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

Eleventh Meeting
Bangkok, 10-12 November 1993

# COUNTRY PROGRAMME: INDIA

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 India

(d) The Country Programme

# INDIA COUNTRY PROGRAMME
# EVALUATION SHEET

The India Country Programme is submitted to the Eleventh Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/11/20.

It consists of:

- Letter of Transmittal
- Country Programme Cover Sheet (Prepared by the Secretariat)
- The country programme document divided into
  - Introduction
  - Current Situation
  - National Strategy and Action Plan
  - Resource Requirements
- Addendum which provides corrigenda, additional information or clarification of some sections of the document.

India produces ozone-depleting substances (ODS). In 1991, India produced 9,280 tonnes of ODS (9,278 Tonnes ODP) of which 490 tonnes (490 tonnes ODP),about 5 per cent of production, was exported. At the same time, 1,580 tonnes equivalent to 4,323 ODP tonnes was imported. Thus nearly 70 per cent of the total consumption of India in 1991 of 13,111 tonnes ODP was met by domestic production. All the demand for CFC-12 and almost all (98 per cent) of the demand for carbon tetrachloride (CTC) and methyl chloroform (MCF) respectively were met through domestic production. However, all the required Halon 1301, 91 per cent of the required Halon 1211, 88 per cent of the required CFC-113 and 27 per cent of the required CFC-11 were imported. CFC-11 was imported as a component of polyol formulation for the polyurethane foam industry.

The annual installed capacity for the production of CFC-11, CFC-12 and HCFC-22 is estimated to be 30,000 tonnes with four producing and one idle plants. The four plants are swing plants which are also producing HCFC-22. There are four manufacturers of carbon tetrachloride (two of which are small) with a total installed capacity of 15,000 tonnes per year. These plants also produce other fluorocarbons. The actual production of CTC in 1991 was 3,920 tonnes. One plant is due to start production of chlorocarbons in 1994 and will also produce CTC. One manufacturer of methyl chloroform with installed capacity of 3,600 tonnes per year produced 540 tonnes in 1991.

Halon production started in 1991 with the production of Halon-1211 in one of two enterprises with planned installed capacity of 500 tonnes per year each. Halon 1301 production was expected to start in March 1993. Production of Halon-1211 and Halon-1301 in the other enterprise was expected to start at the end of 1993.

The capacity utilization of the production enterprises is generally low, but is expected to grow.

The consumption of ODS by substance in 1991 is summarised on page 1 of the Country Programme Cover Sheet. The solvent sector accounts for the highest consumption of 37 per cent of the total consumption. The consumption in the other sectors were: fire-fighting 28 per cent, refrigeration/air-conditioning 15 per cent, foams 12 per cent and aerosol 8 per cent. The unconstrained demand scenarios indicate accelerated ODS consumption arising from factors that are characteristic of a growing economy. The ODS consumption in 2010 compared to 1991 is expected to increase by a factor of about 5 in the fire-fighting sector to a factor of about 24 in the solvent and aerosol sectors.

There are eight refrigerator manufacturers, four of which also manufacture compressors and two compressor manufacturers. The installed capacity of the refrigerator manufacturing sub-sector is 2.5 million units. About 1.4 million units were produced in 1991. The total population of domestic refrigerators in India in 1991 was estimated to be 8.3 million units. There were similarly considerable activities in the other refrigeration sub-sectors.

235 enterprises have been identified in the foam sector of which about 20 per cent are large to medium scale manufacturers and the rest small scale manufacturers.

In the aerosol sector, 200 enterprises ranging from small to large scale have been identified. However, it is believed that many more, particularly in the small scale sector are yet to be identified. 45 million cans of aerosol spray were produced in 1991 of which 90 per cent contained CFC as propellant.

The small scale sector is significantly large, accounting for about 66 per cent of the total ODS consumption. There are estimated to be 2 million units employing about 13 million persons in the organized small scale sector alone and an equal number in the informal sector. There are also said to be about 6,000,000 unregistered small scale industrial units. Although some have been identified, the full extent of the involvement of these small scale units in the ODS-using industries is not known.

The strategy adopted commits the Government to adhere to the provisions of the Montreal Protocol for the phase-out of ODS production and consumption subject to availability of funds and required substitute technologies. Hence, production and consumption of ODS will be phased-out within the time frame and limits specified by the Montreal Protocol. "India's demand for ODS substitutes, substitute products and technologies for ODS products, related equipment and raw materials will be met as far as possible by local production." India is presently self-sufficient in CFCs and CTC and efforts will be made to maintain such status in respect of substitutes as well.

The ODS using and producing industries in India are in their "infancy" and a steep rise in their growth rates are anticipated. The ODS consumption profiles as dictated by the phase-out scenario thus indicate gradual increase in consumption of all ODS from 1991 which reaches a peak level in 1996/1997, (except in the halon sector where the peak level would be reached in 1995) after which consumption is frozen within the Protocol limits (for 4 years in the case of CFCs and 10 years in the case of halons) and/or phased down until complete phase-out in 2010. Assuming that available ODS production capacity is utilized, production would follow similar trend. It is estimated from the profile that production of halons, for instance, for domestic use for the 19 year period 1991-2010, would exceed 82,000 ODP tonnes.

The strategy seeks to ensure that small enterprises are not adversely affected by the phase-out process. It also places emphasis on conduct of studies, and establishment of technology assessment centres for adaptive research and development and economic and technical appraisal of projects.

A three-phase Action Plan covering the periods 1993-1997, 1998-2000 and 2000-2010 has been formulated to support the strategy. This is reproduced in the Country Programme Cover Sheet (page 9).

The main elements of the Action Plan are restrictions on some production and use of ODS, creation of awareness; establishment of a "Reward Fund"; technology transfer, which includes evaluation of substitutes and substitute technologies, development of cleaning processes, adaptation and test manufacture of non-ODS, conversion of manufacturing facilities for production; recovery, recycling and monitoring.

In place of a list of projects, a Table indicating the net incremental costs of ODS phase-out by sector and sub-sector has been provided. The addendum to the Country Programme explains that a list of projects by sector with indication of phase-out of ODS and associated incremental cost has not been provided since India has all the ODS producer and user industries in the private sector which would consider project preparation only after the approval of the Country Programme. Thus it was hoped that unit wise project would be ready in each of the sectors by 1995.

The total net incremental cost is estimated to be US $1,964 million. It is expected to phase-out 199,308 tonnes ODP. However, ODP to be phased-out indicated in the list actually represents the unconstrained consumption in the year 2010 rather than consumption to be phased-out. It is to be understood that the figures for the small scale sector might change after the survey being conducted into the sector.

Institutional framework for implementing and monitoring the implementation of the country programme has been formulated.

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ANIL AGARWAL
DEPUTY SECRETARY (OZONE)

No.4(1)/1/92-IC-I
Dt. Sept. 23, 1993.

Dear Dr. El Arini,

I am enclosing two copies of the English version of the Country Programme for presentation to and approval by the Executive Committee of the Multilateral Fund for implementation of the Montreal Protocol at its eleventh meeting during 10-12 November, 1993 in Bangkok. We appreciate the assistance provided by the UNDP as implementing agency in the preparation of the Country Programme.

There are, however, some important issues related to the national strategy that I would like to draw your attention to. Firstly, the ODS usage in the Small Scale and Informal sector in India is approximately two third of the total consumption. Considering the large number of units, their dispersed nature and size, it has become essential to separately deal with this sector. Secondly, as the throw away practices are non-prevalent, the domestic refrigeration sector will need separate treatment. Thirdly, India being largely self-sufficient in CFCs, we have provided for transfer of patents and design to recreate this capacity with substitute substances. These requirements are essential to avoid economic dislocation.

The Country Programme provides our initial estimate of US$ 1.9 billion at 1993 prices to meet the incremental costs of the switch over from Ozone Depleting Substances. We have given for each sector the indicative category of projects. The detailed schedule of projects is being developed through a survey of units in the large, medium, small scale and informal sectors.

We are in receipt of Fax dated 9th September, 1993 from your office giving comments of the Fund Secretariat on the India Country programme. The clarifications of our Government on the points raised by the Secretariat are enclosed. This may be treated as an addendum to the Country Programme.

We take this opportunity to thank you for the contributions to the formulation of our Country Programme.

With personal regards,

Yours sincerely,

( ANIL AGARWAL )

Dr. Omar E. El-Arini,
Chief Officer,
Multilateral Fund Secretariat,
Montreal, Canada.

# COUNTRY PROGRAMME

# PHASEOUT OF OZONE DEPLETING SUBSTANCES UNDER THE MONTREAL PROTOCOL

**Government of India**
**New Delhi, India**

**September 1993**

# CONTENTS

# TABLES

# FIGURES

# 1. INTRODUCTION

## 1.1 Objective

The possibility that the Earth's Ozone Layer, which protects life on Earth from the sun's harmful radiation, will become seriously depleted is a unique environmental problem. The problem threatens not only human species but plants and other animals as well, and requires urgent international action. International efforts to resolve the issue began in 1977.

India became a Party to the Vienna Convention on June 19, 1991 and the Montreal Protocol on Substances that Deplete the Ozone Layer on September 17, 1992. Since its annual calculated level of consumption of the controlled substances listed in Annex A of the Protocol is less than 0.3 kilograms per capita, India's operating position is under paragraph 1 of Article 5 of the Protocol. India, therefore, qualifies for financial and technical cooperation, including transfer of technologies, through the Financial Mechanism of the Protocol in order to enable compliance with the control measures of the Protocol.

India's per capita level of consumption of Ozone Depleting Substances (ODS) defined in Annex A of the Protocol is at present less than 10 gms. and not likely to cross 20 gms. between 1995-1997, as against 300 gms. permitted under the Protocol. India is self sufficient in the production of chlorofluorocarbons (CFCs), and is expected to become self-sufficient in the production of Halons.

The National Programme for Phaseout of ODS has been prepared to ensure the phaseout of ODS according to the national industrial development strategy, without undue burden to the consumers and the industry; and for accessing the Protocol's Financial Mechanism in accordance with the requirements stipulated in the Report of the Second Meeting of the Parties in London (June 1990).

The objectives are to:

- implement the phaseout without affecting industrial and economic growth in the affected sectors and while protecting consumer interests,
- to meet the demand for substitutes, as far as possible, from local production,
- reflect the commitment to achieve compliance with the obligations as a Party to the Protocol, despite the difficult economic, technological and social problems that India will face in implementation. For example, one of the key considerations is refrigeration, which normally has a major role in the production, conservation and distribution of food everywhere. But

in the tropical climate of India it also has a special role in health programmes and productivity,

- present the data, information and analyses from which the approach to phaseout ODS has been developed, in order to indicate the overall strategy, action plan, institutional framework and policy framework for implementing, in a coordinated, streamlined and cost-effective manner, the phaseout of ODS and the adoption of substitutes and associated technologies,

- budget the cost of ODS phaseout and substitution in terms of the net incremental costs and determine the basis for estimating total phaseout costs.

- serve as the basis for monitoring the progress of implementation of the action plan, the extent of compliance with control measures, the effectiveness in reducing the consumption of ODS, and the need for altering priorities or programmes in the execution of the Country Programme.

