United Nations Environment Programme

Distr.
LIMITED

UNEP/OzL.Pro/ExCom/11/30
5 October 1993

ORIGINAL: ENGLISH

Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Eleventh Meeting
Bangkok, 10-12 November 1993

PROJECT PROPOSALS: VENEZUELA

This document includes:

a) Comments and Recommendations from the Fund Secretariat for the project proposals listed below; and

b) The following project proposals:

- FAACA, Mobile air conditioner (MAC) factory conversion for fabrication of HFC-134a heat exchangers project proposal; and

- AAISA, Mobile air conditioner (MAC) factory conversion for fabrication for assembly of HFC-134a compressors project proposal

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Venezuela
PROJECT TITLE:	FAACA, Mobile air conditioner (MAC) factory conversion for fabrication of HFC-134a heat exchangers
BUDGET:	US $4,100,000
INCREMENTAL COSTS:	US $3,480,000
ODS PHASE-OUT:	Direct: elimination of 1 tonne CFC-12/year; Indirect: 75-90 tonnes CFC-12/year in 30-35,000 MAC units annually produced
COST EFFECTIVENESS:	US $5.66/kg/year
PROJECT DURATION:	2 years
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY: FONDOIN

TECHNICAL REVIEW COMPLETED: YES _X_ NO ___

SECRETARIAT'S COMMENTS

1. Fábrica de Aparatos de Aire Acondicionado, C.A., FAACA, is a domestic manufacturer of MAC evaporators and condensers, and assemblers of compressor. Total annual production of MAC units is between 30,000 and 35,000. FAACA produces both complete MAC units (with compressor), and heat exchangers which are marketed separately. Its products are sold to both assemblers and aftermarket distributors.

2. FAACA is planning to convert its production line of heat exchangers and evaporators to be used in MAC units using HFC-134a as a refrigerant. The project consists of the retooling of the fabrication line and related training, technical assistance and licensing fees for transfer of technical data and design specifications. Consumption of CFC-12 will be completely phased-out when new condenser/evaporator lines are installed.

3. The Government of Venezuela submitted the project proposal to the Fund Secretariat and to the World Bank. The World Bank evaluated the proposal in terms of the technology used and the costs associated. A comprehensive technical review prepared by the World Bank was provided. Of the total cost of the project, the Bank's assessment concluded that US $0.62 million were non-incremental costs since annual design changes and subsequent new tooling requirements of this type are characteristic of the industry and, thus, would be required on an annual basis independently of the refrigerant that is used.

SECRETARIAT'S RECOMMENDATIONS

4. The project is recommended for final approval of funding in the amount of $3.48 million with the proviso that the tooling of the plant will not result in an additional production capacity.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Venezuela
PROJECT TITLE:	AAISA, Mobile air conditioner (MAC) factory conversion for fabrication for assembly of HFC-134a compressors
BUDGET:	US $650,000
INCREMENTAL COSTS:	US $620,000
ODS PHASE-OUT:	Direct: elimination of 11 tonne CFC-12/year; Indirect: 10 tonnes CFC-12/year prorated for 40,000 compressors annually produced
COST EFFECTIVENESS:	US $4.36/kg/year
PROJECT DURATION:	1.5 years
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY: FONDOIN

TECHNICAL REVIEW COMPLETED: YES X NO ___

SECRETARIAT'S COMMENTS

1. Aires Acondicionados, S.A., AAISA, is a domestic manufacturer of domestic air conditioners, MAC evaporators and condensers, and assembler of compressors. AAISA produces both complete MAC units (with compressor), and heat exchangers which are marketed separately. Total annual production of MAC compressors is 40,000 units.

2. AAISA is planning to convert its MAC compressor production line to be used in MAC units using HFC-134a as a refrigerant. The project consists of retooling the compressor manufacturing line and related training for AAISA service personnel and selected dealers and service shops, and a reclamation-recycle-recharge programme for CFC-12 used in the plant. About 97 per cent of the actual CFC-12 consumption will be phased-out when the compressor assembly line is installed.

3. The Government of Venezuela submitted the project proposal to the Fund Secretariat and to the World Bank. The World Bank evaluated the proposal in terms of the technology used and the costs associated. A comprehensive technical review prepared by the World Bank was provided. Of the total cost of the project, the Bank's assessment concluded that the reclamation-recycle-recharge programme at a cost of US $27,000 was not-incremental cost since the implementation of this programme will generate annual savings of US $7,800 in terms of CFC-12 recovered and recycled. This programme is an integral part of the project and will be financed by AAISA.

SECRETARIAT'S RECOMMENDATIONS

4. The project is recommended for final approval of funding in the amount of $620,000 with the proviso that the tooling of the plant will not result in an additional production capacity.

THE MONTREAL PROTOCOL
ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Republic of Venezuela
PROJECT NAME:	FAACA (Fabrica De Aparatos De Aire Acondicionado, C.A.). Mobile Air Conditioner (MAC) Factory Conversion for Fabrication of HFC-134a Heat Exchangers.
SECTORS COVERED:	Automobile Air Conditioning
ODS CONSUMPTION IN AFFECTED SECTORS:	Estimated CFC-12 Consumption in Mobile Air Conditioners: New: 80 tons; Aftermarket Service: 900 tons.
PROJECT IMPACT:	Direct Elimination in Factory - 1 ton/year; Indirect - Approx. 75-90 tons/year in 30-35,000 units annual production.
PROJECT DURATION:	24 months for implementation
TOTAL PROJECT COST:	US$4.10 million for Heat Exchanger Line
PROPOSED ODS GRANT:	US$3.48 million
COST EFFECTIVENESS:	Unit Abatement Cost; $5.66/kg./year
IMPLEMENTING AGENCY:	World Bank
COORDINATING NAT. AGENCIES:	FONDOIN
BENEFICIARIES:	FAACA, a Venezuelan private enterprise.

PROJECT SUMMARY

Please Refer to attached Executive Project Summary

CURRENCY EQUIVALENTS

Currency Unit = Venezuelan Bolivar (BS)
US$1.00 = 95.5 Bs (Exchange rate as of September 10, 1993)

UNITS AND MEASURES

metric ton - Ton (T) = 1,000 kg.

ACRONYMS

AAC	:	Automobile Air Conditioning
AC	:	Air Conditioning
CCl_4	:	Carbon Tetrachloride, a controlled ODS
CFCs	:	Chlorofluorocarbons
GOV	:	Government of Venezuela
FONDOIN	:	Foundation to Implement Montreal Protocol in Venezuela
HFC	:	Hydrofluorocarbon
MAC	:	Mobile Air Conditioner
MCF	:	Methyl choroform, a controlled ODS
MPEC	:	Montreal Protocol Executive Committee
MPOTF	:	Montreal Protocol Ozone Projects Trust Fund (OTF)
ODS	:	Ozone Depleting Substances
OORG	:	Ozone Operations Resource Group
USEPA	:	United States Environment Protection Agency

FISCAL YEAR

January 1 - December 31

MONTREAL PROTOCOL (MP) PROJECT FOR VENEZUELA

INITIAL EXECUTIVE PROJECT SUMMARY

COUNTRY:	Republic of Venezuela
PROJECT NAME:	FAACA: Mobile Air Conditioner (MAC) Factory Conversion for Fabrication of HFC-134a Compatible Heat Exchangers.
ASSOCIATED BANK PROJECT:	None. Free Standing Project.
BORROWER:	None. Montreal Protocol Ozone Trust Fund (OTF) Grant to private enterprise.
GRANT AMOUNT:	US$3.48 million requested. US$3.16 million recommended. Total estimated project cost is US$4.10 million. US$0.63 million funded by FAACA.
BENEFICIARIES:	FAACA, a Venezuelan private enterprise
TENTATIVE APPRAISAL DATE:	2nd Quarter FY '94
RVP APPROVAL DATE:	3rd Quarter FY '94
BOARD PRESENTATION DATE:	Not required per modified procedures for GEF and MP projects.
ENVIRONMENTAL CATEGORY:	B

