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

Tenth Meeting
Montreal, 28–30 June 1993

COUNTRY PROGRAMME: MAURITIUS

This document consists of:

(a) Country Programme Evaluation Sheet (prepared by the Fund Secretariat)

(b) Country Programme Cover Sheet (prepared by the Fund Secretariat)

(c) Transmittal Letter from the Government of Mauritius

(d) The Country Programme

MAURITIUS COUNTRY PROGRAMME
EVALUATION SHEET

1. The Mauritius Country Programme is submitted to the Tenth Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/10/27. The document is consistent with the format indicated in the "Procedures for Presentation of Country Programmes and Project Proposals to the Executive Committee (UNEP/OzL.Pro/ExCom/5/16).

2. It consists of:

- Letter of Transmittal
- Country Programme Cover Sheet (Prepared by the Secretariat)
- Executive Summary
- Introduction
- Current Situation, which includes the description of:
  - Current Consumption
  - Forecast consumption
  - Industry Structure
  - Institutional Framework
  - Policy Framework
- Implementing Phase-Out, which includes the description of:
  - Strategy Statement by Government
  - Action Plan
  - Rules in implementing the strategy
  - Time Table and consumption implications
  - Incremental Cost
  - Budget and financing programme
  - Monitoring arrangements
- Annexes, which include:
  - Project proposals for approval with the Country Programme
  - Project proposals for funding in Phase II
  - Project proposals to be submitted at a later date

3. The total consumption of ODS in Mauritius in 1991 was 70.2 ODP tonnes (according to import data), of which CFC-11 and CFC-12 constituted 22% and 54% respectively. The main user sectors were refrigeration and air conditioning (30.4 ODP tonnes) and aerosol (28.5 ODP tonnes). The use of ODS in the flexible foam sector has already been phased-out. The total ODS consumption until phase-out is estimated to be 99 ODP tonnes consisting of 92 ODP tonnes of Annex A, Group 1 controlled substances (mainly CFC-11 and CFC-12), 7 ODP tonnes of Halon-1211 and 2 ODP tonnes of carbon tetrachloride.

4. The action plan adopted has the following phase-out objectives (using 1991 as the base year):

Annex A, Group 1 substances:	90% phase-out by 1997 100% phase-out by 2009
Annex A, Group 2 substances (halon-1211):	100% phase-out by 1995
Annex B, Group 2 substances: (carbon tetrachloride)	100% phase-out by 1995

The total cost of actions to phase-out is estimated at US $7.7 million.

5. The actions intended to be taken and some projects identified are listed in the cover sheet attached to the Country Programme. Monitoring of the implementation of the Country Programme will be undertaken by the Ministry of the Environment.

Projects Submitted for Approval with the Country Programme

6. Three of the projects amounting to US $216,300 for which approval is being sought, are annexed to the Country Programme. They are:

(i)	G.01: Institutional strengthening for the phase-out of ozone depleting substances (including sub projects budgets for surveys)	US 50,000
(ii)	AFS.01: Conversion of aerosol filling facility from CFC-12 to hydrocarbon propellant	124,300
(iii)	MAC.01: Recovery and recycling of CFC-12 mobile air conditioning sector	26,000

Comments

Implementing Agency

7. UNEP has been selected as the implementing agency for the investment project as well as the lead agency for the implementation of the Country Programme. This role would be in conflict with the terms of reference of UNEP under the agreement between UNEP and the Executive Committee and the Terms of Reference of the Multilateral Fund.

Incremental Costs

8. In the incremental cost analysis, the difference in cost of purchase of new fridges, automobiles and commercial air conditioning equipment operating on non-ODS refrigerants have been assessed as incremental costs. This is not considered as such since the equipment in question do not replace existing user equipment.

Projects in the Country Programme

(a) Projects included in the Country Programme for Approval by the Executive Committee

9. The project costs as indicated in the summary of projects on page 10 for the aerosol and MAC projects are different from those in the projects' write-up in the annex. The following are specific comments on the projects for which funding is requested:

Project G.01: Institutional strengthening for the phase-out of ozone depleting substances (US $50,000).

Detailed project document has been prepared. Funding requested is within reasonable limit. The surveys proposed should be considered as part of the institutional strengthening activity to be undertaken by the proposed Secretariat.

Project AFS.01: Conversion of aerosol filling facility from CFC-12 to hydrocarbon propellant (US $124,300)

The project is ineligible for funding, since no controlled substance will be eliminated. COMANU, the company involved, currently consumes virtually no CFC-12, since it has "almost completely switched over to CO_2" (page 22 of the Country Programme).

Project MAC.01: Recovery and recycling of CFC-12 in the Mobile Air Conditioning (MAC) sector (US $26,000)

One recovery recycling machine at US $2,400 is proposed for each of 10 automobile importing companies in addition to training cost of US $15,000 and operational cost of US $6,457 for four years. Thus the total cost of the project would be US $45,457. However, US $26,000 is being requested. The annual CFC-12 to be recovered is estimated at a total of 1.4 tonnes or average of 140 Kg per shop per year.

(b) Phase 2 Projects

10. Two projects in training and ODS-substitution (50% water blowing of insulation foam) for a total of US $180,000 in the refrigeration sector and one halon recovery and halon bank management project for US $112,000 have been indicated as projects to be submitted in Phase 2 of the implementation of the Country Programme.

(c) Other Projects

11. One project in ODS substitution (HCFC-123 foam blowing) and several retrofit projects in all refrigeration sub-sectors and recovery of CFCs from decommissioned equipment would be developed at a later stage. It may be noted that the toxicity of HCFC-123 makes it an unsatisfactory substitute blowing agent for foam blowing.

12. The training in refrigeration and the halon project will be derived from the results of surveys to be carried out. The survey should make it possible to reassess the costs of the two projects since they (particularly the halon bank project: US $112,000) appear to be high.

Recommendations

1. To approve:

   (i) the Country Programme taking account of the comments made. Approval of the Country Programme does not denote approval or endorsement of projects or funding levels as listed in the Action Plan;

   (ii) the amount of US $56,500, including project support cost of US $5,600 for institutional strengthening to be included as amendment to UNEP's 1993 Work Programme;

2. To invite the Government of Mauritius to adopt a more cost effective approach for recy cling in the mobile air conditioning sector, given the negligible amount of CFC-12 to be saved by each shop per year. Perhaps a centralized facility for recovery and recycling could be the optimal solution.

3. To invite the Government of Mauritius to reassess the aerosol conversion project also submitted with the Country Programme in the light of comments made in paragraphs 7 and 9 above.

4. To consider the role of UNEP as implementing agency for investment projects in the country programme in the light of comments made in paragraph 7 above, and to advise the Government of Mauritius accordingly.

COUNTRY PROGRAMME COVER SHEET

Country : Mauritius

Date Received : 14 May 1993

Period Covered : 1993-1996

Lead National Agency : Ministry of Environment and Quality of Life

Lead Implementing Agency : UNEP

1. Phase-out schedule

Substances	Current Consumption (Tonnes X ODP) in 1991	Planned Consumption till Phase-out Tonnes X ODP	Planned Year of Phase-out
CFC-11	15	92	2010
CFC-12	38		
CFC-115	8		
Halon-1211	7	7	1994
Carbon Tetrachloride	2	2	1994
TOTAL	70	101	

2. Government Action Plan

Year	Description of Action	Sector	Intended Effect	Cost Est. US $
1993	Establish Steering Committee. Create a Secretariat within the Ministry of Environment	All	Monitoring of C.P. implementation	
1994	Ban on import of CFC containing aerosol	Aerosol	Reduce consumption	
1993	Conversion of aerosol filling facility	Aerosol	Phase-out of CFC-12	124,300
1993	Submit project proposal on alternative foam blowing agent	Refrigeration	Phase out CFC-11	
1994	Submit project proposal on alternative refrigerant (Refrigerator manufacturing)	Refrigeration	Phase out CFC-12 in new refrigerators	
1995	Discourage and ban import of CFC based refrigerators	Refrigeration	Phase out of CFC-11 & CFC-12	
1995	Provide incentives for import of non-ODS refrigerators	Refrigeration	Phase out of CFC-11 & CFC-12	
1994	Establish licensing system for servicing companies	Refrigeration	Phase out of CFC-11 & CFC-12	
1993	Training of service technicians	Refrigeration	Phase out of CFC-11 & CFC-12	
1996	Study feasibility of establishing infrastructure for CFC recovery from scrapped equipment	Refrigeration	Recovery of CFC	
1993	Supply of recycling machines to service companies	Refrigeration	Recovery/recycling of CFC-12	42,000
1994	Request car importers to install recovery/recycling machines	Refrigeration	Recovery/recycling of CFC-12	
1995	Ban import of solvent ODS	Solvent	Phase-out of CFC=113 and CFC	
1993	Survey on essential uses of Halons	Halon		1,000
1994	Study feasibility of Halon recovery programme for non-essential uses and manage Halon Bank	Halon	Recycling of halon	
1994	Registration of ODS users	All		
1993	Mandatory reporting of ODS imports	All		

3. Project Summary*

Year(s)	Type of Project	Project Description	Project Cost US$	Incremental Cost US$	Implementing Agency	Tonnes X ODP to be Phased Out
1993	Institutional Strengthening	Institutional strengthening for the phase-out of ODS	50,000	50,000	UNEP	Not applicable
1993-1994	ODS Substitution	Conversion of aerosol filling facility from use of CFC-12 to hydrocarbon as propellant	124,300	124,300	UNEP	20 per year
1994-1997	Recycling	Recovery and recycling of CFC-12 in MAC	42,000	42,000	UNEP	1.4 per year
	Training	Training of refrigeration technicians in improved practices	55,000	55,000		
	ODS substitution	50% water blowing in refrigerator insulation foam	121,000	121,000		
	Recovery	Recovery of halons from non-essential uses and maintenance of halon bank				
	Investment	Conversion to HCFC-123 for refrigerator insulation foam blowing manufacturing facility to produce HFC-134a based refrigerator				
	Investment	Retrofitting of CFC-12 based equipment (cold rooms, bottle coolers, display cabinets) to HFC-134a				
	Investment	Retrofitting of centrifugal chillers to HCFC-123				
	Investment	Set up infrastructure to recover CFCs from decommissioned equipment				
	Survey and investment	Study effect of methylene chloride on workers and make improvements in facilities for safe use				

* A blank space indicates that information is not available.

4.	Cost of Activities and Projects in Country Programme	US $	392,300
	Estimated cost of complete phase-out		7.7 million
	Estimated cost effectiveness		76.3 / kg ODS phase-out

5. Comments

The estimated cost of phase-out included costs of new user equipment in the refrigeration sector which are non-replacement equipment and therefore ineligible for funding as incremental cost.

بسم الله الرحمن الرحيم

MINISTRY OF PLANNING AND ENVIRONMENT
MALE'
REPUBLIC OF MALDIVES.

No. 100-E/mis/93/125

Dr. Omar El-Arini
Chief Officer
Secretariat for the Multilateral Fund
for the Implementation of the Montreal Protocol

1800 McGill College Avenue
27th Floor
Montreal, Quebec
H3A 3J6
Canada

7 June 93

Dear Dr. El-Arini,

Please find enclosed the Maldives Country Programme. The Country Programme has been approved by the Ministry of Planning and Environment. The Government of Maldives submits this Country Programme for consideration by the Executive Committee at its Ninth Meeting to be held in Montreal in June 1993.

I would like to take this opportunity to thank the Fund Secretariat and Industry and Envrionment Programme Activity Centre of United Nations Environment Programme for the assistance provided in preparing this Country Programme.

Please accept, Sir, the assurances of our highest consideration.

Ismail Shafeeu
Minister

cc: Mr. R. Shende
Co-ordinator, Ozone Action programme
Industry and Environment Programme Activity Centre
United Nations Environment Programme

FAX. NO: (960) 327351, TLX NO: 66110 MPDMALE MF

MINISTRY OF THE ENVIRONMENT & QUALITY OF LIFE
MAURITIUS

ENV/40/1

Transmittal Letter

Ken Lee Tower,
10th Floor,
c/r Barracks and
St Georges Streets,
Port Louis.
Mauritius.
Fax (230) 2129407
7 May 1993.

The Chief Officer,
Secretariat of the Multilateral Fund
for the Implementation of the Montreal Protocol
1800 McGill College Ave., 27th Floor,
Montreal, Canada H3A 3J6

Sir,

I have the honour to submit herewith the Country Programme of Mauritius for the consideration and approval of the Multilateral Fund for the Implementation of the Montreal Protocol.

Mauritius adhered to the Protocol on 18 August 1992 and became a Party thereto on 16 November 1992. It is provisionally classified as operating under paragraph 1 of Article 5 of the Protocol.

I would like to place on record the appreciation of the Government of Mauritius of the assistance extended to it by or through the UNEP IE/PAC Ozone Action Programme for the preparation of the Country Programme which started during the late half of last year. I am pleased to say that the Government is committed to the implementation of the actions contained in the Country Programme. The decision to that effect was made by the Cabinet of Ministers at its meeting held on Friday 7 May 1993.

I further assert that it is the Government's intention to monitor compliance with the Protocol. If necessary, further and different actions from those specified in the Country Programme will be taken, and the Country Programme will be updated and submitted to the Executive Committee of the Multilateral Fund.

We hope that the Executive Committee will approve the request for assistance made in respect of the following

(a) Institutional Strengthening

(b) Change over of propellant from CFC to hydrocarbons in aerosols

(c) Recovering and recycling of CFC 12 for mobile AC's

Please accept, Sir, the assurances of my highest consideration.

Yours faithfully,

(T.F. Chan Fong)
Permanent Secretary

MAURITIUS

COUNTRY PROGRAMME

FOR THE REDUCTION AND PHASE-OUT

OF

OZONE DEPLETING SUBSTANCES UNDER MONTREAL PROTOCOL

MINISTRY OF THE ENVIRONMENT
AND
QUALITY OF LIFE

REPUBLIC OF MAURITIUS

MAY 1993

Executive Summary

Background

Mauritius is a developing country under the definition of the Montreal Protocol with a per capita consumption of 0.07 kg (1991) of ODSs per annum.

There is no local production of Ozone Depleting Substances (ODS) and all the demand is met through imports.

With its concern and commitment to protect the global environment, the Government of Mauritius adhered to the Protocol in August 1992 and became a party in November 1992.

The Government of Mauritius entered into an agreement with UNEP IE/PAC to conduct a country wide survey on the supply and use of ODSs in order to prepare a Country Program that would express the Governments commitment to implement a planned phase-out of ODSs and also enable it to approach the Multilateral Fund for obtaining assistance to meet the costs of projects to be undertaken for reducing ODSs consumption.

UNEP IE/PAC accordingly made available the services of a consultant to assist the Government of Mauritius in undertaking the above task.

Approach

The preparation of the Country Program involved the following steps:-

- conducting a survey to assess the present supply and use of ODSs in Mauritius.

- An analysis of future requirements and the limits imposed by the Protocol.

- An assessment of options available for changing over to alternative technologies and substances in each sector and sub-sector and the incremental costs associated with the same.

- An assessment for the actions that the Government would have to take and projects that would require to be undertaken to implement a phase-out.

  This step was accomplished through an intensive process of interaction in a seminar involving representatives from different Government Ministries and Departments, User sectors and international Technical Experts.

- Formulating an indicative schedule of projects in the Government sector and industry for which the Government would seek assistance from the Fund.

Supply and Use of ODSs in Mauritius

There is no indigenous manufacturer of ODSs in Mauritius and the entire requirement of the country is met though imports, largely from producers in the developed countries.

Figures 1 and 2 illustrate the total consumption of ODSs in Mauritius by substance and the total use by sector in 1991.

ODSs CONSUMPTION IN MAURITIUS 1N 1991
BY TYPE OF ODS

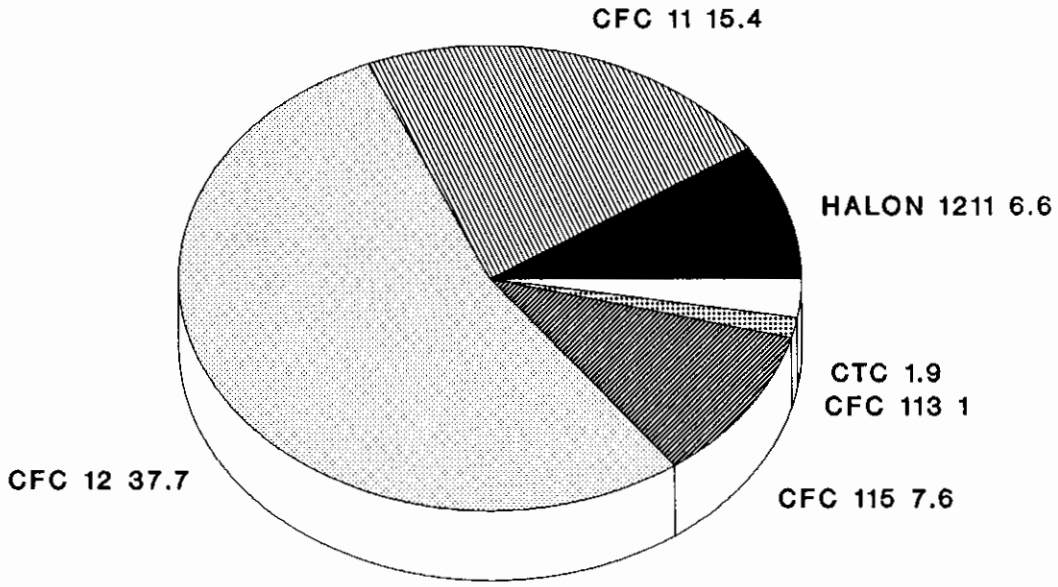


Figure 1

TOTAL CONSUMPTION 70.2 ODP TONS

USE OF ODSs IN MAURITIUS IN 1991 BY END USE

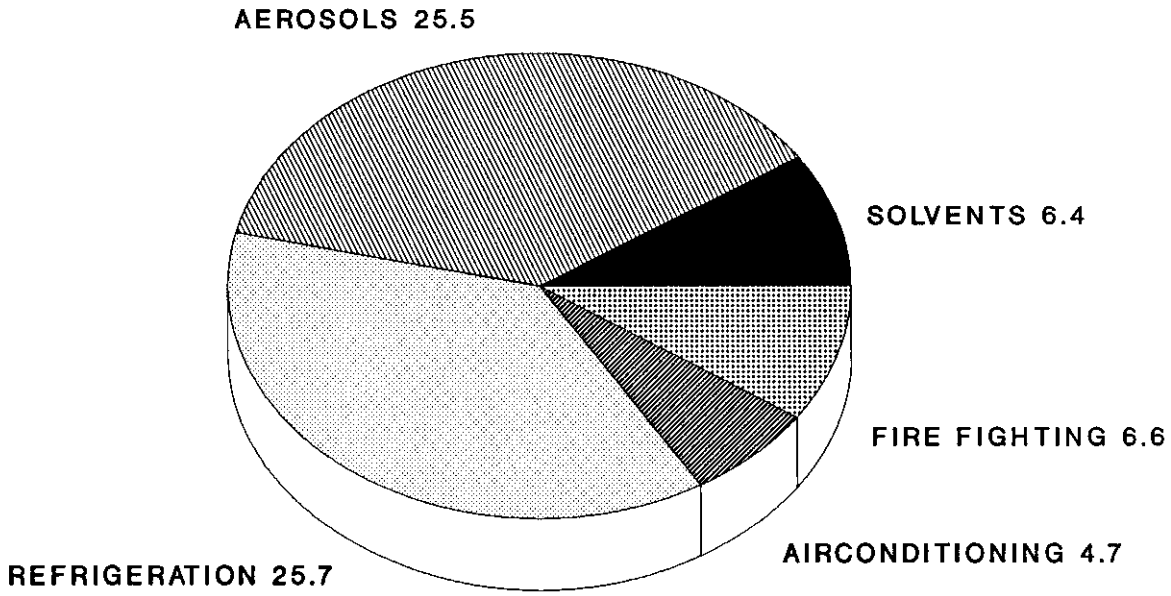


FIGURE 2

TOTAL USE 68.9 ODP TONS

As may be seen the major substances consumed (imported) are CFC-11, CFC-12, CFC-115 (used in the composite refrigerant R-502) and Halon 1211.

The major suppliers of ODSs to Mauritius are ICI, Dupont, Hoechst, GALCO and SICNG.

Each of these have a local importing agent who sources from them and resells them to actual users.

The major area of use of ODSs have been in Aerosols, Domestic Refrigeration, Commercial Refrigeration and Air-conditioning, Mobile Air-conditioning, Solvents (for cleaning) and for recharging fire fighting equipment.

Over the last year one of the major sectors, Aerosols, has seen a substantial reduction in consumption because of directives to local fillers from their Multinational brand licensors to curtail CFC usage.

Industry Structure

Importers of ODSs

There are about ten known importers of ODSs in Mauritius of which four are agents for overseas producers and the others are user industries importing ODSs for captive consumption.

The two large importers who account for more than 80% of the total imports are agents for ICI and GALCO though one of them occasionally sources his requirement from other suppliers as well.

Users of ODSs

The main user sector industries using ODSs are Aerosols, Domestic Refrigeration, Commercial Refrigeration and Air-conditioning.

Other consumers of ODSs are fire-fighting installations, instrument manufacturers, textile industries as well as hotels and food processing industries, cold storages, and importers and service agencies for cars and numerous service agencies servicing refrigeration and air-conditioning equipment. In the Aerosol sector there are four fillers of whom three market products whose brands are licensed by multinationals such as Unilever, Proctor & Gamble and Yves Rocher. The total number of aerosol cans produced is around 500,000 per annum.

There are two manufacturers of Domestic refrigerators each with a capacity of around 5000 refrigerators and deep freezers per annum. These manufacturers manufacture their products under license from abroad and import most of the components

but undertake blowing of insulation foam for which they use CFC-11.

In the commercial refrigeration and air-conditioning sector there are three companies who undertake installation of large systems for buildings and cold rooms. Their volumes are fairly low. Among other consuming sectors it is important to note that mobile air-conditioners are all serviced exclusively by the importers of cars who are ten in number. Large commercial Refrigeration and A/C equipment are serviced by installations themselves who use CFC's and there are numerous service agencies in the unorganised sector who carry out servicing of smaller equipment including recharging.

