NOP	National Ozone Policy
NPV	Net Present value
O&M	Operations and Maintenance
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substance
UAC	Unit Abatement Cost
UC	Unconstrained Demand
UNEP	United Nations Environment Program

WEIGHTS AND MEASURES

Currency Unit:
CFA Franc

Exchange Rates

US \$1 = CFA Franc 500

Metric System

INTRODUCTION

1. Cameroon is a developing country for the purposes of the Montreal Protocol (MP). Given its per capita Ozone Depletion Substances (ODS) consumption of less than 0.3 kg (0.0087 kg/capita), it is eligible for assistance from the Interim Multilateral Fund for the Implementation of the Montreal Protocol (IMFIM). A country program has been prepared and presented to the Executive Committee of the MP. Cameroon has a relatively active ODS-using sector which in 1991 consumed the equivalent of over 100 tons of the ODS regulated by the MP, mainly in the refrigeration and associated insulation foam applications. It is estimated that about 50% of total ODS consumption in 1991 was done by the domestic refrigeration manufacturing and foam applications. The level of consumption is projected to continue to increase substantially.

2. The Government of Cameroon (GOC) has prepared a country program to implement the MP. The country program was developed with the assistance of an international expert sponsored by the United Nations Environment Program (UNEP) who worked with a multi-disciplinary team set up by GOC. The proposed plan of action includes institutional strengthening measures in the key agencies responsible for environmental matters, training and the present specific FAEM industrial project to eliminate CFC consumption in the refrigeration sector. The present report is a feasibility study of the financial implications of the FAEM CFCs phaseout project. The terms of reference are provided in Annex 1.

THE MONTREAL PROTOCOL

3. The global cooperation to protect the stratospheric ozone layer started with the 1985 Vienna Convention for the Protection of the Ozone Layer. This was followed by the 1987 Montreal Protocol on Substances that Deplete the Ozone layer (MP), the London amendments in 1990, and the Copenhagen Amendments in 1992. The MP entered into force in January 1989.

4. The MP is an international agreement to phase out ozone depleting substances on a short and specific timetable. It called for pollution prevention rather than pollution control. According to the terms of the MP, the production and consumption of CFCs and halons were to be restricted to 1986 levels in 1989, subsequently reduced to 80% of 1986 levels by 1994, and then to 50% of 1986 levels by 1999. Developing countries were less restricted. Production was allowed to continue to meet domestic needs, but was not allowed to exceed 110% of 1986 levels and was expected to drop back to 90% by 1994 and then 65% by 1999.

5. As further scientific evidence showed this reduction schedule to be inadequate, the protocol was revised at meetings in 1990 in London. The so-called London Amendments to the MP specified a faster timetable for reducing

CFC levels and called for the complete phaseout of certain substances. This schedule was revised again at the Third Meeting of the Parties in Copenhagen in 1992.

6. The specific substances that have been targeted for phase out are:

- Primary CFCs (CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115)
- Halons (Halon-1211, Halon-1301, and Halon-24020);
- Secondary CFCs (CFC-13, CFC-112, CFC-214, and CFC-216)
- Carbon Tetrachloride (CCl₄);
- Methyl Chloroform (MCF);
- HCFCs (280 HCFCs including HCFC-21, HCFC-22, HCFC-123, HCFC-124, HCFC-141b, HCFC-142b, HCFC-225ca, and HCFC-225cb);
- HBFCs (HBFC-22B1 and 272 others including CHFBr₂, CH₂FBr, and C₂HFBr₄); and
- Methyl Bromide (CH₃BR).

7. At the time of the London Amendments, it was recognized that the incremental costs incurred by developing countries would place a heavy burden in their development efforts. This is why the Multilateral Fund for the Implementation of the Montreal Protocol (MFMP) was established to channel resources from developed to developing countries to meet incremental costs of phasing out ozone-depleting substances (ODS). Likewise, the Global Environment Facility (GEF), which also finances projects that phase out ODS, helps meet incremental costs.

8. Both the MFMP and the GEF require that the countries conceive a strategic framework for the activities to be financed to demonstrate that overall phaseout of ODS will be accomplished. This framework is the Country Program or Plan of Action which sets out a national strategy and a program of proposed activities to meet the phaseout schedules set out in the MP. The overall cost of the phaseout is the country incremental cost of implementing its Action Plan.

GOVERNMENT RESPONSE TO THE MONTREAL PROTOCOL

9. Cameroon is a signatory to the Vienna Convention (March 22, 1985). It also signed and ratified the MP and has worked diligently to encourage its normal implementation. More specifically, the Government of Cameroon

created the Ministry of Environment and Forestry in 1992 and made it responsible for the definition and implementation of environmental policy. It subsequently formed an interministerial working group (Working Group) that included representatives from the Ministry of Environment and Forestry (MEF), the Ministry of Agriculture, the Ministry of Mines, Water and Energy, the Ministry of Trade and Industry, the Ministry of Scientific Research, the Ministry of Health, and the Ministry of Transport. A representative of a Non-Governmental-Organization (NGO) was included in the group. Finally, representatives from the private sector were admitted as active observers. The work of the interministerial working group was coordinated by MEF. Assistance was provided to the working group by an international expert provided by the United Nations Environment Program (UNEP).