1. Venezuela Ozone Depleting Substance (ODS) Sector Background: Venezuela signed the Montreal Protocol on September 16, 1987, and ratified it on February 6, 1989. As an Article 5 signatory (annual per capita ODS consumption of less than 300 grams), Venezuela is eligible for OTF support. ODSs are produced in six developing nations, Argentina, Brazil, China, India, Mexico, and Venezuela. Total production of CFCs and MCF in these nations in 1989 was approximately 70,000 tons, of which Venezuela's share was 4150 tons, or 6%. MCF consumption in 1991 was 130 tons, down from 570 tons in 1990. All CCl_4 (1350 tons in 1991) is used as a chemical intermediate feed stock. CFC/Halon consumption in Venezuela in 1990 was 3420 tons, but rose to 3820 tons in 1991, still a decrease of 12% since 1986. Distribution by end use in 1991 was MACs 25%; other AC/refrigeration 52%; foaming agent 16%; aerosols 4%; Halon fire extinguisher 1%; and solvents 2%. Of the AC/refrigeration share, an estimated 80% was for aftermarket use for servicing and leak replacement. 1992 consumption in the automobile and truck air conditioner (MAC) sector was estimated at 80 tons for newly assembled cars, and 900 tons for aftermarket use. Per capita annual consumption of CFCs decreased from 270 grams in 1986 to 170 grams in 1990. A breakdown of estimated CFC-12 consumption for 1992 in the AC/refrigeration subsectors and more detailed national data are available in the Project File.

2. ODS Phase-Out Strategy for the Mobile Air Conditioner (MAC) Subsector: With more than 75% of Venezuela's CFC consumption currently used in AC/refrigerator applications, these subsectors are the principal focus of the national ODS phase-out strategy. The MAC subsector alone accounts for 25% of national CFC consumption. Venezuela's eight auto assemblers produced 86,000 units in 1992, and imported another 20,000 units already assembled for local sale. An additional 44,000 assembly units, including trucks were imported directly, for total 1992 sales of 150,000 new units of all types. The total national automobile inventory of registered vehicles is approximately 1,200,000. An estimated 60% of new autos and an unknown percentage of the current national inventory have installed MAC systems. Each currently installed unit has an average charge of 1.1 kg. of CFC-12. Two domestic MAC fabricators (FAACA and AAISA) produce a total of approximately 60-75,000 MAC units annually[1], assembling compressors and fabricating evaporators and condensers, selling to both assemblers and aftermarket distributors. FAACA's market share is estimated to be between one-half and two-thirds of the total. FAACA produces both complete MACs, including compressors, and heat exchangers which are marketed separately. 1992 CFC-12 consumption in the MAC sub-sector was estimated at 80 metric tons for testing and charging of systems for newly assembled vehicles, and some 900 tons for aftermarket servicing of all types. Current plans of the auto assemblers for conversion from CFC-12 to HFC-134a refrigerant units call for a transition which will begin as early as August 1993 for one company with the others beginning during 1994. The total transition for new units to HFC-134a is expected to be complete by end 1995. Aftermarket servicing for CFC-12 units will be required for some time afterward. Nevertheless, almost complete phase-out of CFC-12 consumption in the MAC subsector is attainable by 2000. The FAACA factory conversion project, for which OTF funding is requested, is an integral part of the phase-out strategy. The eight auto-assemblers, six of which are 100% foreign owned subsidiaries, will finance their own assembly line conversions, and training of their dealerships for servicing of HFC-134a MAC units. The second MAC fabricator, AAISA, will also present a factory conversion project for OTF financing.

3. FAACA Background: FAACA was founded in 1970 as a member of the MANCIN group. The company employs 500 in the production of MAC units for most of the eight major automobile assemblers in Venezuela. In 1992, FAACA's estimated share of the Venezuelan market (Domestic Production plus Imports) for MAC components production by evaporators/condensers and compressors was 53.6% and 38.2% respectively. In 1992, FAACA earned US$106,000 on sales of US$15 million. The company forecasts net income for 1993 at US$604,000. The financial statements of the company from 1990 to 1992 are available in the project file. At current and anticipated production levels, FAACA is a viable concern. Anticipated production levels, which are similar to those of recent years, will however, not be attainable without conversion of the factory to produce HFC-134a MAC components. The OTF funding requested by FAACA is necessary to enable the firm to carry out this conversion. In the absence of the conversion, FAACA would be forced to cease production in a few years for

---

[1] This statistic is difficult to verify because different numbers of compressors, evaporators and condensers are manufactured, and an equal number of each does not reflect a MAC unit.

lack of markets. MAC compressor components are imported and assembled by FAACA. Conversion of this operation is not being submitted for OTF financing.

4. Project Objectives: The primary objective of the project is to enable FAACA to substitute production of HFC-134a MACs for its current product line of CFC-12 MACs.

5. Project Description: The proposed project consists of the retooling of a heat exchanger fabrication and assembly line, and related training and technical assistance costs. The assembly line conversion will permit production of mobile air conditioning (MAC) systems which permit use of HFC-134a rather than CFC-12 as the refrigeration agent. (See Annex 1, Technical and Cost Assessment, for complete project description). A Calorimeter test laboratory for which funding was originally requested, was not found to be an incremental cost, and has been deleted from the project scope.

6. Project Cost and Financing: Total cost estimate for project implementation, including capital costs, technical assistance and training is US$4.10 million net of taxes, including 10% contingency. Eligible incremental costs are US$3.48 million net of taxes, including 10% contingency. The project cost estimate is summarized in Table 1. Grant financing from the MPOTF is requested for eligible incremental costs. FAACA, itself, will finance the US$.627 million in non-incremental costs, including 10% contingency. The Bank will require FAACA to prepare a financial plan for funding of non-incremental costs, and obtain explicit agreement to do so before entering into a grant agreement with the enterprise.

Table 1: FAACA Project Cost Estimate (US$ 000's)

Evaporator and Condenser Assembly Lines:	(US$ 000's)
Investment:	
Equipment Costs	709
Tooling Costs	2,078
Other Incremental Costs	375
Non-incremental Investment by FAACA	567
Total	US$3,729
Total with 10% Contingency	4,100
Eligible Incremental Costs	3,162
Eligible Incremental Costs Including 10% Contingency	3,480

7. Incremental Costs: FAACA has requested OTF financing for 85% of the Evaporator/Condenser Assembly Line. All plant rearrangements, tooling/equipment, training and product evaluation tests for which grant financing is requested, are required to effect the changeover to production of HFC-134a compatible evaporators and condensers. Resale value of the existing CFC-12 line is negligible, in spite of most equipment and tools having further expected useful life of 5 years or more. Non-incremental investment by FAACA of US$567,330 consists of tooling investments which occur on an annual basis to support new model design changes, whether for CFC-12 or HFC-134a service.

Due to their recurring nature, these are not considered incremental. The total incremental cost estimate is therefore US$3.162 million.

8. Project Implementation: The project will be implemented during a 24 month period. Project implementation is directly tied to FAACA's customer requirements and introduction of HFC-134a MACs into the marketplace, which in Venezuela is planned for the 1994 and 1995 model years. (See Project File, Appendix I, Table XII, HFC-134a Production at Assembly Plants and Localization Program, for phase-in schedule.) FAACA, itself, will manage the project installation. Use of third party agents to manage procurement and supervise installation is not anticipated at this time. FONDOIN will assist with administrative liaison and disbursement operations as required. Technical oversight during installation and start up will be provided by a Bank contracted technical specialist. Procurement and disbursement will be in accordance with Bank guidelines.