Halon and Halon based fire-fighting equipment are imported mainly by two agencies who supply Halon for recharging to a number of users. Use of ODSs as solvents is limited.

Government and Industry Responses to the Protocol

The Government has recognised that compliance with the Protocol would imply shifts in consumption patterns, changes in industries processes and in technical services. It would also require policy decisions to be enforced by appropriate legislation where necessary and an institutional framework to be set up for monitoring implementation.

Accordingly the Government has taken a number of steps till date.

It has set up a National Committee to start work on elaboration of a plan of action.

The Ministry of the Environment and Quality of Life had sought the assistance of UNEP to provide a consultant to assist in carrying out the background work for formulating a Country Programme.

The Ministry has organised a seminar with the participation of users of ODSs, importers, representatives of other ministries and departments and technical experts from overseas in order to evolve in a collaborative manner the elements of a policy framework and a phase-out strategy to comply with the Protocol.

The outputs from this seminar have been used as a basis for drawing up implementation actions elaborated further in this report.

Industry response

There is considerable awareness about the issue of Ozone depletion among various industry sectors, some of whom have

already taken initiatives to curtail or eliminate the use of ODS.

This includes the Foam sector which switched to methylene chloride as a blowing agent over three years back.

Likewise three out of four aerosol fillers have looked at ways of eliminating CFCs from their products.

The importers of Refrigeration and Air-conditioning equipment are of course totally dependent on developments overseas for effecting any change over but even here there is a move to opt for equipment based on HCFC-22 wherever possible.

On the other hand small players like agencies servicing domestic refrigerators or smaller commercial systems are not so aware of the Protocol and its implications on future supply of ODSs.

With the conclusion of the seminar held on the Country Programme there has been enhanced awareness in industry about the Protocol and the implications for ODS phase-out.

Phase-out Strategy

The Government of Mauritius, after considering the present level of consumption of ODSs in various sectors, the technical options available and a review of possible early and late phase-out schedules has decided that it will initiate early action, that is, in advance of the time frame allowed under the Protocol to phase-out the use of ODSs in Mauritius. This would be subject to technical options being available and proven as well as economically viable.

The actual phase-out schedules in various sectors were determined through consensus involving user sector representatives and international experts after considering the appropriateness of technical options.

The key measures contemplated to phase-out ODSs in different sectors are:-

- Eliminating the use of CFCs in Aerosols
- Switching over to 50% water blowing in refrigerator foam manufacture.
- Curtailing installation of any air-conditioning system based on CFC-11.
- Reducing consumption of ODSs in Refrigeration and Air-conditioning maintenance and recharge through training and improved practices.

- Switching over to to HFC-134a based systems in domestic refrigerators as well as commercial refrigeration systems.

- Retrofitting systems in commercial Refrigeration and Air-conditioning to work on alternatives.

- Adopting recovery-recycling in mobile air-conditioning to conserve CFC-12.

- Curtailing the use of ODSs in solvents at the earliest.

- Curtailing the import of Halons for non-essential use and installing a Halon Bank.

These measures when implemented would have the effect of phasing-out 90% of consumption of Annex A.Gr.I substances by 1998, 100% of Annex A.Gr.II by 1995 and 100% of Annex B.Gr.II by 1995.

The table below indicates the planned consumption to phase-out for each Group of ODSs.

Group	1991	1992	1993	1994	1995	1996	1997	1998	1999
Annex A Group I	60.2	61.2	61.3	15.1	12.0	10.3	9.5	5.6	5.3
Annex A Group II	6.0	6.3	6.6	6.9	Nil	Nil	Nil	Nil	Nil
Annex B Group II	1.9	1.9	1.9	2.0	Nil	Nil	Nil	Nil	Nil

Group	2000	2001	2001	2003	2004	2005	2006	2007	2008	2009
Annex A Gr.I	5.0	4.6	4.1	3.1	3.2	2.6	2.1	1.6	1.1	1.2

Much of the reductions above are a result of the switch over in Aerosols to hydrocarbon and to HFC-134a in place of CFC-12 in the Refrigeration and Air-conditioning sector.

The complete phase-out of Annex A Gr I substances takes place only by 2010. This is primarily out of the need to meet the recharge requirements of the large population of domestic refrigerators.

To implement the phase-out as per the schedule above the Government has contemplated a series of actions.

These cover market measures, regulatory and administrative measures as well as institutional strengthening.

In respect of Institutional framework the Government proposes to constitute a secretariat within the Ministry of the Environment and Quality of Life consisting of two senior administrators and two technical officers along with requisite infrastructure to coordinate and be responsible for implemention of the Country Programme.

The Government will also set up a Steering Committee consisting of representatives from different Ministries, user sectors, NGO's and others to monitor the Country Programme implementation.

Projects:

The implementation of the phase-out through actions above entails a number of projects which require funding from the Multilateral Fund.

The projects are presently grouped under three categories.

The first are projects to be approved together with the Country Programme and which can be taken up immediately.

The second set of projects would be taken up once formal proposals for these are made and submitted and the third category of projects are those where proposals would be made at a later point in time.

The main projects and their outlay are summarised below:-

I.	Government Activities	Cost US$	Year	Remarks
1.	Project on institutional Strengthening Ref. GO1	50,000	1993-95	Proposal enclosed with Country Programme
	Sub-project GO2 on ascertaining essential uses of Halons		1993-94	
	Sub-project GO3 on assessing training needs for Refrige-ration technicians.		1993-94	
2.	Training Technicians	55,000	1994	
3.	Creating a Halon Bank	126,000	1995	

Projects in industry

	Sector	Project	Incremental* Cost	ODSs Saving* (Tonnes)	Remarks
1.	Aerosols	Switch over to Hydrocarbon	113,000	82.6 CFC-12	Proposal enclosed
2.	Mobile A/C	Recovery and Recycling	26,006	5.5T CFC-12	Proposal enclosed
3.	Domestic Refriger-rators	50% Water in Foam blowing	121,009	11.8T CFC-11	
4.	"	Convert facilities to produce HFC-134a based refrige-rators	11,000,000**	7.2T CFC-12	

* Calculated for 4 years and at 1993 present value.
** Yet to be assessed.

The projects proposed for funding along with the approval of country programme are on Institutional strengthening. Switching over to Hydrocarbon for an aerosol filler and on Recovery and Recycling for mobile a/c's.

Proposals in the next phase will be submitted for Training of technicians in the Refrigeration Sector, Creating a Halon Bank and for 50% water blowing in domestic refrigerators.

Incremental Cost

The incremental costs applicable to Mauritius comprise of three elements.

(a) Costs incurred in the User Sector: Costs incurred at manufacturer level for changing over from products using ODSs to 'ODS free' technology.

These include

- incremental capital and operating costs
- costs of retraining, R + D etc.

(b) Costs incurred in the Consumer Sector: Costs incurred by the consumer to procure and maintain equivalent ODS free products.

(c) Costs incurred in the Government Sector: Costs incurred by the Government for introducing necessary measures to ensure effective implementation of the Protocol.

The above costs have been estimated for Mauritius for implementing the phase-out schedule for each sector. These costs are arrived at by discounting cash outlays and savings from 1994 to 2010 to 1993 at a discount rate of 10%.

The results are as follows:-

SECTOR	GOVERNMENT	USER	CONSUMER
AEROSOL		913	
MOBILE A/C		3	
DOMESTIC REFRIGERATORS & DEEP FREEZERS	36	2808	3502
COMMERCIAL REFRIGERATION & AIR-CONDITIONING	14		261
SOLVENTS			7
HALONS	114		
PROGRAMME IMPLEMENTATION	50		
Total	214	3724	3756

Costs to the country = US$7,694,900

It may be noted that the major incremental cost is in the Domestic Refrigeration sector which requires a change to HFC- 134a based fridges.

The total ODS consumption till phase-out is as follows:-

Annex A GR I 92.1 ODP Tons
Annex A GR II 6.95 ODP Tons
Annex B GR II 1.95 ODP Tons

1. INTRODUCTION

1.0 Background.

Mauritius is a developing country under the definition of Montreal Protocol with a per capita consumption of 0.07 kg of ODSs per annum. There is no local production of Ozone Depleting Substances (ODSs) and all the demand is being met through imports. With growing concern towards environmental protection the Government of Mauritius signed the Protocol in August 1992 and ratified the same in November 1992.

As per the terms and conditions of the Protocol, the consumption of Ozone Depleting Substances (ODSs) is required to be phased out from a level of the average consumption in the years 1995, 1996 and 1997 by the year 2010 or 2015 depending on the substances.

The Government of Mauritius entered into an agreement with UNEP IE/PAC to conduct a countrywide survey* on the supply-demand scenario of ODSs in Mauritius in order to develop a Country Program for reduction of ODSs as a precursor to availing possible assistance from the Multilateral Fund for ODS phase out projects. UNEP IE/PAC accordingly appointed a consultant to assist the Mauritius Government in conducting the study.

The study was followed by a national seminar involving representatives from various Government Ministries and Departments, User Sectors and eminent technical experts.

The objectives of the seminar were to forge a consensus on the Government's commitment to phase out use of ODSs with minimum delay and to debate and arrive at preferred strategies in terms of options and timing in each sector and sub-sector for phasing out ODSs.

The outputs of the seminar together with the background work done by the consultant have been used to present the Country Program contained in this report.

1.1 Purpose

The Country Programme reflects the intentions and commitment of the Government and people of Mauritius to join international efforts to save the ozone layer by complying with the Protocol.

* List of respondents enclosed in Annexure 1

It provides data on the present supply and usage of ODSs if no attempt was made to comply with the Protocol, an evaluation by consensus of the preferred strategies for phasing out ODS, in terms of technical options and timing, an estimate of costs to the Country of such a phase out, a description of the projects required to be undertaken in various sectors to effect phase out and Government actions to support the same, and an estimate of the assistance required from the Multilateral Fund for successful execution of these projects.

The Country Program provides milestones in respect of the phase-out program for each group of substances and in each sector, which would facilitate monitoring the program.

1.2 Status

The Ministry of the Environment and Quality of Life has taken the lead in preparing the Country Programme. A UNEP IE/PAC Consultant through two missions to Mauritius in September 1992 and April 1993 assisted in formulating the country program by way of designing the research methodology, data analysis and discussions with the Ministry to draw up a plan of action.

The draft Country Programme has been reviewed by the Cabinet who have approved the finalisation and submission of the same to the Multilateral Fund.

The total cost of preparation of the Country Program is roughly US$ 30,000.

1.3 Assistance received

For the preparation of the Country Programme the Ministry of the Environment and Quality of Life received financial assistance from the Government of Finland through UNEP IE/PAC.

The agencies who assisted in the preparation of the Country Program included various Government Departments and Ministries, private sector enterprises and UNEP technical experts.

The nature of assistance provided concerned data, technical assistance and participation in discussions/seminar to arrive at an agreed action plan.

2. CURRENT SITUATION

2.1 Current and Forecast Consumption of ODSs

2.1.1. Current Consumption.

There is no indigenous manufacturer of ODSs in Mauritius and the entire requirement of the same is being met through imports. The main suppliers of ODSs to Mauritius are Du Pont and ICI. There are four main importers of ODSs in Mauritius of which one is fairly recent. Of these the largest importer accounts for 66% of the total imports. Apart from these importers some of the big consumers import their requirements of ODSs directly. The total amount of ODSs imported are as given in **Table 2.1.**

Table 2.1
Current (1991) consumption of ODSs in Mauritius

Source Tonnes Substance	Production	Import	Exports	Consumption	ODP	ODP Tonnes
Annex 1 Group 1						
CFC-11	-	15.40	-	15.40	1.0	15.40
CFC-12	-	37.70	-	37.70	1.0	37.70
CFC-113	-	1.22	-	1.22	0.8	0.98
CFC-114	-	-	-	-	-	-
CFC-115*	-	22.38	-	22.38	0.34*	7.61
Sub-Total						61.69
Group II						
Halon 1211	-	2.20	-	2.20	3	6.60
Halon 1301	-	-	-	-	-	-
Halon 2402	-	-	-	-	-	-
Sub-Total		-		-	-	6.60
TOTAL						68.29
Annex B Group I			Nil			
Group II Carbon Tet (CTC)	-	1.73	-	1.73	1.1	1.91
Group III Methyl Chloroform (MCF)	-	-	-	-	-	-
Total						70.20

Source: Field Survey of importers

* Worked out the basis of that contained in R-502 in terms of HCFC-22 and CFC-115 and their respective ODP.

The survey of imports has revealed that there has been a sharp reduction in the quantity of imports compared to 1989 in CFC-11 and CFC-12 when over 87 Tonnes of these were imported.

The survey has also brought out that in the last year and a half there has been a further fall in imports of CFC-11 and CFC-12 but a substantial increase in the import of R-502 ostensibly for the purpose of servicing ships calling at Mauritius port.

There is an awareness among importers about the depletion of the ozone layer by various ODSs and that these substances are gradually being phased out in the international market.

Some of the importers have been informed by their suppliers overseas regarding policies in restricting supply of ODSs to specific sectors e.g. Aerosols, as also the developments regarding substitutes, their availability and prices. Nevertheless the technologies in the user sector are still ODSs based and, other than in case of flexible foams and to a large extent in aerosols, no major initiatives have been taken to look at technology involving substitutes.

The prices of various ODS as reported by various importers are as given in **Table 2.1(a).**

Table 2.1(a)

Substance	CIF Price in US $ per Kg in 1991
CFC-11	2.30
CFC-12	3.32
R-502	5.66
CTC	0.77
CFC-113	0.99

The various duties/taxes applicable on these substances are:

Import Duty	-	5 %
Levy	-	17 %
Sales tax	-	5 %

The prices are reported to be stable at around these levels for the past three years though some increases have been reported of late.

2.2 Use of ODSs

The Ozone Depleting Substances are largely used as a propellant in aerosol cans (Aerosol segment); as a refrigerant in the refrigeration and air-conditioning equipment; and as a blowing agent for insulation in domestic fridges. Besides they are also being used as cleaning agents. Halons (1211 & 1301) are being imported in the form of fire-fighting equipment (mostly portable fire-extinguishers) and the quantity shown in **Table 2.1** for the recharge requirements of fire fighting equipment.

Table 2.2 summarises the use of various ODSs by the different sectors.

Table 2.2

Estimated Consumption of ODSs by End Use & Application (for 1991)

User Sector	Substance	Application	Consumption (Metric tons)
AEROSOLS	CFC-12	Propellant in Aerosols Can	25.51
REFRIGERATION		Annex A	Annex A Annex B
Group I	Group II	Group II	& III
Domestic	CFC-12	Installation & Servicing of refrigerators & Freezers	7.02
	CFC-11	PUF insulation for domestically made fridges	6.40
Commercial	CFC-12	Servicing of Display Cabinets	0.02
	CFC-12	Servicing of Bottle Coolers	0.04
Industrial	CFC-12	Installation and Servicing of Cold Stores	0.95
	CFC-12	Servicing of Refrigerated containers and refrigeration plants on board fishing Vessels/Ships	3.50
	R-502	Installation & Servicing of cold Stores (R-502 plants)	0.35
	R-502	Installation & Servicing of refrigeration plants on board fishing vessels/ Ships	21.83

Table 2.2 (Continued)

Estimated Consumption of ODSs by End Use & Application (for 1991)

User Sector	Substance	Application	Consumption (Metric tons)		
			Annex A Group I	Annex A Group II	Annex B Group II & III
AIR CONDITIONING					
Cars	CFC-12	Servicing of car air conditioners	2.89		
Industrial	CFC-11	Servicing of central chillers	1.70		
	CFC-12	Servicing of central a/c plants	0.08		
SOLVENTS					
	CTC	Various minor applications			1.73
	CFC-11	Used as a solvent	3.50		
	CFC-113	Used as a solvent	1.22		
FIRE FIGHTING	Halon-1211	Portable/transportable fire-extinguishers - Used for recharging		2.20	
TOTAL ODSs			75.01	2.60	1.73
TOTAL ODP Tons			60.37	6.60	1.91

The table is based on the assumptions explained in the description of various segments given below.

A) Refrigeration and Air-conditioning

The sector can be further broken down into the following sub-sectors.

i) Refrigerators and deep freezers

There are only two domestic manufacturers of these equipment. Besides there are about 6 or 7 importers of these equipment catering to the domestic market.

The total production and imports of refrigeration equipment reported for last few years is as per **Table 2.3.**

Table 2.3

	1989	1990	1991
Production	6325	7140	8750
Imports	6996	7562	9125

The total refrigerator population (in 1991) is estimated at 2,00,000. Both the domestic and Imported refrigerators and deep freezers are available in various sizes. The refrigerant used is CFC-12 and almost all of them have PUF insulation for which CFC-11 is used as a blowing agent. The average technical norm for refrigerant charge comes to about 140g per refrigerator. For PUF insulation the average technical norm is around 700g per refrigerator.

The servicing of old equipment is being done mostly by private service agencies in the organized as well as unorganized sector.The agencies in the unorganised sector account for more than 90% of the repair jobs as they are easily accessible and more economical as compared to authorised service agencies of manufacturers. It is estimated that there are about 100 service agencies in the unorganized sector each consuming around 60-70 Kgs of CFC-12 every year. There is no recycling/ reclaim equipment available with these agencies.

It is assumed that around 20% of existing and 10% of the new refrigerators need repairs every year. Of these only 50% require recharge. While the practices of service agencies regarding charging, cleaning, flushing and leak detection have not been explored exhaustively it appears that recharging frequency is usually high and also involves excess use. For the study we have assumed the recharging norm to be around 300g/unit based on available inputs.

ii) **Mobile Airconditioners**

There in no local manufacturer of automobiles in Mauritius and the demand is being met by imports. There are about 8-10 agencies which represent the leading international manufacturers like Toyota, Mercedes, BMW, Mitsubishi, Volkswagen, Audi etc. The total car/ van population in Mauritius was estimated at around 36,855 at the end of 1986 of which around 10% were airconditioned. Subsequently the inputs of a/c cars increased to about 20% of total new purchases. Thus in 1991 of the total car/van population of 57,000, 8988 were estimated to be air-conditioned. Most of the a/c vehicles are reportedly pre-charged with CFC-12 by the manufacturers themselves. The maintenane of these vehicles is being done by the agents of their own workshops.

On an average a car a/c requires service once in three years. Of these only 25% of the cars a/c's require topping up of the gas whereas the rest of them require complete refilling. The amount of CFC-12 required for topping up is estimated to be 25% of the total capacity of the car airconditioner (1000g approx.). The average wastage during refilling is around 20%. Therefore the average norm for topping up works to 300g whereas that for complete refilling is around 1200g. The total consumption of CFC-12 by this sector is about 2900 Kg per annum.

The field survey indicated that workshops of two leading importers who are imported cars fitted with a/cs based on HFC 134-a equipped with reclaim and leak detection equipment. However such equipment was not reported by other importers/vehicles agencies.

iii) **Commercial Refrigeration**

The commercial refrigeration sector consists of

a) Cold storages

b) Bottle coolers

c) Display cabinets

d) Ships and fishing trawlers.

The description of these sectors in Mauritius follows.

a) **Cold storages**

Cold Storages are being used for storage of food items by agencies like Hotels, Agricultural Marketing Board and the companies in Food processing, Poultry, Dairy

products etc. As per the survey the total number of cold storages in the country is reported to be around 200 of which around 150 are estimated to be based on CFC-12 and the rest on R-502. While the cold stores of the Agricultural Marketing Board are large installations with aggregate capacity in excess of 10.000 TR most of the others are small cold rooms in hotels. The equipment for these cold storages is imported. Most of the agencies are maintaining these cold storages on their own. On an average the refrigeration capacity of the cold storages is around 60 TR. and the CFC-12 requirement is 2 kg per TR. The annual recharge requirement for these cold storages is estimated to be around 4 - 5 kg per unit on the average.

The consumption of CFC-12 and R-502 for this subsector is estimated to be around 0.95 MT and 0.35 MT, respectively.

b) **Bottle coolers**

Though the exact number of these equipment is not available, it is estimated that there is one bottle cooler per 1000 persons. On this basis the number of these equipment is around 1078. While no precise inputs were available from the survey, the initial charge of a bottle cooler is assumed to be 120g per unit and the annual recharge requirement to be 40g.

c) **Display cabinets**

It is estimated that there is one display cabinet per 5000 persons. The total population of these equipment works to around 216. Here again, no precise inputs were available from the survey and the average initial charge of the equipment was assumed to be around 300g per unit and the recharging norm to be 100g per unit per annum.

d) **Ships and Trawlers**

The cold rooms of fishing vessels are fitted with CFC-12 and CFC-502 based refrigeration equipment. Additionally many shipping vessels with refrigerated stores call on Mauritius port for their CFC requirement. They could be using CFC-12 or CFC-502. The shipping vessels consume more than 90% of the total imports of CFC-502 (around 20MT) and about 3.5 MT of the imports of CFC-12 in Mauritius.

iv) **Domestic and Commercial Air-Conditioning**

Only central airconditioning units are considered for analysis since all other types of air-conditioning systems (window, split, packaged units etc.) reportedly

use only HCFC-22, which has been covered under the Protocol only recently.

It is estimated that there are around 13 CFC based central airconditioning units in Mauritius installed at places like five-star hotels, important government buildings etc. Of these it is estimated that 12 units are centrifugal chillers based on CFC-11 and only one is based on CFC-12. The average size of CFC-11 based units is around 500 TR while the CFC-12 based unit is of 400TR. It is estimated that the initial charge requirement for these units is 1 Kg per TR. Ideally there should be very little recharge requirement for these units. The standard norm prevailing in other developing countries is approximately 2 per cent of the initial charge required for necessary purging. However, a high recharge requirement of around 20% per annum has been reported.

The total consumption of ODSs by the subsector is estimated to be about 1700 Kg of CFC-11 & 75 Kg of CFC-12.

B) **Aerosols**

This sector is the second largest consumer of ODSs in Mauritius. The use of CFC-12 as an aerosol propellant is mainly for perfumes and deodorants. There are four known manufacturers namely Comanu Ltd., Grays Ltd., Mauritius Cosmetics Ltd., and Prince Industries. Comanu accounts for a large percentage of the production of aerosol products in Mauritius. They market product which are brands of Unilever while the others market brands of P&G, Yves Rocher, etc.

The total aerosol production in Mauritius is around 500,000 cans per annum. The propellant content in these cans is approximately 45% of the total volume. These companies are using imported Semi-Automatic filling equipment and Pressure filling equipment for filling of the aerosol cans.