The Country Programme is contingent on assistance for funding the component of incremental costs, including for transfer of technology, from the Multilateral Fund of the Protocol. The Country Programme is a dynamic document and will be updated in the light of the availability of substitutes and related technologies as well as review of transfer of technology and provision of adequate funding to meet incremental costs.

The Country Programme has indicated for each sector the indicative categories of projects which have been considered, with the assumption that each identified medium to larger sized unit would constitute an individual project. Small projects would be aggregated into larger umbrella projects coordinated by the Development Commissioner for Small Scale Industry (DCSSI). The first update of the Country Programme in 1995 would utilize the results of completed, detailed surveys of ODS usage in the large-to-medium size, small scale and informal sector and will finalize an overall database from which a detailed schedule of projects for submission would be developed*.

* Five projects have already been approved by the Fund in its 10th meeting.

## 1.2 Status

### *Process of Programme preparation*

In May 1991, before India's accession to the Montreal Protocol, the Ministry of Industry, Government of India, constituted a Task Force for formulating the national strategy for phasing out ODS and for adoption of substitute substances and related technologies. Three Sub-committees of the Task Force in the following sectors were also constituted to examine the various aspects of ODS phaseout:

- Refrigeration and Air-conditioning
- Fire-fighting (Halons)
- Electronics, Foams and Aerosols

The Sub-committee reports, submitted in December 1991 were integrated into the Task Force Report which was submitted to the Government in March 1992. Consequent to India's accession to the Montreal Protocol, and the major policy decisions emerging from the Third Review Meeting of the Parties to the Protocol in 1992, the Task Force Report was updated taking these developments into consideration. The final report was submitted to the Government in March 1993. The Country Programme broadly reflects the directions in the National Strategy recommended in the Task Force Report.

The Ministry of Environment & Forests (MOEF) is the coordinating agency in India for all matters relating to the Montreal Protocol. For preparation of the Country Programme, the MOEF appointed its Ozone Cell as the National Lead agency. The Ozone Cell has prepared the Country Programme with assistance from the United Nations Development Programme (UNDP), the Tata Energy Research Institute (TERI), New Delhi, ministries, representatives of industry and scientific institutions.

The Country Programme has been developed as a result of a unique cooperation between industry and Government organizations. Since the implications of phase out of controlled substances pervade virtually every sector of the economy, the Government's involvement in preparation of the Country Programme also required a cooperative effort between several Ministries.

In early June 1993, the Ozone Cell constituted six industry groups representing the Aerosols, Foams, Halons, Refrigeration & Air-Conditioning, Solvents and Chemical Producer Sectors. These sectoral groups were entrusted with the task of developing sectoral reports in Country Programme format from the report of the Task Force. This required updating and augmentation of some of the data, plans, strategies and costs contained in the Task Force Report. Simultaneously, the MOEF also constituted an Inter-Ministerial Group to review and facilitate the preparation of the Country Programme by providing the views

and inputs of Government on various issues. The following Ministries/Departments were involved:-

1. Department of Industrial Development
2. Department of Small Scale Industries
3. Department of Chemicals & Petrochemicals
4. Department of Electronics
5. Department of Telecommunications
6. Department of Economic Affairs
7. Department of Science and Technology
8. Ministry of Petroleum & Natural Gas
9. Ministry of Defence
10. Ministry of Home Affairs
11. Ministry of Commerce
12. Ministry of External Affairs
13. Ministry of Agriculture

The composite Country Programme was developed through an iterative process involving sectoral meetings followed by two national Country Programme Workshops.

The six sectoral group meetings were convened by the Ozone Cell in mid-June and early-July, 1993, and submitted their draft reports to the Ozone Cell. At the First Country Programme Workshop in New Delhi, July 14-16, 1993, these reports were presented by the sectoral group convenors before approximately 200 participants comprising members of Government Ministries, all sectoral groups, and other invitees from industry, financial institutions, industry associations, academic and research institutions. Sectoral production, consumption and phaseout scenarios upto the year 2010, were presented and inter-sectoral issues were identified, addressed and resolved. The updated sectoral reports arising from the First National Country Programme Workshop were integrated into the first draft Country Programme by the Ozone Cell.

The first draft Country Programme relied on the following documents:

1. Report on "Reducing the Consumption of Ozone Depleting Substances in India - Complying with the Montreal Protocol", (1991). Touche Ross Management Consultants assisted by Cremer and Werner and S.B. Billimoria and Company.

2. Report of Task Force on National Strategy of Phasing Out Ozone Depleting Substances (March 1993). Department of Industrial Development, Ministry of Industry, Government of India.

3. "Technology in Indian Chloro Fluorocarbons, Refrigerants and their Substitutes Industry" (December 1992). A Status Report prepared under the National Register of Foreign Collaboration by Shriram Institute of Industrial Research, Published by Government of India, Department of Scientific and Industrial Research, Ministry of Science and Technology.

4. "1993 Report of the Technology and Economic Assessment Panel", UNEP (July 1993).

The Second Country Programme Workshop was held during 18-19 August, 1993 in New Delhi. The sectoral groups discussed the comments received on the first draft of the Country Programme. Detailed analyses were made on ODS production/consumption in 1991, demand scenarios, phaseout profiles, action plan, indicative list of category of projects, and incremental costs. Presentations were made by the DCSSI, Central Pollution Control Board (CPCB), UNDP, and the World Bank. The Ozone Cell also discussed the project approval process being considered for Country Programme implementation.

Technical assistance for preparation of the Country Programme was received from the following sources.

- Industry
- Government Ministries/Departments

The total cost of preparing the India Country Programme has been estimated at approximately US $ 500,000. This cost was supported as follows:

- Multilateral Fund (through UNDP)
- Government of India
- Indian Industry

Slightly less than one half of the total cost of preparing the Country Programme was funded by the Multilateral Fund through UNDP. The remaining costs have been borne by Government of India and industry.

# 2. CURRENT SITUATION

## 2.1 Production and Consumption in 1991

India commonly produces and uses the following seven of the twenty substances controlled under the amended Montreal Protocol:

| | | |
|---|---|---|
| Annex A Group I | : | CFC-11, CFC-12, CFC-113 |
| Annex A Group II | : | Halon-1211, Halon-1301 |
| Annex B Group II | : | Carbon Tetrachloride (CTC) |
| Annex B Group III | : | Methyl Chloroform (MCF) |

The production, consumption and import of these seven ODS and their Ozone Depleting Potential (ODP)* equivalent in 1991 are shown in Table 1. India's ODS consumption in 1991, assessed on the basis of producers' data and estimates refined by user groups, was about 10370 tonnes. Of this, about 85% was produced domestically and 15% was imported. In ODP terms, the total consumption in 1991 was 13111 tonnes. Approximately 60% of the total Carbon Tetrachloride (CTC) produced in 1991 was used as feedstock for CFC production and pesticides manufacture and was therefore transformed to other substances during the process. The CTC figures shown in Table 1, therefore, exclude this quantity and consist of only the quantity used as cleaning solvent. Figure 1 graphically represents the proportion of production and import of each ODS in 1991.

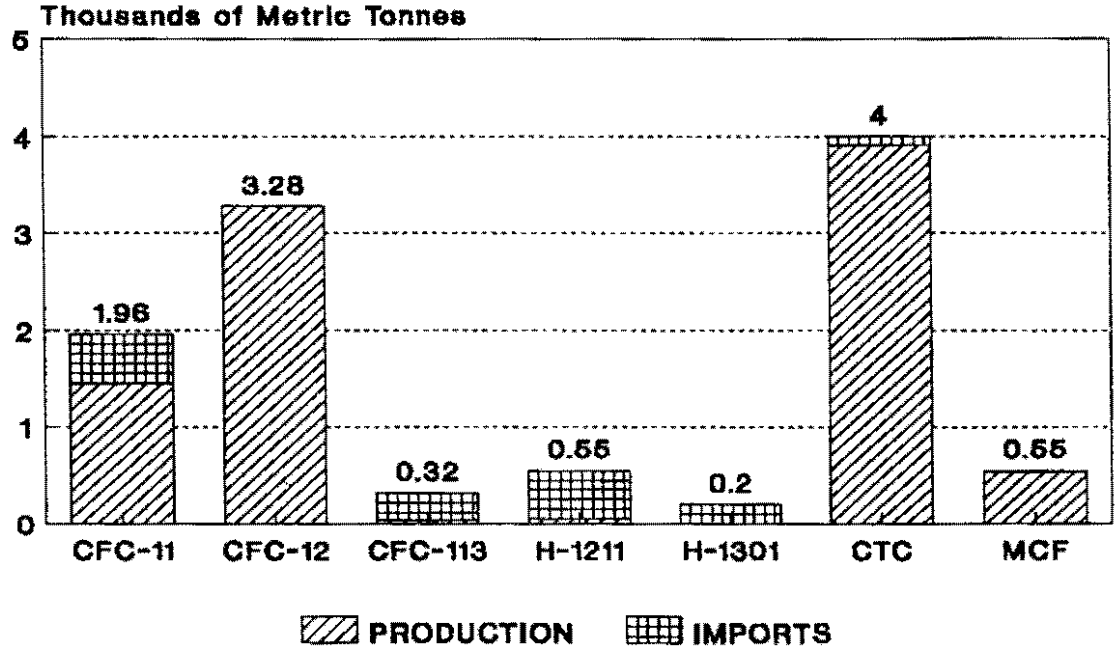


**Figure 1: 1991 ODS Production and Imports.**

* ODP: Ozone depleting potential. ODP is assigned in relation to CFC-11, which is taken as ODP-1.

**Table 1: ODS/ODP Production, Imports, Exports and Consumption in 1991 (Metric Tonnes and percent)**

| Substance/Source | Domestic production | Imports | Exports | ODS consumption | | ODP value | ODP consumption | |
|---|---|---|---|---|---|---|---|---|
| | | | | MT | % | | MT | % |
| **Annex A, Group I** | | | | | | | | |
| CFC-11 | 1450 | 510 | 60 | 1900 | 18.3 | 1.0 | 1900 | 14.5 |
| CFC-12 | 3280 | 0 | 430 | 2850 | 27.5 | 1.0 | 2850 | 21.7 |
| CFC-113 | 40 | 280 | - | 320 | 3.1 | 0.8 | 256 | 2.0 |
| Sub total | 4770 | 790 | 490 | 5070 | 48.9 | | 5006 | 38.2 |
| **Annex A, Group II** | | | | | | | | |
| Halon 1211 | 50 | 500 | - | 550 | 5.3 | 3 | 1650 | 12.6 |
| Halon 1301 | - | 200 | - | 200 | 1.9 | 10 | 2000 | 15.2 |
| Sub total | 50 | 700 | - | 750 | 7.2 | | 3650 | 27.8 |
| **Annex B, Group II** | | | | | | | | |
| CTC (used as solvent) | 3920 | 80 | - | 4000 | 38.6 | 1.1 | 4400 | 33.5 |
| **Annex B, Group III** | | | | | | | | |
| Methyl chloroform | 540 | 10 | - | 550 | 5.3 | 0.1 | 55 | 0.5 |
| TOTAL | 9280 | 1580 | 490 | 10370 | 100 | | 13111 | 100 |

Note: 1. Imports of CFC-114 and CFC-115 and exports of CTC were negligible in 1991.