9. Project Sustainability: The primary purpose of the MPOTF is to provide a financial incentive to facilitate ODS phase-out by compensating beneficiaries for incremental costs incurred as a result of converting to non-ODS technologies. A further important benefit of the Fund is to permit beneficiary nations to implement phase-out strategies without incurring a process of deindustrialization. ODS phase-out in the MAC sub-sector in Venezuela will take place with or without the MAC projects. Development of local HFC-134a MAC production capacity is essential to retention of MAC production capacity in Venezuela. The grant to FAACA will not only permit factory conversion without financial prejudice to the firm, but will, at the same time, ensure continued production of MAC components in Venezuela, and facilitate aftermarket servicing of HFC-134a units. In the absence of the subsidy, FAACA domestic markets would disappear as assemblers and aftermarket clients would still have the option, albeit at higher cost, of importing all HFC-134a units.

10. Rationale for Montreal Protocol Financing: With or without the project, and that of AAISA, auto assemblers will only assemble cars with HFC-134a compressors after 1996. It is estimated that complete transition of assembly and aftermarket to HFC-134a units will be virtually complete in Venezuela by 2000. The integrated program of assembler financed transition, supplemented by MPOTF subsidies to the two MAC fabricators, will thus result in the elimination of over 25% of current national CFC consumption, while, at the same time, permitting the retention of domestic MAC production capacity and related employment generation. Given the decision of the auto industry to undertake worldwide conversion, the alternative to project implementation would be a loss of FAACA and AAISA market share to imports, and eventual disappearance of the MAC industry in Venezuela. Protection against deindustrialization associated with the transition to non-ODS technologies is an approved use of MPOTF resources.

11. Issues and Actions: There are no major technical issues associated with project implementation. Preparation of a direct Grant Agreement between the Bank and FAACA, analogous to that between the Bank and Plasticos Molanca, S.A., will be required in order to avoid substantial delays in project implementation, if it were to be linked with the possible preparation of an umbrella operation in Venezuela. Procurement may involve numerous small contracts. Procurement and disbursement arrangements will be developed with a

view towards minimizing direct Bank involvement in processing of transactions, while maintaining adequate oversight. The possibility of utilizing FONDOIN for such tasks will be explored.

12. Environmental Aspects: The elimination of CFC-12 consumption is the basic environmental objective of the conversions. The project will contribute to elimination of approximately 90,000 kg. of CFC-12 consumption per year based upon an annual production level of 30,000 units (See Annex 1, for estimate of CFC consumption eliminated). There are no major environmental issues associated with the installation or operation of the converted assembly lines themselves, other than routine workplace safety measures.

13. Project Benefits: The major environmental benefit of the project is the enabling of FAACA to now produce MAC heat exchangers which use non-ODS HFC-134a as the refrigerant in place of CFC-12. A secondary environmental benefit is the elimination of CFC-12 now used and emitted into the atmosphere in the testing of assembled compressors and heat exchangers. The direct economic benefit is the retention in Venezuela of production capacity to supply both assemblers and aftermarket users with HFC-134a units, and the associated net savings in foreign exchange earnings, and the employment level retained by avoiding the demise of the local MAC industry. The unit abatement cost associated with CFC-12 consumption eliminated by production of HFC-134a MAC units, including CFC consumption eliminated in the factory, is US$5.66/kg./year based on an annual production level of 35,000 units. The calculations and interpretation of results are presented in Annex 2, Calculation of Unit Abatement Costs.

14. Project Risks: There are no significant technical project risks, the technologies to be employed having already been proven through application in parent countries of assemblers. There is a potential commercial risk of FAACA being able to compete with imported MAC units and with AAISA for both original equipment and aftermarket shares. The same risks also apply to AAISA. Nevertheless, FAACA is a financially viable concern of proven technical and commercial competence. The fact that both enterprises have spot export markets including, occasionally, the U.S.A. would indicate that both probably have reasonably competitive cost structures.

15. Technical Evaluation: The Bank's technical assessment consisted of a detailed review of the technical and financial proposals with FAACA, field inspection of existing units and proposed replacement installations, and verification of appropriateness with market demands for assemblers and aftermarket dealers. Annex 1, Technical and Cost Assessment, provides a complete description of the project and associated costs. Tooling requirements by car model upon which the tooling specifications and costs are based are available in the Project File.

16. On the basis of the assessment, the Bank considers the proposals to be of sound technical design, and qualified for OPTF grant financing of eligible incremental costs. FAACA is judged to be technically and organizationally capable of implementing the project. Annex 3, A Technical Opinion, indicates concurrence with the project by the Bank's Ozone Operations Resource Group (OORG) technical expert for MAC systems projects. Annex 4 is a copy of the letter from FONDOIN to the MP Secretariat officially requesting the project.

17. Staff Review Arrangements: The following staff is responsible for the project and for the review:

Task Manager:	Donald Rhatigan, LA1EI
Division Chief:	Stephen J. Ettinger, LA1EI
CD Director:	Rainer B. Steckhan, LA1DR
RED Chief:	Dennis J. Mahar
Bank Technical Advisor:	Donald Brown
Outside Specialist:	Peter Turner
OORG Reviewer:	Robert Proctor

September 23, 1993

Annex 1

FABRICA DE APARATOS DE AIRE ACONDICIONADO C.A. (FAACA)

Automobile Air Conditioner (AAC) Factory Conversion for Production of HFC-134a Refrigerant Mobile Air Conditioners (MACs)

Technical and Cost Assessment Prepared by F. Peter Turner

September 1993

PROJECT DESCRIPTION

1. Evaporator and Condenser Assembly Lines: The project request is the result of new AC component designs required to meet new thermodynamic requirements that arise in the conversion from CFC-12 to HFC-134a refrigerants. FAACA plans to use the following designs to meet the needs of its customers when HFC-134a MACs are introduced in vehicles in the Venezuelan market:

EVAPORATORS:

- SPT (Serpentine type): Produced with one straight extruded multiport tube, formed several times to dimension, with corrugated fins between every two tubes and brazed together in a vacuum, utilizing non corrosive flux process.

- PLATE & FIN type: Produced with several stamped plates joined together to form a flat tube with interposed external corrugated fins. All components are brazed together by a vacuum brazing process. This core normally presents two side tanks stamped in the plates which might be located to each side or one side of core. The last configuration will increase strength, performance and compactness and is known as "U-Flow" type.

CONDENSERS:

- SPT (Serpentine type): Similar to SPT evaporators but produced with several formed tubes to divide the core in several internal circuits to decrease pressure drop.

- PF (Parallel Flow type) Produced with several straight microextruded multiport tubes linked with two side vertical tanks that are divided internally to provide several circuits to decrease pressure drop, with interposed external corrugated fins between tubes. All components will be joined together by a non corrosive flux brazing process.

There are two different types of PF design which will be used:
1) Headered Tube Center (HTC) type - Has side tanks that will be manufactured using a stamped header and extrusion shaped tank.
2) Standard type - Sidetanks will be manufactured using a tube mill and will be tubular in shape.

2. Current production designs used in CFC-12 systems will be available locally for Original Entry Market (OEM), Port of Entry (POE) Retrofit, and aftermarket service until 1998.

3. Some of the designs are currently produced, but new requirements mandate designs change to the physical characteristics of component parts.

4. Design Basis for Equipment and Tooling Requirements: An analysis of FAACA's customer requirements indicated four types of design applications for which equipment and tooling specific to conversion to HFC-134a evaporators/condensers production will be required:

i) Carry over models with minor changes in AC system for HFC-134a application (current production).
ii) Carry over models with complete AC component design changes for HFC-134a change over.
iii) Car line model substitution with complete changes in the AC system.
iv) New models designed for CFC-12 already submitted for customer validation that need major changes for HFC-134a application.