In the last two years manufacturers have already looked towards alternatives to aerosols like mechanical pumps/roll on applicators etc. as also CO2 as a propellant. This has largely been dictated by the fact that fillers have been asked by the multinational licencors of their brands to stop using CFCs. As a matter of fact COMANU has almost completely switched over to CO2 while Mauritius Cosmetics have switched over to pumps. Grays are examining HCFC blends. The consumption of CFC-12 by this sector has dropped from 25 Tons in 1991 to 5.1 Tons in 1993.

C) **Foams**

None of the flexible foam manufacturers contacted were using any ODS as a blowing agents. The blowing agents reportedly being used are methylene chloride blended with water. Only one manufacturer was reportedly using CFC-11 till about 1990 and had imported its requirement for 1989-90. Since 1990 it too has switched over to Methylene Chloride.

D) **Solvents**

The main ODSs used as solvents are CFC-11, CFC-113, and Carbon tetrachloride. One of the users has reported the use of Forane 113 and Flugene 113 (the brand names for CFC-113) in polishing of glass. Another user was identified using around 3,500 Kg of CFC-11 for cleaning PCB's. He expects this to reduce drastically in future. Importers mentioned supplying 1500-2000 litres of CTC/TCE annually to various textile companies. For the study we have assumed that amount of CTC & TCE are equal (around 1000 litres).

E) **Halon Fire Extinguishers**

Portable fire extinguishers are based on Halon 1211 and the fixed type flooding systems are based on Halon 1301. There are very few fixed fire fighting systems in Mauritius. Portable fire extinguishers are being imported by various companies from Republic of South Africa, U.K. and Malaysia. The total number of portable fire extinguishers imported in the last three years are as follows:

Table 2.4

	1989	1990	1991
No. of Portable Fire Extinguishers	725	800	1150

These fire extinguishers come in various sizes ranging from 1 Kg. to 12 Kg. The average capacity assumed for this report is around 4.5 Kg. The import of Halons otherwise is for recharging existing equipment. This is reported to be about 2.2 Tonnes annually.

2.1.2 Current use of ODS in Mauritius

Table 2.5 gives the summary of the use of various Ozone Depleting Substances by the various and user segments during the period 1989 to 1991.

Table 2.5
Summary of ODS Use in Mauritius, 1989-91 (in metric tonnes)

	1989	1990	1991
Refrigeration			
CFC-11	5.91	6.53	8.10
CFC-12	12.75	13.45	14.50
R-502	8.82	17.00	22.38
Total Refrigeration	27.48	36.98	44.98
Foam			
CFC-11	18.00	0	0
Total Foam	18.00	0	0
Aerosols			
CFC-12	51.13	42.36	25.51
Total Aerosols	51.13	42.36	25.51
Solvents			
CFC-11	3.50	3.50	3.50
CFC-113	1.22	1.22	1.22
CTC	1.00	1.00	1.75
Total Solvents	5.72	5.72	6.47
Halons			
Halon 1211	2.2	2.2	2.2
Halon 1301	0	0	0
Total Halons	2.2	2.2	2.2
Total CFCs			
CFC-11	27.41	10.03	11.60
CFC-12	63.88	55.81	45.28
CFC-113	1.22	1.22	1.22
R-502	6.62	17.00	22.36
Annex A. Group I Total CFCs	101.33	64.06	75.01
Annex A. Group II Total Halons	2.2	2.2	2.2
Annex B, Group III Total CTC	1.58	1.69	1.73
Annex B, Group III Total CFCs	0	0	0

Note: Consumption of CFC-11 in Refrigerator Foam is included in Refrigeration.

2.1.3 Forecast Consumption - Unconstrained

Basic Assumptions

The unconstrained future demand for the controlled substances is estimated assuming that the Montreal Protocol does not exist. It is, therefore, assumed that:

- ODSs are not regulated
- unconstrained quantities of controlled substances continue to be available from existing sources, at current prices.

The unconstrained demand for ODSs is derived from the demand for products that contain or are made with ODSs and from the need for servicing of equipment using ODSs. These in turn, are determined by the following factors:

- population growth rate
- current and forecast market saturation level for various consumer goods, e.g.,aerosols, refrigerators.
- past consumption trends. (as referred in **Table 2.5** above)

These factors along with sector specific information are used to project the unconstrained ODS demand up to the year 2010.

Table 2.6 gives the population/use of equipment/products in various sector in Mauritius.

Table 2.6

Population of various equipment/products using ODSs in Mauritius - 1991

Item	Population/Use estimate
Aerosol products	1.5 cans per person between 10 - 50 years of age
Air Conditioned cars	8988 cars of a total of 57,223
Domestic Refrigerators	200,000
Cold Storages	
CFC-12 based	150
R-502 based	50
Bottle Coolers	1078
Display Cabinets	216
Central Airconditioning Plants	
CFC-11 based Chillers	12
CFC-12 based	1

Basis of Forecasts

A. **Aerosols**

The unconstrained demand is estimated by projecting the per capita consumption of aerosol products in Mauritius.

It is assumed that:

- aerosol products are consumed by the population aged between 10 and 50.

- the per capita consumption of aerosol products would increase to a level of 4 cans in the year 2000 and 5 cans in the year 2010 from the level of 1 can in 1989.

- It is assumed that the domestic production would grow at 3% per annum with the share of the three fillers using CFCs as at present

- there are significant volumes of imports of aerosol products particularly in insecticide sprays and it is assumed that imports will continue.

There has been a dip in the CFC-12 consumption by the aerosol sector from 1989 to 1991 and further in 1992-93. However for purposes of unconstrained demand with 1991 as the base year these subsequent developments have been ignored.

It is known that three of the four fillers have partially and in some cases fully switched over to alternatives like CO2 or HCFC blends as propellants and to mechanical pumps etc. primarily as per directions from the licencors of their brands.

B. **Mobile Airconditioners**

The unconstrained demand in this sector is calculated by forecasting the future demand for cars in Mauritius. Past data on population of cars and the total population of Mauritius indicates a strong correlation between the two. Since reasonable estimates were available on the future population of Mauritius, the following assumptions were made to estimate the future consumption of CFC-12 by this sector:

- The total car population is represented by the regression equation:

  Car Population = -447962.5 + 0.4687 * Population of Mauritius

- Initial population of a/c cars in 1986 was 10% of the total population.

- Demand for a/c cars from 1987 onwards is assumed to be 20% of the total demand

- Life of a car as well as car a/c is assumed to be 15 years.

- Scrap Rate:

  * Initial population in 1986 is scrapped uniformly @ 1/15 per year every year for 15 years.

  * New cars added are scrapped after 15 years.

- **Since HFC 134a based a/c cars are available in the market, and since it is also known that nearly all international manufacturers of car a/c's are completely switching over to HFC-134a and since Mauritius imports all cars it is assumed that even in unconstrained situation 20% of the total a/c cars imported in 1994 would be HFC-134a based. The figure would increase to 40% in 1995, 60% in 1996, 80% in 1997 and 100% from 1998 onwards.**

- Frequency of servicing a car a/c is assumed to be once in every 3 years of which 25% of the time it requires topping up (@ 0.3 kg per service) and 75% of the time complete refilling is needed (@ 1.2 kg per service).

Annexure 2.1 shows the unconstrained forecast consumption of CFC-12. It increases from 2.9 tonnes in 1991 to 4.1 tonnes in 1997 and gradually reduces to 0.25 tonnes in 2010.

C. Domestic Refrigerators & Deep Freezers

The demand for domestic refrigerators in the future is expected to be from two fronts:

- increase in the number of households because of reducing family size, and
- scrapping of old fridges

Following assumptions were made to calculate the future consumption of CFCs in the sector:

- Since the population of deep freezers is small and no data is available on the sector separately, the future consumption by this sector is assumed to follow the same pattern as the refrigerator sector.
- The average family size in Mauritius is expected to decrease from a level of 5 in 1991 to 4 in the year 2001 and remain constant thereafter.
- The current market penetration level of 93% is assumed to be the point of saturation and no further penetration is assumed likely.
- Life of a refrigerator is assumed to be 20 years.
- Scrap Rate:
  * Of the population of 200,000 fridgesin 1991 for which no age schedule is available, a uniform scrap rate of 5% per annum is assumed.
  * New demand is scrapped after 20 years.
- Past data shows that roughly half the demand is catered to by domestic production and half by imports. The pattern is assumed to be the same in future also.

- Repair Rate:

  * 20%, i.e., once in every 5 years for the old population of 200,000 in 1991.

  * 10% for the new demand of fridges.

  - As per estimates of various service agencies, 50% of the fridges that come for repair require recharge. The same is assumed to be the case in future also.

  - Consumption norms for CFCs

    * CFC-11 0.7 Kg per refrigerator produced domestically

    * CFC-12 0.14 Kg per refrigerators as OE demand
      0.3 Kg per refrigerator as recharge demand.

Annexure 2.1 shows the unconstrained forecast consumption of CFC-11 and CFC-12 for this sector. The consumption of CFC-11 reduces from 6.4 MT in 1991 to 6 MT in 1997 and 4.3 MT in the year 2010 while that of CFC-12 reduces from 7 MT in 1991 to 6.9 MT and 5.5 MT in 2010.

D. **Commercial Refrigeration**

Following assumptions are made to calculate the future CFC requirement in this sector:

- Transport refrigeration sector, excluding ships, is not included in the analysis as the consumption in this sector is negligible and no data is available on the sector.

- Population of cold storages in Mauritius is estimated using the population of hotels, supermarkets and companies engaged in production and marketing of processed food in Mauritius.

- The future demand is assumed to increase by 3 cold rooms every year of which 2 would be CFC-12 based and 1 based on R-502.

- The scrap rate for cold storages is assumed to be negligible.

- The average size of a cold room is 50 TR requiring an initial charge of 100 kg.

- Recharge demand for cold rooms is 5KG per cold room every year (as per the estimates of service agencies).

- The population of bottle coolers and display cabinets is estimated by using the following norms:

  * 1 bottle cooler per 1000 people

  * 1 display cabinet per 5000 people

- The recharge demand for bottle coolers is assumed to be 40 grams per bottle cooler every year and the same for display cabinets is assumed to be 100 grams per display cabinet every year. The OE demand for the sector is negligible and is, therefore, assumed to be zero.

- The demand for CFCs for ships is assumed to increase at the rate of 5% per annum.

As shown in **Annexure 2.1**, the demand for CFC-12 in year 2000 is 6.5 tonnes and the same in year 2010 is 10.0 tonnes. The respective figures for R-502 are 34.6 tonnes in year 2000 and 56.1 tonnes in year 2010.

E. **Commercial Air-conditioning**

Following assumptions are made to estimate future demand of CFCs in this sector:

- The current population of Central Air- Conditioning Systems (CACs) in Mauritius was estimated using the information on population of big hotels and other centrally air- conditioned buildings in Mauritius and information provided by importers of large systems.

- Only some of the large installations are reported to be CFC-11 based centrifugal chillers, other installations and smaller systems except one are based on R-22. Thus in the unconstrained situation it is assumed that:

- One new centrifugal chiller would be installed every year, based on CFC-11

- New demand for smaller CAC installations would be HCFC-22 based.

- Consumption norms for CFC are assumed to be the same as provided by the service agencies. They are:

  * For CFC-11:
    Initial charge - 500kg
    Recharge demand - 100 kg per chiller per year

  * For CFC-12:
    Recharge demand - 75 kg per installation per year

Annexure 2.1 shows the future consumption of CFCs by the sector which is 2.6 tonnes of CFC-11 in year 2000 increasing to 3.6 tonnes in the year 2010. The consumption of CFC-12 remains constant at 0.08 MT per annum as there are no new additions.

F. **Solvents**

Due to lack of information, consumption of ODS, in this sector is assumed to grow at the rate of 10% once in every three years. However, the consumption of CFC-11 by Hanna Instruments is expected to decrease by 50% over the period 1992-93 since their cleaning system was working inefficiently. The future consumption trends are depicted in **Annexure 2.1.**

G. **Halons**

The present consumption of Halons is for recharging existing fire fighting equipment.

In estimating the unconstrained demand it is significant to note that existing sources have indicated supply constraints both for fire extinguishers and for Halons for recharging. Nonethelesss considering the quantity involved it is assumed that unconstrained demand will be growing at 5% every year over the current consumption of 2.2 tonnes.

Total Unconstrained Future Consumption of ODSs and Protocol Limits as Applicable

2.1.4 **Figures 2.1 and 2.2** graphically depict the unconstrained future demand of Annex A Group 1 and Group II ODSs in ODP tonnes and the applicable limits as per Article 5 of Montreal Protocol and **Figure 2.3** shows the same for Annex B Group 2 ODSs.

Annexure 2.1 shows that the total forecast consumption of Annex A Group 1 comes out to be 75 ODP tonnes in year 2000 and 92 ODP tonnes in year 2010. Also, the per capita consumption of all ODS in 1998 is 0.13 Kg which is lower than the limit of 0.3 Kg per-capita cited in the Protocol.

2.2. Industry Structure

This section outlines the structure and ownership ofindustries importing and using ODSs in Mauritius.

2.2.1. Importers of ODSs as chemicals.

There is no indigenous manufacturer of ODS and the entire requirement of the same is being met through imports. The main importers and their imports and sources of supply are as given in the table below (for the year 1991).

UNCONSTRAINED CONSUMPTION OF ODS
ANNEX A GROUP I SUBSTANCES

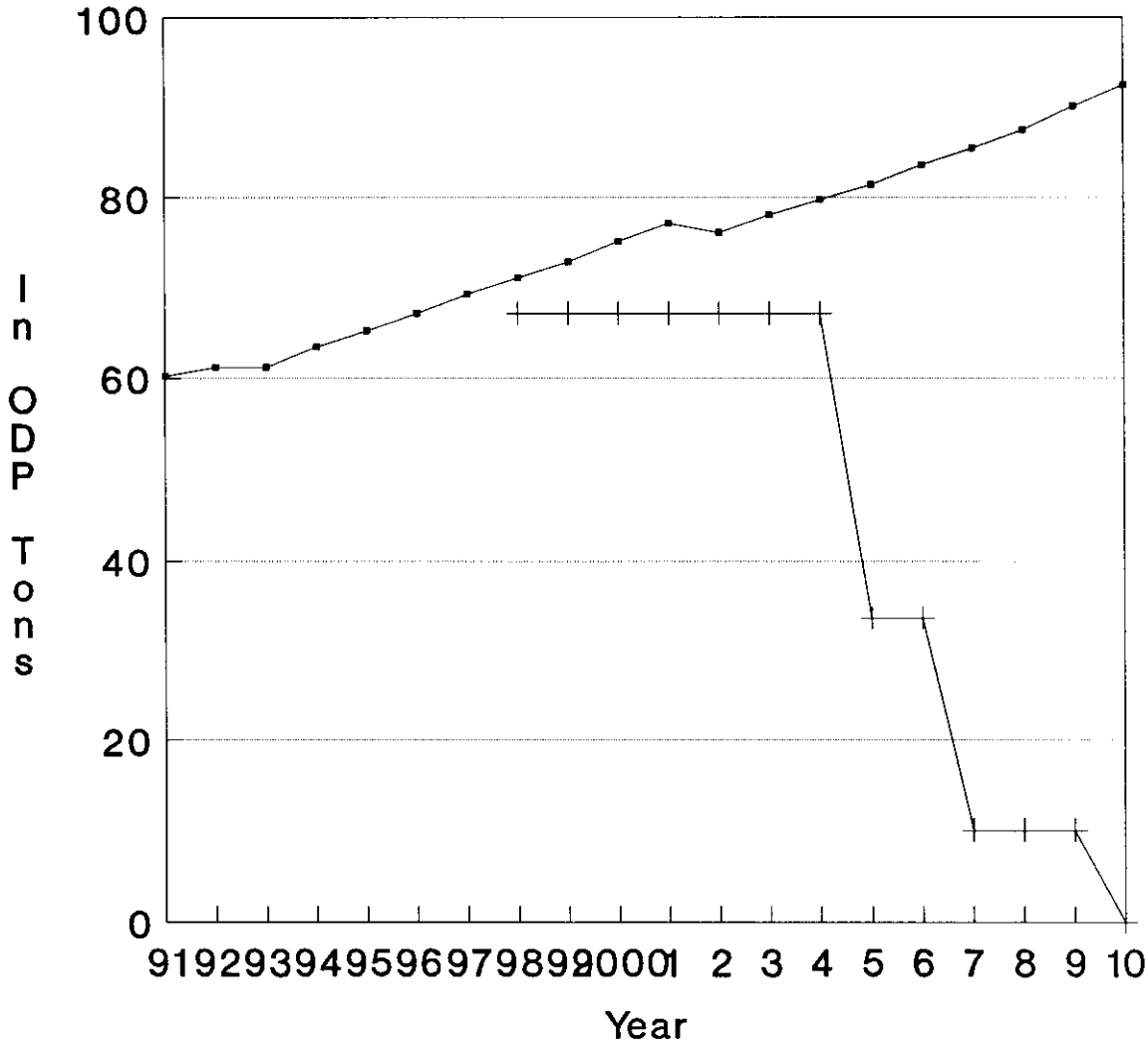


Figure 2.1

Unconstrained Demand Protocol Limits

UNCONSTRAINED CONSUMPTION OF ODS
ANNEX A GROUP II SUBSTANCES

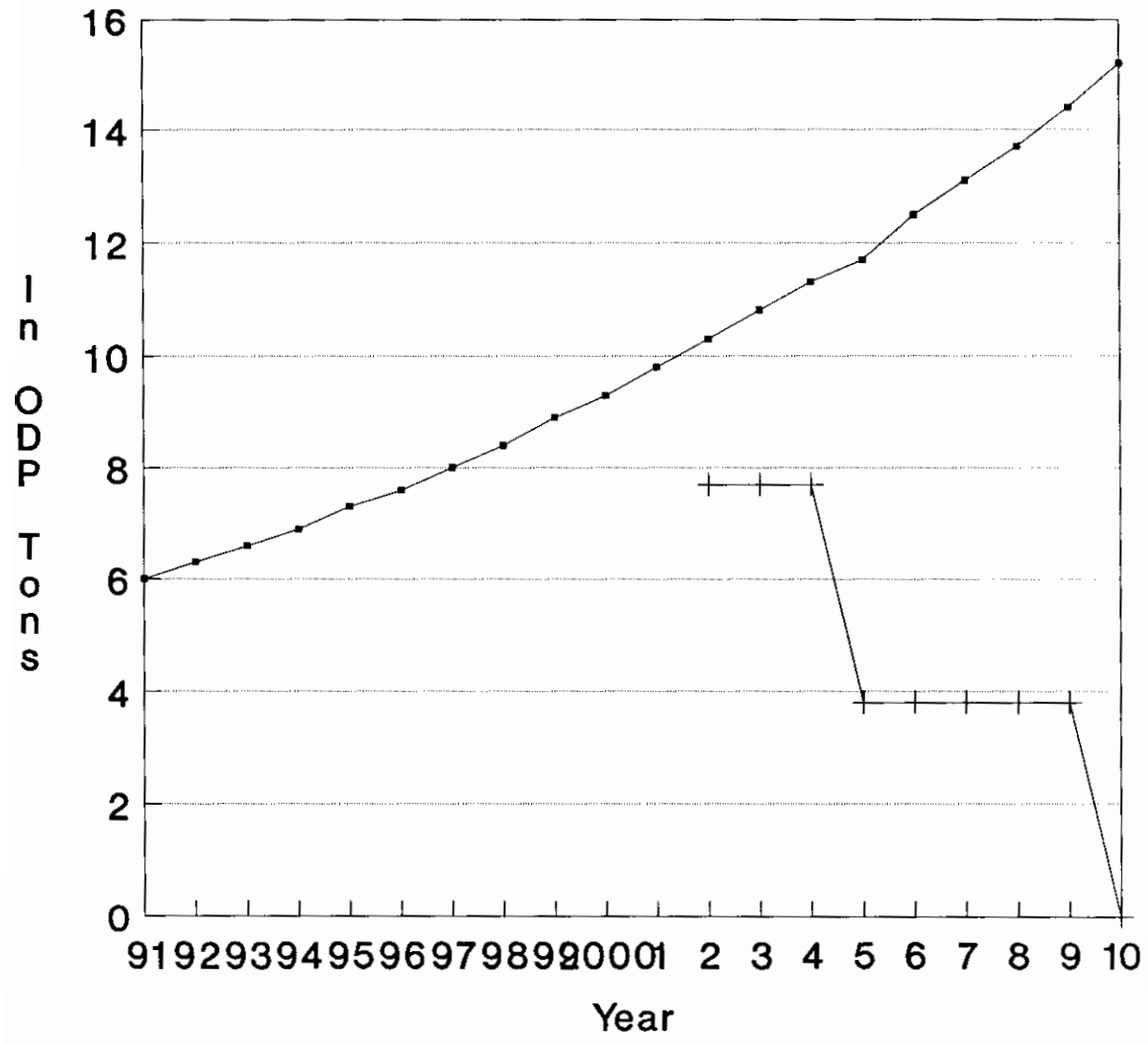


Figure 2.2

Unconstrained Demand — Protocol Limits

Table 2.7

Imposters of ODS as Chemicals

	Importer	Substance Imported	Qty. (Tonnes)	Source of Supply	Usage
1.	AEL-DDS	CFC-11	8.9	ICI	Captive Users for servicing chillers/ supply to users of cleaning agents
		CFC-12	32.8	ICI Filler/ Service Agencies	Aerosol
		R-502	6.5	ICI	Ref. & A/C
		Halon-1211	1.0		Recharging
2.	Barbes Pougnet	CFC-12	2.7	DuPont Agencies	Service
		R-502	1.08	DuPont	Ref. & A/C
3.	T. Pillay	CFC-12	2.2	ICI/ DuPont	Local Sales + Shipping Vessels
		R-502	14.8	GALCO	"
4.	Blyfridge	CFC-11	3.50	Hoechst (PUF Ins)	Captive
5.	Bahemia	CFC-11	3.0	- (PUF Ins)	Captive
6.	Chemco	CFC-12	-	SICNG Greece	Ref.& A/C service
7.	Ducray Lenoir	CTC/TCE	0.10		Cleaning Agent
8.	Cernol Chemicals	CTC/TCE	2.00	FISONS	Supply to Dry Cleaner
9.	Nundanee Trading	Halon 1211	1.2	South Africa	Recharging Fire Extin-guishers
10.	Stettler Mauritius	CFC-113	1.2	SICNG	Polishing of Glass (Captive)

The main supplier of ODS in Mauritius is AEL-DDS which ac counts for amount 66% of the total imports. Besides these there are two other large importers namely Barbes Pougnet and T. Pillay. In fact in the last two years T. Pillay has been a major importer though his imports are for supplying to ships. Chemco is a more recent importer. CTC is being imported by Cernol Chemicals.Apart importers some of the big consumers import their requirements of ODS directly as shown above.