2. A comprehensive data survey is being undertaken to assess ODS consumption in the small-scale and informal sector. It is expected that the historical ODS consumption figures would be increased accordingly.

3. The imports of CTC are being ascertained.

Figure 2 shows the ODS and ODP consumption in India by substance in 1991. CTC was the substance of widest use, accounting for 38.6% of the total ODS consumption, followed by CFC-12 accounting for 27.5%. In ODP terms, CTC accounted for the largest share of consumption (33.5%) followed by CFC-12 (21.7%), Halon-1301 (15.2%), CFC-11 (14.5%), and Halon-1211 (12.6%). CFC-113 and MCF had very small consumption shares. The high ODP consumption of Halons is partly explained by their high ODP values.

The proportions of ODS/ODP consumption in various sectors are given in Table 2 and shown in Figure 3.

In ODS terms, Solvents was the major user sector accounting for 47.7%, followed by Refrigeration and Air-conditioning (R&AC) sector (19.2%), Foams (15.2%), Aerosols (10.6%) and Fire Extinguishing (7.2%). In ODP terms, Solvents was again the largest user sector accounting for 36.6% of the total ODP use. This was followed by Fire Extinguishing (27.8%), R&AC (15.2%), Foams (12.0%) and Aerosols (8.4%). Again, the high ODP consumption in the Fire Extinguishing sector is partly due to the high ODP value of Halons.

The figures are based on available information as the number of units and consumption in the small-scale and informal sector have not been surveyed yet.

**Table 2: 1991 ODS/ODP consumption by sector (Metric Tonnes and percent)**

| | Refrigeration and Air-conditioning | Foams | Solvents | Aerosols | Fire extinguishing | Total |
|---|---|---|---|---|---|---|
| ODS | 1990 | 1580 | 4950 | 1100 | 750 | 10370 |
| % | (19.2) | (15.2) | (47.7) | (10.6) | (7.2) | (100) |
| ODP | 1990 | 1576 | 4795 | 1100 | 3650 | 13111 |
| % | (15.2) | (12.0) | (36.6) | (8.4) | (27.8) | (100) |

The break-up of 1991 ODS/ODP consumption in various sectors disaggregated by substance and application is shown in Table 3.

*India Country Programme, September 1993.*

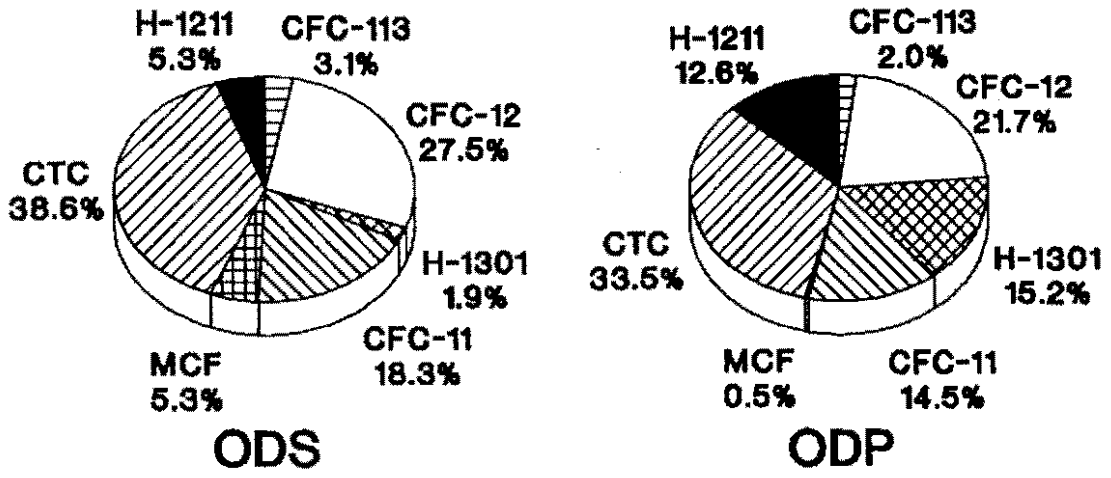


**Figure 2: 1991 ODS/ODP consumption in India by substance.**

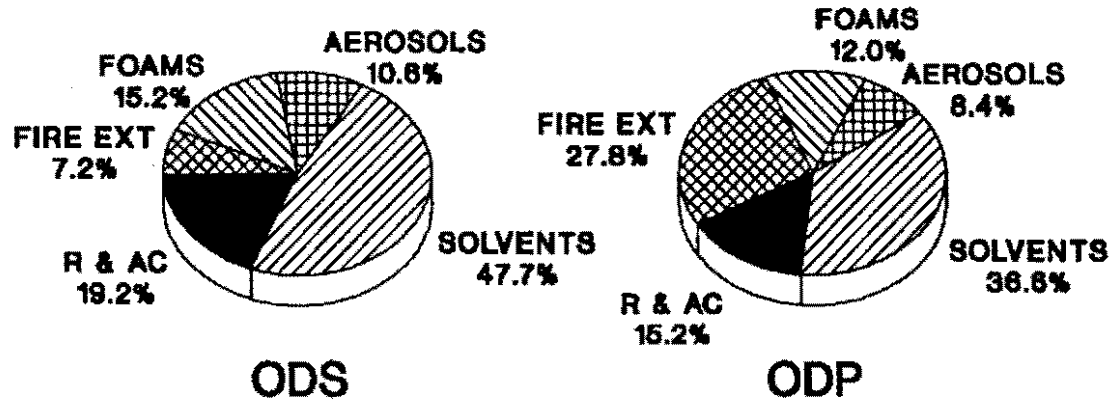


**Figure 3: 1991 ODS/ODP consumption in India by sector.**

**Table 3: 1991 ODS consumption in various sectors disaggregated by substance and application**

| Sector | | Sub-sectors | Application | ODS | Consumption ODS tonnes |
|---|---|---|---|---|---|
| 1. | Refrigeration and Air-conditioning | Domestic refrigerators | Initial charge | CFC-12 | 200 |
| | | | Recharge | CFC-12 | 110 |
| | | Central air-conditioning plants | Initial charge | CFC-11 | 50 |
| | | | Recharge | CFC-11 | 130 |
| | | | Initial charge | CFC-12 | 50 |
| | | | Recharge | CFC-12 | 150 |
| | | Ice candy machines | Initial charge | CFC-12 | 30 |
| | | | Recharge | CFC-12 | 500 |
| | | Refrigerated cabinets | Initial charge | CFC-12 | 30 |
| | | | Recharge | CFC-12 | 70 |
| | | Mobile air-conditioning | Initial charge | CFC-12 | 90 |
| | | | Recharge | CFC-12 | 220 |
| | | Others: water coolers, process chillers, cold stores, walk-in-coolers, room air-conditioners, shipping, etc. | Initial charge | CFC-12 | 110 |
| | | | Recharge | CFC-12 | 250 |
| | | **Sub-total** | | **CFC-11** | **180** |
| | | | | **CFC-12** | **1810** |

*India Country Programme, September 1993.*

| | | | | |
|---|---|---|---|---|
| Foams | Polyurethane foams (PUF) | | | |
| | Flexible PUF | | | |
| | • Slabstock | Mattress, furniture, padding | CFC-11 | 40 |
| | • Moulded | Automotive, furniture | CFC-11 | 160 |
| | Rigid PUF | | | |
| | • Refrigeration insulation | Domestic refrigerators, freezers | CFC-11 | 500 |
| | • General insulation | Cold storage, boilers, buildings | CFC-11 | 240 |
| | • Thermoware | Thermo-bottles, casseroles | CFC-11 | 220 |
| | Thermo plastic foam - polystyrene, polyolefinic | Fastfood - packaging | CFC-11<br>CFC-12 | 70<br>280 |
| | Miscellaneous: | Building, shoe industry, furniture, automotive, packaging etc. | CFC-11<br>CFC-113 | 50<br>20 |
| | **Sub-total** | | **CFC-11**<br>**CFC-12**<br>**CFC-113** | **1280**<br>**280**<br>**20** |

| | | | |
|---|---|---|---|
| Solvents | Electronics | CFC-113 | 150 |
| | | CTC | 80 |
| | | MCF | 30 |
| | Textile cleaning | CTC | 600 |
| | Pharmaceuticals | CTC | 1060 |
| | Pesticides | CTC | 800 |
| | Rubber industry | CTC | 320 |
| | Chemicals & laboratory | CTC | 70 |
| | | MCF | 50 |
| | Sterilization | CFC-113 | 10 |
| | | CFC-12 | 100 |
| | Metal cleaning, precision cleaning | CFC-113 | 130 |
| | | MCF | 40 |
| | Miscellaneous uses | CFC-113 | 10 |
| | | CTC | 1070 |
| | | MCF | 430 |
| | **Subtotal** | **CFC-12** | **100** |
| | | **CFC-113** | **300** |
| | | **CTC** | **4000** |
| | | **MCF** | **550** |

*India Country Programme, September 1993.*

| | | | | |
|---|---|---|---|---|
| Aerosols | Personal products: perfumes sprays, shaving foam, industrial aerosols: silicone sprays, mould release; household products: room fresheners, insecticides; automotive products: paints, tyre inflators; pharmaceutical products | | CFC-11<br>+ CFC-12 | 440<br>660 |
| Fire Extinguishing | Fire extinguishing<br>Fire extinguishing | Portable system (partly fixed<br>Fixed system systems) | H-1211<br>H-1301 | 550<br>200 |
| | **TOTAL** | | **CFC-11**<br>**CFC-12**<br>**CFC-113**<br>**H-1211**<br>**H-1301**<br>**CTC**<br>**MCF** | **1900**<br>**2850**<br>**320**<br>**550**<br>**200**<br>**4000**<br>**550** |

Note:
1. The figures are based on best-available estimates.
2. Data for the small-scale and informal sector are to be verified after survey.
3. Inhalants have not been taken into account as they are an essential use, for which no substitutes are available.

## 2.2 Unconstrained Demand Scenario

India is a developing country that has enjoyed relatively rapid rates of economic growth during the eighties and early nineties, that have spurred both industrial and consumer demand. The current development strategy of the Government centers around macro economic stabilization to serve as a basis for rapid long term growth while at the same time addressing the basic structural imbalances in the economy. The key objectives are to raise Gross Domestic Product (GDP) growth to about 6 per cent year. These measures are leading to a more dynamic and competitive industry, and to a burgeoning demand for consumer goods, particularly white goods (consumer durables such as refrigerators, washing machines, cooking ranges). It is expected that the economy will speed up in the coming years, and goods such as refrigerators and air-conditioners, considered luxury items today, will be commonly used household items by the year 2010.

ODS use in India is in sectors that produce consumer and essential goods & services, e.g., refrigeration and air-conditioning, aerosol sprays, foam products, electronic devices, light engineering goods, etc.. Sales of such consumer goods have been increasing at an overall annual growth rate of about 15% during the eighties, as real per-capita consumer spending has been rising at 2.4% per year; unrelated to the GDP growth rates. This increase is because of various factors such as the increased competitive nature of the market due to liberalization of the economy; increasing per capita incomes; and, most importantly, due to the increasing ease in the availability of consumer credit.