5. Table V of Appendix 1 in the Project File summarizes FAACA's customers, vehicle models, reason for design change, and anticipated volumes when production of HFC-134a MAC units begins.

6. Table VI of Appendix 1 in the Project File further explains present/future product designs and their applications to customer HFC-134a refrigerant-using MACs.

7. To develop the equipment and tooling specifications for the cost estimate, customer design change requests were validated, and then the equipment and tools required to manufacture the new designs were reviewed in detail.

8. Criteria used to review and justify equipment/tooling lists included the following:

- Were requests consistent with actual design changes?
- Was there duplication of existing tooling and equipment?
- Could proposed dies be modified by using inserts thus reducing the number of actual dies used?
- Could current tooling be modified to accommodate new tooling requirements?

9. Appendix 1, Table VII of the Project File was developed to show the relationship between the Project equipment list (Table I, Project File) and FAACA's customer requirements. Items 8E & 11E will have a major impact in the reduction of CFC-12 and the use of Perchloroethylene at FAACA's facilities. Also, the total number of customer applications for each required equipment varies due to specific component design requirements.

10. Appendix 1, Table VIII of the Project File shows the relationship between the Project tooling requirements (Table II) and FAACA's customer requirements.

11. Estimated Project Costs: Total project costs are estimated at US$3.729 million, disaggregated into incremental equipment and tooling costs, other incremental costs, and non-incremental investment financed by FAACA. Equipment costs (US$709,000) are itemized in Appendix 1, Table I of the Project File by equipment type and location of fabrication. Tooling costs (US$2.08 million) are itemized in the same manner in Appendix 1, Table II of the Project File. Other incremental costs (US$375,000) consisting of licensing fees and training, are itemized in Appendix 1, Table III of the Project File. Non-incremental costs (US$567,330) which will be financed by FAACA, are detailed in Appendix 1, Table IV of the Project File. The tooling and training costs noted in Table IV of the Project File are specific to particular evaporator/condenser designs. Nevertheless, annual design changes

and subsequent new tooling requirements of this type are characteristic of the industry, and would be required on an annual basis, regardless of whether CFC-12 or HFC-134a MACs were being fabricated. FAACA and the Bank agreed, therefore, that such costs are recurrent annual capital costs rather than incremental costs, and thus not eligible for OTF financing.

12. CFC Consumption Eliminated: This project offers the opportunity to eliminate both the direct use of CFC-12 and CFC-11 at FAACA's production facility, and indirectly, the initial and replacement charges of CFC-12 which would be used in each MAC fabricated by FAACA, in the absence of the conversion to production of HFC-134a heat exchangers. CFC-12 is used directly as a test media in the manufacture of evaporators and condensers, whereas CFC-11 is used to internally flush AC systems/components in the engineering and garage facilities. Direct use of CFC-11 will be eliminated when recycle/reclaim/recharge equipment, currently on order, is delivered and its use implemented by the engineering/shop groups.

13. CFC-12 will be completely eliminated when new condenser/evaporator lines are installed. The new process uses a helium based mass-spectrometer test procedure as opposed to CFC-12 currently being used. Appendix I, Table XIII of the Project File shows that based on 1993 CFC consumption/usage, 1000 kg. of direct use of CFC-12 and CFC-11 will be eliminated. Indirect use eliminated is much greater. An average of approximately 1.1 kg. of initial charge of CFC-12 is used in each CFC-12 MAC fabricated. At an estimated production level of 30-35,000 units/yr. in recent years, assuming a total of 2.5 kg./unit of consumption over useful life of the MAC, indirect consumption foregone made possible by the project is 75-90 tons CFC-12 annually.

14. Environmental Issues: There are considered to be no adverse environmental issues associated with this project. Current material washes used in production of evaporator/condenser components utilize perchloroethylene vapor degreasers which the United States Environmental Protection Agency (USEPA) has declared a "Health Hazard". New process technology will use washes containing "Day-Trex" developed by S.A. Day Manufacturing, which is non-toxic and environmentally compatible. Perchloroethylene used for 1992 and 6 months of 1993 production was estimated to be 12,184 U.S. gallons, with 7,000 gallons estimated for 1994 production. The proposed project will eliminate this environmental contaminant.

15. Recommendations: Following a review of all proposals with FAACA personnel, appropriate modifications have been made in the design and configuration of the relevant production areas of the facility. The Project is found to be technically correct and consistent with FAACA's customer requirements. Furthermore, the project will also allow FAACA to develop designs for FAACA's aftermarket and future AC component business.

16. The Evaporator/Condenser Assembly Line is recommended for OTF financing in the amount requested (US$3.480 million, including 10% contingency).

Calculation of Unit Abatement Costs

A. Definition:

Capital costs are annualized and expressed as a ratio of the average annual amount of ODS reduction, weighted according to its ozone depleting potential.

The unit abatement cost is defined as follows:

$$c = \frac{CC.CRF + (OC - OS)}{M.ODP}$$

where:

c	=	unit abatement cost
CC	=	incremental capital costs (including all one-time costs such as training, installation, freight, etc.)
CRF	=	capital recovery factor
OC	=	incremental annual operating costs
OS	=	incremental annual operating savings, benefits
M	=	annual average mass of ODS not released as a result of the phaseout action
ODP	=	ozone depleting potential of the ODS

B. Calculations:

1. Unit abatement costs were calculated to include both direct and indirect reduction of CFC consumption. Direct reduction relates only to CFC consumption within the factory itself for cleaning and testing of MACs and equipment. Indirect consumption relates to the CFC-12 which would be consumed in the MACs installed in vehicles over their useful expected life, if the project were not implemented. Direct in plant CFC consumption is very low, relative to that of the MAC units produced in the operation.

2. Calculations (Component 1 only):

CC	=	$3,162,000
CRF	=	CRF/10 years/10% = .163
OC	=	OS = 0; no significant difference in fabrication costs between HFC-134a and CFC-12 MACs.
M Direct	=	1000 kg. (in plant)
M Indirect	=	90,000 kg. (in MAC units)
ODP	=	1

$$c = \frac{(3,162,000)\ (.163)}{91,000 \text{ kg./year}(1)} = \$5.66/\text{kg./year (for current capacity utilization)}$$

3. Interpretation: The abatement cost is a measure of the cost effectiveness of replacing CFC-12 MAC production capacity with HFC-134a MAC capacity. Without investment in the production capacity, regardless of where the MAC producers are located, the transition is not possible. The calculated c of $5.66/kg./year is based upon a production level of approximately 35,000 units, far below full capacity utilization. An increase in production levels would lead to a corresponding decrease in c. For purposes of estimation, it has been assumed that each CFC-12 MAC would have an average initial charge of 1.1 kg., and consume by way of leakage and replacement a total of 2.5 kg. of CFC-12 including the initial charge, over the useful life of the MAC. Such figures are typical in the U.S.A. No reliable data on replacement levels for Venezuela are available.

TECHNICAL OPINION

Montreal Protocol Project for FAACA MACS of Venezuela by the Ozone Operations Resource Group (OORG). A TECHNICAL OPINION -

1. Recommendation: The proposal appears to be sound and consistent with the objectives of the Montreal Protocol Ozone Projects Trust Fund. However, even though some laboratory and support facility expense is expected, the justification for a calorimeter is questionable and is recommended that this portion be deleted.

2. Relevance and Adequacy of Information Provided: The information supplied appears to be adequate provided it has not been outdated.

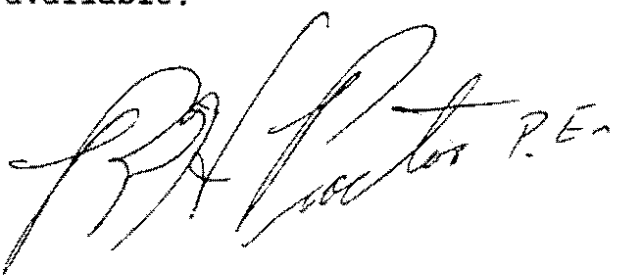
3. Technical Soundness: The writer has been familiar with the company, its products and reputation for many years and believes them to be competent and reputable. This proposal involves a low technical risk approach.