10. The purpose of the Working Group was to define the country program or action plan for the implementation of the MP. The program was produced and officially adopted by the Government. It is summarized below.

National Ozone Policy

11. The following national Ozone Policy (NOP) has been adopted by the Government:

12. Objective. The objective of the Government Action Plan is to eliminate in the most cost effective way the consumption of CFCs in the country in a manner consistent with the MP. Specific reduction targets have been defined for the elimination of ODS.

13. Components. The main components of the country program are:

- Institutional Measures. The establishment of an Ozone Monitoring Commission (OMC). The main purpose of the OMC to:
 - (i) provide a consultative role in the formulation and promulgation of specific policies forming the NOP;
 - (ii) help develop voluntary agreements when necessary within the industry to establish specific end-use bans consistent with the overall objectives of the ODS phaseout program;
 - (iii) monitor phaseout progress and evaluate the need to increase the prices of ODS (e.g. import tax) to levels at or below which substitutes become financially attractive in order to provide incentives for the phaseout;
 - (iv) help design licensing system for ODS users which encourages environmentally responsible handling practices;

- (v) help establish ODS import monitoring procedures which account for all ODS as required under the MP, and from which progress in reducing ODS consumption can be tracked to make appropriate adjustment in programs and policies; and
- (vi) help create and enhance public awareness of the "ozone issue".

- Institutional Strengthening Measures. The provision of technical assistance and appropriate training to the OMC and customs agents directly concerned with the NOP and the monitoring of the import and use of ODS. The related assistance to the private sector to also train its professionals on the needs, the technologies and the application of the NOP.
- Regulatory Measures. The establishment of a licensing system for ODS users and of appropriate import control procedures for the ODS and the introduction of excise tax to CFCs to accelerate the phaseout.
- Public Awareness. The intensification of public awareness of the "ozone issue" through media attention to policies, programs and projects for ODS reduction technologies. Initial emphasis is to be placed on the conservation aspects and subsequently on the demonstration of cost savings.
- Specific Industrial Phaseout Projects. The identification, preparation and appraisal of a specific ODS phaseout project have been carried out in the refrigeration industry. The project is now in its implementation phase.
- Program Cost. The cost of the Government program has been estimated at US\$3,510,258 as follows, over a three year period:

	US Dollars
(i) Institutional measures	210,300
(ii) Institutional Strengthening	158,500
(iii) Industrial CFC Phaseout	3,150,258
 Total	 3,510,258

INDUSTRY RESPONSE TO THE MONTREAL PROTOCOL

14. The industrial sector has cooperated fully with the Government in the assessment of ODS use and the generation of project concepts and feasibility studies for the phaseout of ODS. Representatives of the main industrial users of CFCs worked closely with the Working Group.

15. The proposed project for the phaseout of CFCs in the refrigeration industry was conceived, prepared and developed in close coordination with the MEF. The sectoral background data that led to the phaseout project was diligently put together with the help of the private sector as part of the Government's general effort to obtain a broader understanding of the importance of CFCs in the economy.

THE FAEM CFCs PHASEOUT PROJECT

The Sector

16. All the ODS needs of Cameroon are imported from Western Europe for the most part. The imported ODS are used mainly in the following sectors: refrigeration and air conditioning, foam blowing, solvents, fire-extinguishing, aerosols, and cigarette manufacturing. Available statistics indicate the following consumption levels:

Table 1: Consumption of ODS

Year	ODS -----tons-----	ODP
1986	350.8	160.9
1987	343.0	141.4
1988	337.7	126.6
1989	309.3	111.1
1990	314.2	123.1
1991	284.1	103.9
1992	274.3	101.3

17. The breakdown by major use is given as below for 1991 where detailed information is available:

Table 2: Consumption of CFCs by Sector in 1991

Sector	Tons ODS	Tons ODP	% Total ODP
Refrigeration	52.8	51.6	49.7
Solvents	212.4	21.2	20.4
Foam	15.0	15.0	14.5
Fire Extinguishing	2.9	15.0	14.5
Tobacco	1.0	1.0	0.9
Total	284.1	103.8	100

18. These numbers indicate that refrigeration is the major consumer of CFCs in terms of ODP, especially when the foam requirements for panel insulation are taken into account. If the MP is not implemented, unconstrained demand for ODS is projected to from present levels to 252.6 tons ODP equivalent by 2010.

The Company

19. FAEM was founded in 1979 by a group of Cameroonians to assemble household appliances that included initially refrigerators and freezers. The decision was subsequently made to include gas cooking ranges and air conditioners. Imported kits and sheet plates for the frame of the appliances are the key raw materials used.

20. The basic process can be described as follows: on arrival, the metal sheets are directed to the paint and body shop where they are cut to the required specifications, shaped as desired, cleaned, welded when necessary and painted. This shop has the capacity to prepare parts for more than 50 appliance units per one shift day.