It is anticipated that the prime market for consumer goods and services will be largely confined to the top 20-25% of the population who account for 50% of the national income. This population class, which will number over 45 million households in 2000 and about 60 million households in 2010 (equal to the current number of households in Germany, France and Britain, combined), is expected to sustain annual growth rates of 15 to 20% in most consumer goods and services over the next twenty years.

As a part of this trend, the consumer electronics industry has grown at a rate of about 25% per annum during the eighties. This rate of growth is expected to continue as the penetration of consumer electronics goods increases from the present low base.

Domestic refrigerator penetration in the population has been increasing at about 1% per year and is currently at a level of about 10%. Current penetration in urban and rural markets are 14.3% and 1.5% respectively; with the total penetration remaining at 4.6%. Penetration in the Upper Higher Income group is 88% and in the Higher Income Group about 52%. With changes in taxation, spurt in demand from 1995 is anticipated. A major upsurge in demand on account of increase in the replacement demand during the period 1998-2002 is

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*India Country Programme, September 1993.*

also expected. Present production growth rates are nearly 20%, and it is estimated that nearly all urban households and 50% of rural households would be owning refrigerators in 2010.

Refrigeration requirements are also rapidly increasing in the food processing and health delivery systems, and these growth rates are expected to continue to grow as these systems expand. The upsurge in the demand for air-conditioners is expected to be greater compared to refrigerators. It is important that post sales service operators are fully exposed and trained, as these activities have mushroomed in every city in the informal sector.

Aerosol sprays have been recently introduced in the Indian market, and are rapidly penetrating various user sectors. The growth rates are expected to be of the order of 20% during the nineties. Penetration is estimated to be especially rapid for insecticides. It is projected that the usage level in 2010 amongst urban households and 50% of rural households would be about 1.5 cans per year, i.e, about 20% of the current level of European usage.

India is a vast country with a highly diversified industrial structure. The use of ODS in India started in the various end user sectors at different times and it today pervades a large number of sectors. The forecast for increased ODS consumption is based on the development plans for each sector. The present estimates of unconstrained ODS/ODP demand by substance and by sector are given in Table 4 and Table 5 respectively. Figure 4 illustrates the forecast sector-wise unconstrained ODP demand between the years 1991 and 2010. Figures 5 and 6 show the break-up of the unconstrained demand in 2010 by substance and sector, respectively.

The following are the salient features and underlying assumptions of this demand forecast:

***Refrigeration & air-conditioning (1991: 1990 ODP tonnes, 2010: 23760 ODP tonnes).*** The growth rates for individual applications were developed by studying past growth trends, the present market situation and the anticipated growth in consumer demand. The demand growth has largely followed the sigmoidal (S-shaped) market penetration curve for consumer goods. A demand growth rate of 15% per annum over the period 1991-2010 is anticipated for: refrigerated cabinets (deep freezers, ice-cream cabinets, bottle-coolers, visi-coolers), car air-conditioners, bus/van air-conditioners and refrigerated road transports, central air-conditioning plants, process chillers, room air-conditioners and packaged air-conditioners. For ice-candy machines and cold stores a higher annual growth rate of 20% is expected. Water coolers, walk-in-coolers and other applications (shipping, etc.) will grow at 10% annually. In case of train air-conditioning, the following growth scenario is taken: Air-conditioned

(A/C) coaches produced per year 1991-1995: 150, 1996-2000: 200, and 2001-2010: 250.

Domestic refrigerator penetration in the population has been increasing at about 1% per year and is currently at a level of 10%. However, the penetration in rural areas (where 70% of India's population lives) is only about 1% and provides a huge rural market waiting to be exploited. With incomes rising in the rural areas and the increasing penetration of other household goods like Audio systems, televisions and videos it would be logical to expect a higher penetration of refrigerators in the rural sector. Further, even in urban areas, where the purchasing power is higher the penetration is of the order of only 11 to 12% and the urban sector itself is a big unexploited market. Added to all this is a series of recent developments which will fuel and accelerate the demand for refrigerators and air-conditioners, and other R&AC applications.

(a) Reduction in excise duties by the government. Excise duties form a sizable proportion of the prices of appliances. Since consumer durables are highly price-elastic, the continuing reduction in their duties will further encourage market growth in the referigeration and air-conditioning sector.

(b) The government's policy of liberalization has resulted in a number of tie-ups with multinationals with buy-back arrangement for exports and this also will give an impetus to growth.

(c) Greater penetration and availability of electricity in rural areas, as part of the government's electrification programmes (wherever the private sector is not allowed to generate electricity) will also increase the demand for electrical power driven appliances.

(d) The greater emphasis laid on the food processing industry and Health Delivery Systems will generate a great demand for cold storages, walk in coolers, refrigerated cabinets and refrigerators.

(e) The trend now slowly emerging for larger sized refrigerators, at least in the up-market segment, will also contribute to the high quantities of CFC consumption.

(f) As the industry is already 30 years old, replacement of refrigerators adds to the market growth.

For these reasons, it is projected that growth will continue at the 20% level till 1998, and then reduce to 15% between 1999 and 2005, and to 10% between 2006 and 2010.

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*India Country Programme, September 1993.*

***Foams (1991: 1576 ODP tonnes, 2010: 16555 ODP tonnes).*** CFCs are now used in all foam-blowing applications. Refrigeration insulation accounts for a significant share in the total demand for foams. The annual growth rate of rigid foams is linked to the expected growth rate in the R&AC sector. Foams demand is increasing because the refrigeration market is experiencing a product-mix change, with large refrigerators now at 10% of the market vs. 5% previously. In the past five years, about 75% of refrigerator production has shifted to CFC-based foams. The shift is expected to be complete by 1995; particularly with the increasing consumer preference for frost-free refrigerators.

Other foams (for slabstock, moulded, general insulation, thermoware, thermo-plastic and phenolic foams etc.) use CFC-11, CFC-12 or CFC-113. In other countries, foams growth is generally along the lines of GDP and although Indian consumption is currently below average, it is growing upward and is expected to achieve higher growth rates with greater penetration into rural markets and transportation. Additionally, more construction foam materials are being used in order to improve energy efficiency (air-conditioning). For CFC-11 foams, growth rates of 12% per annum are expected from 1993 through 1996, 9.5% from 1997 through 2005, and 8% from 2006 through 2010. For CFC-12 foams, growth rates of 18% are expected from 1991 to 1996, 10% from 1997 through 2005, and 8% from 2005 through 2010. The growth rate of CFC-113 demand is anticipated to be 17.5% from 1991 through 2003, 10.5% from 2004 through 2005, and 8% from 2006 through 2010.

***Solvents (1991: 4795 ODP tonnes, 2010: 116573 ODP tonnes).*** In the solvents sector, which enjoys a large rapidly growing export market, the application-wise growth expected till 2010 is as follows: Due to government incentive programmes which are encouraging the rapid growth of entrepreneurial small scale circuit board manufacturing, electronics applications are expected to grow at 25% from 1991 through 2006 and 20% thereafter upto 2010. Several private sector companies are now producing new non-steroidal anti-inflammatory drugs whose demand is rapidly growing in the domestic and export market. Thus, pharmaceutical applications are expected to grow at 20% and pesticides at 15% from 1991 through 2010. The growth rate in the sterilization industry is taken as 20% from 1991 through 2000 and 15% from 2001 through 2010. With two new plants expected to come on stream to meet market demands, chlorinated rubber industry is expected to grow at 55% from 1991 through 1996, 35% from 1997 through 2000, 15% from 2001 through 2006, and 10% from 2007 through 2010. The growth rate for metal cleaning and precision cleaning, textiles and other applications is expected to grow 15% from 1991 through 2010.

***Aerosols (1991: 1100 ODP tonnes, 2010: 26120 ODP tonnes).*** Aerosols were relatively scarce in India till the mid-eighties, but production growth

rate is now extremely rapid, even on a low base. A reduction in excise duties has stimulated cosmetic sales and has brought multinational corporations in India to produce for this newly emerging customer base. There has been a large unfulfilled need in India for personal care products and insecticides. This need is now being met through numerous aerosol fillers producing both insecticides and deodorants in the small scale and informal sector. The demand for CFCs in aerosol products is expected to grow at a rate of 20% between 1991 and 2000; 18% between 2001 and 2005; and 15% from 2005 to 2010.

***Fire extinguishing (1991: 3650 ODP tonnes, 2010: 16300 ODP tonnes).*** As a result of (a) the large growth in specific industrial sectors such as electronics, telecommunication, chemicals & petrochemicals and petroleum where Halons are the best option for fire-fighting, (b) rapid growth in international transportation and shipping carriers which are now berthing in India (needing Halons maintenance) and (c) due to increased attention to fire safety requirements and enforcement in India, a growth rate of 15% is expected.

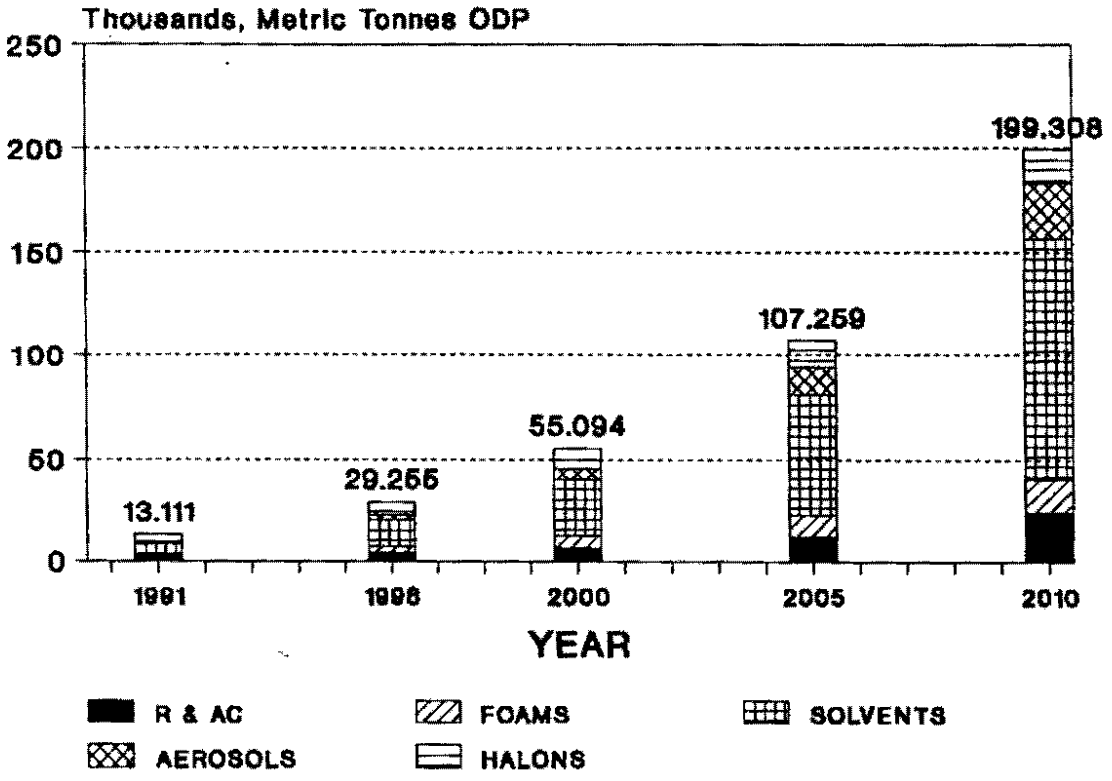


**Figure 4: Estimated unconstrained ODP demand by sector to the year 2010.**

*India Country Programme, September 1993.*

**Table 4: Estimated unconstrained ODS/ODP demand by substance (in 1996, 2000, 2005 and 2010) Metric tonnes**

| | 1991 Actual | | 1996 | | 2000 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Substance | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| CFC-11 | 1900 | 1900 | 4350 | 4350 | 7800 | 7800 | 15500 | 15500 | 27200 | 27200 |
| CFC-12 | 2850 | 2850 | 5960 | 5960 | 10560 | 10560 | 20900 | 20900 | 41200 | 41200 |
| CFC-113 | 320 | 256 | 750 | 600 | 1580 | 1264 | 4240 | 3392 | 10300 | 8240 |
| H-1211 | 550 | 1650 | 1050 | 3150 | 1350 | 4050 | 1750 | 5250 | 2100 | 6300 |
| H-1301 | 200 | 2000 | 340 | 3400 | 500 | 5000 | 800 | 8000 | 1000 | 10000 |
| CTC | 4000 | 4400 | 10600 | 11660 | 23800 | 26180 | 48900 | 53790 | 96000 | 105600 |
| MCF | 550 | 55 | 1120 | 135 | 2000 | 240 | 3560 | 427 | 6400 | 768 |
| Total | 10370 | 13111 | 24170 | 29255 | 47590 | 55094 | 95650 | 107259 | 184200 | 199308 |