2.2.2 Users of ODSs

The **Table 2.8** alongside gives the structure of the users of ODSs by substance and application.

Table 2.8

The table below gives the structure of the users of ODSs by substance and application

SUBSTANCE	NATURE OF USE	NAME OF COMPANY	OWNERSHIP	CURRENT (1991) ANNUAL USE TONNES	MANUFACTURING/ SERVICE FACILITIES SET-UP
CFC-11	Refrigerator Foam Blowing	Blyfridge Industries	Private (Part of large group)	3.5	Factory for assembling about 5000 refrigerators with a foam blowing station
		A.H. Bahemia & Co	Private	3.0	Reported to be similar
	Recharging centrifugal chillers	Ministry of Energy Other large buil-installations AEL-DDS Harel Mallac	Government Private Private Private	1.7	Ministry of Energy services major Government installations. Others are services by own engineers or by suppliers of equipment.
	Cleaning of PCB's	Hanna Instruments (Part of multinational)	Private	3.5	Manufacture of sophisticated ph meters. Have a recirculating vapour degreasing system using CFC-11.
CFC-12	Propellant for Aerosols	Comanu Ltd	Private (Licence of Unilever)	20.0	Semi automatic hand filling line capacity approx. 1.2 m cans/ annum
		Grays Ltd	Private	2.3	Manual filling machine.
		Mauritius Cosmetics	Private (Licence of P & G)	0.1	Semi automatic hand filling line

BSTANCE	NATURE OF USE	NAME OF COMPANY	OWNERSHIP	CURRENT (1991) ANNUAL USE TONNES	MANUFACTURING/ SERVICE FACILITIES SET-UP
		Prince Industries	Private	3.1	Semi automatic hand filling line.
	Initial charge for Refrigerators	Blyfridge Industries	Covered above	0.7	covered above
		A.H. Bahemia & Co		0.6	
	Servicing (re-charge) of Domestic refrigerators, charging and servicing of bottle coolers and display cabinets.	Many service agencies, few in the organised and many in the unorganised sector.	Private	5.8	In general with minimal facilities for charge measurement, leak detection etc. No recovery and recycling facilities.
FC-12	Recharge of Mobile a/cs	(i) Iframac Ltd	Private	2.89	(i) Importer of Mercedes, Peugeot and Mitsubishi. Has recovery recycling equipment for HFC 134-a.
		(ii) ABC Motors			(ii) Importer of Nissan with good service facilities
		(iii) Leal & Co			(iii) Importer of BMW, Fiat with good service facilities.

BSTANCE	NATURE OF USE	NAME OF COMPANY	OWNERSHIP	CURRENT (1991) ANNUAL USE TONNES	MANUFACTURING/ SERVICE FACILITIES SET-UP
		(iv) Beechand & Co (v) and six others			(iv) Importer of Toyota with good service facilities. (v) Large service agencies with good facilities.
	Servicing and recharge of Cold Rooms, central A/Cs	Many agencies	Government and Private	1.03	Most installations are serviced by own service personnel. In general not formally trained, but most practice pumping CFC-12 into receiver tank before servicing.
	Recharge of Cold rooms on ships	Many shipping companies	Private/ Foreign	3.5	No specific data available.
-502	Servicing of cold rooms	Many agencies	Private	0.35	Installations serviced by own personnel
-502	Recharge of Cold rooms on ships	Many shipping companies	Private/ foreign	21.83	No data available
FC-113	Solvent for cleaning and polishing glass	Stettler Mauritius Ltd	Private	1.2	Data on facilities not available.
TC	Solvent in Textile Processing	Two or more Companies	Private	1.73	Data on facilities not available.

BSTANCE	NATURE OF USE	NAME OF COMPANY	OWNERSHIP	CURRENT (1991) ANNUAL USE TONNES	MANUFACTURING/ FACILITIES	SERVICE SET-UP
lon 11	Recharge of Fire Extinguishers	Two companies	Private	2.2	Data on facilities not available	

2.3 Institutional Framework

This section describes the institutional framework existing in the country in terms of the government departments and agencies, non-governmental organizations, and other associations/groups in industry and the consumer sector which are likely to have a role in the program to reduce the consumption and eventually phase out ODSs.

2.3.1 Government Agencies - Historical Evolution

Environment became an issue at the Government level in the early seventies. At that time environmental protection was the responsibility of the Ministry of Agriculture and Natural resources.

In 1983, responsibility for environmental protection was transferred to a new Ministry of Housing, Lands and Environment with 2 officers earmarked for this area.

In late 1990, the Ministry of Housing, lands and Environment was split into two separate ministries; Ministry of Environment and Land Use and the Ministry of Housing each headed by a Minister.

In September 1991 the former ministry became the Ministry of the Environment & Quality of Life.

The principal institutional arrangements for environmental protection is as provided for under the Environment Protection Act (1991).

2.3.2 Environment Protection Act & Institutional Framework

The Act provides for the establishment of various bodies engaged in the management and protection of the environment. These are:-

- The National Environment Commission
- The Department of Environment
- Environmental Advisory Council
- Enforcing Agencies.
- Environment Coordination Committee.

The structure, roles and responsibilities of each of these is set out below.

i) **National Environment Commission**

The Nati The National Environment Commission is composed and Chaired by the Prime Minister. Its role is to approve policies, provide coordination through the Minister of the Environment, set goals and objectives for environmental protection and natural resource management, approving standards, criteria, laws and regulations.

It functions as the apex body to oversee the implementation of policies not only by the Ministry and Department of Environment but by other ministries and para-statal organizations.

ii) **The Department of Environment**

The Department of Environment was established by the Government of Mauritius in 1989.

The Department is responsible for the following:-

- Administration of Environmental Legislation.
- Design and development of standards, codes of practice and environmental guidelines.
- Review of EIA's submitted by undertakings for obtaining an EIA license.
- Assisting other ministries and agencies of the Government with the task of incorporating environmental considerations and sustainable development criteria into their policies and plans of action.
- Provide training and disseminate information on environmental issues.

The Department of Environment is headed by a Director. He is supported by a Deputy Director and other technical staff, who are attached to different wings within the Department. The Department's organization is depicted in the **Annexure 2.2.**

Under the Environment Protection Act, the Director and officers of the Department of Environment have considerable powers to serve notices on undertakings for enforcement and prohibition, effect entry and carry out arrests, etc. Most of these powers are not called to use in actual practice.

Nevertheless it seeks to emphasize the importance which the Government has placed on arming the Ministry with adequate powers for implementing environmental policies and regulations.

iii) **Environmental Advisory Council**

The Environmental Advisory council is also a body that has been established under the provisions of the Environment Protection Act.

The council consists of one representative from each of the organization listed in the 3rd schedule to the act. These include representatives from the Ministries of Environment, Water Resources, Health, Agriculture, Local Government, Labour & Industrial Relations, Rodrigues Island as also from the Medical Council, Chamber of Commerce and Industry, University, Institution of Engineers, Trade unions, NGO's, and other bodies.

The Council's duties are to consider any matter affecting the quality of the environment and measures for the improvement of the quality of the environment.

iv) **Enforcing Agencies**

The Department of Environment has been mentioned as being an enforcement agency under the Environment Protection Act.

There are presently other enforcing agencies which have been designated with sphere of responsibility covering specific medium, pollutants and zones.

These are:-

a) In relation to air, noise, quality control of water, and odour - the Permanent Secretary to the Ministry of Health.

b) In relation to inland waters and effluents - the Permanent Secretary to the Ministry responsible for the subject of water resources.

c) In relation to solid wastes - the Permanent Secretary to the Ministry of Local Government.

d) In relation to pesticide residue and to waters in the coastal and maritime zone - the Permanent Secretary to the Ministry of Agriculture, Fisheries and Natural Resources.

e) In relation to national environmental standards affecting the island of Rodrigues - the Island Secretary for Rodrigues.

For any medium or pollutant not covered by the above the Department of Environment will be the deemed enforcing agency.

Given the multiplicity of enforcing agencies the Environment Protection Act has provided for an Environment Coordination Committee.

V) **The Environment Coordination Committee**

The Environment Coordination Committee consists of the Permanent Secretary of the Ministry of Environment, the enforcing agencies or their representatives, the environment liaison officers, the Director and the Deputy Director of the Department of the Environment and any other public officers designated by the Committe.

The role of the committee is:

a) To develop policies and administrative measures necessary to ensure prompt and effective consultation on matters relating to environment protection and management;

b) To ensure that information is shared among the enforcing agencies, the Department of Environment and other public departments, so as to develop a better understanding of environmental issues and of problems relating to enforcement of environmental laws;

c) Advise the minister and where requested the Commission, on matters relating to environmental standards, guidelines, codes of practice and other control measures for the purpose of avoiding duplication of functions among public department and of ensuring proper enforcement of environmental laws; and,

d) Generally to ensure the maximum cooperation and coordination among enforcing agencies and other public departments dealing with environment protection.

The above paragraphs have described the institutional framework within the Government for dealing with environmental issues.

2.3.3 **Other Government/Non Government Agencies**

Among other agencies the Mauritius Chamber of Commerce and Industry is perhaps one organized body, which has as its members key players in Industry and Trade, which can currently be seen to also have a role in implementing the phase out of consumption of ODSs.

This is by virtue of the fact that apart from its wide membership, the Chamber is represented in the Environment Advisory Council and also has a representative in the Country Team setup as part of the exercise to formulate a Country Programme.

There is also a Mauritius Consumers Association which has also shown interest in the matter of import and use of products containing ODSs.

In terms of other Government Departments and Ministries two which are seen to have an immediate and relevant role in relation to ODS-phase-out are the Ministry of Trade and Shipping and the Department of Customs which is under the Ministry of Finance.

The Ministry of Trade & Shipping issues regulations in relation to goods that may be imported into Mauritius. Specifically the powers of the Ministry allow it to ban import of goods which are classified as prohibited and to control import of 'controlled goods' which can be imported only under an import permit. The import permit is a prerequisite for a bank to open a letter of credit or to release foreign exchange for payment for imports of a controlled good. The Ministry has, vide Government notice No. 106 of 1991 issued a set of regulations which list the set of 'controlled goods' and 'prohibited goods'. In addition the regulations specify the conditions under which certain controlled goods may be imported. For instance while aerosol insecticides may be imported, they should not contain CFC's as a propellant.

The Customs Department is the agency that facilitates smooth clearance of goods coming into the country. The Department has a role in term of adopting procedures and systems to identify and monitor importation of goods.

Mauritius is the first country in the Indian Ocean and first member of PTA to have adopted ASYCUDA a computerized system supported by UNCTAD.

The Customs Department has also adopted the Brussel's Harmonized system of classification .

2.4 Policy Framework

The Section discusses some of the important policy measures earlier undertaken by the Government of Mauritius to stabilize its economy which can give an indication to the policy framework available for implementation of a Country programme for phase out of ODSs.

As discussed earlier Mauritian Economy suffered a severe setback in late seventies. In 1979 the Government embarked on a stabilization and structural adjustment programme. The programme initially focussed on demand management and incorporated the following policies:

a) Reduction in credit and money supply

b) Liberalization of Trade including lowering of tariff and more flexible exchange controls.

c) Reduction in consumer subsidies.

d) Wage restraints

These were followed up a few years later with moves that laid greater emphasis on supply side particularly with a view to improve the performance of the manufacturing sector. The policy measures were geared to an export led growth strategy which recognised that there was a limit to growth in the sugar sector and there was a need for investment in the manufacturing that could use the large labour force and produce goods for markets where the country had access at a competitive advantage. The policy measures included,

a) incentive for export promotion/import substitution,

b) eliminating quantitative restriction on import,

c) initiating tariff reforms,

d) measures to attract foreign investment and technology,

e) adoption of a flexible exchange rate and,

f) rationalization of wage policy.

A number of schemes were legislated mainly with a focus to boost export.

a) **Import substitution scheme**

Involving award of a Development Certificate (DC) to certain industries of strategic importance which entitled them to concessions in import duties of machinery and inputs, free repatriation of capital and dividends, tax holiday on profits and dividends pay out.

b) **Export Processing Zone(EPZ) Scheme.**

Under the EPZ Act the enterprises are provided duty free imports of machine and other material inputs. The enterprises are charged at a flat rate of tax of 15% through out the life span as against a normal rate of 35%. Besides they are given several other preferences and assistance in relation to provision of infrastructure.

c) **Export Service Zone Scheme**

Similar to (b) above for export and re-export of goods and services including other schemes applicable to Hotels, Industries, building construction, etc.

Thus it can be observed that at least for the past decade, after the economic restructuring programme was launched, the economic policies have been oriented towards encouraging private enterprise both in manufacturing and service sector. The Government has applied minimum controls on the economy and industrial sector.

There are, however, laws and regulations available within the framework of industrial administration which may be relevant in managing a ODSs phase out strategy.

These pertain to setting up and operating industrial enterprises which entails obtaining permits from:-

a) Department of Fire Safety with respect to Fire safety Provisions

b) Ministry of Health with respect to Environment

c) Factory Inspectorate of Ministry of Labour with respect to issues like safety, ventillation, fire hazards for the workers.

In addition Ministry of Trade and Shipping is empowered to issue regulations under the Supplies Control Act for restricting the import of goods into Mauritius. At present items under regulation fall into two categories

a) Controlled goods - which fall under Schedule I and require an import permit.

b) Prohibited goods - which cannot be imported under any circumstances.

In fact, the list of items mentions Aerosol Insecticides as a "controlled good" which can be imported only on a condition that it should not contain CFC as a propellant.

It can thus be concluded that while a legislative framework exists which can be used to initiate policies for ODSs phase-out, there have as yet been no significant initiatives taken in terms of addressing the Protocol. At the same time the existing framework does not provide for legislations/codes of practice or standards in respect of the following:

- Restrictions on use of specific substances in manufacture.
- Standards/Codes of practice in manufacture.
- Identification of ingredients in packed commodities.
- Accredition of service personnel.
- Basis for imposing quantitative restrictions on imports.

There are issues which are addressed in developing a policy framework for managing ODS phase-out.

2.5 Government and Industry response to Montreal Protocol

2.5.1 Government Response

With the growing concern for environmental protection the Government of Mauritius signed the Montreal Protocol in August 1992 and ratified the same in November 1992. Mauritius is a developing country as per the definition of the Protocol.

The Government has recognised that compliance with the Protocol would imply shifts in consumption patterns, changes in industrial processes and in technical services. It would also require policy decisions to be enforced by appropriate legislation where necessary and an institutional framework to be set up for monitoring implementation.

Accordingly, the Government has taken a number of steps till date.

- It has set up a National Committee to start work on elaboration of a plan of action.
- The Ministry of the Environment & Quality of Life has sought the assistance of UNEP to provide a consultant to assist in formulating the present Country Programme.
- The Ministry has organised a Seminar with the participation of users of ODSs, importers, representatives of other ministries and departments and technical experts from overseas in order to evolve in a collaborative manner the elements of a policy framework and a phase out strategy to comply with the Protocol.

In addition, some Government Departments notably the Customs have already taken steps in response to the Protocol. They have completed a comprehensive codification of all the ODSs by extending the existing Brussels Harmonised System of

clarification. This will enable monitoring imports by each individual ODS.

The input from this seminar are used as a basis for arriving at implementation actions discussed further in this report

2.5.2 Industry Response

There is an awareness about the depletion of Ozone Layer caused by these ODSs amongst the major consumers of these substances with an attempt to cut down on their consumption. This is supportd by the fact that;

a) The foam sector has already switched to a substitute such as methylene chloride as blowing agent.

b) One of the manufacturers of refrigeration equipment is planning to invest in a new foaming machinery (for 50% water blowing in PUF insulation) which will lead to a 50% reduction in CFC consumption. However, these manufacturers are not in a position to switch to substitute refrigerants due to a lack of technology which is still awaited from their overseas partners.

c) The total consumption of ODSs in the Aerosol segment has decreased considerably in the past few years. Some of the fillers have been compelled to discontinue use of CFCs because of the directives of their multinational licencors. The major fillers are well aware of the substitute such as propane butane mixture which is being used by aerosol fillers overseas. However, there is some hesitation to adopt the substitute due to its flammable properties which require special precautions while filling as also the cost.

The importers of Refrigeration and Air-Conditioning equipment and the Fire fighting equipment are totally dependent on the international developments and their collaborators for supply of equipment based on the substitutes. Moreover, even though the manufacturers of refrigeration equipment may switch to substitutes there is the issue of continued supply of CFC based refrigeration equipment by certain developed countries through importers which could pose a problem in terms of recharge demand for CFC's in future.

On the other hand the small players like service agencies are not so aware of the Protocol. The demand of ODSs by this sector is dependent on the recharging demand of the present equipment in the country which will be difficult to cut down immediately. Except a few service agencies in the organised sector, none of these agencies have proper equipment with them and they are all following manual procedures for servicing the

equipment. The consumption of CFC's by this segment can perhaps be cut down significantly by cutting down on the use of CFC's in flushing and leak detection, recycling etc.

There is a lack of awarenss about ODSs amongst the Dry Cleaners and the other users of ODS as cleaning agents. Most of them initially reported that they were not using any ODS. However, importers contacted have subsequently reported that they are supplying CTC and CFC-11 to the industry. One company was not aware that Forane 113 being used by it is only the brand name for CFC-113.

These are some of the issues which would be addressed in subsequent sections of the Country Programme.

Annexure 2.1

Sectorwise Unconstrained Future consumption of ODSs (in MT)

		1991	93	94	95	97	2000	05	07	2010
Aerosols										
CFC-12 Consumption		25.5	27.1	27.9	28.7	30.5	33.3	38.6	40.9	44.7
mobile Air Conditioners										
Total CFC-12 requirement (in Kgs)		2.9	3.6	3.9	4.0	4.1	3.9	2.2	1.3	0.3
Refrigerators & Deep Freezers										
Total CFC-11 requirement	6.4	5.6	5.7	5.8	6.0	6.4	4.3	4.3	4.3	
Total CFC-12 Requirement		7.0	7.1	7.0	7.0	6.9	6.9	6.1	5.9	5.5
Commercial Refrigeration										
Demand for CFC-12	4.5	4.9	5.1	5.3	5.8	6.5	8.1	8.8	10.1	
for Cold Storages		1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1
for Ships	3.5	3.9	4.1	4.3	4.7	5.4	6.9	7.6	8.8	
Bottle coolers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
Display Cabinets		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Demand for R-502	22.4	24.6	25.9	27.1	29.9	34.6	44.0	48.5	56.1	
for Cold Storages		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
for Ships	22.0	24.3	25.5	26.8	29.5	34.2	43.6	48.1	55.7	
Commercial Airconditioning										
Demand for CFC-11	1.7	1.9	2.0	2.1	2.3	2.6	3.1	3.3	3.6	
Demand for CFC-12		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Solvents										
Consumption of CTC		1.7	1.8	1.8	1.8	1.8	1.9	1.9	2.0	2.0
Consumption of MFC										
Consumption of CFC-11		3.5	1.9	1.9	1.9	2.1	2.3	2.6	2.8	3.1
Consumption of CFC-113		1.2	1.2	1.3	1.3	1.5	1.6	1.8	2.0	2.2
HALONS										
Consumption of Halon 1211	2.0	2.2	2.3	2.4	2.7	3.1	4.0	4.4	5.1	
Consumption of Halon 1301										

Sectorwise Unconstrained Future consumption of ODSs (in MT)

	1991	93	94	95	97	2000	05	07	2010
TOTAL ODS CONSUMPTION (in MT)									
CFC-11	11.6	9.3	9.6	9.8	10.4	11.4	10.0	10.4	11.0
CFC-12	40.0	42.7	43.9	45.1	47.4	50.7	55.1	57.0	60.6
R-502 22.4	24.6	25.9	27.1	29.9	34.6	44.0	48.5	56.1	
CTC	1.7	1.8	1.8	1.8	1.8	1.9	1.9	2.0	2.0
HCF									
CFC-113	1.2	1.2	1.3	1.3	1.5	1.6	1.8	2.0	2.2
Halon 1211 2.0	2.2	2.3	2.4	2.7	3.1	4.0	4.4	5.1	
Halon 1301									
TOTAL ODP (in ODP Tonnes)									
CFC-11 1	11.6	9.3	9.6	9.8	10.4	11.4	10.0	10.4	11.0
CFC-12 1	40.0	42.7	43.9	45.1	47.4	50.7	55.1	57.0	60.6
CFC-113 0.8	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.7
R-502 0.34 7.6	8.4	8.8	9.2	10.2	11.8	15.0	16.5	19.1	
Total for Annex A									
Group I	60.2	61.3	63.4	65.2	69.2	75.1	81.4	85.5	92.5
Halon 1211 3 6.0	6.6	6.9	7.3	8.0	9.3	11.9	13.1	15.2	
Halon 1301 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total for Annex A									
Group II	6.0	6.6	6.9	7.3	8.0	9.3	11.9	13.1	15.2
CTC 1.1	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.2	2.2
MCF o.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Montreal Protocol Limits									
Annex A GroupI 60.2	61.3	63.4	65.2	69.2	67.2	33.6	10.1	0.0	
Annex A GroupII 6.0	6.6	6.9	7.3	8.0	7.7	3.8	3.8	0.0	
CTC	1.9	1.9	2.0	2.0	2.0	2.0	0.3	0.3	0.0
MCF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNEXURE 1

LIST OF RESPONDENTS

Sector		Name of Company	if Contacted
A. Ref. & Deepfreezer			
i)	Manufacturers	Blyfridge Ltd.	Yes
		Bahemia & Co.	Yes
ii)	Importers	Happy World	Yes
		J. Kalachand & Co.	Yes
		Li Sung Sang	-
		Ireland Blythe	Yes
		J.M.Goupille & Co.	Yes
		King Brothers	-
		Currimjee Jeewanjee	-
		Harel mallac	Yes
		Coca Cola	Yes
		Phoenix Camp Minerals	-
		Pepsi Cola	-
B. Commercial Refrigeration (Cold Storages)			
i)	Importers	Harel Mallac	Yes
		AEL-DDS	Yes
		Charlmar	Yes
		IBL	-
		Happy World	Yes
		New Maurifoods Ltd.	Yes
		Agricultural Marketing Board	Yes
C.	Car Air-Conditioners	ABC Motors	Yes
		Beechand & Co.	-
		Man-Him	-
		Iframac	Yes
		Leal & Co.	Yes
		Agritch	-
		Ford	-
		Asas	-
		Peermamode	Yes
		Raouf Dushmohammed & Co.	Yes

D.	Central Chillers	Ministry of Energy	Yes
		AEL	Yes
E.	Foam Manufacturers	Multifoam	Yes
		Dromun	-
		Bata	-
		Mattress Manufacturers	-
		Resiglas	Yes
		Plyfoam	Yes
F.	Aerosol Fillers	Comanu	Yes
		Grays	Yes
		Mauritius Cosmetics	Yes
		Medipharm	-
		Terry Stores	-
G.	Importers of Aerosols	Hotel Amenities	-
		Medipharm	Yes
		IBC	-
		Terry Stores	-
		ABC	-
		Lim How	-
		Lai Tong	Yes
		Grays	-
H.	Users of Cleaning Agents	Compo Centre	-
		Photocells Ltd	Yes
		Dragon Electronics	Yes
		Venus Electronics	Yes
		Richter Watches	-
		Best Electronics	-
		Isry	-
		Stettler (Mtius) Ltd	Yes
		Hy-Q	Yes
		Cernol Chemicals	Yes
		Sofab Ltd	Yes
		Mauvillac Paints	-
		Autolac	-
		National Paints	-
		Fapeon	-
		Perfection Dry Cleaners	-
		Dry Cleaning & Steam Laundry	-
		Hanna Instruments	Yes

I.	Importers of ODS	
	AEL-DDS	Yes
	T. Pillay	Yes
	Barbes Pougnet	Yes
	Andre Services	-
	Ducray Lenoir	Yes
	Roger Fayd'herbe	Yes
	Cernol Chemicals	Yes
J.	Training Institutes	
	Industrial & Vocational Training Board	-
	Other Affiliated Institutions	-
	University of Mauritius	-

3. IMPLEMENTING PHASE OUT

3.1. Strategy statement by the Government.

The following issues have been considered by the Government in formulating a strategy for phase out of ozone-depleting substances in Mauritius:

- The present level of use of the substances in various sectors and movement of market forces.
- The options available for phase out in each area.
- The commitment of the Government and people of Mauritius to protect the environment.
- The existing policy and regulatory regime existing in respect of trade and industry.
- A preliminary review of the costs of phasing out under two scenarios, viz earliest possible and extended.