21. From the paint and body shop, the components are sent to the main assembly sections depending on the unit to be produced. For the refrigerators and the freezers, the housings and doors are pre-assembled and sent to the foaming section which is a great consumer of CFC-11. From the foaming section, the rigid frames are fitted with the required components such as the compressor, the condenser and the heat exchangers. Subsequently, freon gas is filled into the freezers and the usual fittings (ice-box, vegetable containers, glass separators, ...) are installed in the refrigerators. The finished product is then tested, packed and stored to await shipment.

22. In the air conditioners' line, the sheet plates are sent from the paint and body shop straight to the assembly line where the frames are put up and

fitted with all the components before gas is filled in. The same procedure is followed in the cooking range section except for gas filling.

The Project

Project Objective and Definition

23. The main purpose of the project is to phaseout chlorofluorocarbons (CFCs) consumption at FAEM, by far the largest supplier of refrigerators to the Cameroon market. Investments would be completed in 1996 and operations start in 1997.

24. The project has the following main components:

- Purchasing of the equipment and technical support necessary to facilitate the switch from CFCs to non-ODSs in the production of household refrigerators.
- Recovery, processing and reutilization of CFC-12 from household refrigerators already in service and being repaired by FAEM and in various small shops around the country.
- Minor civil works modifications to prepare the factory for the new equipment.
- Personnel training to improve skills and introduce the new technology.
- Limited and Intermittent Technical Assistance from external partners to help smooth the introduction of the new technology.

Technology and Specific Investments

25. CFCs are used as the fluid for the cooling mechanism in refrigerators and air conditioners and are also be found in the insulating foam of refrigerators. Both these pieces of equipment have long lifetimes (in some appliances as long as 25 years, especially in a low income country like Cameroon where consumers hold on to their equipment for as long as possible) and require servicing that involves regular recharging of the ODS within the appliances. The long lifetimes and servicing needs of these appliances mean that the effort to eliminate the banned substances will require retrofitting of the existing stock in addition to substituting for them in new appliances. Recycling also plays an important role in ensuring that sufficient stock remains of the banned substance for servicing need while retrofitting is being carried out.

26. FAEM will replace CFC-11 and CFC-12 with HCF-134a and HCFCs in the substitution appliances. Investments here will include injection or gas charging machinery with spare parts, testing and quality control equipment, a

measurement and testing laboratory, and micro-computer system with the related software for conception, simulation and analysis of equipment performance.

27. To address the recuperation and recycling needs of ODS in existing appliances, a complete line of recuperation and recycling equipment will be installed. There are an estimated 130-150 shops in the main urban areas that service appliances such refrigerators and freezers. The typical compressor procedure is to unsolder the drier, allowing the refrigerant to be emitted to the atmosphere, resolder the new compressor and drier, evacuate the system with a vacuum pump, charge with CFC-12, check for leaks with a halogen leak detector, and operate the refrigerator to check for proper performance.

28. Investments will also be made to modify the factory layout and add some new structures in order to make it better suited to accommodate the new equipment to be installed.

29. Finally, the project finances laboratory equipment necessary to deal with the expected increase in product testing activities. The testing will seek to determine the optimum capillarity restriction and refrigerant charge to provide appropriate refrigerator storage temperatures, minimize energy consumption, attain necessary low voltage operation and determine ice-freezing rates. The project is also providing the capability of producing insulation samples in the laboratory for bench testing of physical properties and thermal conductivity as well as foaming cabinet and line assemblies which are subjected to thermal cycling tests in the laboratory.

The Market

30. Supply. Before 1982, when the FAEM factory became operational, appliances such as refrigerators and freezers were imported. Since then, they have been supplied from both the local industry and from imports, with the local industry having the lion's share of more than 95% . The main reason for this dominance was the decision of the government to protect FAEM as an "infant industry".

31. The lucrative market that was thus established led to the creation of other assembly units to compete with FAEM. In 1990, the requirements of the World Bank and the IMF-supported structural adjustment program led to trade liberalization measures that eliminated previous protective ones and opened the gate to imports. The combined effect of this liberalization and the recession severely hit local assembly plants and led to their closing down, except for FAEM, and a resurgence of imports as a source of supply to the market.

32. Demand. The demand of first time buyers of major household appliances is driven by chiefly by factors such as the number of newly employed couples above a certain income, availability of consumer credit, the importance of the urban population and access to electricity. In the replacement market, it is

generally assumed that refrigerators are replaced every 8th year and freezers every eleventh year. However, actual lifetime is considerably longer than that.

33. It is estimated that close to 300,000 refrigerators and 135,000 freezers are currently in use in the country. At a yearly renewal rate of 14% and 10% respectively, this points to an estimated yearly potential replacement demand of 42,000 refrigerators and 13,500 freezers respectively. If one were to add to this the potential demand of first time buyers, the numbers obtained would be too far removed from the recent sales experience. It is therefore more realistic to assume that demand has been equal to sales estimates.