**Table 5: Estimated unconstrained ODS/ODP demand by sector (in 1996, 2000, 2005 and 2010) Metric tonnes**

| | 1991 Actual | | 1996 | | 2000 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sector | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| R&AC | 1990 | 1990 | 3780 | 3780 | 6330 | 6330 | 11860 | 11860 | 23760 | 23760 |
| Foams | 1580 | 1576 | 3570 | 3563 | 5910 | 5897 | 10700 | 10684 | 16580 | 16555 |
| Solvents | 4950 | 4795 | 12700 | 12632 | 27820 | 28137 | 57540 | 58465 | 114640 | 116573 |
| Aerosols | 1100 | 1100 | 2730 | 2730 | 5680 | 5680 | 13000 | 13000 | 26120 | 26120 |
| Fire Ext. | 750 | 3650 | 1390 | 6550 | 1850 | 9050 | 2550 | 13250 | 3100 | 16300 |
| Total | 10370 | 13111 | 24170 | 29255 | 47590 | 55094 | 95650 | 107259 | 184200 | 199308 |

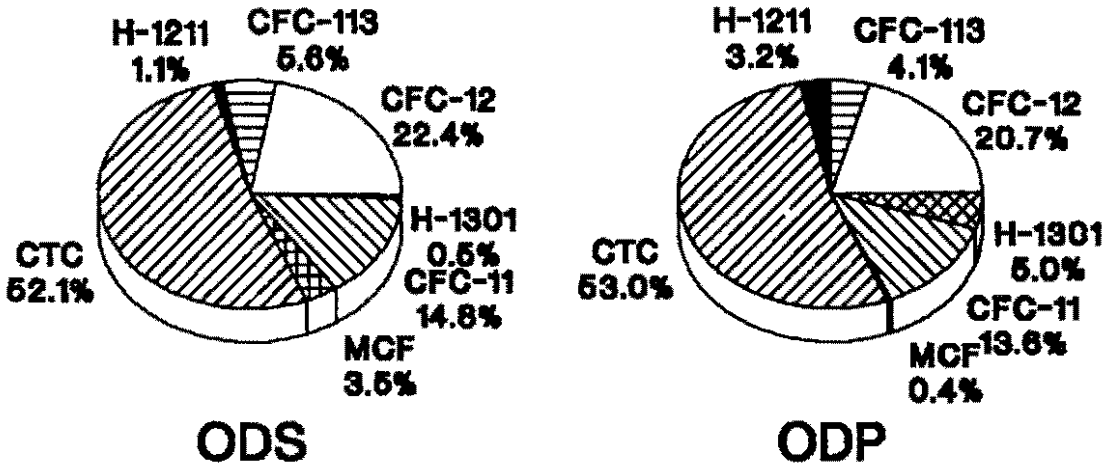


**Figure 5: 2010 ODS/ODP demand in India by substance.**

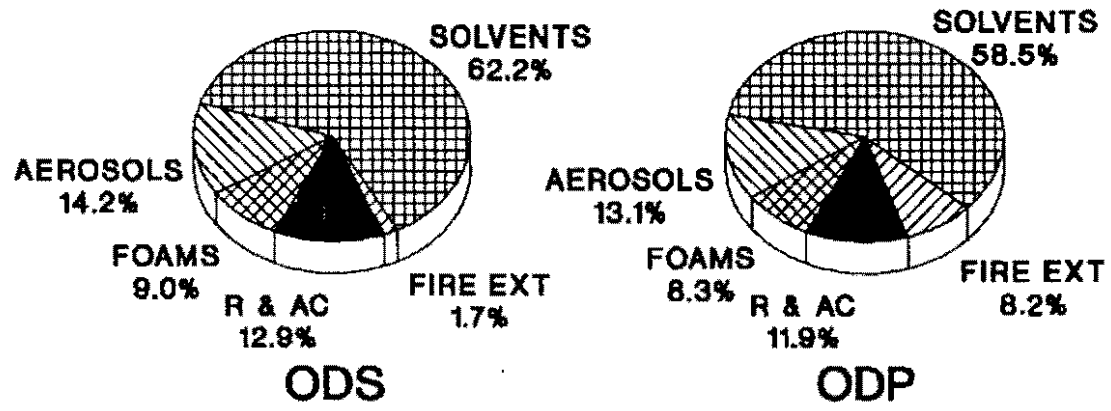


**Figure 6: 2010 ODS/ODP demand in India by sector.**

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*India Country Programme, September 1993.*

## 2.3 Industrial Structure Framework

The manufacturers of ODS as well as those of intermediate goods that use ODS are mostly in the Private Sector. The Private Sector is structured along the following lines:

(a) Large and Medium Scale Industries which include manufacturers of ODS and ODS-using intermediate goods like refrigerators, central air-conditioning and refrigeration plant room air-conditioners, packaged air-conditioners.

(b) Small scale industries which are mainly manufacturers of intermediate goods like Aerosol fillers, refrigerated cabinets, cold storages, flexible and rigid foams, fire extinguishers and also include repair and service shops particularly in the R&AC sector.

(c) Informal units which are mainly manufacturers of intermediate goods like those referred to in the small scale and also include repair and service shops particularly in the R&AC sector.

The small scale sector in India has shown a remarkable performance during the last decade and contributes significantly to the informal sector. The database for SSI is under preparation. It is estimated that two-thirds of total production of CFC is utilized by the small and informal sector.

### *ODS production sector*

CFCs: There are five enterprises in India with capacity to manufacture CFC 11/12. One is currently idle. The total production capacity of these units to manufacture CFC 11/12 and HCFC-22 is estimated to be around 30,000 tonnes per year*. Four of the above plants are swing plants which are also producing HCFC-22. Only one enterprise, with a production capacity of 600 tonnes per annum, manufactures CFC-113. All these enterprises are locally owned, comparatively new and in the private sector.

Existing CFC production capacity, although under-utilized at present, was set up to meet the expanding demand in the future. At present, there is limited commercial import of CFCs. However, some quantities are imported as part of polyol composition for polyurethane foams. CFCs produced in India are mainly for the domestic market with only a quantity of about 490 tonnes exported.

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*. The chemical producers have stated their total capacity to produce CFC 11/12, with minor debottlenecking is about 50,000 TPA.

CTC: There are four manufacturers of CTC in the country, with a total production capacity of 15,000 tonnes per year. Two of these are small plants which produce CTC using Carbon-disulphide; the other two use methanol/methane. They also produce other fluorocarbons. One enterprise is expected to commence production of chlorocarbons during the next year and will also produce CTC as a part of the product mix. About 80 tonnes of CTC was imported in 1991 and a small quantity exported.

MCF: MCF is produced by only one manufacturer with a production capacity of around 3600 tonnes per year. Production during the year 1991 was around 550 tonnes.

Halons: Considering the critical nature of Halon requirements, during 1989 Government of India encouraged two enterprises to produce Halons. These enterprises plan to set up 500 TPA plants each. One of the units commenced production of Halon-1211 in 1991 and Halon-1301 in March 1993. India consumed about 750 tonnes of Halons in 1991 which comprises 550 tonnes of Halon-1211 and 200 tonnes of Halon-1301. About 700 tonnes of Halons were imported during 1991 and 50 tonnes produced locally.

## *Aerosols sector*

In India, there are over 200 identified Aerosol fillers entirely in the private sector - concentrated mainly in the Western and Northern part of the country. These have been categorized as large, medium, and small. It is estimated that many more units exist in the tiny sector. A majority of small and tiny fillers are in the informal sector, manufacturing principally perfume and silicon sprays.

In 1991, consumption of CFC-11 and CFC-12 was about 1100 tonnes (40% CFC-11 and 60% CFC-12). During 1991, 45 million containers were produced, of which over 90% contained CFC as propellant. Destenched Liquified Petroleum Gas (LPG) is also being used by six units, predominantly for household and industrial products.

While some large aerosol fillers have semi-automatic filling machines, most of them are old and outdated. The smaller fillers are predominantly using locally made hand-filling machines. These machines are considered unsafe for filling flammable propellants and would need to be replaced. In addition, many plants have inadequate ventilation for safe filling of flammable propellants and thus would require plant modification or relocation to provide safe filling facilities some would be constrained to switch to atomizers. All facilities will require extensive training for safety measures to switch from ODS.

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*India Country Programme, September 1993.*

The use of CFCs in pharmaceutical inhalation therapy is considered essential and not taken into account in the phaseout.

## *Foams sector*

There are 235 enterprises which have been identified in India that manufacture foamed plastics. There are mainly three foam products which use CFCs as foaming agents i.e. flexible and rigid polyurethane foam, and thermoplastic foams. About 20% of these enterprises are in the large/medium scale, and the remaining are small scale units.

Of the enterprises manufacturing PUF, less than half are flexible polyurethane producers and the rest are rigid PU units. The rigid polyurethane foams are generally used in refrigerators, cold storages, transport refrigeration and thermoware.

There are 4 major polyol system manufacturers who supply bulk of the demand for polyol blends. However, significant quantities of polyol systems are imported in addition to isocyanates which are not produced currently.

It is estimated that a total of 500 tonnes and 780 tonnes of CFC-11 were consumed during 1991 by the domestic refrigeration industry and other foam units respectively amounting to a total of 1280 tonnes.

Producers of phenolic foams, extruded polyolefinic foams and, extruded polystyrene foams also consumed around 280 tonnes of CFC-12 and 20 tonnes of CFC-113.

The following HCFCs are considered in the foam industry as an interim replacement: HCFC-22, HCFC-123, HCFC-141b and HCFC-142b. Only HCFC-22 is currently indigenously produced. The foam industry will adopt technology for HCFC-22 in the early phasing out efforts.