Based on the above, the following strategy has been articulated by the Government.

The Government will initiate early action, that is in advance of the time frame allowed under the Protocol, to phase out the use of ozone depleting substances in Mauritius subject to technical options being available and proven as well as economically viable.

Government will adopt a collaborative approach involving industry and trade in selecting and initiating actions for implementing the phase - out program.

A step has already been taken in this direction by holding a seminar involving the participation by Government, Industry and technical experts.

The seminar was used to arrive at, among other things, the most appropriate options and timing for phase out of ODS's in various sectors and subsectors by considering options available.

3.1.1 Options considered in each sector/ sub-sector and timing of phase out.

The following paragraphs describe, for each sector and sub-sector the technical options considered for reducing ODS consumption, by representatives of the Government, User Sector, and technical experts and the specific set of options selected and the timing agreed upon for implementing the same.

In many instances where it was recognised that technical options had yet to be proven or widely established the timing suggested is tentative and subject to the options actually being viable at the appropriate time.

AEROSOLS.

The options considered are:

(i) changing propellant to propane-butane.
(ii) Dimethyl ether and/or other HCFC blends.
(iii) Carbon dioxide.
(iv) substituting aerosols by natural sprays (pumps).

All but one of the four existing fillers have already taken steps to shift to other methods. The largest filler has started launching CO2 based products and awaiting feed back from the market on product acceptance and quality.
This filler is intending to opt for propane butane.Given the size and scale of the other fillers it is unlikely that in the immediate future they would opt for propane butane. In all likelihood they will examine new HCFC's or their blends and/or dimethylether.
The fourth filler has switched to mechanical pumps.

Timing:

All above considered it is proposed to completely eliminate CFC's in the aerosol sector by 31st December 1994.

AIRCONDITIONING AND REFRIGERATION.

Mobile Airconditioners (MAC)

The options considered to reduce CFC consumption in this sector are:-

(i) New car air-conditioners to be imported with HFC 134a based systems instead of CFC-12 based systems.
(ii) Recovery and recycling of system charge, during servicing of cars using CFC 12 as refrigerant.

Proposed Action:

(a) Since there are 10 large car service agencies in Mauritius and the total recovery of CFC-12 possible is to the tune of 1.2 tonnes, it is proposed that each service station be provided with a recovery - cum - recycling machine to be used in servicing CFC-12 based mobile a/c's.

(b) Since all the demand for cars in Mauritius is met by imports, a ban on import of cars fitted with CFC-12 based airconditioners would ensure reduction in overall recharge demand in future.

(c) Retrofit CFC 12 based cars with HFC 134a based a/c's at a later date if economic considerations justify the same.

Timing of actions

OPTIONS	**Likely date of implementation**
Recovery/Recycling of system charge	By 31st December' 94.
Ban on import of a/c cars with CFC-12 based AC systems.	From 1995.
Retrofit with HFC 134a a/c's	Examine in 1996.

Domestic Refrigerators & Deep Freezers

(a) Blowing of insulation foam.

As of now, the viable alternatives to CFC-11 as the foaming agent in the refrigerator foam are :

- 50% water blowing wherein a mixture of 50% water and 50% CFC-11 is used. The foam thus formed has 3-5% less insulation strength and as a result there is a 5% increase in energy consumption.

- Switch to HCFC 123 as a foaming agent. Since HCFC 123 is not commercially available as yet, this option cannot be exercised perhaps before 1996.

(b) **Refrigerant.**

(i) In the case of refrigerant, the only viable refrigerant in place of CFC-12 is HFC-134a and most of the international manufacturers of refrigerators are expected to switch over completely to this refrigerant during 1994-95.

(ii) There is a strong case for training of technicians involved in servicing of refrigerators in Mauritius. The average consumption of CFC-12 related to servicing of domestic refrigerators is of the order of 0.3 Kg unit as compared to an average charge of 0.14 Kg. it is estimated that increased awareness and modified servicing procedures can reduce the current consumption of CFC-12 for servicing of domestic refrigerators in Mauritius by 25%.

(iii) Retrofitting CFC 12 based refrigerators with HFC 134a based systems.

Proposed Action:
Foam blowing.

(i) Switch to 50 % water blowing in domestic manufacture.

Timing: By 31st December 1994.

(ii) Eliminate CFC's from foam entirely by switching to other substances like HCFC-123. This would be subject to the technology being available and the substance also being available in commercial quantities.

Subject to these considerations the timing proposed is by 1998.

Refrigerant.

A major consideration in this area is the remoteness of Mauritius from overseas suppliers of refrigerators and the implication for servicing equipment should there be teething troubles.
With the above, the following actions and timings have been adopted.

(i) Switch to HFC 134a in both domestic and imported fridges by 31st December' 96. This can involve capital investments in the manufacturing facilities of domestic manufacturers which would require funding from the Multilateral Fund.

(ii) Training of service technicians through a programme to be convened by the IVTB (the Industrial and Vocational Training Board) and funded by the Multilateral Fund to facilitate bringing overseas experts to be scheduled in 1994 in order to reduce consumption in recharging.

(iii) Retrofitting of CFC-12 based refrigerators with HFC-134a based systems can be considered once it is established as an accepted and viable practice.

Commercial Refrigeration and Airconditioning

This sector covers a number of sub-sectors. The options considered and the timing of proposed actions are detailed hereunder for each sub-sector.

Commercial Refrigeration.

Cold Rooms.

The cold rooms in Mauritius are based on either CFC 12 or R-502.
The options considered for R-502 based systems are:

- New systems to the based on HCFC 22.

- Retrofit existing systems to HCFC 22.
  The first option has been technically and commercially established and can be implemented immediately.

Retrofits would depend on the economic viability of the scheme, the life of equipment and so on. Subject to this it is tentatively assumed the retrofit can be undertaken in a phased manner over 3 years commencing 1996.

For CFC 12 based cold rooms the options considered are:

- New systems to be based on HFC 134a and in some cases HCFC 22.

- Retrofit existing systems with HFC 134a.

The considerations in implementing the first option particularly with regard to HFC 134a would be the same as in domestic refrigerators. The timing for this is taken to be by 1996.

In respect of HCFC 22 it was recognised that in cases where HFC 134a is also suitable, careful consideration would have to be given to this fact that HCFC 22 itself is a transitional substance and not a long term answer.

Retrofitting would be done when criteria of economies apply and after detailed evaluation of each individual case.

For the purpose of phase-out it is assumed that retrofits can be achieved in a phased manner over a three year period from 1996 to 1998 for the entire population.

Bottle Coolers and Display Cabinets.

The options considered here are the same for other CFC-12 based systems in cold rooms and the issues for implementation would be the same.

The timing assumed is also the same viz.

- New systems from 1st December 1996 to be based on HFC 134a.

- existing systems to be retrofitted over three years commencing in 1996.

Ships

The demand in this sector is for the maintenance of cold rooms in the ships anchoring at Mauritius port. The consumption in this sector can be reduced by imposing a ban on supply of CFCs to the sector.

It is proposed to make this ban effective 1st January 1997.

Commercial Air-conditioning

(i) CFC-11 Based Centrifugal Chillers

The options considered are:

- New installations to be based on HCFC 22 where technically feasible.

- Retrofit.

Selected large CFC-11 Chillers can be retrofitted to use HCFC 123. HCFC 123 is not a drop-in substitute and requires substantial technical evaluation prior to any change. HCFC 123's aggressiveness as a solvent makes it necessary to change seals and elastomer components to more resistant materials. HCFC 123 retrofit is not possible for hermetic designs. Since HCFC- 123 may not be commercially available to developing countries at reasonable prices before 1995-96, this option cannot be exercised immediately.

Proposed Action
Procure new chillers either based on HCFC 22 or those which are compatible with HCFC-123 . Retrofit the ones that can be retrofitted.

Timing considered for the above actions.

Meet new demand by HCFC-123 based chillers	-	1998
Retrofit chillers which are compatible to HCFC-123	-	50% of 1997 population in 1998
	-	100% of 1998 population in 1999

(ii) CFC-12 Based Central Air-conditioning systems
There are only a couple of Central A/C systems based on CFC 12 in Mauritius.

It is assumed that like other countries, new installation of reciprocating type central air-conditioning systems in

Mauritius would be HCFC-22 based. As a result, there would be only recharge demand of CFC-12 in this sector. The consumption can be reduced by modifying the existing CFC-12 systems which in any case are very few, to operate on HFC-134a. The same would be taken up by 2000.

For the sector of Commercial Refrigeration and Airconditioning as a whole, a major need that can be addressed in improving practices is maintenance and use of CFCs.

This is borne out by the fact that for cold rooms and central a/c installations the recharge requirements are currently as high as 20% of initial charge for each unit.

With appropriate training and servicing procedures this can be reduced by 90%. The training can be coordinated by the IVTB with funding from the Multilateral Fund to bring in overseas expertise in this area.

Another proposal that has been identified for further examination is to set up an infrastructure, again with funding from the Multilateral Fund, to collect all refrigerant from used and decommissioned or condemned equipment to prevent venting to the atmosphere.

SOLVENTS

A number of substitute techniques are available to replace ODS in this sector. These include:

- Aqueous & semiaqueous cleaning systems
- Substitute cleaning agents like trichloroethylene (TCE) and perchloroethylene (PCE) which are not ODSs.

The applicability of all these options depend upon the exact product & process requirements of the industry they are used in.

Proposed Action

Since the electronics and precision metal parts industry in Mauritius is very limited with very small scales of operation it is proposed that CFC-113 and CFC-11 which are used by electronics & instrumentation manufacturers be replaced by TCE, and Carbon Tetrachloride (CTC) which is primarily used in the textile processing industry be replaced by PCE.

These actions are intended to be completed by 31st December 1994.

HALONS

The magnitude of consumption of and nature of use of this substance makes it imperative that a survey be undertaken first of all to identify 'essential uses' which will enable an assessment of the genuine requirement and facilitate identification of non-essential uses and unwanted emissions. The survey could be completed soon after country programme approval.

Thereafter a ban could be imposed on import of Halons for non-essential uses.

The ban would come into effect from 1st January 1995.

Another action that has been identified for further investigation is the assessment of feasibility of setting up an infrastructure to recover Halons from non essential and idle stock to serve as a bank for meeting essential uses in future. This project could be carried out based on the survey results above and put up to the Multilateral Fund for assistance.

Planned phase-out
Figures 3.1, 3.2 and 3.3 give the consolidated phase-out profiles for each group of substances in relation to the protocol limits on the basis of the options indicated above. The table below gives the consumption of ODSs in different groups based on the above actions till phase-out.

Group	1991	1992	1993	1994	1995	1996	1997	1998	1999
Annex A Group I	60.2	61.2	61.3	15.1	12.0	10.3	9.5	5.6	5.3
Annex A Group II	6.0	6.3	6.6	6.9	Nil	Nil	Nil	Nil	Nil
Annex B Group II	1.9	1.9	1.9	2.0	Nil	Nil	Nil	Nil	Nil

Group	2000	2001	2001	2003	2004	2005	2006	2007	2008	2009
Annex A Gr.I	5.0	4.6	4.1	3.1	3.2	2.6	2.1	1.6	1.1	1.2