34. In this respect, the recent sales history and forecast of home appliances in the Cameroon has been as summarized below:

Table 3: Appliances Sales History

	Year	Refrigerators	Freezers
1. Actual or Estimate			
	1990	8,700	8,500
	1991	8,000	8,500
	1992	7,500	9,345
	1993	7,000	9,000
	1994	7,200	9,000
	1995	7,500	9,500
2. Projections			
	2000	8,450	13,450
	2005	9,800	16,600
	2010	13,440	18,100

35. After many years of recession, the Cameroonian economy is showing signs that it has stabilized and it is ready to start on the road to recovery, albeit timidly. In the appliance sector, this should lead to a more stable market that could grow at the rates implied by the numbers above: about 3% per annum between 1996 and 2000 for refrigerators, more than 10% for freezers and close to nothing for cold stores.

36. FAEM's overall market share would continue to be substantial and grow from at about 50% of the total market in 1997 to around 80% after four

years. One reason for this scenario is the regulatory measures which will gradually take effect concerning ODS appliances. Initially, imports will continue to make significant inroads in the local market because of the time it will take for the government to fully implement the Action Plan and therefore insure a better control of compliance with the MP by the local economy. The resulting production and sales figures would be over the next ten years as shown in Table 4 below:

Table 4: FAEM's Projected Sales
(Units)

Year	FAEM's Sales	Total Demand	FAEM's Market Share
1. Refrigerators			
1997	3,300	7,725	43%
1998	4,000	7,960	50%
1999	5,000	8,200	61%
2000	5,750	8,440	68%
2001	6,325	8,600	73%
2002	6,640	8,960	74%
2003	6,970	9,225	76%
2004	7,200	9,500	76%
2005	7,400	9,800	76%
2. Freezers			
1997	6,500	11,300	57%
1998	7,500	12,440	60%
1999	9,000	13,060	69%
2000	10,350	13,450	77%
2001	11,400	13,850	82%
2002	11,950	14,270	84%
2003	12,550	14,700	85%
2004	12,930	15,150	85%
2005	13,320	15,600	85%

37. Sales of cold stores are expected to oscillate around 115-120 units per year.

Incremental Costs

38. Compliance with the MP and its amendments constrains industrial development and therefore adds to costs. These costs, incremental costs, are incurred at the country, sector and industry levels when special efforts, that would not otherwise have been made, are made to comply with the MP prescriptions. The additional (or incremental) costs are calculated as the costs that the country or enterprise incurs by reason of its compliance with the MP. These would not have been incurred in the absence of such compliance. In other words, the situation that results from the compliance course of action (the with situation) is compared with what might have been expected otherwise, in the absence of that action (the without case).

39. The incremental costs in the case of FAEM are enterprise financial costs. The following cost elements have been identified:

A. One-time, Capital or Capitalized Costs

- Plant design and layout modification costs: the installation of new equipment requires some modification in the factory design and layout.
- Equipment investment costs: new equipment is necessary to convert the plant from the use of CFCs to that of substitute, non-ODS and for quality control.
- Equipment investment costs for the recovery and recycling of CFCs from existing appliances pending the complete implementation of the phaseout.
- Personnel training, technology transfer, and technical assistance costs.
- Research and Engineering costs to adapt the new technology to the local conditions.
- Licenses, Patents and Royalties.

B. Working Capital Needs

C. Recurrent Costs

- The net incremental operating costs including the cost of new components like compressors for non-ODS use and the non-ODS themselves over CFCs.

40. These costs are summarized below:

Table 5: Project Costs

(US\$000)

	Local	Foreign	Total
Plant Modifications	394	-	394
Machinery/Equipment	-	1,463	1,463
Total Fixed Assets	394	1,463	1,857
Training	393	91	484
Technical Assistance	-	187	187
License/Patents/Royalties	-	53	53
Interest During Construction	-	435	435
Incremental Working Capital	-	54	54
Contingencies	79	228	307
Total	866	2,511	3,377

41. A contingency of 10% has been taken on all project costs, whether expressed in US dollars or in local currency. No physical contingency has been included because of the modest nature of the plant layout and design work and because of the long experience and familiarity that management has with the site and the plant. Details on costs are provided in Annex 2.

Project Financing

42. It has been assumed, for the current financial analysis purposes, that the investments considered would be financed with the equivalent of 100% debt. Although this may not accurately reflect the grant nature of the Multilateral Fund mechanism, the hypothesis made seeks to determine, according to the terms of the reference, if the undertaking would be financially viable. The interest rate assumed is Libor plus a spread of 375 basis points. In addition, a country risk factor of 200 basis points has been assumed. Detailed assumptions are in Annex 2.

PROJECTED PERFORMANCE

Revenues

43. Revenues are based on the concept that since the investments themselves are incremental and relate specifically to the phaseout of CFCs and the government has already imposed a 40% excise tax on imported ODS-appliances, FAEM can set its selling price at the equivalent of what the imported products would sell for taking into account the excise tax application. Since the FOB prices of imports are not always well known and to avoid overpricing which might lead to severely reduced sales, the increments in selling prices have been obtained by adding 20% of the costs of total, not incremental imported raw materials to FAEM's normal price structure. This is substantially below what would be obtained by applying the excise tax to imports. The additional unit revenues derived have been applied to the projected sales volumes as explained in Annex 2.