## *Fire fighting sector*

In India, Halon is being produced presently by one producer company, which has a production capacity of 300 tonnes Halon 1211 and 200 tonnes Halon 1301. Halon-1211 production started in 1991 and its production at present is very low. A second enterprise has plans to start production of Halon-1211 by the end of 1993. Production of Halon-1301 is in the early stages. Both facilities have been set up in order to ensure Halon supply for critical uses in India.

India has production of BC powder, water type extinguishants, foam and $CO_2$ for fire-fighting purposes. There are over 200 fire equipment manufacturers in the private sector. Of these, 75% manufacture all types of portable extinguishers, about 15% manufacture all types of fixed systems. Halon based fire protection equipment accounts for about 5% of their total turn over.

## *Refrigeration and air-conditioning sector*

There are about 14 major applications in the Refrigeration and Air-conditioning sector which use ODS. They are refrigerators, refrigerated cabinets, water coolers, automotive (car) air-conditioners, road transport refrigeration and air-conditioning, train air-conditioning, central air-conditioning, process chillers, walk-in coolers, cold stores, ice candy machines, room air-conditioners, package air-conditioning and shipping. Since each application is unique, each is being dealt in detail.

*Domestic refrigerators*: The refrigerator industry in India is 30 years old. There are, at present, eight manufacturers for refrigerators and four of them have captive facilities for manufacture of compressors. Two other manufacturers, who exclusively manufacture compressors, supply to the refrigerator industry as well as to other applications like refrigerated cabinets, water coolers, room AC, etc. Refrigerators range in capacities from 65L to 380L; the 165L unit had 90% of the market sales in 1990; the future demand for larger size refrigerators is expected to grow.

*Refrigerated cabinets*: Totally about 40,000 units are made per annum consisting of deep freezers, ice-cream cabinets, bottle coolers and visi coolers. The refrigerated cabinets is dominated by the informal sector which enjoys around 80% of the total market share presently. Hermetic compressors are supplied by the two compressor manufacturers (referred to under refrigerators) and open type compressors by organized/informal sector.

*Water coolers*: There are five manufacturers in the medium sized sector, with a total capacity of over 27,000 units per annum and they account for 90% of the market share. Current production is estimated to be over 27,000 units annually.

*Automotive (car) air-conditioners*: Manufacturing of car air-conditioners in India started in 1984. At present, there are two manufacturers of car air-conditioners in the organized sector, both of them set up with technology from abroad. A third manufacturer has also recently emerged based on completely indigenous technology. Approximately 40,000 auto air-conditioners are manufactured in India annually. In addition, an equal number, or more, is imported.

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*India Country Programme, September 1993.*

*Road transport refrigeration and air-conditioning:* Air-conditioning and refrigeration systems in buses and vans started in the early seventies. There are three manufacturers in the organized sector. They use local and imported compressors. Few units in the informal sector also assemble these systems.

*Train air-conditioning:* Air-conditioned coaches are manufactured at the coach factories of the Indian Railways at Madras and Kapurthala. The compressors are supplied by four manufacturers in the organized sector. Each coach requires two compressors. Presently about 100 AC coaches are built annually at the Madras factory using CFC-12, whereas the Kapurthala factory has just started production of 50 coaches per annum using HCFC-22.

*Central air-conditioning:* The central plants (using CFC-12, HCFC-22 and CFC-11) as well as compressors used in these plants are mainly manufactured in the organized sector. Four companies make central plants and compressors, while two other manufacture compressors only and feed the other manufacturers and the replacement market. There are three companies which manufacture vapour absorption systems. About 3800 central plants are installed annually.

*Cold stores:* The manufacture of cold storage plants in the country started around mid-sixties. There are over 14,000 plants in the country and most of them use ammonia. A few plants use CFC-12 and R-502 also.

*Ice-candy machines:* Manufacturing is in the hands of units in the small and informal sector. At least a third of the production is in northern India. Detailed information on this sector is being collected since this sector consists of informal units spread out all over the country. They are mostly used in semi-urban areas and small towns. It is estimated that presently about 2500 machines are made annually.

*Room air-conditioners:* The room ACs are made in both the organized and informal sector, the latter accounting for 70% of the production. Hermetic compressors for room air-conditioners are supplied by four companies in the organized sector, three of them also make air-conditioners. The standard models are 1, 1.2, 1.5, 2 and 3 T in window and split types. Most of the room ACs use HCFC-22, but CFC-12 is also used in some of the units. It is estimated that about 138,000 units are produced per year.

*Process chillers:* The process chillers for a large number of industries like plastic, food chemicals, medical diagnostics, etc. (using CFC-12) are made by small manufacturers. The annual production of process chillers is estimated to be about 300 units.

*Walk-in coolers*: There are two manufacturers in the organized sector and several manufacturers in the small scale sector of walk-in coolers. Present production is estimated to be about 500 units per annum.

*Package air-conditioners*: Bulk of the production is accounted for by 5 manufacturers in the organized sector. Technology has been imported by most of the companies. The range of capacities for ACs vary from 3 to 15TR which use hermetic and semi-hermetic compressors and primarily HCFC-22 refrigerant. About 5000 units are estimated to be produced annually.

## Solvents sector

The solvent sector covers a wide range of industrial applications e.g. in electronic industry, metal and precision cleaning, textile cleaning, pharmaceutical and pesticide industry, chlorinated rubber manufacture and numerous other miscellaneous uses. The usage of CTC as a solvent by the Industry is relatively large and accounts for nearly 80% of the total ODS used as solvent.

In the pharmaceutical subsector one of the identified usage of CTC as a solvent is in the manufacture of Ibuprofen and chlorophenesin. There are ten large manufacturers of Ibuprofen in the country, some of which consume large quantities of CTC. Apart from these, CTC is also being used as a solvent in a large number of small scale units manufacturing intermediates for various other pharmaceutical products.

In the pesticide subsector, there are four bulk manufacturers of products like endosulfan, dicofol, etc. where CTC is used as a process solvent. In case of chlorinated rubber, there are three production units using large quantities of CTC. It is estimated that there are about 1200 small units in the electrical engineering sector and a large number of units in the mechanical engineering sector that use ODSs as solvents for a variety of applications.

The solvent sector industrial structure is characterized by the presence of a large number of units in the small scale and informal sector. It is estimated that nearly 70% of ODS solvents consumption is by consumers whose annual consumption is less than 5 tonnes (many of them consume even less than 1 tonne per annum).

## Small scale and informal sector

The small scale sector in India has made remarkable progress during the last decade and contributes significantly to the total industrial production and exports.

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*India Country Programme, September 1993.*

There are about 2 million units employing about 13 million persons in the organized small scale sector; and, an equal number in the informal sector.

The small scale industries sector basically includes enterprises with investments in plant and equipment not exceeding Rs. 6 million and for small scale ancillary and exports oriented units (with an export obligation of 30% of their production) not exceeding Rs. 7.5 million. According to survey information available with the DCSSI, there are about 6,00,000 unregistered SSI units. The informal sector also consists of units which are not registered; a number of informal companies are equal in size to SSI units. Therefore, the ODS consumption of this informal sector is estimated to be at least as large as that of the registered units.

Small Scale industries are not the manufacturers of ODS but are major users in the areas of Foams, Aerosols, Solvents, Halons and Refrigeration (excluding domestic refrigeration) and Air-conditioning. The database for SSI units consuming ODS is under preparation. However, based on available knowledge and information gathered from industry, and the DCSSI, it is estimated that approximately two-thirds of the total production of CFC in the country is utilized by the small scale and informal sector. About 70% of Room Air-conditioners and about 80% of Deep Freezers and Bottle Coolers are manufactured by the small scale sector. Almost all units in the Aerosol sector are in small scale and informal sector. Similarly, 95% of units manufacturing Halon fire extinguishers are in small scale and informal sector. There are 200 identified units in the Aerosol sector (all but one are SSI units) and 188 identified units in the foams sector. Overall, it is estimated that there are around 275 Foam units; about 6000 electronic units engaged in manufacturing and assembly of printed circuit board and various assemblies; and over 500 chemical units in the small scale and informal sector which consume CFCs and other ODSs. Further, it is estimated that there are about 1200 units in electrical engineering sector and large number of units in mechanical engineering sector which use ODSs as solvents. The 1991 composite consumption of these sectors was approximately two-thirds of the total production of ODS in India, and it is even greater today due to the rapid growth in this sector. The number of users of ODS in the informal sector is estimated to be equal to the units in the formal sector, if not more.

## 2.4 Institutional Framework

The Government of India has entrusted work relating to ozone layer protection and implementation of the Montreal Protocol to the MOEF.

The MOEF has established a Steering Committee which is supported by four Standing Committees and responsible for the implementation of the Montreal

Protocol provisions, review of various policy and implementation option, project approval, project monitoring, etc.

Figure 7 shows the Institutional framework for Ozone layer protection in India. The division of responsibility is as follows:

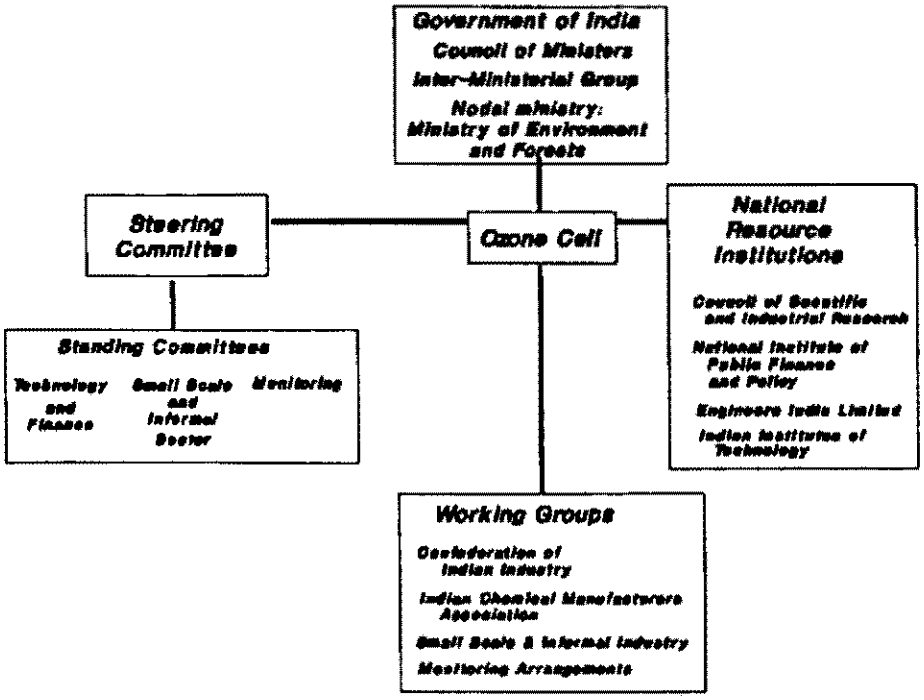


**Figure 7: Institutional framework for the implementation of the Montreal Protocol.**

*Ministry of Environment and Forests*: Ministry of Environment and Forests is the designated National Authority for the implementation of the Protocol and the Country Programme. This includes, notification of related regulations, issues relating to International Cooperation, scrutiny of data relating to production, import, export and consumption and reporting to the Montreal Protocol Secretariat. The Ministry will also coordinate with various other ministries responsible for implementation. The Departments of Chemicals and Petrochemicals and Industrial Development will play a key role in this process.