PLANNED PHASE OUT SCHEDULE
ANNEX A GROUP I SUBSTANCES

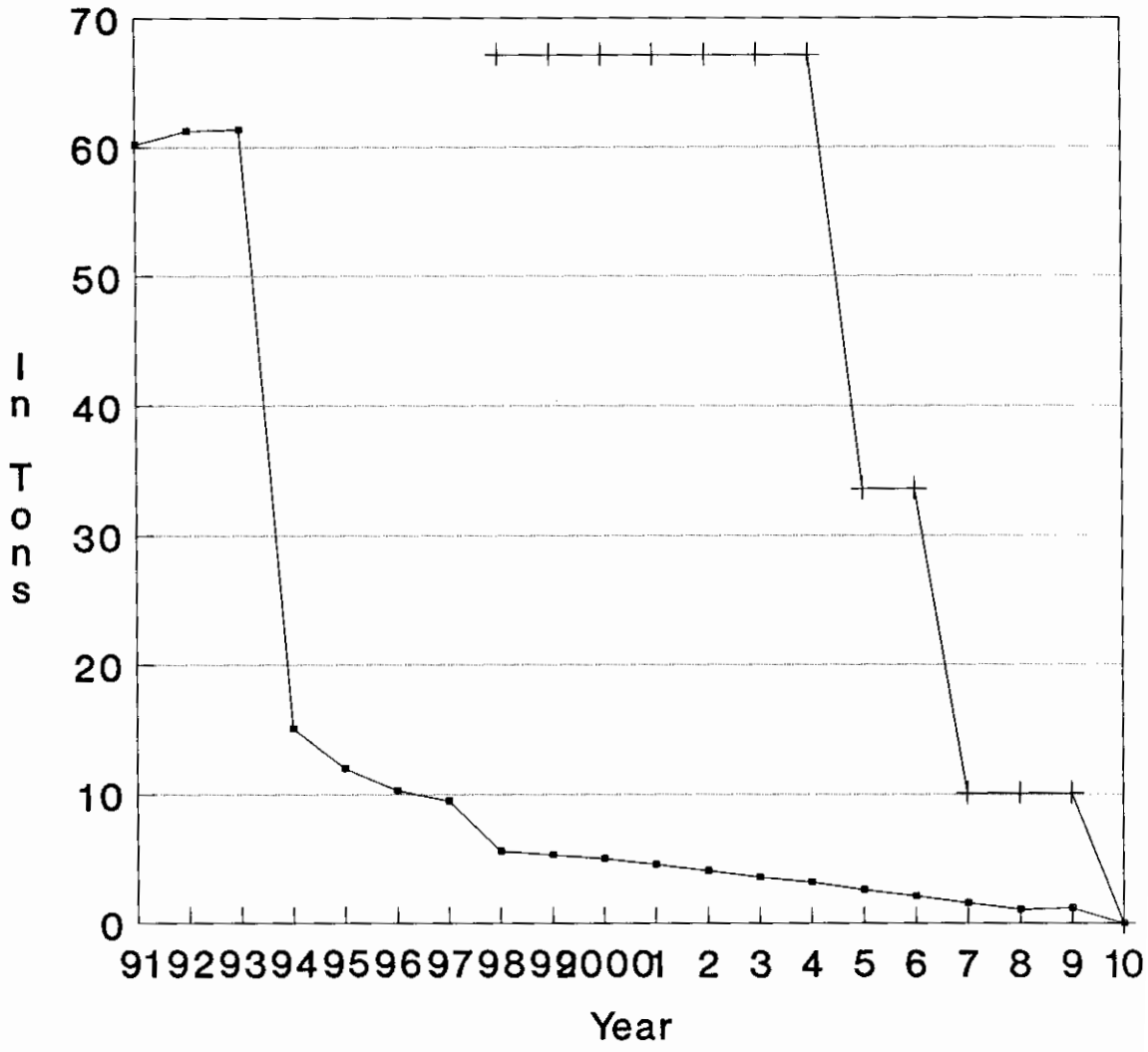


Figure 3.1

Planned Consumption — Protocol Limits

PLANNED PHASE OUT SCHEDULE
ANNEX A GROUP II SUBSTANCES

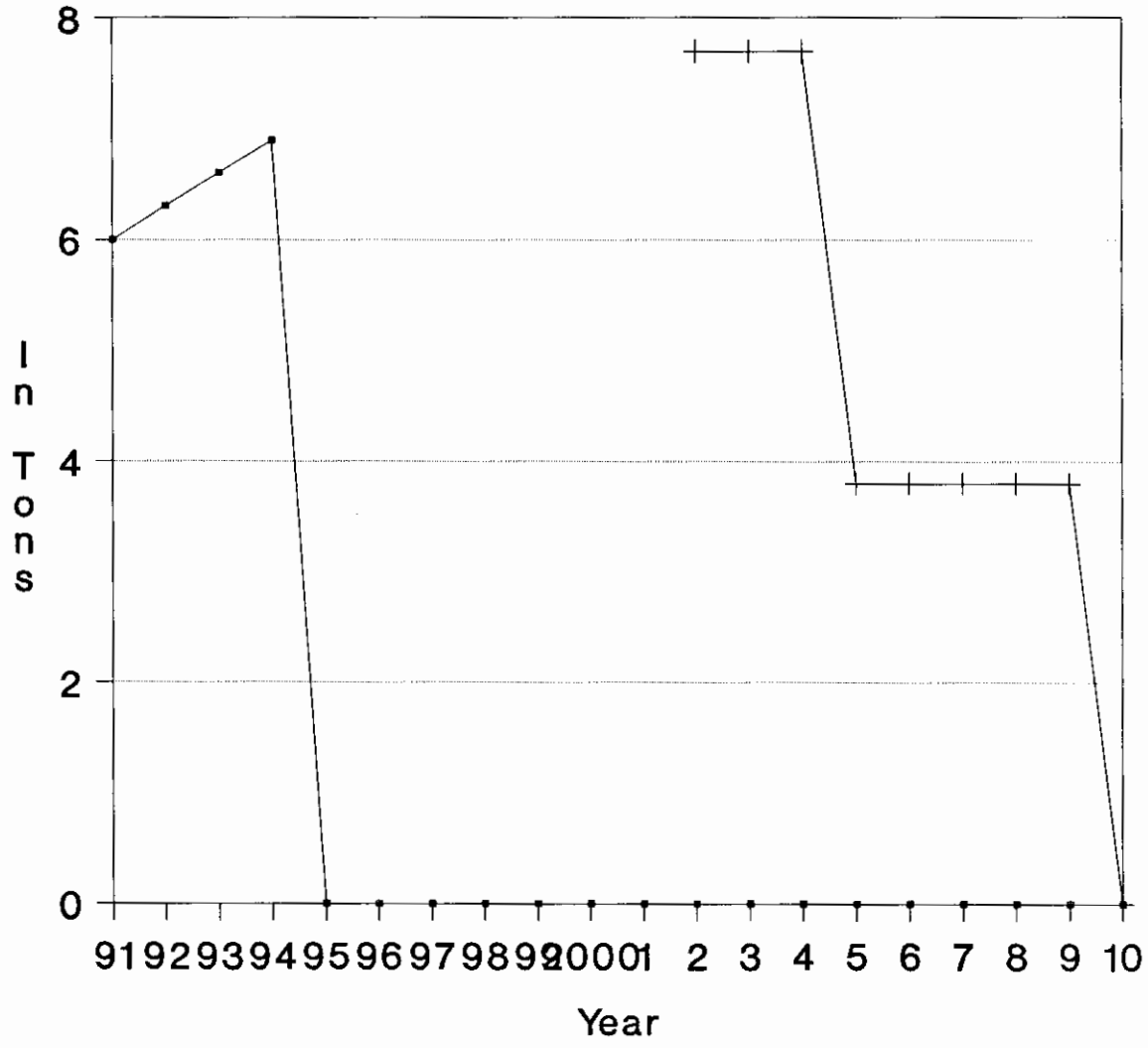


Figure 3.2

PLANNED PHASE OUT SCHEDULE
ANNEX B GROUP II SUBSTANCES

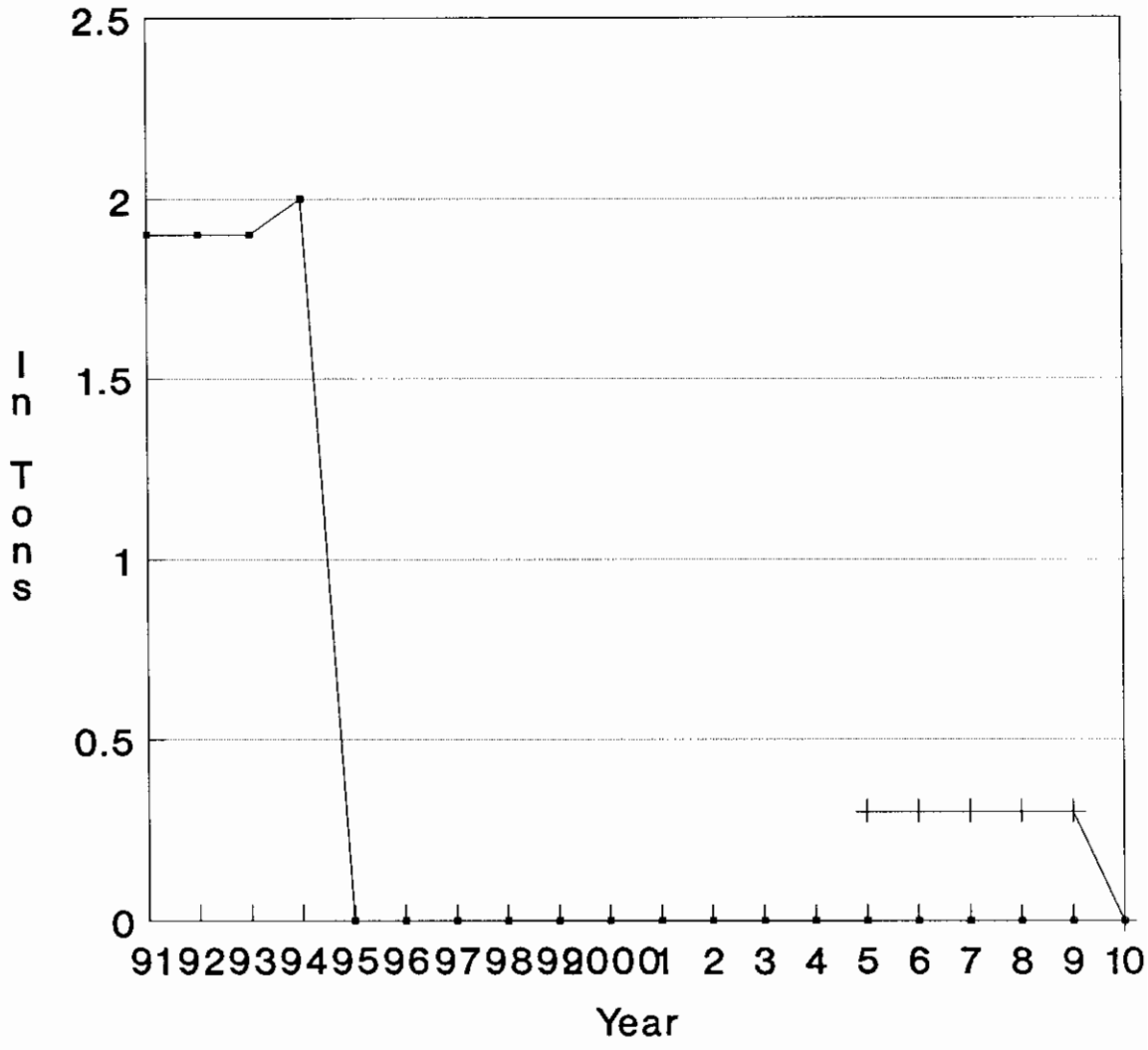


Figure 3.3

3.2 Action Plan.

3.2.1 Government Actions.

To implement the options proposed to be adopted in the various sub- sectors above for phasing out the use of ozone-depleting substances, the following actions are being contemplated by the Government.
The actions cover a range of measures including market measures, regulatory and administrative measures as well as institutional strengthening.

Market Measures
The market measures contemplated are:

Possible imposition of higher tariffs on imports of ODSs and on goods containing ODSs.

Possible reduction in tariffs on substitutes of ODSs and equipment based on alternative technologies once these are established and are freely available.

Regulatory measures

These include:
Control on imports of ODSs and commodities containing ODSs as also imposition of bans in future in some sectors.

Other control measures aimed at better monitoring of ODS use such as:

- mandatory identification (labelling) of products and equipment using ODS.
- mandatory registration by industries, traders using ODS directly or in equipment.
- Obligation to report on annual consumption of ODS.

Measures aimed at conservation of ODSs such as:-

- making it obligatory for servicing agencies of mobile air conditioners to install recovery equipment;and,
- having a system of certification of servicing technicians and firms.

Measures for Institutional Strengtheneing

The activities connected with implementation of the Montreal Protocol consequent to the country ratifying the same are being currently looked after by the Ministry of the Environment and Quality of Life.

With the articulation of a country strategy as reflected in the country program it is proposed to set up a small

secretariat within the Ministry to coordinate on a dedicated basis all activities in terms of:

(i) Project feasibility assessment and documentation and coordinating implementation

(ii) Coordination with other Ministries, departments and the private sector;

(iii) Creating public awareness

(iv) Coordination with the funding agency identified for disbursing funds received from the Multilateral Fund. While the resource persons for this activity would be drawn from the existing staff in the Ministry the costs of setting an infrastructure would require funding from the Multilateral Fund. A proposal in respect of the same is annexed to this report.

Legislative measures.

The Government will be relying on the existing legislative framework which is comprehensive enough to allow for the above measures through minor amendments.

For instance,the labelling of goods can be dealt with by a modification to the existing Fair Trading Act.

In cases where laws do not exist presently, the Government will consider promulgation of new laws.However, it is believed that given the consensus approach contemplated this may not be necessary.

The table below summarises various action by the Government contemplated for different sectors and sub-sectors.

Table 3.1

Sector	Measures	Timing
Programme Implementation	Set up a Steering Committee to monitor the Country Programme implementation.	Withapproval of Country Programme
	Create a secretariat within the Ministry of the Environment to coordinate all the activities detailed out in the Country Program.	-do-
Aerosols	Submit project proposal to Multilateral Fund for a project to change from CFC to Propane - Butane.	Proposal enclosed
	Ban on import of aerosols with CFCs (except pharmaceutical) with effect from 1.1.95.	By 31.12.94
	Take measures to ensure labelling of products.	By 30.06.94
Refrigeration & Airconditioning	Forward proposals for projects in the manufacture of refrigerators :	
	-using alternatives for foam blowing	31.12.93
	-using alternative refrigerant.	30.6.94
	Discourage and eventually ban import equipment based on CFC 12.	Start 1995
	Provide incentives for import of equipment based on subsitutes.	Start 1995
	Set up a system for licensing of firms engaged in servicing equipment.	31.03.94
	Forward proposals for Training of service technicians through a National Program to be funded by the Multilateral Fund.	30.09.93
	Examine the feasibility of setting up infrastructure with funding from Multilateral Fund to run a program for recovery of CFC from condemned equipment.	1996

Sector	Measures	Timing
Mobile Airconditioning	Submit a project proposal to the Multilateral Fund for equipping service agencies of MAC's with recovery-recycling equipment.	Proposal enclosed 1.1.94
	Take administrative measures requiring importers of cars to install recovery recycling equipment.	
Solvents	Ban import of ODS like CTC and CFC-113.	By 1.1.95
Halons	Organise a survey to identify essential uses of Halons.	By 30.09.93
	Examine viability of setting up a programme to recover Halons from non essential uses and manage a Halon Bank.	Proposal enclosed 31.3.94
General	Undertake measures for registration by all users of ODSs.	31.3.94
	Undertake measures to make it mandatory for reporting imports of ODSs.	31.12.93

3.2.2 Projects

In line with the Government's commitment to phase out consumption of ODSs and to implement the actions spelt out earlier a number of projects are envisaged.

Annexure 3.1 gives the detailed project proposals for those projects for which approval is sought along with approval of the Country Programme.

Annexure 3.2 gives a list of further projects for which proposals will be generated once the secretariat for implementing the country program becomes operational and the Country Programme is approved. A majority of these projects have already been discussed with representatives from industry,reviewed by technical experts and would be amenable for implementation.

Annexure 3.3 gives a list of projects which will be taken up for investigation in the future.

The projects planned for early implementation are briefly discussed below:

Government Sector: Projects G01, G02, G03

Project G01: Institutional strengthening

Purpose: To create the necessary infrastructure within the Ministry of the Environment and Quality of Life which will enable effective management and monitoring of the country program.

The incremental cost of the project is estimated to be US $ 50,000.
A detailed working is given in **Annex 3.1.**

Project G02 Survey of firefighting installations and uses of Halons

Purpose: To determine the requirement of Halon for essential use and to estimate the extent of Halon available from non essential uses to subsequently examine feasibility of Halon recovery and banking which can be financed by the Multilateral Fund.

Details are given in **Annex 3.1**

Project G03: Survey to assess training needs in the refrigeration and airconditioning sector

Purpose: To identify the service agencies in the Domestic Refrigeraion and Commercial Refrigeration and Airconditioning sector with a view to set up a training program to be coordinated by the IVTB to be financed by the Multilateral Fund.

User sectors.

Projects in the first phase are contemplated in the following sectors.

Mobile air conditioning -	For recovery and recycling of CFC 12	MAC 01 Refer. Ann.3.1
Aerosols -	For changing over to propane butane as propellant	AFS 01 Refer Ann.3.1

The projects envisaged in the second phase are:-

Domestic refrigerators -	for substituting CFC in foam blowing	DRF 01 Refer Ann.3.2
Refrigeration & airconditioning -	For Training of technicians	TAR 01 Refer Ann.3.2
Fire Fighting	Recovery of Halon from non-essential uses and maintaining a Halon Bank	Refer Ann.3.2

3.3 Roles in Implementing the Strategy

The responsibility for implementation of the Country Programme will rest with the Ministry of the Environment and Quality of Life.

The Ministry has already had discussions with representatives from other Ministries and Departments and it has been proposed to set up a Steering Committee which will have representatives from different Ministries and departments as well as the private sector to monitor the Country Programme.

The Steering Committee will be supported by a secretariat set up within the Ministry of the Environment and Quality of Life. The Secretariat will have two senior administrators supported by two technical officers with a specific mandate to oversee all activities connected with the implementation of the Country Programme.
The Government Departments and Ministry sectors who will be represented on the Steering Committee are as follows:-

Ministry of the Environment & Quality of Life
Ministry of Local Government
Ministry of Industry & Industrial Technology
Ministry of Finance
Customs Department
Representative of Importers of ODSs
Reapresentative of Refrigeration and Airconditioning/ Manufacturers and Importers
Representative of Electronics/Instrument Manufacturers
Representative of Textile Manufacturing Units
Representative of University of Mauritius
Representative of Consumer Association

It is proposed that UNEP , which has till now coordinated and supported all activities leasing to the preparation of the Country Programme will be the Implementing Agency for the Programme.

It is envisaged that the funding of any projects/activities from the Multilateral Fund will be handled through the Development bank of Mauritius which has facilitated numerous projects under multilateral funding.The precise mechanism for this is to be worked out.

3.4 Timetable and Consumption Implications

3.4.1 Phase out Programme

Figures 3.4, 3.5 and 3.6 present the total planned consumption for each group of ODSs as against the Protocol's Limits on consumption and against the total forecast consumption in the unconstrained situation.

The total phase-out for Annex A Group I is achieved by 2009 though 90% reduction from 1991 levels of 60 ODP Tons is achieved by 1997.

The phase out of Annex A Group II is achieved by end 1994 and that of Annex B Group II is also achieved by end 1994.

The consumption to phase-out from 1994 in ODP Tons for each group of ODSs is as follows:-

Annex A - Gr I	92.1
Annex A - Gr II	6.95
Annex B - Gr II	1.95

PLANNED PHASE OUT SCHEDULE
ANNEX A GROUP I SUBSTANCES

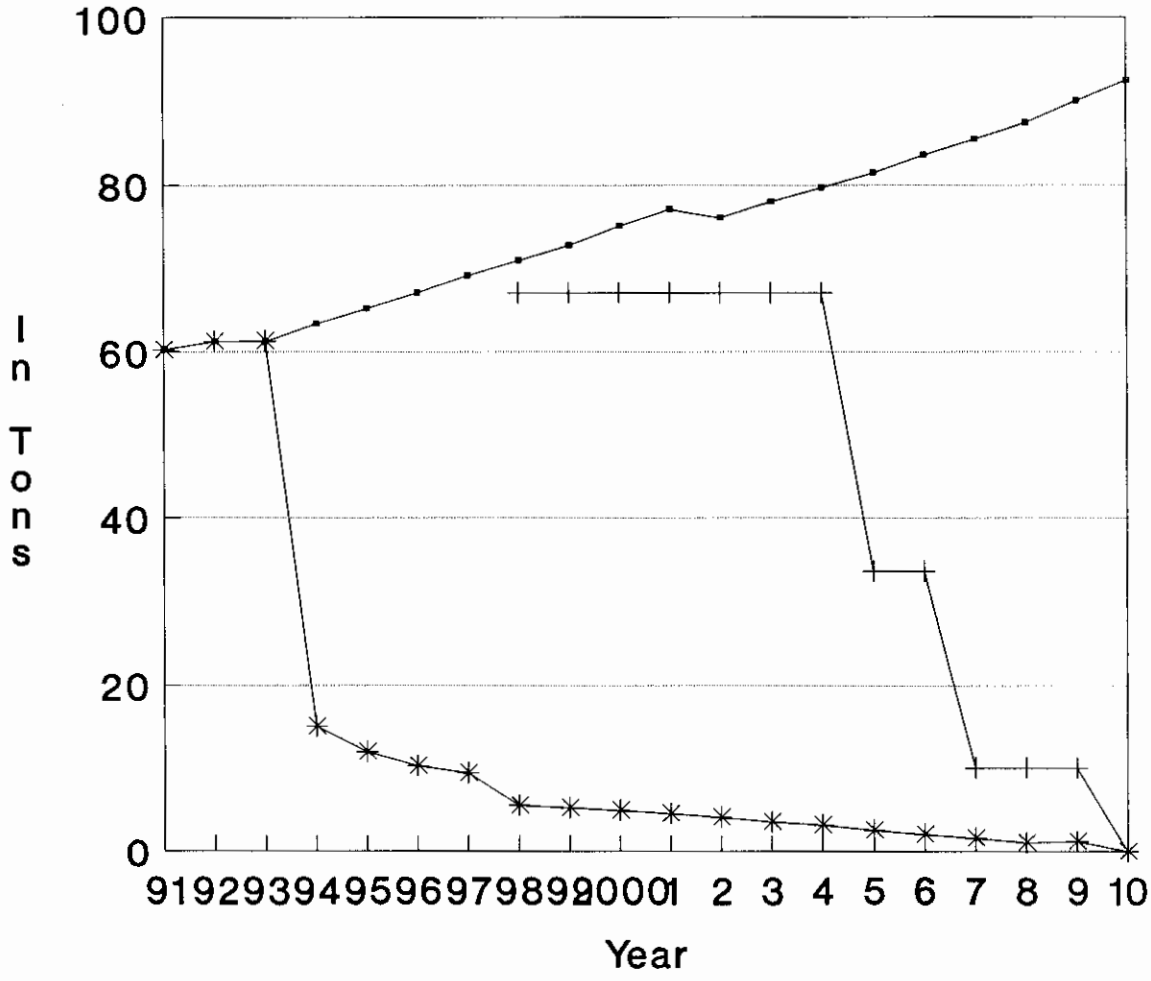


Figure 3.4

Unconstrained Demand — Protocol Limits

Planned Consumption

PLANNED PHASED OUT SCHEDULE
ANNEX B GROUP II SUBSTANCES

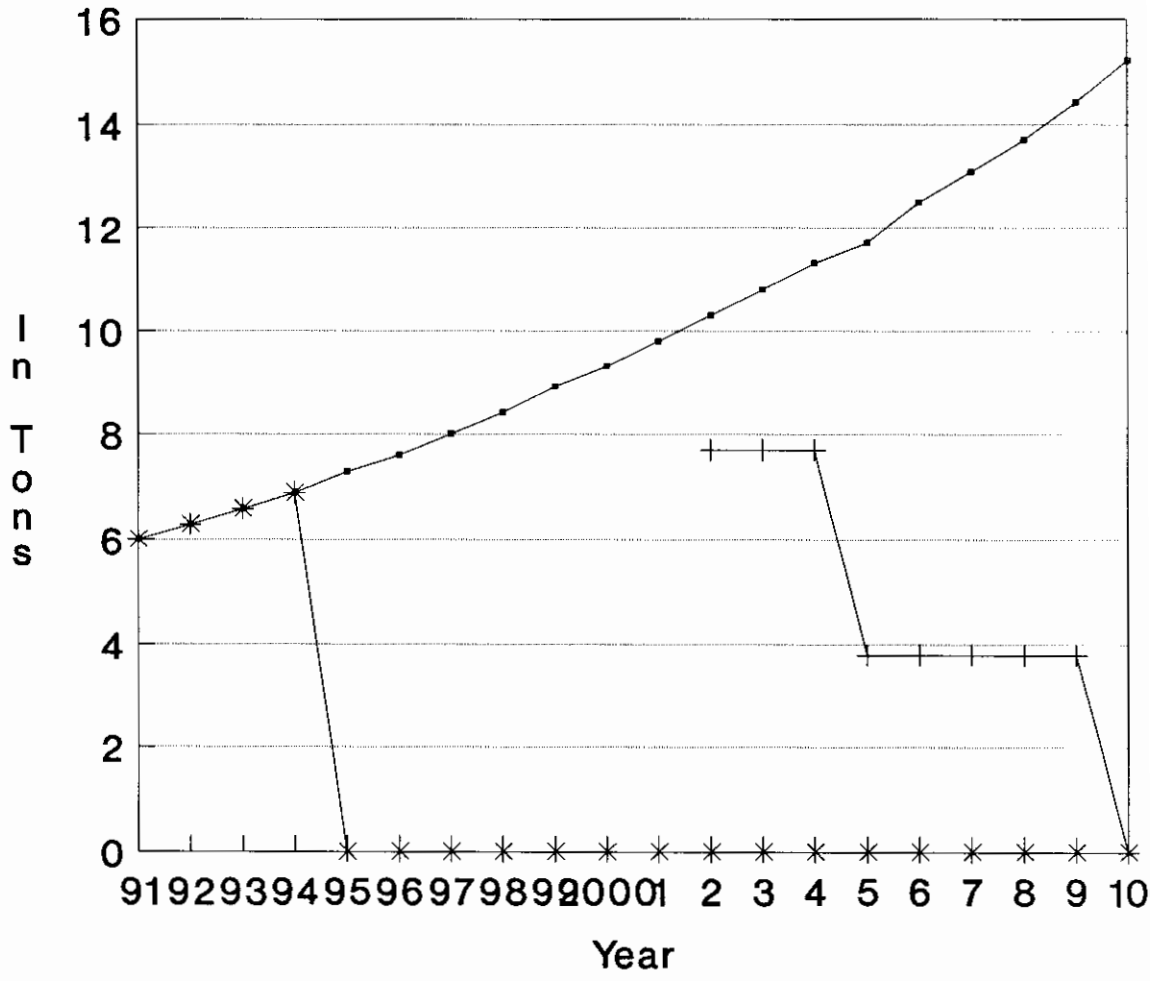


Figure 3.5

Unconstrained Demand — Protocol Limits

Planned Consumption

PLANNED PHASE OUT SCHEDULE
ANNEX B GROUP II SUBSTANCES

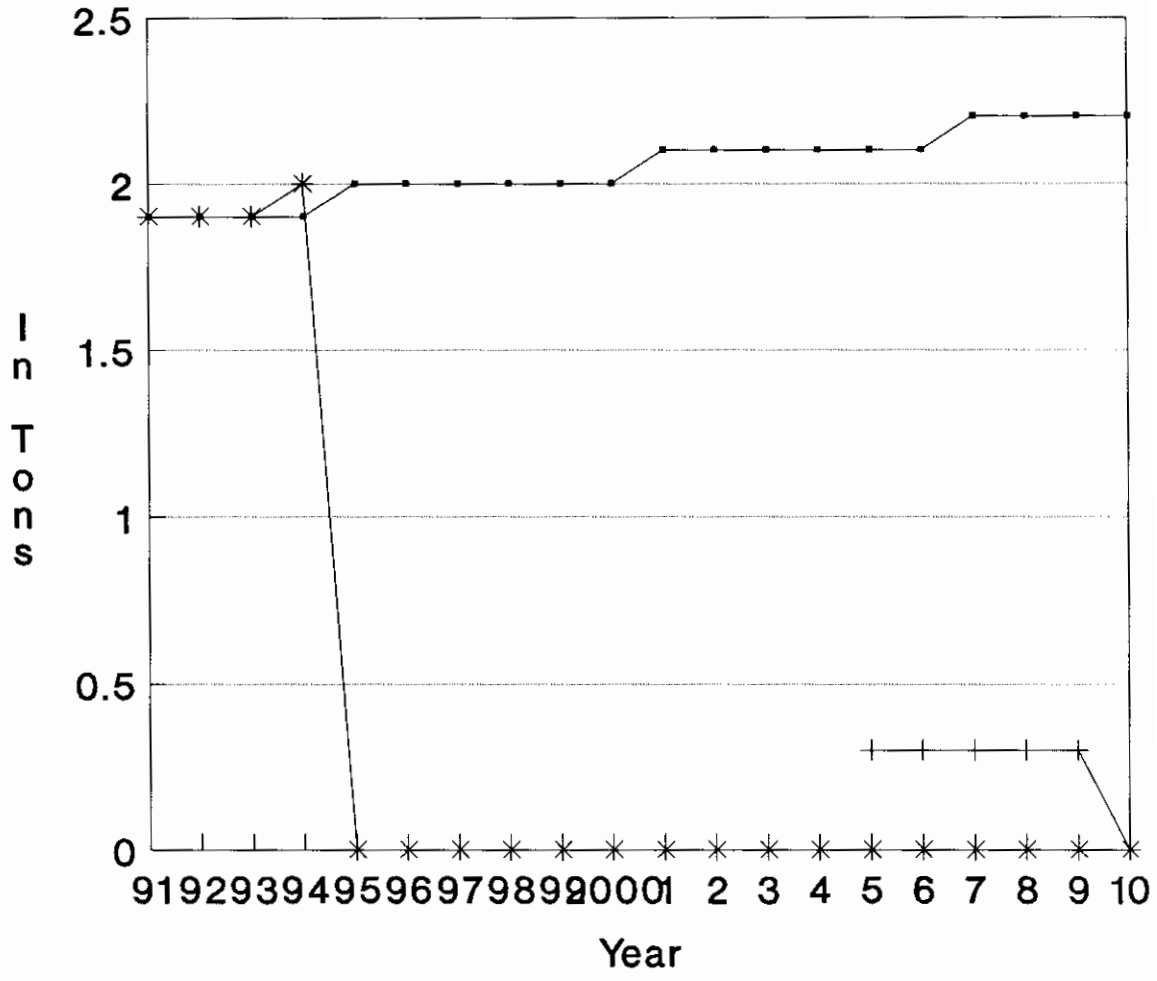


Figure 3.6

Unconstrained Demand — Protocol Limits

Planned Consumption

3.4.2 Incremental Cost

The incremental costs applicable to Mauritius comprise of three elements:-

a) User costs: Costs incurred at the level of manufacturers of ODS using products in connection with adaptation to ODS free technology. These include

- incremental capital and operating costs,
- costs of retraining of personnel,
- costs of research and development, and
- costs of technical assistance and support.

b) Consumer costs: Costs borne by the consumers using products containing ODSs (such as refrigerators, car a/cs etc.) to procure and maintain equivalent ODS free products, including the costs of forced early replacement of equipments due to non availability of ODSs

c) Government costs: Costs for introducing the necessary measures to ensure effective implementation of the protocol.