44. Resulting incremental unit revenues may appear high but, as shown in para. 50, the project would still be attractive even with a substantial reduction in unit prices or quantities sold. Incremental unit revenues are given below:

Table 6: Incremental Unit Revenues

	CFAF	US Dollars
Refrigerators	80,000	160
Freezers	75,000	150
Cold Stores	400,000	800

Costs

45. Production costs that have been taken into account are only those deemed to be incurred because of the conversion of FAEM plant to produce non-ODS appliances. They include, the cost differential for inputs, variable costs and fixed costs. For the inputs, it has been determined that an HFC-134a compressor costs US\$10 higher than a CFC-12 compressor and that non-ODS costs typically US\$40 more per kg than the ODS they replace. This factor has been used to compute the cost per appliance or cold store and the result applied to the number of units projected to be produced and sold.

46. Since the manufacture of non-ODS compressors/appliances implies a much higher stringency in the requirements of quality of production surroundings and extensive field testing is required to properly adapt the new technology to the local conditions, it has been assumed that FAEM would incur additional production costs other than for raw materials approaching 5% of its normal operating costs.

Profitability

47. Annual incremental revenues and operating profits have been estimated as follows in constant CFA Francs. Production is expected to start at the beginning of calendar year 1997. The numbers show that the proposed investments would be profitable for FAEM over the ten-year projection period adopted. margins are attractive. A summary of the projected incremental performance is provided below with details in Annex 6:

Table 7: Summary - Projected Income Statements
(CFA Francs)

	1997	1998	1999	2000	2001
Incremental Revenues	795,500	928,500	1,121,000	1,282,250	1,405,875
Incremental Raw Mat.	107,105	122,763	144,263	162,323	176,169
Income Before Tax	305,717	412,629	536,932	787,490	877,798
Ratios: As % of Sales					
Gross Margins	87%	87%	87%	87%	87%
PBT*	11%	22%	32%	54%	54%
DSCR**	2.5	1.5	2.0	2.4	2.9

* Profit Before Tax. ** Debt Service Coverage Ratio, expressed as a number.

48. The project has good margins which provide a sound cushion for adverse possible unforeseen circumstances. Profits before tax margins improve gradually as a result of gains in efficiency. The debt service coverage ratio dips substantially in 1998 because this is the first year of principal repayment.

Internal Rate of Return

49. The Internal Rate of Return on the incremental investments is estimated at 48% as shown in Annex 7. The rate is calculated on the cash flow that includes all incremental investments except interest during construction, and all operational costs excluding financial costs and depreciation.

Sensitivity Analysis

50. A sensitivity analysis has been done to determine the impact of the most likely adverse developments of the key variables on the results. The key variables have been identified as incremental revenues, sales volumes, and the costs of raw materials. The results are provided below.

Table 8: Sensitivity Analysis

	IRR (%)	Lowest DSCR
Base case	48%	1.5 (1998)
Unit Revenues Less 50%	17%	0.6 (1998)
Sales Volumes Less 50%	23%	0.7 (1998)
Materials Costs Plus 100%	39%	1.2 (1998)
Investment Costs Plus 100%	24%	1.5 (1998)

51. According to these numbers, the investments are generally sound and yield a good internal rate of return. The project's return is most affected by a decline in the unit sales prices. A 50% decline in this variable reduces the rate by more than half but still to an attractive 17% and the Debt Service Coverage Ratio (DSCR) to less than 1 (0.6). A substantial increase in the costs of the non-ODS would not have a significant adverse impact on the results of the project.

CONCLUSION

52. The project is financially attractive and justifies the investments that are being undertaken. The analysis shows that under the worst case scenario, when unit sales prices increments would decrease by 50%, the investments would still yield a decent 17% financial or internal rate of return. However, if debt monies were to be 100% used to finance the project, the company would have some problems meeting its debt obligations in the early years of principal repayment. However, short term debt or internally generated cash flow could be used to meet this shortfall given the zero-equity option considered.

53. The normal case would be for unit sales prices to decrease by 25% and the most probable case would be for sales volumes to decrease by 25-50%. Eitherway, the project would still be financially attractive as shown in Table 8.

FAEM CFCs PHASEOUT PROJECT ANNEX 1: TERMS OF REFERENCE

Preamble

The project covers the conversion of the domestic refrigerator manufacturing plant at FAEM S.A., Douala, Cameroon. The implementation of the project will result in an estimated phaseout of 45.6 MT of CFC-11 and 16.26 MT of CFC-12. It represents about 64% of ODS consumption in the domestic refrigerator sector. The replacement alternatives chosen by the Company are cyclopentane as foam blowing agent and HFC-134a as refrigerant. The project includes the redesign of all current refrigerator models and the conversion of the plants. The conversion of the production facilities will cover the refrigeration system, insulating foam blowing system as well as the refrigeration service carried out by the company. Cyclopentane and HFC-134a technologies are ultimate conversion solutions. The conversion is on-going and the impact of these changes on investment cost and operational cost have a direct effect on the market price of the different manufactured models.