*Ministry of Industry, Department of Industrial Development*: The Department frames and implements, the industrial strategy for the country. The Department was entrusted with the task of preparation of the National Strategy for Ozone Depleting Substances in 1991.

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*India Country Programme, September 1993.*

*Ministry of Petroleum and Natural Gas*: The Ministry is responsible for ensuring adequate feedstocks of both propane-butane mixtures and commercial propane of acceptable quality for the Aerosol industry.

*Ministry of Chemicals and Fertilizers - Department of Chemicals & Petrochemicals*: The Department is responsible for management of Chemical production in the country. The transition in the chemical industry to facilitate the setting up of units for manufacturing chemical ODS substitute will be managed and implemented by the Department.

*Ministry of Science and Technology*: The Council for Scientific and Industrial Research, within the Ministry of Science and Technology, is the major research and development council in the country and has the task of development of ODS alternates and substitutes and technology development.

*Ministry of Industry, Development Commissioner for Small Scale Industry*: The Department frames and implements national policies with respect to the small scale and informal industry. The Department, through its offices in all district headquarters in the country, provides an outreach and support programme for small scale units.

*Ministry of Commerce:* This ministry implements policies related to imports and exports.

## *Inter-ministerial group*

An inter-ministerial group chaired by MOEF has been constituted to effectively monitor and implement the action plans proposed by the Government. The group consists of representatives of:

1. Ministry of Industry
   - Department of Industrial Development
   - Development Commissioner for Small Scale Industry
   - Directorate General of Technical Development
2. Ministry of Chemicals and Fertilizers
   - Department of Chemicals and Petrochemicals
3. Ministry of Electronics
4. Ministry of Telecommunications
5. Ministry of Petroleum and Natural Gas
6. Ministry of Defence
7. Ministry of Home Affairs (Fire Advisor)

8. Ministry of Finance
   - Department of Economic Affairs
9. Ministry of Commerce
10. Ministry of Agriculture
11. Ministry of External Affairs
12. Ministry of Environment and Forests
    - CPCB
13. Ministry of Science and Technology
    - Department of Scientific and Industrial Research
    - Department of Science and Technology
14. Planning Commission

## 2.5 Policy Framework

The policy framework to phase out ODS has been developed based on the National Strategy drafted for ODS phase out and the Environment Protection policies currently being implemented along with the Industrial and Economic policies of the Government of India.

To achieve the objective of phaseout of ODS, maximum use will be made of a mix of instruments in the form of voluntary agreements, legislation and regulation, fiscal incentives, educational programmes and information campaigns.

It is not enough for the Government to notify laws which are to be complied with. A positive attitude on the part of everyone in society is essential for the phaseout of ODS and wide consultation has been held with those who will ultimately adopt the measures.

A comprehensive approach will be taken to integrate environmental and economic aspects in development planning; stress will be laid on preventive aspects for abatement and promotion of technological inputs to reduce ODS; and reliance upon public cooperation in securing a clean environment to respond to the coming challenges.

A wide range of enterprises have committed themselves to the phaseout of ODS, having in place technologies and practices to effect such change, to measuring their progress and reporting this progress as appropriate. The Ozone Cell will continue this interaction to integrate these policies, programmes and priorities into each business as an essential element of management. The activities will include assessment of technologies, development of products or services, employee education and advice to the consumer. Consumer organizations will also be involved, along with industry associations.

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*India Country Programme, September 1993.*

The Ozone Cell will, directly or through an appropriate institution, conduct a study of the incentive policy to be adopted for ensuring the phaseout. This will include a mix of monetary, fiscal and regulatory measures. The existing "Ecomark", or eco-label scheme will be used to give labels to products manufactured using ODS substitutes or products completely free of ODS. A public awareness campaign on the importance of the ozone layer will also be initiated. A special fund will be established to support and encourage institutions in developing technologies applicable to ozone layer protection in India. Institutional arrangements will also be set up to support phaseout in the small scale and informal sector, according to the technical and socio-economic requirements.

## 2.6 Government and Industry Response

India has been actively associated with the various matters relating to the Protocol from the year 1987. A series of activities was undertaken to gauge the extent of ODS usage and phase out implications since 1989. Before signing of the Montreal Protocol on June 19, 1992, the draft National Strategy for phasing out ODS was already in place. This was prepared by the Task Force constituted for this purpose by the Ministry of Industry, Department of Industrial Development. The Ministry of Science and Technology also documented the various technologies in India for CFC refrigerants and their substitute industries.

It has been decided to use the existing pollution control monitoring institutions at the State level for the purpose of implementation and monitoring the various provisions of the Protocol. The requisite administrative, State level and Ministry level framework will be set up by the relevant authorities.

A notification banning import from and export to non-parties has been issued by the Chief Controller of Imports and Exports, Ministry of Commerce. The above notification also includes Halons.

Research and development activities have been undertaken by various Research Institutions in the country. India has been self-sufficient in ODS production and to maintain this self-sufficiency in substitutes, synthesis of HFC-134a is already completed on a semi-pilot scale. Experiments on HFC-152a and ternary blends are being carried out for use in the refrigerators. Industries are also engaged in substitution research with a direct commercial implication.

The flexible slabstock industry has CFCs already substantially replaced, mainly by methylene chloride. This has, however, created in many cases health hazards through high exposure levels and corrective action is planned. Six units are using destenched LPG as propellant for their captive use.

Major automotive seat moulders have taken positive steps towards a change to CFC-free systems.

Polyol manufacturers and system suppliers are experimenting with the preparation of low CFC and non-CFC systems.

Several rigid foam manufacturers have tried low CFC and HCFC-141b systems.

Various international and domestic activities for exchange of technical policy and related information and technologies have been organized such as:

- Conferences on the Montreal Protocol for Indian Industry in January and March, 1993.
- Halons and the Ozone Depleting Problem: Global Trends-Strategy for India, 1992.
- A number of publications have been published by researchers in various academic journals as well as magazines and newspapers in order to raise public understanding of the importance of Ozone Layer Protection and ODS control measures.

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*India Country Programme, September 1993.*

# 3. NATIONAL ACTION PROGRAMME

## 3.1 Approach

India is committed to adhere to the provisions of the Montreal Protocol for the phase out of ODS production and consumption, provided sufficient funds are made available and required technologies are transferred in accordance with the provisions of the Protocol. In view of the shortage of funds available to industry and the non-availability of appropriate technology, ODS phaseout progress in India will be determined by the availability of assistance from the Multilateral Fund. This assistance is expected to include cost of conversion of existing facilities, costs arising from premature retirement or enforced idleness, and costs of patent and designs and investment costs for establishing new production facilities. Availability of cost effective substitute technology and sufficient financial assistance required for implementation will greatly speed up ODS phase out in India.

India's demand for ODS substitutes, substitute products and technologies for ODS products, related equipment and raw materials will be met as far as possible by local production. India is presently self sufficient in CFCs and CTC. Efforts will be made to maintain this status in respect of substitutes as well.

ODS using and producing industry in India is in its infancy and steep rise in growth rates is anticipated. The demand, therefore, for products manufactured using ODS will be far from saturated even by the year 2010. The phase out of ODS should cause the minimum economic dislocation.

In India, most products have a long life span (as opposed to the throw away practices commonly adopted in some developed countries), and consequently the servicing of products to meet local consumer demands has to be borne in mind so as to ensure that the consumer is not affected by the ODS phaseout strategy. In a tropical country like India, it is necessary to ensure that the consumers are not penalized during the replacement of items like refrigerators. The cost to the consumers for scrapping their equipment is of a major nature (80% - 85%), this can be substantially reduced if drop-in substitutes are used for the equipment with a useful life even after 2010. Refrigerant conservation and recycling projects will be devised to partially offset the costs.

The programme seeks to ensure that the small and tiny enterprises are in no way affected and are fully compensated for phaseout, including appropriate retraining and provision for worker severance. For ensuring this, existing institutions will be strengthened and new institutions set up, if necessary.

National agencies will be strengthened for evolving and implementing the new standards, procedures, programmes and regulations to ensure compliance with the provisions of the phaseout.

Considering the non-availability of appropriate substitute technology in various sectors the country programme will be adjusted as required during the process of implementation based on newer developments, unexpected developments and risks. Indian Government will conduct studies, set up technology assessment centres and organize the technical and economic appraisal of projects to ensure effective and optimum use of grants from Multilateral Fund.

The ODS phaseout in India will be closely integrated to the growth of various sectors, economic reforms growing exports markets the adjustment of the industrial structure and consumer-driven product mix. Relevant fiscal and regulatory mechanisms will be put in place to optimize the phaseout activities.

## 3.2 Technical Concerns

The choice of projects for funding will be guided by the following principles:

1. **Minimize economic dislocation**: The process should not lead to closure of units, loss of productive capacity, or major capital expenditure for modifying facilities (such as existing equipment for production, transport and storage) which could become obsolete. In determining economic feasibility, energy efficiency and machine characteristics will be considered.

2. **Maximize indigenous production**: Transfer of technology and local production of substitutes and equipment will be encouraged. This will require good test methods and facilities.

3. **Preference to one time replacement**: This will be preferred unless there is another more cost-effective alternative; and for which information will be required on the availability and assessment of substitutes.

4. **Decentralized management**: Development of arrangements to facilitate feedback for smooth implementation; including awareness building, training and consumer protection. For efficient ODS phaseout, particularly in the small scale and informal sector, the feasibility of implementation has to be studied and planned.

5. **Development of standards and certification system**: New standards (including those for safety) are needed for production and distribution operations.

6. **Minimize obsolescence costs:** Existing technology would be kept running as long as possible by recycling and using drop-in substitutes while new technologies are phased in as they become available. This will minimize the cost of obsolescence.

The six sectoral working groups of the industry and country Workshops have analyzed the structure of ODS production and consumption in India; projected future growth patterns based on macroeconomic growth estimates and sectoral (and, where necessary, sub-sectoral) development plans; surveyed alternate (non-ODS) technologies available and their suitability for incorporation into the Indian industrial units; and estimated the financial and economic costs of the phase out programmes.

The major principle in all phase out programmes is to evaluate the available technologies and follow them up with large-scale adaptation and dissemination. Wherever possible, it is attempted to identify "drop-in substitutes" which would minimize costs and facilitate phaseout.

Alternate technologies are not available for all ODS applications. The Country Programme will be revised and updated periodically to reflect new technologies available; the progress in phase out implementation; and evolving consumption trends.

## 3.3 Substitutes

The phaseout of ODS production in India, and the introduction of non-ODS substitutes will be based on local production of substitutes. The overall approach will be to ensure the indigenous availability of substitutes while the producer (and user) industry initiates new production lines based on substitutes of choice.

The CFC-11/12, CFC-113, CTC, MCF and Halon production capacities will be limited in accordance with the protocol limitations so as to ensure compliance. The current configuration of the CFC-11/12 producing capacity in the country allows for HCFC-22 swing production capability. This will be promoted as HCFC-22 use is expected to grow rapidly in the R&AC sector. Exports to other Article 5 countries will be encouraged.

The production and availability of Hydrocarbon Aerosol Propellant and not-in-kind substitutes will be facilitated to substitute CFC use in the aerosols sector.