4. Lessons from Experience: The licensing arrangement FAACA has should provide sound technical support. The posture as an independent supplier of systems and service should provide good penetration into the application and service field outside the O.E.M. arena enhancing the primary objective of C.F.C. containment.

5. Environmental Issues: It is recommended that the implementation of these changes and especially the training of both the manufacturing personnel and the field service personnel be monitored for techniques and procedures to facilitate subsequent programs.

6. Safety Issues: I am not aware of any unique safety practices required for handling 134A and 134A products. There are, however, safety practices associated with interchangeability of parts for mechanical and functional reliability that service personnel must be aware of.

7. Cost Effectiveness: The proposal using incremental costs during normal product change over is undoubtedly the lowest cost and most difficult accounting approach. It will also provide minimum product availability interruption and expedite availability of product using 134A instead of CFC. It is, therefore, my opinion that this approach is not only the most cost effective but also the most objective (C.F.C. containment) oriented approach available.



THE MONTREAL PROTOCOL
ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Republic of Venezuela
PROJECT NAME:	AAISA (Aires Acondicionados Integral, Sociedad Anonima). Automobile Air Conditioner (MAC) Factory Conversion for assembly of HFC-134a compressors.
SECTORS COVERED:	Automobile Air Conditioning
ODS CONSUMPTION IN AFFECTED SECTORS:	Estimated CFC-12 Consumption in Automobile Air Conditioners: New: 80 tons; After Market Service: 900 tons.
PROJECT IMPACT:	Direct Elimination in Factory - 11 tons/year; Indirect - Approx. 10 tons/year (prorated for 40,000 compressors/year production level).
PROJECT DURATION:	18 months for implementation
TOTAL PROJECT COST:	US$650,000
PROPOSED ODS GRANT:	US$620,000
COST EFFECTIVENESS:	Unit Abatement Costs: US$4.36/kg. ODS eliminated/year
IMPLEMENTING AGENCY:	World Bank
COORDINATING NAT. AGENCIES:	FONDOIN
BENEFICIARIES:	AAISA/COROVEN MAC Fabricator and affiliated Compressor Fabricator

PROJECT SUMMARY

Please Refer to attached Executive Project Summary

CURRENCY EQUIVALENTS

Currency Unit = Venezuelan Bolivar (BS)
US$1.00 = 95.5 Bs (Exchange rate as of September 10, 1998)

UNITS AND MEASURES

metric ton - Ton (T) = 1,000 kg.

ACRONYMS

AAC	:	Automobile Air Conditioning
AC	:	Air Conditioning
CCl_4	:	Carbon Tetrachloride, a controlled ODS
CFCs	:	Chlorofluorocarbons
GOV	:	Government of Venezuela
FONDOIN	:	Foundation to Implement Montreal Protocol in Venezuela
HFC	:	Hydrofluorocarbon
MAC	:	Mobile Air Conditioner
MCF	:	Methyl choroform, a controlled ODS
MPEC	:	Montreal Protocol Executive Committee
MPOTF	:	Montreal Protocol Ozone Projects Trust Fund (OTF)
ODS	:	Ozone Depleting Substances
OORG	:	Ozone Operations Resource Group
USEPA	:	United States Environmental Protection Agency

FISCAL YEAR

January 1 - December 31

MONTREAL PROTOCOL (MP) PROJECT FOR VENEZUELA

INITIAL EXECUTIVE PROJECT SUMMARY

COUNTRY:	Republic of Venezuela
PROJECT NAME:	AAISA: Automobile Air Conditioner (MAC) Factory Conversion for assembly of HFC-134a compressors.
ASSOCIATED BANK PROJECT:	None. Free Standing Project.
BORROWER:	None. Montreal Protocol Ozone Trust Fund (OTF) Grant to private enterprises.
GRANT AMOUNT:	US$620,000 requested. Total estimated project cost is US$650,000.
BENEFICIARIES:	AAISA / COROVEN
TENTATIVE APPRAISAL DATE:	2nd Quarter FY '94
RVP APPROVAL DATE:	3rd Quarter FY '94
BOARD PRESENTATION DATE:	Not required per modified procedures for GEF and MP projects.
ENVIRONMENTAL CATEGORY:	B

1. Venezuela Ozone Depleting Substance (ODS) Sector Background: Venezuela signed the Montreal Protocol on September 16, 1987, and ratified it on February 6, 1989. As an Article 5 signatory (annual per capita ODS consumption of less than 300 grams), Venezuela is eligible for OTF support. ODSs are produced in six developing nations, Argentina, Brazil, China, India, Mexico, and Venezuela. Total production of CFCs and MCF in these nations in 1989 was approximately 70,000 tons, of which Venezuela's share was 4150 tons, or 6%. MCF consumption in 1991 was 130 tons, down from 570 tons in 1990. All CCl_4 (1350 tons in 1991) is used as a chemical intermediate feed stock. CFC/Halon consumption in Venezuela in 1990 was 3420 tons, but rose to 3820 tons in 1991, still a decrease of 12% since 1986. Distribution by end use in 1991 was MACs 25%; other AC/refrigeration 52%; foaming agent 16%; aerosols 4%; Halon fire extinguisher 1%; and solvents 2%. Of the AC/refrigeration share, an estimated 80% was for aftermarket use for servicing and leak replacement. 1992 consumption in the automobile and truck air conditioner (MAC) sector was estimated at 80 tons for newly assembled cars, and 900 tons for aftermarket use. Per capita annual consumption of CFCs decreased from 270 grams in 1986 to 170 grams in 1990. A breakdown of estimated CFC-12 consumption for 1992 in the AC/refrigeration subsectors and more detailed national data are available in the Project File.

2. ODS Phase-Out Strategy for the Mobile Air Conditioner (MAC) Subsector: With more than 75% of Venezuela's CFC consumption currently used in AC/refrigerator applications, these subsectors are the principal focus of the national ODS phase-out strategy. The MAC subsector alone accounts for 25% of national CFC consumption. Venezuela's eight auto assemblers produced 86,000 units in 1992, and imported another 20,000 units already assembled for

local sale. An additional 44,000 assembly units, including trucks were imported directly, for total 1992 sales of 150,000 new units of all types. The total national inventory of registered vehicles in December 1991 was approximately 2,145,000. An estimated 60% of new autos and an unknown percentage of the current national inventory have installed MAC systems. Each currently installed unit has an average charge of 1.1 kg. of CFC-12. Two domestic MAC fabricators (AAISA and FAACA) produce a total of approximately 60-75,000 MAC units annually[1], assembling compressors and fabricating evaporators and condensers, selling to both assemblers and aftermarket distributors. AAISA's market share is estimated to be between one-half and two-thirds of the total. AAISA produces both complete MACs, including compressors and heat exchangers, and also sells components which are marketed separately to auto assemblers and aftermarket installers. 1992 CFC-12 consumption in the MAC sub-sector was estimated at 80 metric tons for testing and charging of systems for newly assembled vehicles, and some 900 tons for aftermarket servicing of all types. Current plans of the auto assemblers for conversion from CFC-12 to HFC-134a refrigerant units call for a transition which will begin as early as August 1993 for one company with the others beginning during 1994. The total transition for new units to HFC-134a is expected to be complete by end 1995. Aftermarket servicing for CFC-12 units will be required for some time afterward. Nevertheless, almost complete phase-out of CFC-12 consumption in the MAC subsector is attainable by 2000. The AAISA compressor assembly line conversion project, for which OTF funding is requested, is an integral part of the phase-out strategy, as is conversion of an evaporator/condenser fabrication line. The latter project is now under preparation, and will be submitted at the first 1994 MPEC meeting. The eight auto-assemblers, six of which are 100% foreign owned subsidiaries, will finance their own assembly line conversions, and training of their dealerships for servicing of HFC-134a MAC units.