Duties

- make feasibility studies for different solutions (different levels of investments to increase local content of products, different refrigerator models, capacities and pricing).
- calculate for different investment amounts, production programs and models and their sales.
- evaluate the influence of the current purchase price on the following:
 - total project costs, including working capital and interest during construction,
 - depreciation costs of the project,
 - forecast of profit and loss of the project under normal, worse case and most probable scenarios,
 - profitability, return on investment and financial internal rate of return for the normal case, worse case and most probable case scenarios.

Impact of the recent changes of the market and foreign exchange conditions because of the devaluation of the currency from CFA 50.00 for FF 1.00 to CFA 100.00 for FF 1.00.

Language: English
Duration: 4 weeks

FAEM CFCs PHASEOUT

Annex 2

Basic Assumptions

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1. Historical Sales of Appliances																	
Refrigerators	8692	7933	7500	7000	7200	7500	7500	7725	7957	8195	8441	8695	8955	9224	9501	9786	10079
Freezers	8448	8495	9345	9000	9000	9500	9500	11305	12436	13057	13449	13852	14268	14696	15137	15591	16059
Cold Stores				100	100	103	106	110	115	115	115	115	115	115	120	120	125
Total	17140	16428	16845	16100	16300	17103	17106	19140	20507	21368	22005	22662	23338	24035	24758	25497	26263
Growth Rate (%)																	
Refrigerators		-9%	-5%	-7%	3%	4%	0%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Freezers		1%	10%	-4%	0%	6%	0%	19%	10%	5%	3%	3%	3%	3%	3%	3%	3%
Cold Stores						3%	3%	4%	5%	0%	0%	0%	0%	0%	4%	0%	4%
Total		-4%	3%	-4%	1%	5%	0%	12%	7%	4%	3%						
2. Recharging Considerations																	
Total Stock of Appliances																	
Refrigerators		341000	331883	322789	313649	305167	297409	290038	283261	277055	271398	266269	261650	257523	253871	250678	247930
Freezers		122000	124395	127520	130144	132637	135505	138230	142623	147928	153589	159358	165243	171249	177382	183650	190059
Additions		463000	456278	450309	443794	437804	432914	428268	425885	424983	424986	425627	426893	428772	431253	434328	437989
Removal																	
Refrigerators		7933	7500	7000	7200	7500	7500	7725	7957	8195	8441	8695	8955	9224	9501	9786	10079
Freezers		8495	9345	9000	9000	9500	9500	11305	12436	13057	13449	13852	14268	14696	15137	15591	16059
Net Stock		16428	16845	16000	16200	17000	17000	19030	20392	21253	21890	22547	23223	23920	24638	25377	26138
Removal																	
Refrigerators		17050	16594	16139	15882	15258	14870	14502	14163	13853	13570	13313	13083	12876	12694	12534	12397
Freezers		6100	6220	6376	6507	6632	6775	6911	7131	7396	7679	7968	8262	8562	8869	9183	9503
Net Stock		23150	22814	22515	22190	21890	21646	21413	21294	21249	21249	21281	21345	21439	21563	21716	21899
Net Stock																	
Refrigerators		331883	322789	313649	305167	297409	290038	283261	277055	271398	266269	261650	257523	253871	250678	247930	245613
Freezers		124395	127520	130144	132637	135505	138230	142623	147928	153589	159358	165243	171249	177382	183650	190059	196615
Available CFCs for Recharges (tons)		456278	450309	443794	437804	432914	428268	425885	424983	424986	425627	426893	428772	431253	434328	437989	442228
Refrigerators (@180gr/unit scrapped)		3069	2987	2905	2823	2747	2677	2610	2549	2493	2443	2396	2355	2318	2285	2256	2231
Freezers		1098	1120	1148	1171	1194	1220	1244	1284	1331	1382	1434	1487	1541	1596	1653	1711
Recuperation Efficiency		4167	4107	4053	3994	3940	3896	3854	3833	3825	3825	3831	3842	3859	3881	3909	3942
Net available CFCs (tons)								964	1533	1912	2295	2873	2882	2894	2911	2932	2956

FAEM CFCs PHASEOUT

Annex 2

Basic Assumptions

SALES AND PRICE ASSUMPTIONS

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
A. Units Sold										
Fridges	3300	4000	5000	5750	6325	6641	6973	7183	7398	7620
Freezers	6500	7500	9000	10350	11385	11954	12552	12929	13316	13716
Cold Stores	110	115	115	115	115	115	115	120	120	125
Total	9910	11615	14115	16215	17825	18711	19640	20231	20834	21461
Annual Growth Rate										
Fridges		21%	25%	15%	10%	5%	5%	3%	3%	3%
Freezers		15%	20%	15%	10%	5%	5%	3%	3%	3%
Cold Stores		5%	0%	0%	0%	0%	0%	4%	0%	4%
B. Market Size										
Fridges	7725	7957	8195	8441	8695	8955	9224	9501	9786	10079
Freezers	11305	12436	13057	13449	13852	14268	14696	15137	15591	16059
Coolers	138	144	144	144	144	144	144	150	150	156
Total	19168	20536	21396	22034	22691	23367	24064	24788	25527	26294
Market Share										
Fridges	43%	50%	61%	68%	73%	74%	76%	76%	76%	76%
Freezers	57%	60%	69%	77%	82%	84%	85%	85%	85%	85%
Coolers	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
	52%	57%	66%	74%	79%	80%	82%	82%	82%	82%
Sale prices (CFAF/Unit)										
Fridges	80000									
Freezers	75000									
Cold Stores	400000									