Table 3.3 summarizes the various incremental costs associated with the various options mentioned above in each sub-sector.
The actual costs taken in the analysis and their sources are discussed below:

A. Conversion of CFC based filling unit to Hydrocarbon

Hydrocarbon (which is a mixture of propane and butane) is widely recognised as suitable replacement for CFCs as propellant in aerosols. Although it is quite light in liquid form, as a gas it is heavier than air. Thus, it requires strong movement of air to dissipate any leakages which may occur. This factor combined with its high combustibility has important implications for manufacturing safety.

The use of Hydrocarbon would require following equipment/adaptations to manufacturing facility.

- Special filling room with safety features
- Conveying systems for cans

The pumps and piping of CFC based equipment its utilised for Hydrocarbon too. The pump

The total project cost is assessed to be US$124,300 including training by overseas expert for start up and safety.

Since there are no local suppliers of aerosol grade hydrocarbon, the requirement will have to be met through special imports. Considering the hazard involved, however there may be no saving in operating costs.

Conversion of CFC based filling units to use HCFC blends or/ dimethyl ether.

If this option is exercised there will be an increase in operating costs owing to significant differences between prices of CFC-12 and the alternatives.

Best estimates indicate the substitutes to be cost four times as much in Mauritius.

B. Mobile Air-conditioners
Switch to cars fitted with HFC-134a based a/cs

The price differential between a car fitted with CFC-12 based a/c and a car fitted with HFC-134a based a/c is assumed to be the cost differential between a CFC-12 based car a/c and HFC-134a based a/c. Based on available information, the cost of an HFC-134a based car a/c, is assumed to be 15% more, i.e. US$ 120 more than a CFC-12 based car a/c.

The operating incremental cost is calculated based on prices given in **Table 3.2.**

Table 3.2

Prices of ODSs and Substitutes

Product	Cost/Kg in US$
CFC-11	2.30
CFC-12	3.32
R-502	5.66
CTC	0.77
CFC-113	0.99
HCFC-22	4.13
HFC-134a	16.50
Hydrocarbon	3.32*
HCFC-123	8.00
TCE	0.99
PCE	0.99

* Assumed price if aerosol grade hydrocarbon were to be imported.

Recovery & recycling programme

The price of a composite recovery and recycling unit is taken as US$ 2400 based on the price estimates from leading manufacturers of recovery & recycling equipment.

It is assumed that the quantity of CFC-12 recovered by servicing agencies would be recycled and used by them for recharging.

Proper training is required to operate the recovery & recycling machines. The cost of the training session is estimated to be US$ 15,000/-(one time).

C. **Domestic Refrigerators & Deep Freezers**

Switch to 50% water blowing

Increasing the amount of water used in refrigerator foam insulation does not require any major plant modification but the foam thus produced has less insulation strength and therefore results in 5 percent increase in energy costs to the consumer. Since the plants of the two manufacturers of refrigerators in Mauritius is very small (less than 10,000 refrigerators per annum), the estimation of conversion cost is very difficult. We estimate that switching to 50% water blowing would cost each manufacturer a capital outlay of US$ 40,000, which is approximately 5% of initial investment of one of the manufacturers.

The savings to the fridge manufacturers would be the price equivalent of 50% of their annual CFC-11 consumption.

The costs to the consumer sector is the 5% increase in electricity consumption which is equal to (no. of hours a year * average compressor rating * duty cycle * tariff rates)

Average compressor rating is assumed to be 150 w. The average duty cycle is taken to be 0.3 and the Tariff rate is estimated at Rs. 2 per KWH.

Conversion to HCFC 123 blowing

The capital costs involved in switching over to HCFC 123 blowing are assumed to be around 3% of the total initial outlay because of lack of availability of any estimates for the relevant plant sizes. This comes to around US$ 30,000 per manufacturer.
The operating cost is the price differential between HCFC-123 & CFC-11 multiplied by the consumption of HCFC-123.

Training of servicing personnel

High recharge demand in the sector indicates that the proper servicing practices are not being followed by the servicing agencies. Therefore, a training programme is envisaged for the technicians involved in servicing of domestic refrigerators in order to train them on efficient & optimum use of CFC-12 while servicing the refrigerator.

The training programme would involve inviting two foreign experts who would import the training in two batches. The cost of training would include:

- Cost of travel for experts	$ 10000
- Professional Fees	$ 10000
- Allowance	$ 5000
- Seminar Expenses	$ 15000
Total cost of technician training	$ 40000

Switch to HFC 134a based refrigerators

The incremental capital cost in switching over to HFC 134a based line is estimated to be $ 50,000 per manufacturer in costs and minor changes in the assembly line.

Incremental operating cost would be the price differential of CFC-12 and HFC-134a multiplied by the consumption of HFC-134a as also the price differential of a HFC-134a compressor and a CFC-12 compressor if these are imported.

For the fridges that are imported, the incremental capital cost would be the additional price of an HFC-134a based fridge as compared to CFC-12 based fridge. According to a newspaper reports in March 1993, the price of a HFC-134a fridge is 10% more than that of a CFC-12 based fridge. Taking an average price of $ 600 for a fridge, the incremental capital cost comes out to US $ 60 per refrigerator imported.

In addition, there would be costs to the consumer sector due to premarture scrapping of CFC-12 based fridges from the year 2010 onwards. The cost of the fridge scrapped prematurely is taken to be equal to its resale value if CFC-12 were available for recharge (assumed to be its depreciated value as per age schedule purchase price) and is discounted back to its value in year 2010 to get net costs due to premature scrapping.

D. Commercial Refrigeration & Air-conditioning

Cost of Training

As mentioned earlier, the recharging norm reported for this sector is very high. This strongly suggests that the appropriate maintenance and servicing procedures are not being followed and therefore, there is a strong case for training of servicing personnel involved in this sector. The cost of training, along the lines above is estimated to be US$ 15,000 (one time). The savings realized is the value of CFCs saved every year.

Commercial Refrigeration

Retrofit CFC-12 and CFC-502 systems to operate on HCFC-22/HCFC-134a

HCFC-22 is known to be the most suitable refrigerant for system retrofit. Since HCFCs are also expected to be phased out once economically viable non-ozone depleting substitutes are developed, retrofitting with HCFC should be considered as an interim measure only and retrofitting with HFC-134a would be carried out. Average retrofitting cost is estimated to be $ 500 per cold storage(Source:Country Programme - Zambia) and $ 200 per bottle cooler and display cabinet.

The incremental operating cost includes the price difference between CFC-12/CFC-502 and HCFC-22 multiplied by the consumption of HCFC-22. Prices of gases taken for analysis are shown in **Table 3.2**

Commercial Air-conditioning

CFC-11 Based Centrifugal Chillers

New Systems to be compatible with HCFC-123

In open-type centrifugal chillers, HCFC-123 can easily replace CFC-11 without any major modification. Therefore, any new centrifugal chiller installation should be an open type system. Since no estimates of incremental costs are available, it is assumed for the moment that incremental capital cost in installing such a system is negligible.

Retrofit existing population to run on HCFC-123

The major cost of retrofitting would be the cost of replacement of CFC-11 with HCFC-123. Other costs incurred due to system modification are assumed to negligible.

CFC-12 Based Systems

Retrofit existing population to run on HCFC-22

Since these system are similar to CFC-12 based cold storages, cost of retrofitting in this sub-sector is also assumed be $ 500 per system. Here again it should be noted that retrofitting with HCFC-22 is only an interim measure.

Operating cost includes the price difference between CFC-12 & HCFC-22 multiplied by the total annual consumption of HCFC-22.

E. Solvents

Switch From CFC-113 & CFC-11 to Trichloroethylene (TCE)

Though TCE can be directly substituted, a proper disposal system for vapours formed with the use of TCE needs to be installed. As per the survey there is only one consumer each of CFC-113 and CFC-11. The capital cost involved in providing a proper vapour disposal system is estimated to be $ 10,000 per system.

The increase or savings in operating cost is the price difference between CFC-13 (or CFC-11) and TCE multiplied by the annual consumption of TCE.

Switch from Carbon Tetrachloride (CTC) to Perchloroethylene (PCE)

CFC is largely used by the textile processing and the dry-cleaning industry in Mauritius and could easily be replaced by PCE. There are no capital costs involved and the incremental operating cost is the price difference of PCE and CTC multiplied by the annual consumption.

F. Halons

The incremental costs considered for this sector are the costs associated with the construction of a Halon Bank.

Based on a report on managing the Canadian Halon Bank and estimating the stock of halons in non-essential sectors which can go for the Bank it is calculated that a bank of 6000 Kg of halons can be set up.

This would involve an outlay of US$ 120,000

Cost of recovery machines (2) would be US$ 6,000.

The operating costs are estimated at US$ 8,000/ per annum which would include total logistics and administration of the bank.

The savings is the difference between unconstrained demand and the consumption of Halons for essential uses which is assumed to be 10% of the total demand.

Estimated Incremental Cost for the proposed phase out schedule

The incremental costs have been computed for all sectors over the time period 1994-2010 at present prices.These have been discounted to 1993 to arrive at the NPV or the cost to the country for complying with the Protocol.

Table 3.4 provides the net NPV for each sector as well as the total NPV under the phase-out scenario contemplated.

Discount Rate
A discount rate of 10 % is used which is the accepted rate for computing NPV's for UNDP Projects.

Table 3.3

Incremental cost considered for each sub-sector for various options

Sector & Options	Capital Costs	Operating Costs
Domestic	Govt. Sector	Consumer Sector
<u>Refrigerators</u>		
Training of Technicians	- Cost of organizing a training programme for the servicing agencies	- Savings = 25% reduction in recharge demand (for CFC-12)
	User Sector	User Sector
- Switch to 50% water blowing	- Cost of equipment to accomodate mixture of CFC-11 & water	- Saving = 50% reduction in OE demand of CFC-11
		Consumer Sector
		- Additional Energy Cost
- Switch to HCFC-123	Cost of Equipment in ventillation system	- Cost = (Price difference between HCFC-123 & CFC-11) *OE Demand for
	HCFC-123	
	User Sector	User Sector
- Switch to HFC-134a	- Cost of additional facilities to assemble HFC-134a based fridges	- Cost = (Price difference between HFC-134a & CFC-12) *OE Demand for HFC-134a fridges
		- Cost of a HFC-134a based compressor minus the cost of CFC-12 based compressor
	Consumer Sector	Consumer Sector
	- Cost of an imported HFC-134a based fridge minus cost of a CFC-12 based fridge	- Cost = (Price difference between HFC-134a & CFC-12) * Recharge demand for HFC-134a

Sector & Options	Capital Costs	Operating Costs
Aerosols	User Sector	
-Switch to LPG	- Cost of filling room conveying unit & fire safety measures	NIL
	User Sector	
- Switch to Co2	Nil	- Savings (CFC-12-CO2 price *Consumption of CO2
-Switch to HCFC's	NIL	Price difference between CFC-12 and substitutes
Mobile a/c		
	User Sector	User Sector
- Recovery & Recycling	- Cost of procuring recovery & re-cycling equipment for 10 importers operating the	- Savings equal to the value of CFC-12 recovered minus cost of
	- Cost of training	equipment
-Switch to HFC 134a	Consumer sector	Consumer sector
	- Cost of a car fitted with HFC 134 based a/c minus the cost of a car fitted with CFC-12 based a/c	- Cost =(Price of of HFC 134a minus price of CFC-12)* Requirement of HFC-134a for recharging

Sector & Options	Capital Costs	Operating Costs
Commercial Refrigeration		
Cold Rooms		
-New Demand HCF-134a based	User Sector	Consumer Sector
	No incremental costs	- No incremental costs
- Retrofit to HFC-22 HFC-134a	Consumer sector	
	- Cost of retro-fitting Cost of initial charge of HCFC22	- Recharge Requirement * (Price of HCFC 22 or HFC-134a
-Price ofCFC-12 or	CFC-502)	
Display Cabinets/ Bottle Coolers		
- Retrofit to HFC-134a	Same as above	Same as above
Ships		
- Ban of supply of CFCs to ships	No Incremental cost	No incremental cost
Commercial Air-conditioning		
CFC-11 Based Chillers	Consumer Sector	Consumer Sector
- New Demand HCFC-123 compatible	- Cost of initial charge of HCFC-123 *Price difference	- Recharge - Requirement between CFC-11 & HCFC-123
- Retrofit Existing population to HCFC-123	Consumer Sector	Consumer Sector
	- Cost of initial charge of HCFC-123 - Cost for minor modifications	-Recharge Requirement * Price difference between CFC-11 & HCFC-123
in the system		

Sector & Options	Capital Costs	Operating Costs
CFC-12 Based Central a/c		
- New Demand HCFC-22 or HFC-134a based	No incremental cost	No incremental costs
- Existing Retrofit to HCFC-22	Consumer Sector - Retrofitting Charges & HCFC-22 - Cost of initial charge of HCFC-22	Consumer Sector -Recharge Requirement * price between CFC-12
Solvents		
- Switch from CFC-113 & CFC-11 to TOE	Consumer Sector - Cost for providing system for vapour discharge	Consumer Sector -Price Difference between CFC-113 (or CFC 11) & TOE * TOE consumption
- Switch from CTC to PCE	Consumer Sector No incremental cost	Consumer Sector - Price difference between CTC & PCE * PCE consumption
Halon	Govt. Sector	Govt. Sector
Construction of Halon Bank	Cost of creating Halon Bank + Cost of recovery equipment	Cost of operating Bank less Halon saved
Programme Implementation	Govt.Sector Cost of creating infrastructure	Govt.Sector cost of administration

Table 3.4

NPV OF COSTS (000US$)

SECTOR	GOVERNMENT	USER	CONSUMER
AEROSOL	913		
MOBILE A/C	3		
Domestic Refrigerators & Deep Freezers	36	2807	3502
Commercial Refrigeration & Air-Conditioning	14		261
Solvents			-7
Halons	114		
Programme implementation	50		
Total	214	3724	3756

Costs to the country = US$ 7,694,000

* includes $ 152,950 as cost of fridges scrapped because of non-availability of CFC-12 in 2010.

It may be seen from the above that the bulk of the incremental cost is incurred in domestic refrigerators where a change to HFC 134a based refrigerators is called for.

3.5 Budget and Financing Programme

Table 3.5 presents costs expected to be incurred by the Government for various activities covered under the Action Plan for phasing out of ODSs through the period 1994 to 1997.

It is suggested that these costs as incremental costs are funded by the Multilateral Fund.

It is assumed that such funding will actually become available in 1994.

The Action Plan envisages certain actions to be taken up in 1993 including the project for institutional strengthening and surveys on Halon use and traiming needs of refrigeration servicing technicians.

The Government would commence work on these once the proposed projects are approved by the Multilateral Fund.

Table 3.5

Cost of Government activities for the period 1993-96

Activity	1993	1994	1995	1996	Cost in US$ 000
1. Institutional Strengthening					
- Creating Infrastructure	16	12	12	6	
- Conduct Surveys	2	2			
2. Training of Technicians		55			
3. Creating a Halon Bank			126.0		
4. Public awareness	1	1	1	1	
	19	70	143.1	7	

The costs above (would almost entirely) require to be funded by the Multilateral Fund.

The Government in its actions also has a proposal to raise taxes of ODSs and equipment and products containing ODSs. These are not considered here pending formal adoption of the proposals.

3.5.1 Project funding priorities

Listed below are projects for which it is proposed to make an application to the multilateral fund for assistance.

Table 3.6

Industry sector Company	Description and purpose	Start year	Amount of assistance sought	Reduction in amount of substance (over 4 years) (in Tonnes)
Aerosols -				
Comanu Ltd	To switch over foam CFC-12 to Hydrocarbon	1994	124,300	82.6 CFC-12
Mobile a/c's				
10 Importers	To install recovery and recycling machines	1994	26,006	5.5(CFC-12)
Domestic Refrigerators				
Blyfridge Ltd	Use 50% water in foam blowing	1994	121,009*	11.8(CFC-11)
A.H. Bahemia Ltd	To reduce consumption of CFC 11			
- do-	Convert mfg facilities to produce HFC 134A based fridges	1996	To be worked out	7.2 CFC-12

* indicative

While, proposals for the first 2 are enclosed with the Country Programme those for others will follow.

3.6 **Monitoring Arrangements**

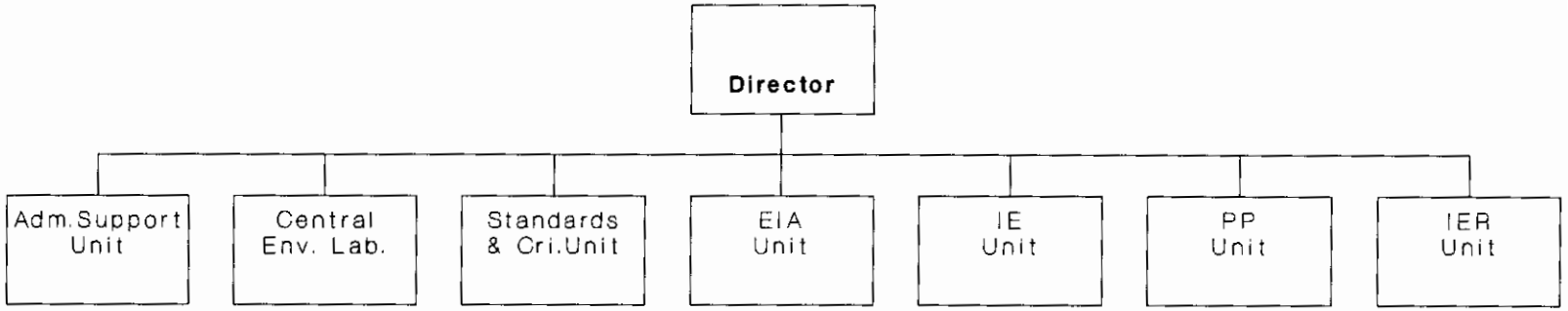
As already spelt out, the Ministry of the Environment and Quality of Life is constituting a secretariat within the Ministry which will enable monitoring all aspects of compliance with the agreed phase-out schedule as well as the projects for reducing consumption of ODS.

The secretariat will also keep the Fund informed on progress of implementation of the agreed actions for phase-out. A proposal on the means of doing this is being worked out. It may be mentioned that since the survey of the supply and use of ODS in Mauritius has been undertaken by the Ministry of the Environment itself the secretariat is familiar with all user sectors and will be well placed to undertake the role of a monitoring agency.

Moreover the Government is planning for mandatory registration by all kinds of users of ODS and reporting imports of ODS.

This will enable monitoring of imports as well as reporting to the Protocol Secretariat and other agencies in ODS consumption.

DEPARTMENT OF ENVIRONMENT



EIA -Environmental Impact Assessment

IE -Investigation and Enforcement

PP - Policy and Planning

IEA -Information Education and Research

ANNEXURE 3.1

PROJECT PROPOSALS FOR APPROVAL WITH THE COUNTRY PROGRAMME

PROJECT PROPOSAL G 01

COUNTRY: MAURITIUS

PROJECT TITLE: Institutional strengthening for the phase out of zone depleting substances.

Sector covered: Across sectors.

ODS consumption in Affected sectors :Not applicable

Project Duration: 6 months.

Project Impact: Strengthening implementation.

Proposed Budget: US $ 50,000

Implementing agency: UNEP.

National Coordinating: Agency The Ministry of the Environment & Quality Life.

PROJECT SUMMARY.

The Ministry of the Environment and Quality of Life has been looking after the activities connected with compliance to the Montreal Protocol.
With the formulation of a country program and the country's commitment to phase out ODSs at as early a date as practical a number of activities and projects are envisaged in this area to be completed in a short duration.
While resource persons have been identified at the Ministry to manage these activities the infrastructure needs to be strengthened particularly in terms of facilities for information exchange, given that Mauritius is geographically distant from other countries. Secondly, in some areas pilot studies or surveys may have to be undertaken before finalising actions for which support is required. These activities entail an incremental cost necessitated by compliance with the Protocol which is to be funded by the Multilateral Fund.

Project Title: Institutional strengthening for the phase out of ozone depleting substances Ref: G01

Project Description.

The Ministry of the Environment and Quality of Life is the part of the Government that will be responsible for implementing the country program.

The country program envisages phasing out of ODSs consumption in Mauritius at as early a date as practical determined by availability of proven technical alternatives.
To accomplish this there are a number of activities which must be coordinated and completed within a short span of time i.e. over the next three to four years.

These activities cover:
- acting as the secretariat for the national steering committee on ODS.
- formulating and forwarding project proposals for funding assistance (envisaged in the country program).
- Inter-ministerial coordination for implementing administrative measures.
- Act as an information exchange center. In particular this will entail linking up to the Ozone Action Information Center and provide information to local agencies on technical issues, concerned experts and case studies.
- to monitor consumption of ODS and the phase-out and report to the Protocol Secretariat under Article 7.
- to initiate and coordinate public awareness and sensitization programs by dissemination of materials, holding seminars etc.
- to deal with the local agency (in all likelihood the Development Bank of Mauritius) to coordinate funding of projects by the Multilateral Fund.