3. Background. AAISA is a diversified company employing 325 in the fabrication of MACs as well as domestic AC/refrigeration products. The client base for its MAC line of components consists of the major auto assemblers and aftermarket clients. AAISA's MAC compressor assembly line is owned and operated by COROVEN, one of the companies in the AAISA group. The last decade has been a period of steady growth for the firm, which is expected to continue due to the recently announced establishment of a common automotive policy between Colombia, Ecuador and Venezuela. The firm's annual compressor production is approximately 40,000 units. AAISA reported earnings of US$301,400 and US$329,000 on sales of US$8.7 and US$8.4 million respectively in 1991 and 1992. Net income is projected to decline to US$111,000 in 1993, followed by increases in 1994 and 1995 reaching US$460,000 and US$630,000 respectively. Current and anticipated production levels indicate that AAISA is a viable concern.

4. Project Objectives: The primary objective of the project is to enable AAISA to convert its MAC compressor assembly line for production of HFC-134a MAC compressors, and to provide both in house and dealer training for servicing of HFC-134a MACs.

---

[1] This statistic is difficult to verify because different numbers of compressors, evaporators and condensers are manufactured, and an equal number of each does not reflect a MAC unit.

5. Project Description: The project will have four separate components:

Component 1: Refitting of the COROVEN compressor assembly line;
Component 2: Technical Training Program for AAISA service personnel;
Component 3: Service Training - Selected Venezuelan dealerships and service shops; including HFC-134a recovery/evacuation and recycling/charging demonstration unit.
Component 4: Reclaim/Recycle/Recharge (CFC-12 and HFC-134a) equipment for the AAISA/COROVEN factory.

The project is more completely described in Annex 1, Technical and Cost Assessment of AAISA/COROVEN Factory Conversion Project.

6. Project Cost and Financing: Estimated Project Costs, and Incremental Costs by Component, all net of taxes, are summarized below. Detailed project costs of the four Project Components are available in the Project File.

Project Component	Costs (US$ 000s)	
	Estimated	Incremental
Component 1 - Compressor Assembly Line (Annex 1, Table I)	529	529
Component 2 - Technical Training (AAISA Personnel)	6	6
Component 3 - Dealer Service Training	28	28
Component 4 - Reclaim/Recycle/Recharge at AAISA	27	0
Subtotal:	US$590	US$563
10% Contingency:	60	57
TOTAL:	US$650	US$620

A breakdown of Component 1 Tooling and Equipment Costs is given in Annex 1, Table I). Total estimated project cost is US$650,000, of which US$620,000 is an incremental cost. An OTF Grant will be requested for the latter amount. AAISA will provide the US$30,000 difference. The Bank will require AAISA to prepare a financial plan for funding of non-incremental costs, and obtain explicit agreement to do so before entering into a grant agreement with the enterprise.

7. Determination of Incremental Costs: All Component 1 costs, including all tools and dies are specific to the conversion of the facilities to permit production of HFC-134a compressors. Component 2 and Component 3 costs are all incremental, including the HFC-134a recovery/evacuation and recycling/charging units which will be used as demonstration units for the dealer program. Component 4, while a necessary component for reducing CFC emissions, is not an incremental cost. The investment, US$27,000 generates savings in terms of CFC-12 recovered and recycled of US$7,800 annually, which for 5 years of operation generates a 14% internal rate of return (IRR). This component will therefore be financed by AAISA. Total incremental costs including 10% contingency are therefore US$620,000.

8. Project Implementation: All major project components will be implemented during the next 18 months. Project implementation is directly tied to AAISA's customer requirements and introduction of HFC-134a MACs into

the marketplace, which in Venezuela is planned for the 1994 and 1995 model years. Component 1 - Compressor Assembly Line will have a lead time from purchase order to start-up of 15 months. Components 2 to 4 will be scheduled as appropriate. AAISA, itself, will manage the project installation. The only outside contracts required for installation will be for small amounts for equipment relocation and hook-up. FONDOIN will assist with administrative liaison as required. Technical oversight during installation and start up will be provided by a Bank contracted technical specialist. Procurement and disbursement will be in accordance with Bank guidelines.

9. Project Sustainability: The primary purpose of the MPOTF is to provide a financial incentive to facilitate ODS phase-out by compensating beneficiaries for incremental costs incurred as a result of converting to non-ODS technologies. An equally important benefit of the Fund is to permit beneficiary nations to implement phase-out strategies without incurring a process of deindustrialization. ODS phase-out in the MAC subsector in Venezuela will take place with or without the projects. The grants to AAISA/COROVEN and FAACA will, however, not only permit factory conversion without financial prejudice to the firms, but will, at the same time, ensure continued production of auto MAC components in Venezuela, and facilitate aftermarket servicing of HFC-134a units. In the absence of the subsidy, AAISA domestic markets would disappear as assemblers would still have the option, albeit at higher cost, of importing all HFC-134a units. Also important, without HFC-134a component production capacity, aftermarkets for both AAISA and FAACA would eventually disappear.

10. Rationale for Montreal Protocol Financing: With or without the project, and that of FAACA, auto assemblers will only assemble cars with HFC-134a compressors after 1996. It is estimated that complete transition of assembly and aftermarket to HFC-134a units will be virtually complete by 2000. The integrated program of assembler financed transition, supplemented by MPOTF subsidies to the two MAC fabricators, will thus result in the elimination of over 25% of current national CFC consumption, while, at the same time, permitting the retention of domestic MAC production capacity and employment generation. Given the decision of the auto industry to undertake worldwide conversion, the alternative to project implementation would be a loss of AAISA market share to imports, and eventual disappearance of the MAC industry in Venezuela. Protection against deindustrialization associated with the transition to non-ODS technologies is an approved use of MPOTF resources.

11. Issues and Actions: There are no major technical issues associated with project implementation. Preparation of a direct Grant Agreement, analogous to that between the Bank and Plasticos Molanca, S.A., will be required in order to avoid substantial delays in project implementation, if it were to be linked with the possible preparation of an umbrella operation in Venezuela. Clarification of ownership structure of AAISA/COROVEN will be required in order to prepare the Agreement. Procurement may involve numerous small contracts. Procurement and disbursement arrangements will be developed with a view towards minimizing direct Bank involvement in processing of transactions, while maintaining adequate oversight. The possibility of utilizing FONDOIN for such tasks will be explored.

12. Environmental Aspects: The elimination of CFC-12 consumption is the basic environmental objective of the conversion. Project implementation will

reduce direct in plant CFC-12 consumption now used for compressor testing, product development and service shops from 11,365 kg./year to 320 kg./year. In addition, each of the 40,000 compressors will go in a MAC system which uses 2.5 kg. CFC-12 over its useful life. Indirect consumption eliminated in installed MAC units has been allocated to the compressor assembly line conversion, in the same proportion as the latter's cost is to the total cost of an integrated MAC factory, or approximately 10%. Prorating CFC consumption in this manner, approximately 10,000 kg./year indirect CFC consumption eliminated can be attributed to the compressor assembly line project. There are no major environmental issues associated with the installation or operation of the converted assembly lines themselves, other than routine workplace safety measures.

13. Project Benefits: The major environmental benefit of the project is the enabling of AAISA to now produce MAC compressors for use with non-ODS HFC-134a as the refrigerant in place of CFC-12. A secondary environmental benefit is the elimination of CFC-12 now used and emitted into the atmosphere in the testing of assembled compressors and heat exchangers. The direct economic benefit is the retention in Venezuela of production capacity to supply both assemblers and aftermarket users with HFC-134a units, and the associated net savings in foreign exchange earnings, and the employment level retained by avoiding the demise of the local MAC industry. The unit abatement costs associated with the project is US$4.36/kg./year based on an annual production level of 40,000 compressors. The calculations are presented in Annex 2, Calculation of Unit Abatement Costs.