FAEM CFCs PHASEOUT

Annex 2

Basic Assumptions

SALES REVENUES AND COST ASSUMPTIONS										
Sales Revenues	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Fridges	264000	320000	400000	460000	506000	531300	557865	574601	591839	609594,1
Freezers	487500	562500	675000	776250	853875	896568,8	941397,2	969639,1	998728,3	1028690
Coolers	44000	46000	46000	46000	46000	46000	46000	48000	48000	50000
Total	795500	928500	1121000	1282250	1405875	1473869	1545262	1592240	1638567	1688284
Operating Costs				CFAF 1000						
A. Variable Costs										
Materials and Supplies	18000	16000	19000	19000	19000	19000	19000	19000	19000	19000
Memo: Unit Cost	1,816	1,378	1,346	1,172	1,066	1,015	0,967	0,939	0,912	0,885
Turnover Tax (%)	15,75	15,75	15,75	15,75	15,75	15,75	15,75	15,75	15,75	15,75
Amount	125291,3	146239	176558	201954	221425	232134	243379	250778	258074	265905
Other Services	1404,5	1404,5	1404,5	1404,5	1404,5	1404,5	1404,5	1404,5	1404,5	1404,5
Memo: Unit Cost	0,142	0,121	0,100	0,087	0,079	0,075	0,072	0,069	0,067	0,065
Memo: Weighted Unit Costs	14,601	14,089	13,954	13,713	13,567	13,497	13,431	13,404	13,366	13,341
B. Fixed Costs (Taken at 5% of the base costs)										
External Services	1000	1250	1750	1750	1750	1750	1750	1750	1750	1750
Transport	750	1000	1517,1	1517,1	1517,1	1517,1	1517,1	1517,1	1517,1	1517,1
Miscellaneous	1506	2139,1	3500	3500	3500	3500	3500	3500	3500	3500
Personnel	10000	10250	11000	11000	11000	11000	11000	11000	11000	11000
Taxes and Rates	650	750	1000	1000	1000	1000	1000	1000	1000	1000
Total	13906	15389,1	18767,1	18767,1	18767,1	18767,1	18767,1	18767,1	18767,1	18767,1

FAEM CFCs PHASEOUT
Annex 2
Basic Assumptions

	FAEM RECONVERSION INVESTMENT COSTS					
	US\$1=		CFAF 1000			
	FOREX US \$000	CFAF EQUIV (1000)	LOCAL CFAF (1000)	TOTAL CFAF (1000)	US Dollars 1000	% FOREX
1. Civil Works						
Modifications	0	0	182000	182000	364	0%
Trial Rooms	0	0	4218	4218	8	0%
Ovens	0	0	6500	6500	13	0%
Various Upgrades	0	0	4530	4530	9	0%
Total 1: Civil Works	0	0	197248	197248	394	0%
2. Equipment						
A. CFC-11 TO HCFC-123 C.						
3 Injection machinery	295	147483	0	147483	295	100%
Laboratory Equipment	171	85251	0	85251	171	100%
Micro-Computer & Software	62	31222	0	31222	62	100%
Total A: Equipment	528	263956	0	263956	528	100%
B. CFC-11 TO HFC-134 A						
3 Charge Stations	170	84970	0	84970	170	100%
3 Electronic leak detectors	81	40597	0	40597	81	100%
5 Leak seals	6	2833	0	2833	6	100%
Testing Equipment	144	71753	0	71753	144	100%
Total B: Equipment	400	200152	0	200152	400	100%
C. Recovery Equipment						
Main Factory	249	124623	0	124623	249	100%
Laboratory	94	47206	0	47206	94	100%
Regional Recovery Centers	191	95544	0	95544	191	100%
Total C: Equipment	535	267372	0	267372	535	100%
Total Equipment	1463	731479	0	731479	1463	100%
3. Training					0	
Local Training	45	22650	41500	64150	128	35%
Overseas Training	1	378	113508	113886	228	0%
Laboratory Training	45	22650	41500	64150	128	35%
Total Training	91	45677	196508	242185	484	19%
4. Technical Assistance	187	93467	0	93467	187	100%
5. Licence, Patents, Royalties	53	26435	0	26435	53	100%
6. Interest During Construction	435	217402	0	217402	435	100%
7. Incremental Working Capital*	54	26776	0	26776	54	100%
TOTAL	2282	1141235	393756	1534991	3070	74%
8. Contingencies	228	114124	39376	153499	307	74%
GRAND TOTAL	2511	1255359	433132	1688490	3377	74%
* Incremental Working Capital as follows:						
	Fridges	Freezers	Cold Stores	Total		
Year 1 Production (units)	3300	6500	110	9910		
Incremental Unit costs: (US\$)						
Compressor	10	10	15	35		
Non-ODS	7.2	7.2	400	414		
Total	17.2	17.2	415	449		
CFAF/Unit	8600	8600	207500	224700		
Total Incremental Costs(CFA 1000)	28380	55900	22825	107105		
Requirements for 3 months	7095	13975	5706	26776		
Equivalent in Dollars (1000)	14	28	11	54		