The above activities call for staff in terms of resource persons and infrastructure.

Since the activities would be concentrated over a period of three to four years by which time significant phase-out would have been achieved the Ministry considers it appropriate not to seek additions to staff but to draw upon its existing resources who will be dedicated to the above activity. It is envisaged that a team of four persons, two senior administrators supported by two technical officers will counstitute the team. The team members will be persons who are conversant with the issues concerning the Protocol and fully capable of managing the activities set out.

This team however would require an infrastructure and a budger for carrying out its activities.

The infrastructure would be in terms of a computer system with a link to external data bases particularly the ozone action Information Center, and other basic office equipment.
The operating budget would cover expenses on activities mentioned earlier required for country program implementation.

These include expenses on:

- dissemination of information through printed material.
- conducting field studies or surveys on ODS consuming sectors to formulate section programs.

Two such surveys -

- to assess requirement of Halons for essential use
- to assess the training requirements of technician servicing refrigeration and airconditioning equipment are budgeted and included as sub-projects with the present project.

The costs of all the activities above are costs entailed by the need to ensure accelerated compliance with the Protocol and would therefore be an incremental cost.

Project Time frame.

The project technically has a duration till complete phase out of ODSs is achieved in Mauritius.

It is however envisaged that the next four years will be the period of focussed activity.

Budget	Item		Year
1.	Start up costs in terms of equipment including: 1. Computer system with . Printer . modem . necessary software . accessories. 2. Fax machine. 3. Photocopier.	US10.000	1993
2.	Operating costs. (for various functions)	Us $ 12000/yr	1994-1996
3.	Budget for surveys	US $ 4000	1993-1994.
	Total costs (1. + 2. + 3) =	Us $ 50,000.	

Implementation arrangements

The implementing agency for the project would be UNEP

Coordination of the project from the Government of Mauritius would be done by the (PS or PAS) Ministry of the Environment & Quality of Life.

PROJECT PROPOSAL G 02

COUNTRY: MAURITIUS
PROJECT TITLE: Survey to assess requirements of Halon for essential uses and Halon available from non-essential uses for future recovery.

SECTOR COVERED: Fire Fighting.
ODS Consumption: 2.2 Tonnes annually (6.6 ODP Tonnes). in affected sectors.
Project Duration: 3 months.
Project Impact: Will provide information for eliminating wasteful use of HALON.
Proposed Budget: US $ 1000/.
Implementing agency: UNEP.
National Coordinating Agency. The Ministry of the Environment and Quality of Life.

PROJECT SUMMARY:

Mauritius imports about 2.2 Tons of HALONS annually. This is to service refilling requirements of HALON based fire extinguishers of which more than 1100 are imported every year containing totally about 4.5 to 5.0 tonnes of HALON.

As per the inputs provided by the fire services department it is likely that much of this is for non- essential use. On the other hand many critical installations are not equipped with HALON based systems which are essential.

Of late the importers inform that Halon imports are difficult and scarce.

This project is being undertaken to immediately assess the areas where Halons are essential and determine the amount of idle stock of Halons in non essential use which can be recovered.

Project title:
Survey to assess requirements of Halons for 'essential uses' in Mauritius and Halon stock available fron non essential sectors for possible future recovery.

Project Description.

Mauritius imports about 2.2 Tons of Halons annually. This is to service recharging requirement of fire extinguishers of which more than 1100 are imported every year which translates, into 4.5 to 5.0 Tonnes of Halon.
The 'consumption' of Halon in ODP Tonnes is 6.6 which is almost 8% of the total ODP consumption.

As per the inputs provided by the fire services department it is possible and likely that much of this is for non essential use. On the other hand many critical installations are apparently not equipped with Halon based systems though it is essential.

Of late the imports are becoming difficult with accompanying rise in prices.

A study is therefore necessary to

- identify at the earliest the requirement of Halons for essential uses so that their maintenance requirement for the future can be planned.

- to assess the 'idle' stock in non essential uses to subsequently plan for their retrieval.

While no reliable figures are available as of now it can be estimated that future annual requirement for 'essential uses' can perhaps be met for the next 10-15 years (about 3-4 Tons) even if 25% of the Halon can be recovered from the 'idle' stock in non essential uses. (15-20 tons). This is particularly significant since the Government of Mauritius wishes to ban import of Halons for non essential uses from 1.1.95.

The survey would be conducted by a team of two persons selected for the assignment.

Project Time frame.

It is expected that the results of the survey would be available in 6 weeks from start.

The results would be analysed thereafter by the Ministry in collaboration with the Fire Services Department and the two large importers to devise the future course of action.

Outputs.

A report covering the requirement of Halons for essential uses an estimate of Halon stock in non essential sites and a strategy outline for managing future Halon requirement and supply.

Budget.

The budget for contracting the survey is US $ 1000/.
A provision has been made in the project for institutional strengthening for this amount too,.

Implementation Arrangements.

The section in the Ministry of the Environment and Quality of Life dealing with the country programme will be responsible for this project and will report on the outcome to UNEP which is the implementing agency for the institutional strengthening project.

PROJECT PROPOSAL G 03

COUNTRY: MAURITIUS

PROJECT TITLE: Survey to assess training needs of technicians in the Refrigeration and Airconditioning maintenance and servicing sector.

SECTOR COVERED: Refrigeration and Airconditioning.

ODS consumption Affected sectors: 12 ODP Tons

Project duration: 2 months.

Project Impact: Will provide inputs to organise training workshops for such technicians to subsequently enable a reduction in use of CFC for maintenance and recharging.

Proposed Budget: Us $ 1000/

Implementing Agency: UNEP

National Coordinating Agency: The Ministry of the Environment & Quality of Life.

PROJECT SUMMARY:

Mauritius has a large population of domestic refrigerators and a large number of cold rooms which have equipment based on CFC 12. The recharge requirements in both these subsectors are far too high in relation to the norm.

While large installations are serviced by dedicated maintenance personnel, the smaller systems and domestic fridges are serviced by the unorganised sector.

In both cases most of the service technicians do not possess formal training nor is there a code of practice.

As part of the country programme the Mauritius Government wishes to effect reduction in consumption of ODSs by imparting training to technicians and having a system of registration and licensing. This survey would be precursor to devising the training p training program.

Project title: Identification of training needs for technician servicing airconditioning and refrigeration equipment.

Project Description.

Mauritius has a population of 200,000 domestic refrigerators, about 200 cold storages and about 12 large centrifugal chillers.

The servicing of these equipment account for a consumption of 10.3 tons of CFC 12 and 1.7 tons of CFC 11 annually.

The initial survey during preparation of the country program revealed that the consumption norm for use of CFC's in servicing domestic refrigerators is over twice the normal requirement.

In the commercial refrigeration and airconditioning sector the recharge requirement reported is 20% of the initial charge which is 10 times as much as the normal requirement.

While in the commercial sector the larger systems are serviced by dedicated technicians attached to the installation, most domestic refrigerators and small cold rooms are serviced by smaller firms and individual technicians of which there may be 100 in the country.

These agencies procure their requirement of CFC's from the importers and there is no restriction on use or supply.

In most cases in both the sub sectors above, the technicians do not have any formal training nor is there a code of practice.

As part of the commitment to reduce consumption of ODSs in this sector the Government and users feel that there should be a system of licensing service technicians who will be trained in proper practices and in due course only such licensed technicians would be able to purchase and use CFC.

This would have an impact of reducing CFC consumption in this sector from 12 tons in 1991 to 8.4 tons in 1997.

For this a training program requires to be organised which can be convened by the IVTB. (Industrial and Vocational Training Board).

Before a training program can be convened it would be necessary to identify all the service agencies operating and assess their training needs to formulate a suitable training program.

The present survey is directed to achieving these objectives. A detailed proposal for organising a training program would be put up for funding by the Multilateral Fund on completion of the study.

The survey would be conducted by a team of 2 persons selected for the assignment with the involvement of a Refrigeration Engineer as well as the IVTB.

Project Time frame.

The study is expected to be completed in a month and a proposal for the training program documented in one month thereon.

Outputs.

The outputs of the study will be a report documenting the structure of the refrigeration land airconditioning equipment servicing sector, an assessment of training needs in this area and a recommended contents for a training program to be convened by the IVTB in this area.

Budget.

The budget for conducting this study is US $ 1000/.
A provision for the above is made as part of the budget for institutional strengthening activities.

Implementation Arrangements.

The responsibility for coordinating the study will be with the section in the Ministry of the Environment and Quality of Life responsible for country programme implementation.

PROJECT PROPOSAL AFS 01

COUNTRY:	Mauritius
PROJECT TITLE:	Conversion of aerosol filling facility to switch over from CFC-12 to hydrocarbon as propellant
SECTOR COVERED:	Aerosols
ODS USE IN SECTOR:	25 tons CFC-12 (25 tons ODP) in 1991
PROJECT IMPACT:	Phase out 20 tons per year of CFC-12 (20 tons ODP)
PROJECT DURATION:	12 months
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	U.S. $124,300.00
PROPOSED FINANCING:	U.S. $124,300.00
IMPLEMENTING ENTERPRISE:	COMANU
COORDINATING NATIONAL BODY:	THE MINISTRY OF THE ENVIRONMENT & QUALITY OF lIFE
IMPLEMENTING AGENCY:	UNEP

PROJECT SUMMARY:

This project will accomplish the conversion to hydrocarbon (HC) propellants at COMANU. They have good machinery, completely explosion proof, that does not require replacement. Their existing facility has little unoccupied space, which is marginal for use of the "open air filling room" (OAFR) method. It was decided to recommend an enclosed explosion proof filling room.

They will require 2 conveyors to transport the cans from where the concentrate is filled to the gassing room and to return them to the packing area. Some safety equipment is needed. Startup/safety training will be done by a foreign expert.

PROJECT TITLE: Conversion of aerosol filling facility to switch over from CFC-12 to hydrocarbon as propellant.

PROJECT OBJECTIVES:

Phase out the use of 20 tons of CFC-12 annually by completing the conversion process from CFCs to HAPs at COMANU.

SECTOR BACKGROUND:

COMANU is the largest filler of aerosols in Mauritius. There are 3 other fillers, Mauritius Cosmetics, Grays Ltd., and Prince. COMANU accounts for well over 50% of all fillings, and about 80% of all CFC usage.

Based on the April, 1993 aerosol study mission it would appear that the following estimates for CFC consumption in the aerosol sector are within reason:

1991	25.3 tons
1992	25.0 tons
1993	5.1 tons

What is perfectly certain is that a major reduction in the use of CFC in the aerosol sector has occurred. This reduction may be temporary if COMANU 's clients don't like the results with CO2 and ask to return to CFC filled aerosols.

Current findings would indicate that virtually the entire aerosol market is in perfumes and personal deodorants. This is unusual but not unknown (Ecuador is another case).

ENTERPRISE BACKGROUND:

COMANU was founded in 1982 with shareholders 100% Mauritian. This industry forms part of a large group of companies that sells automobiles, dyestuffs, pharmaceuticals, computers, etc. They do not manage their own brands - they are contract packagers.

They are by far the largest filler. They fill all of Unilever's brands - "Impulse", "Rexona" and "Axe", which are market leaders. Until several months ago, they also filled the important "Fa" brand, which has converted to a pump sprayer.

COMANU has 1 PAMASOL hand filling machine capable of filling 1,200,000 cans per year on a 1 shift basis. Currently they are using about 30% of capacity.

PROJECT DESCRIPTION:

COMANU has enough space for on-going operations, but they cannot safely fill HAPs "open air" at this plant. It is just too small, and natural ventilation would be marginal.

They will purchase an explosion proof gassing room complete with dual speed ventilation systems, gas detectors, etc. This room will be installed outside the actual building where they now have a driveway. To transport the cans from the main building to the gassing room and to return them to the main building 2 5 meter conveyor belts will be required.

There is a high tension transformer very nearby that must be moved a minimum of 5 meters. Simple safety equipment must be purchased and safety/startup training will be provided by a foreign expert.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants have been the principal alternatives to CFC-12 employed worldwide. They are approved by the 1991 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant (HAPs) would have to be imported into Mauritius. Existing imported LPG is not of requisite grade to permit on site destenching.

PROJECT COST:

The total project incremental cost of $124,300.00 plus 10% contingency was calculated as the economic capital cost (see "Recurring Costs/Savings" below).

Capital Costs:

$124,300.00 for the above specified equipment and training plus 10% contingency.

Recurring Costs/Savings:

COMANU does only contract packaging, and that no client will accept the change from CFCs to HC without a reduction in price. As a contract filler COMANU will never receive even a short term savings. Here these savings will go to the marketer, the owner of the brands packaged.

Mormally the recurring savings in the Project would arise from the lower cost of hydrocarbons vis-a-vis CFC-12 and the marginal reduction in filling norms. Because of its geographical location and the low aggregate levels of demand it is expected that the price to Comanu of imported aerosol grade hydrocarbon would be as much as CFC-12. (This is subject to receipt of actual quotations from suppliers).

UNIT ABATEMENT COSTS:

The calculated unit abatement costs for this project is $1.01 per kilogram (see Appendix #2) - See "Note #1 above".

IMPLEMENTATION:

This is a very simple project to implement, as it can be completed in 2 phases during 3 quarters:

Task	01	02	03	04
Purchase filling room	XXXX			
Start up/training visit			XXXX	

PROCUREMENT:

The filling room must be purchased in the U.S. or Europe. Everything else should be purchased locally. The person contracted for training must be fully prepared concerning aerosol filling plant safety and enclosed gassing rooms. Experience with HC aerosol formulations would be useful.

DISBURSEMENTS:

As negotiated with the suppliers.

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has certified that plant personnel are fully trained, the use of CFC in aerosols in Mauritius should be prohibited.

RESULTS:

This project will result in the immediate reduction of 20,000 kilograms of CFC usage in the first year. If this company's volume grows COMANU could reduce CFC usage as much as 50 tons for 1994-1995.

APPENDIX # 1 COMANU PROJECT CONVERSION COSTS:

The project costs are as follows:

		YEAR 1994
1.	1ea. ENCLOSED EXPLOSION PROOF FILLING ROOM	$ 80,000.00
2.	1ea. Two conveyors 5 meters explosion proof	16,000.00
3.	1ea. Move transformer	2,000.00
4.	1ea. Lot safety equipment	5,000.00
		$ 103,000.00
5.	Plant safety/startup training	10,000.00
		113,000.00
6.	10% Contingency	11,300.00
	Total	$ 124,300.00

APPENDIX # 2 - UNIT ABATEMENT COSTS:

The unit abatement costs of the COMANU aerosol conversion project are calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C = $ 124,300. OC = 0

(C)F = $ 20,260 OS = 0

W = 20,000

Doing the calculation, unit abatement cost = $ 1.01/Kg.

Where

(C)F is the annualised incremental fixed cost
OC is the incremental operating cost and
OS is the incremental operating savings

which is assumed to be zero since the price of imported aerosol grade hydrocarbon is assumed to be the same as CFC-12.

An alternative computation has been made taking a 4 year project life and assuming the hydrocarbon is cheaper than CFC-12 by US$ 1 per kg. The incremental project cost works out to US$ 18,331 and costs per kg. of CFC saved is US$ 0.22.

APPENDIX # 3 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, nor is it carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (voc) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low.

Hydrocarbons are extremely flammable, and explosiveThe storage of the hydrocarbon propellants must be accomplished by strict adherence to the U.S. National Fire Protection pamphlet # 58 standard for the Storage and handling of Liquefied Gases, as well as all applicable local codes and regulations.

The controlling concept for the proper handling of LPG is double protection:

* Eliminate sources of ignition

* Absolutely avoid a dangerous concentration of HAP.

The foreign expert employed to do the training should be familiar with how to manage the control of these two factors.

PROJECT PROPOSAL MAC 01

COUNTRY:	Mauritius
PROJECT TITLE:	Recovery and recycling of CFC-12 in the Mobile A/C Sector
SECTOR COVERED:	Refrigeration and Air-Conditioning
ODS CONSUMPTION IN AFFECTED SECTOR:	2.89 Tons CFC-12 in 1991
PROJECT DURATION:	4 years
PROJECT IMPACT:	Will enable reduction of CFC-12 consumption for mobile a/cs and will enable operation of such systems till retrofitting becomes viable
PROPOSED BUDGET:	US$ 42,000.
IMPLEMENTING AGENCY:	UNEP
NATIONAL COORDINATING AGENCY:	THE MINISTRY OF THE ENVIRONMENT & QUALITY OF LIFE

PROJECT SUMMARY:

Mauritius has a population of about 10,000 a/c cars which use CFC-12 as refrigerant. This would increase to over 12,000 by 1995. After which it is expected that mobile A/Cs based on HFC-134a will be available. Most of these cars are new and would have a life of 10-15 years. New cars based on HFC-134a are expected to be available in a year or two. Retrofitting, may or may not be a viable option economically even if found technically feasible. Hence recovery and recycling would be the appropriate option to conserve ODSs use in this sector and ensure the car a full operating life. The project envisages providing each of the 10 importers who are the only agencies servicing car a/cs with a recovery and recycling machine.

PROJECT TITLE: Recovery and recycling of CFC-12 in the mobile a/c sector.

PROJECT DESCRIPTION:

Mauritius had a population of about 11,150 a/c cars in 1993 which are based on CFC-12 which would increase to over 12,500 in 1995 after which it is expected that all cars would be imported using HFC-134a as a refrigerant.

The cars using CFC-12 are fairly new and have a life of 10 - 15 years. The recharge requirement of CFC-12 for this sectorwhich was 2.89 Tonnes in 1991 is expected to increase to 4 Tons by 1995.

The recharging and servicing of the a/c's of these cars is carried out only by the importers of the cars.

There are 10 importers of cars in Mauritius dealing in different makes of cars.

With the commitment of the Government to phase out ODSs at the earliest the options in this sector are either to retrofit with HFC-134a based systems or implement a program for recovery and recycling.

Retrofitting has yet to be proven and established and could entail very high costs since HCF-134a based a/c's are themselves a recent development and each individual car would have to be retrofitted itself is also currently very expensive and the costs of the initial charge on retrofitted cars would be significant.

Recovery and recycling is thus the preferred option.

Since there are 10 importers in Mauritius and since they alone service mobile a/c's it is administratively feasible to install a recovery and recycling equipment with each importer.

The 10 importers are, in alphabetical order:-

ABC MOTORS	-	Nissan
ASAS	-	Mazda
BEECHAND	-	Toyota
EAL MAN HIN	-	Honda
HYUNDAI	-	Ford
IFRAMAC	-	Mercedes Benz, Peugeot
LEAL	-	BMW, Fiat, Hyundai
PEERMAMODE	-	Subaru
RAOUF Dusmohammed	-	Proton
SCOTT	-	Renault

This project envisages providing each importer with a recovery and recycling equipment, the costs of which alongwith cost of training would require to be met by the Multilateral Fund. This will be supported by a regulatory measure introduced by the Government requiring all servicing agencies of mobile a/c's to install recovery and recycling equipment.

An alternative considered has been to provide each importer with just a recovery machine and set up a central recycling unit. However, given the volumes per importer it is unlikely that they will be motivated to comply with the logistics imposed by the system.

It is considered more appropriate though at higher cost to provide a recovery cum recycling machine at each service installation.

PROJECT DURATION:

The project is simple and can be implemented within three months and have, as such a life of over 10 years.

PROCUREMENT:

There are many suppliers of recovery and recycling equipment the world over. The costs used in this proposal relate to machine that is supplied by SKYE in Australia. While the machine is relatively easy to operate, an initial training of 3 days is recommended to be imparted by the equipment supplier.

OUTPUTS:

In the first four years the quantity of CFC-12 saved through the project will be 5.5 Tonnes.

BUDGET:

The projected expenditure for the project are given herein:-

US$(000)

Year	1994	1995	1996	97
Capital Costs	24.000			
Cost of Training (through a common seminar)	15,000			
Operating Cost	1666	1631	1597	1563
Savings of CFC 12 (tons)	1.4	1.4	1.4	1.3
Total incremental cost at 1993:	26,006			
ODS saved	5.5 Tonnes			

IMPLEMENTATION ARRANGEMENTS:

The implementing agency for the project will be UNEP. The national agency responsible for coordinating the project will be the secretariat in the ministry of the Environment and Quality of Life responsible for implementing the Country Program and also reporting on the project.

The financial intermediary envisaged for receipt and disbursement of funds is the Development Bank of Mauritius.Details of arrangements are to be worked out.

Annexure 3.2

PROJECT PROPOSALS FOR FUNDING IN PHASE 2

This annexure lists the projects which are an integral part of the set of actions for implementing phase-out, in respect of which detailed proposals would be prepared in consultation with affected user sectors once the secretariat is constituted in the Ministry of the Environment and Quality of Life to implementing the Country Programme.

The incremental costs furnished at this stage are therefore only indicative and would be revised when the detailed proposal is worked out.

Sector	Project	Incremental Cost *	Benefit (ODS Saved)
Refrige-ration & Air-Condi-tioning	Training of Technicians to improve practices	US$ 55,000	CFC-11 2.18 MT CFC-12 11.73 MT CFC-115 0.33 MT
Domestic Refrige-rators	Using 50% water in blowing of insulation foam	US$ 121,009	CFC-11 11.8 MT
Fire Fighting	Recovery of Halons from non-essen-tial uses & maintaining a Halon bank	US$ 112,117	Halon 1211 11.5MT

* Worked out considering 4 years of project life.

Annexure 3.3

This annexure lists those projects which are required to be executed as part of the program of actions for implementing phase-out in respect of which only tentative estimates are available of costs. Proposals for these would be worked out and submitted by the Country at an appropriate time.

Sector	Project
Domestic Refrigerations	Switch to HCFC-123 for foam blowing.Investments in manufacturing facilities to produce HFC 134a based fridges.
Commercial Refrigeration - Cold Rooms - Bottle Collers - Display Cabinets	Retrofit CFC-12 based equipment to HFC-134a
Commercial Air-Conditioning Centrifugal Chillers	Retrofit to HCFC-123
Others	Retrofit to HFC 22/134a
Ref. A/C	Set up infrastructure to recover CFC's from decommisioned equipment.
Foam	Study and assess the effect of Methylene Chloride on workers and making improvements in facilities for safe use.