14. Project Risks: There are no significant technical project risks, the technologies to be employed having already been proven through application in parent countries of assemblers. There is a potential commercial risk of AAISA/COROVEN being able to compete with imported MAC units and with FAACA for both original equipment and aftermarket shares. The same risks also apply to FAACA. Nevertheless, AAISA/COROVEN is a financially viable concern of proven technical competance. The fact that both enterprises have spot export markets, including, occasionally, the U.S.A. would indicate that both probably have reasonably competitive cost structures.

15. Technical Evaluation: The Bank's technical assessment consisted of a detailed review of the technical and financial proposals with AAISA, field inspection of existing units, and proposed replacement installations, and verification of appropriateness with market demands for assemblers and aftermarket dealers. Annex 1, Technical and Cost Assessment provides a complete description of the project and associated costs, and incremental cost determination.

16. On the basis of the assessment, the Bank considers the proposals to be of sound technical design, and qualified for OTF grant financing of eligible incremental costs. AAISA/COROVEN is judged to be technically and organizationally capable of implementing the project. Annex 3 indicates concurrence with the project by the Bank's Ozone Operations Resource Group (OORG) technical expert for mobile air conditioning systems (MACS) projects, subject to the incremental cost adjustments already discussed. Annex 4 is a copy of the latter from FONDOIN to the MP Secretariat officially requesting the project.

17. Staff Review Arrangements: The following staff is responsible for the project and for the review:

Task Manager:	Donald Rhatigan, LA1EI
Division Chief:	Stephen J. Ettinger, LA1EI
CD Director:	Rainer B. Steckhan, LA1DR
RED Chief:	Dennis J. Maher
Bank Technical Advisor:	Donald Brown
Outside Specialist:	Peter Turner
OORG Reviewer:	Robert Proctor

September 27, 1993

Annex 1

AIRES ACONDICIONADOS INTEGRAL, S.A. (AAISA)

Automobile Air Conditioner (AAC) Factory Conversion for Production of HFC-134a Refrigerant Mobile Air Conditioner (MAC) Compressors

Technical and Cost Assessment by F. Peter Turner

September 1993

A. SUMMARY AND RECOMMENDATIONS

1. Introduction: The primary objective of the proposed project is to enable AAISA to convert its MAC compressor assembly line for production of HFC-134a MAC compressors, and to provide both in house and dealer training for servicing of HFC-134a MACs. In addition, a program to reuse and recycle both HFC-134a and CFC-12 MAC systems/components will be established.

2. Principal Components: The project involves 4 major components: Each component is described in Section B, Detailed Project Description.

Component 1 - COROVEN Compressor Assembly Line
Component 2 - Technical Training Program for AAISA Personnel
Component 3 - Service Training for Selected Venezuela Dealerships and Service Shops.
Component 4 - Reclaim/Recycle/Recharge CFC-12 automotive AC systems/components.

3. Cost Estimates (US dollar): Total Cost Estimate for all Project Components is US$588,010 net of taxes and excluding contingency.

Component 1 - Coroven Compressor Assembly Line:	
Equipment/Tooling Costs	$436,790
Other Incremental Costs	$ 91,883
Project Implementation Schedule	
Schedule of Payments	
Total Component 1	$528,673
Component 2 - Technical Training Program for AAISA Personnel:	$ 5,900
Component 3 - Service Training for Selected Venezuelan Dealers:	$ 27,094
Component 4 - Reclaim/Recycle and Recharge (CFC-12):	$ 26,343
Total Project (less contingency)	$588,010

---

4. Incremental Costs: Components 1, 2, and 3 are eligible incremental costs. Component 4 is not, due to its favorable financial rate of return. Its installation is, however, essential to in plant reduction of CFC-12 consumption. Plant rearrangements, tooling/equipment, training and product evaluation tests are required to effect the changeover to use of HFC-134a.

5. Proposed Project Implementation: All major project components will be implemented during the next 18 months. Due to the late notice of HFC-134a implementation by AAISA and COROVEN customers, and the necessary investigation into Nippondenso's technical and license requirements, most projects will not commence until Dec. 1993 time frame, or as soon as possible after MPEC approval.

6. Components 3 and 4 (Service Training for Selected Venezuelan Dealers and Reclaim/Recycle, and Recharge (CFC-12), will commence as soon as AAISA/COROVEN have new assembly line installation under way and their customers vehicles, utilizing HFC-134a AC systems, are manufactured and released to Venezuelan markets. Components 3 and 4 will be considered an ongoing process during the succeeding 18 months.

7. Technical Evaluation: Technical Assessment consisted of a detailed review of the technical and financial proposals with AAISA/COROVEN engineering and administration departments. An in depth review of current manufacturing processes was conducted. In addition, a review of AAISA/COROVEN market strategy, rationale/justification for required tooling/equipment and an overview of their proposed training programs was made. I consider their project request technically correct, consistent with their customer requirements, and qualified for MPOTF financing of eligible incremental costs.

8. CFC Consumption Eliminated: Implementing Components 1 and 4 will result in a potential CFC-12 emissions reduction of 97% of current estimated in house consumption of 25,000 lbs/year, through elimination of 17,600 lbs./year, and recycling of 6,700 lbs./year.

9. COROVEN's current compressor assembly process utilizes CFC-12 as a test media in performance testing resulting in all CFC-12 being vented to the atmosphere following the performance test.

10. AAISA manufacturing, engineering, development area and service shops utilize CFC-12 for AC component/system manufacturing and development testing where all CFC-12 used is vented to the atmosphere.

11. Component 1, COROVEN Compressor Assembly Line, will not use CFC-12 as a test media, but will utilize dry air and HFC-134a to conduct performance tests, thus eliminating completely the use of CFC-12 in the assembly area.

12. Component 4, Reclaim/Recycle/Recharge, will allow manufacturing, product engineering development shops, and service shops (7,400 lbs./year consumption) to reclaim/recycle/recharge CFC-12 currently being vented to the atmosphere. Full use of recycling equipment should reduce CFC-12 loss by 90%, assuming a 10% loss of CFC-12 due to processing errors/leaks etc.

13. As HFC-134a refrigerant is introduced into the AAISA manufacturing/engineering/service areas, reclamation and reuse of HFC-134a will be possible.

14. Additional reductions in CFC-12 consumption are possible only when COROVEN/AAISA customers convert their automotive and commercial AC systems to HFC-134a refrigerant designs.

15. Recommendations: Following a review of all proposals with COROVEN/AAISA personnel appropriate modifications have been made. I find all major project components technically correct and consistent with COROVEN/AAISA customer requirements and qualified for MPOTF financing.

B. DETAILED PROJECT DESCRIPTION

PROJECT COMPONENT 1 - COROVEN COMPRESSOR ASSEMBLY

16. Project Component 1 - COROVEN Compressor Assembly: A new compressor assembly line for processing Nippondenso designed compressors is required due to the incompatibility of P.A.G. oil used in HFC-134a systems and mineral oils used for lubricating AC systems utilizing CFC-12.

17. In addition, the following Nippondenso parts have been redesigned for compressors using HFC-134a refrigerants. These parts have been assigned new/exclusive part numbers which cannot be mixed with similar parts designed for CFC-12 refrigerant compressors.

- Shaft Seals
- Compressor Heads
- O-rings
- Gasket
- Thrust Bearings
- Swash Plate
- Valve Plate
- Cylinder Block
- Relief Valve
- Clutch Rotor Bearing
- Clutch Rotor Ring
- Shield
- P.A.G. Oil

18. The new assembly line will be built using available space in the assembly room of the current compressor building.

19. Tooling and equipment layouts have maximized existing CFC-12 assembly space allowing for both CFC-12 and HFC-134a compressors to be assembled separately and then share a common assembly line when differences in parts/process allow common operations.