FAEM CFCs PHASEOUT
Annex 2
Basic Assumptions

		FAEM RECONVERSION INVESTMENT COSTS				
US\$1=	500	CFAF 1000				
	FOREX	CFAF	LOCAL	TOTAL	US Dollars	
	US \$000	EQUIV (1000)	CFAF (1000)	CFAF (1000)	1000	% FOREX
1. Civil Works						
Modifications	0	0	182000	182000	364	0%
Trial Rooms	0	0	4218	4218	8	0%
Ovens	0	0	6500	6500	13	0%
Various Upgrades	0	0	4530	4530	9	0%
Total 1: Civil Works	0	0	197248	197248	394	0%
2. Equipment						
A. CFC-11 TO HCFC-123 C.						
3 Injection machinery	295	147483	0	147483	295	100%
Laboratory Equipment	171	85251	0	85251	171	100%
Micro-Computer & Software	62	31222	0	31222	62	100%
Total A: Equipment	528	263956	0	263956	528	100%
B. CFC-11 TO HFC-134 A						
3 Charge Stations	170	84970	0	84970	170	100%
3 Electronic leak detectors	81	40597	0	40597	81	100%
5 Leak seals	6	2833	0	2833	6	100%
Testing Equipment	144	71753	0	71753	144	100%
Total B: Equipment	400	200152	0	200152	400	100%
C. Recovery Equipment						
Main Factory	249	124623	0	124623	249	100%
Laboratory	94	47206	0	47206	94	100%
Regional Recovery Centers	191	95544	0	95544	191	100%
Total C: Equipment	535	267372	0	267372	535	100%
Total Equipment	1463	731479	0	731479	1463	100%
					0	
3. Training						
Local Training	45	22650	41500	64150	128	35%
Overseas Training	1	378	113508	113886	228	0%
Laboratory Training	45	22650	41500	64150	128	35%
Total Training	91	45677	196508	242185	484	19%
4. Technical Assistance	187	93467	0	93467	187	100%
5. Licence, Patents, Royalties	53	26435	0	26435	53	100%
6. Interest During Construction	435	217402	0	217402	435	100%
7. Incremental Working Capital*	54	26776	0	26776	54	100%
TOTAL	2282	1141235	393756	1534991	3070	74%
8. Contingencies	228	114124	39376	153499	307	74%
GRAND TOTAL	2511	1255359	433132	1688490	3377	74%
* Incremental Working Capital as follows:						
	Fridges	Freezers	Cold Stores	Total		
Year 1 Production (units)	3300	6500	110	9910		
Incremental Unit costs: (US\$)						
Compressor	10	10	15	35		Estimated incremental unit costs.
Non-ODS	7.2	7.2	400	414		Estimates as follows: for fridges and freezers:
Total	17.2	17.2	415	449		\$40/kg for 180 grams per appliance. For cold
CFAF/Unit	8600	8600	207500	224700		stores: \$40/kg for about 10 kgs of substance/store.
Total Incremental Costs(CFA 1000)	28380	55900	22825	107105		
Requirements for 3 months	7095	13975	5706	26776		
Equivalent in Dollars (1000)	14	28	11	54		

FAEM CFCs PHASEOUT
Annex 2
Basic Assumptions

FAEM LOAN ANALYSIS											
CFAF 1,000											
Total Amount	1688490										
Duration (Years)	10										
Grace Period	2										
Interest Rate (Libor (7)+3.75+2)	12.75										
Front End Fee	0.75										
Special Services Fee	1.5										
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Principal Outstanding	1688490	1688490	1688490	1477429	1266368	1055306	844245	633184	422123	211061	
Repayment	0	0	211061	211061	211061	211061	211061	211061	211061	211061	211061
Balance Outstanding	1688490	1688490	1477429	1266368	1055306	844245	633184	422123	211061	0	
Interest Payments	215283	215283	201827	174917	148007	121096	94186	67276	40365	13455	
Front End Fee	12664										
Special Services Fee	25327										
Total Financial Charges	253274	215283	201827	174917	148007	121096	94186	67276	40365	13455	
Debt Burden:											
Repayment	0	0	211061	211061	211061	211061	211061	211061	211061	211061	211061
Financial Charges	253274	215283	201827	174917	148007	121096	94186	67276	40365	13455	
Total Debt Burden	253274	215283	412889	385978	359068	332158	305247	278337	251427	224516	
Debt Service Coverage Ratio		2.5	1.5	2.0	2.4	2.9	3.3	3.8	4.4	5.1	