20. Tool and Equipment Proposals: Tool and equipment proposals were reviewed and found to be technically correct and necessary for HFC-134a compressor assembly (See Table I).

21. The performance Test Stand (Table I), for testing HFC-134a compressors comprises approximately 30% of total tooling and equipment costs.

22. Information supplied by Nippondenso indicates present test stands, which only measure pump capacity and electrical clutch engagement, will not meet 1994 customer contract requirements. Rebuilding them to meet customer requirements appears to be cost prohibitive.

23. The new performance test stand is designed to perform the following checks:

- Vacuum Leak Check
- Pressure Leak Check
- Noise/Vibration Test
- Clutch Speed (RPM) Verification
- "Pump Up" Cooling Capacity Check

24. Most significant of all is that the new performance test stand will not use CFC-12. The test stand is designed to function using dry air and HFC-134a.

25. Production capacity of the new test stand is approximately 50 units/hour as compared to 5 units/hour of the current test stand. New HFC-134a assembly line is designed for 69,000 units/year which is the same design capacity for the CFC-12 line utilizing 6 performance test stands. Design capacity is consistent with AAISA's production schedule forecast for the foreseeable future.

26. Other incremental costs (total US$92,000) include shipping (US$35,000), relocation of current CFC-12 line and installation of the HFC-134a line (US$12,000), and technical assistance and training expenses for operation of the new test stand (US$45,000).

Table I: Tooling and Equipment

Item No.	Process Description	Equipment	Tooling	Estimated Costs	
				Equipment	Tooling
1	Parts Wash	Machine Wash	Wash Basket	US$70,440	US$3,940
2	Parts Assembly	Shaft Keypress for Machine	Assembly Fixtures, Driver Torque Wrench & Assembly Table	$16,910	$12,280
3	Oil Charge	Charge Machine	Digital Scale & Assembly Table	$28,170	$5,500
4	Leak Check	Leak Check Equipment	Air Driver	$14,080	$390
5	Performance Test	Performance Test Machine	Air Driver	$129,300	
6	Oil Charging		Digital Scale & Assembly Table		$5,500
7	Assembly Torque Check		Assembly Table, Jig, & Torque Wrench		$3,120
8	Refrigerant Charge	Charging Machine		$34,470	
9	Quality Assurance Test	Performance Test Stand/Table		$21,130	
		Moisture/Foreign Material Check Instruments		$35,220	
		Thermometer for Opaque		28,170	
10	Attachment		Assembly Jigs & Shutes		$28,170
Subtotals				US$377,890	US$58,900
TOTAL				US$436,790	

PROJECT COMPONENT 2 - TECHNICAL TRAINING PROGRAM FOR AAISA

27. Project Component 2 - Technical Training Program for AAISA Personnel: AAISA has developed a 40 hour training program which will be given to 86 employees. Attendees will be selected from the following departments:

- Engineering
- Quality Assurance
- Manufacturing
- Sales
- Aftermarket Sales
- Service Shop

The program will consist of the following subject areas and hours of training:

HOURS	DESCRIPTION
5	Philosophy of changes in today's world.
5	Theory of changes from CFC-12 to HFC-134a
10	Practical elements of changes in design of products to utilize HFC-134a
16	Practical use of reclaim/recycle/recharge equipment. Diagnostic steps to use on vehicles utilizing HFC-134a.
4	Review/question/answer session.

The cost of the whole program is estimated at US$5,900. With the confusing and often conflicting conceptions surrounding the conversion of AC Systems from CFC-12 to HFC-134a, a course of this nature is fundamental. I strongly endorse and recommend its consideration.

PROJECT COMPONENT 3 - SERVICE TRAINING

28. Project Component 3 - Service Training: AAISA will develop a Training Program for Selected Venezuela Dealerships and Service Shops. The following are its objectives:

- Develop understanding of the ozone layer and Montreal Protocol requirements.
- Upgrade service personnel on new AC system products and service techniques.
- Recovery and recycling principles relating to refrigerant when servicing automotive AC systems utilizing CFC-12 and HFC-134a refrigerants.
- Training in the use of CFC-12 and HFC-134a recovery and recycling equipment.

29. AAISA will arrange for procurement and training of instructors which will consist of an engineer and automotive technician. In addition, AAISA will supply a truck to transport the instructors, equipment and training materials to the training sites. The truck will have an HFC-134a system installed which will be used for demonstration purposes and for "hands on" training.

30. Duration of the training program will be 8 hours: 5 hours theory and 3 hours "hands on" practice with equipment. Maximum trainee attendance is recommended at 12 persons per session.

31. The training program will utilize training materials developed by: i) Chrysler Corporation; ii) Nippondenso; iii) ASE (Automotive Service Excellence - Washington, D.C.); and iv) IMACA (International Mobile Air Conditioning Association - Grande Prairie, Texas).

32. AAISA, in conjunction with its customers, has identified a list of eleven cities where training will be conducted.

33. Costs: Total costs of component 3, Service Training (US$27,094), include US$15,000 for "Recovery/Evacuation & Recycling/Charging" equipment and tooling required for CFC-12 demonstrations, as detailed in Item 1 of "Service Tools" in Table VII of the Project File, Tooling and Equipment Required for HFC-134a, and US$12,094 in training expenses.

34. I have reviewed program materials from ASE and IMACA and find the programs consistent and technically sound with respect to servicing automotive AC systems using CFC-12 and HFC-134a.

35. AAISA does not hesitate to point out that the cost of Reclaim/Recycle/Recharge equipment is prohibitive for 99% of Venezuela's AC service shops. Dealerships with direct financial support from parent companies may have the equipment by 1994.

36. The initial cost of certified reclaim/recycle equipment and the fact that Venezuela will not mandate the use of HFC-134a until the year 2006 leaves little doubt that the amount of CFC-12 used by the Venezuelan automotive service industry will not be dramatically reduced until CFC-12 is not available.

37. The reality of the service situation should not preclude the implementation of the training program. There is a definite need for training when HFC-134a is introduced mid-year 1994.

PROJECT COMPONENT 4 - RECLAIM/RECYCLE/RECHARGE SERVICE

38. Project Component 4 - Reclaim/Recycle/Recharge Service Tooling: Service tools described in Table VI of the Project File are the minimum tools required to reclaim/recycle/recharge either CFC-12 or HFC-134a components/systems and must be considered essential to reduce CFC-12 consumption. Average annual consumption of CFC-12 for testing purposes is now 25,000 lbs./year (11,365 kg.), of which 17,600 lbs. is consumed in the CFC-12 compressor assembly line for testing, and the remainder (7,400 lbs.) in the service shop and other areas of the factory. All of this is now vented to the atmosphere. The CFC-12 consumption used in the compressor assembly line will be eliminated by the switchover to HFC-134a compressors, which use a mixture of air and HFC-134a as the testing medium. It is estimated that 90% of the remaining consumption or approximately 6,700 lbs. (3050 kg./year) can be

captured and resold as a result of the installation of the recycling apparatus. Total annual CFC-12 emissions will therefore be reduced from 11,365 kg. to 320 kg. Even using the current low price (US$2.57/kg.) for CFC-12 in Venezuela, and assuming no change in price, the return on the investment in recycling equipment is US$7,800/year. Over an assumed five years of operation, the internal rate of return on the investment is 14%, indicating that it is a worthwhile financial investment, and, therefore not eligible to be included as an incremental cost.

39. Though not recommended for OTF financing, Component 4 is an integral part of the in plant CFC-12 elimination strategy, and should, therefore, be retained within the project scope.