Plants for the manufacture of substitutes (e.g. HFC-134a, HFC-152a, HCFC-142b, HCFC-141b, HCFC-123, etc.) would be established as demand for these substitutes increases, and the demand for CFCs decreases. Simultaneously,

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*India Country Programme, September 1993.*

the ODS production industry will carry out the development processes associated with the purchase, adaptation and adoption of technologies for the manufacture of non-ODS substitutes.

Incremental costs will cover the costs of patents and royalties, capital costs of conversion and establishment of new production facilities (including benefits, gains and operating costs), retraining of personnel, premature retirement and enforced idleness.

## 3.4 Domestic Refrigeration, Industrial/Commercial Refrigeration and Air-conditioning

The principle followed in the technical approach is to, as far as is possible, use non-CFCs (like HCFC-22) made in India to convert products using CFCs. Phaseout of HCFC-22 has not been considered. Substitution technologies which have been proved through international field applications will be adopted by the industry, if technology can be absorbed and adapted locally. Table 6 gives, by subsector and application, the alternatives/substitutes in the Indian context that the sector would rely on for the changeover. These substitutes mentioned are based on current knowledge available. As more alternatives are developed internationally, the list of substitutes/alternative technologies indicated will be updated.

Assessments using the alternatives recommended above will be carried out and, based on the results, the choice for final conversion will be made. In the adoption of substitute refrigerants and technologies, considerations will include cost-effectiveness and that there is no increase in the specific energy consumption of units in various applications. Simultaneously, materials development would be carried out to ensure compatibility of substitutes with lubricants, system components including compressors, and system interconnections.

Attention will be paid to minimize consumer costs due to retirement of CFC-based equipment (particularly domestic refrigerators). Recovery and recycling programs will be established so as to ensure reduced CFC usage and continued availability of CFCs even after the phaseout. Retrofits and drop-in substitutes would also be developed. Towards the end of the phaseout period, CFC based refrigerators that need recharging would be provided an incentive (equal to their residual economic value) to trade in existing refrigerators for CFC-free appliances. All three strategies (recovery and recycling; drop-in substitutes; and trade in) would be pursued so as to phaseout the stock of CFC-based appliances after new production has switched over to ODS substitutes.

**Table 6: Available CFC substitutes**

| Sl. No. | Product | Present | Currently known Alternatives/Substitutes |
|---|---|---|---|
| 1. | Domestic refrigerators | CFC-12 (Refrigerant) | HFC-134a, HFC-152a, Mixtures and Blends, Hydrocarbons (Propane/ Butane, Propane/Iso-butane Mixtures) |
| | | CFC-11 (Foam blowing) | HCFC-22, HCFC-22/HCFC-142b, Cyclo-pentane, HCFC-141-b, HFC-134a |
| 2. | Refrigerated Cabinets (Deep Freezer, Ice Cream Cabinets, Bottle Coolers, Visi-Coolers) | CFC-12 (Refrigerant) | HFC-134a, HFC-152a, Mixtures, Hydrocarbons (Propane/ Butane, Propane/Iso-butane Mixtures) |
| | | CFC-11 (Foam blowing) | HCFC-22, HCFC-22/HCFC-142b, Cyclo-pentane, HCFC-141b, HFC-134a |
| 3. | Water Coolers | CFC-12 (Refrigerant) | HCFC-22, HFC-134a, HFC-152a, Hydrocarbons, and mixtures |
| | | HCFC-22 (Refrigerant) | HCFC-22 |
| 4. | Auto (Car) A/C | CFC-12 (Refrigerant) | HFC-134a, mixtures |
| 5. | Bus & Van A/C & Refrigerated Road Transport | CFC-12 (Refrigerant) | HCFC-22, HFC-134a, mixtures |
| 6. | Train A/C | CFC-12 (Refrigerant) | HCFC-22, HFC-134a |
| 7. | Central A/C Plants | HCFC-22 (Refrigerant) | HCFC-22 |
| | | CFC-11 (Refrigerant) | HCFC-123 |
| | | CFC-12 (Refrigerant) | HFC-134a, |
| | | Ammonia (Refrigerant) | Ammonia |
| 8. | Process Chillers | CFC-12 (Refrigerant) | HCFC-22, HFC-134a |
| 9. | Ice Candy M/C | CFC-12 (Refrigerant) | HCFC-22, HFC-134a |
| 10. | Cold Stores | HCFC-22 (Refrigerant) | HCFC-22 |
| | | CFC-12 (Refrigerant) | HCFC-22, HFC-134a, |
| | | Ammonia (Refrigerant) | Ammonia |

*India Country Programme, September 1993.*

| | | | |
|---|---|---|---|
| 11. | Walk-in Coolers | HCFC-22 (Refrigerant)<br>CFC-12 (Refrigerant) | HCFC-22<br>HCFC-22, HFC-134a |
| 12. | Room A/C | HCFC-22 (Refrigerant)<br>CFC-12 (Refrigerant) | HCFC-22<br>HCFC-22 |
| 13. | Packaged A/C | HCFC-22 (refrigerant) | HCFC-22 |
| 14. | Shipping | HCFC-22 (Refrigerant)<br>CFC-12 (Refrigerant) | HCFC-22<br>HCFC-22 |

Alternative technologies like vapour absorption systems, stirling cycles, vacuum insulations, etc. would also be considered in applications where such technologies have been commercially successful.

As far as possible, the changeover to non-CFC's should be through one switch-over. However if more switch-overs are needed due to technological changes and the provisions (present and future) of the Montreal Protocol, incremental costs in such switch-overs would be included in the subsequent revisions of the Programme.

## 3.5 Foams

The residual use of ODS in the production of flexible slabstock polyurethane foam (PUF) may be phased out by the use of methylene chloride or an alternative manufacturing technology. In case of flexible moulded PUF, CFC-free HR systems are being evaluated for phasing out CFC-11 usage in this category.

In the rigid PUF sector, uncertainty still prevails world over for the selection of an equally suitable alternative to CFC-11. Various alternative routes under consideration for refrigeration insulation are CFC reduced systems, HCFC-22 based systems, blends of HCFC-22/142b, HCFC-141b, cyclopentane and HFC-134a. For general insulation, evaluation of low CFC, HCFC-22, HCFC 123 and HCFC-141b is being done. Similarly, for thermoware insulation, $CO_2$, HCFC-22 and HCFC-123 technologies are being looked at. The polyol manufacturers in India are actively considering to equip themselves for undertaking the above evaluation work under Indian conditions so as to develop suitable polyol systems for each application. A clear direction on alternate routes to adopt can emerge only after the evaluation work has been completed.

In case of thermoplastic foams (extruded polyolefinic and extruded polystyrene), substitutes viz. hydrocarbons, HCFC-22 or $CO_2$ are being evaluated

instead of CFCs. For phenolic foams, the use of pentane has been selected as an alternative to CFCs. Similarly alternatives to CFC-11 in Integral Skin (IS) and Reaction Injection Moulded (RIM) PUF will be tested and evaluated.

Whereas it is expected that CFC-11 usage in flexible PUF, phenolic foams, thermoplastic foams, thermoware and some rigid PUF used for general insulation may be phased out by the year 2000, substitution of CFC-11 in Integral skin, refrigeration insulation and other foams with high dependence on 'K' factor would take longer and might stretch beyond the year 2006. Table 7 lists the available non-ODS technologies for various foams applications.

**Table 7: Available technologies for the Foam industry**

| Category | Technology | Currently known alternatives/substitutes |
|---|---|---|
| Flexible PUF<br>Slabstock<br>Moulded | <br>Methylene chloride<br>CFC-free HR Systems | <br>Alternative Mfg Techn.<br>Methylene Chloride |
| Rigid PUF<br>Refrigerator | <br>Low CFC/HFCC-22 | <br>HCFC-22/142b, Cyclopentane, HCFC- 134a, HCFC-141b |
| General Insulation | Low CFC/HCFC-22 | HCFC-123, HCFC-141b |
| Thermoware | CO2 | HCFC-22, HCFC-123 |
| IS and RIM PUF | HCFCs, atmospheric gases | Methylene Chloride |
| Phenolic Foams | Pentane | Other Hydrocarbons (like isobutane) |
| Thermoplastic Foams<br>EPE/EPP Foams<br>EPS Foams | <br>Hydrocarbons<br>Hydrocarbons | <br>HCFC-22<br>HCFC-22, $CO_2$ |

## 3.6 Solvents

In the short-term, "good housekeeping" measures will be promoted to reduce ODS consumption. The introduction of alternative technologies would be staggered based on the evaluation of alternatives for the key subsectors.

***Electronic and precision cleaning***: This covers metal cleaning, aerospace, marine equipment, optics, jewellery cleaning, etc.. Available technologies depending on application include:

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*India Country Programme, September 1993.*

(a) no-clean technologies (e.g. LS flux applications, controlled atmosphere soldering)
(b) aqueous cleaning (including partially water-based semi-aqueous emulsion systems and compatible fluxes)
(c) organic non-halogenated solvents (e.g. alcohol, ketones, glycols, esters, terpenes, petroleum distillates, etc. along with compatible fluxes)
(d) halogenated solvents (e.g. trichloroethylene, percholoroethane, etc.)
(e) perfluorocarbons (e.g. perfluoro hexane)
(f) a combination of the above.

***Coating and its applications such as in medical syringe manufacture***: The available replacements are aqueous and/or chlorinated solvents, perfluoro hexane, and controlled mechanical applications.

***Pesticides and pharmaceutical industries***: They consume large quantities of CTC in the manufacture of bulk substances such as endosulfan, dicofol, ibuprofen and chlorophenesin. Present replacement technologies here include hydrocarbons, chlorinated solvents, process modifications, or a combination thereof.

***Textile cleaning***: While the immediate option is better "housekeeping" measures, alternatives include aqueous systems, chlorinated solvents, HCFCs, hydrocarbon-based solvents, and/or combinations of the above.

***Chlorinated rubber***: No substitutes have yet been identified for carbon tetrachloride used as the process solvent in the production of chlorinated rubber. The phaseout in this application shall, therefore, be two-stage. The first stage shall be to adopt new technology of sealed systems and recycling, defined as 'zero emissions' technology enabling accurate control of CTC emission to the ambient. The second stage shall be the replacement of CTC in the process making a total phaseout.

The overall sectoral phaseout strategy involves national assessment of alternatives, the spread of good "housekeeping" and recycling measures, industry evaluation of alternatives, and implementation of investment projects in identified user subsectors so as to facilitate the incorporation of their results into the other units. The small-scale and informal sector will need separate treatment.

Table 8 lists available technologies for various solvent applications

**Table 8: Available technologies for the Solvent industry**

| Major Subsector | Present | Currently known alternatives/substitutes |
|---|---|---|
| Electronics and precision cleaning | CFC-113 | No clean technologies |
| | CTC | Aqueous cleaning processes |
| | Methyl Chloroform | Semi-Aqueous cleaning processes |
| | | Organic non-halogenated solvents |
| | | Halogenated solvents perfluorocarbons Combination of above |
| Coatings | CFC-113 Methyl Chloroform | Aqueous solvents |
| | | Chlorinated solvents |
| | | Perfluorocarbon |
| | | Controlled mechanical applications |
| Pesticides and pharmaceutical (process solvent) | CTC | Process modification |
| | | Chlorinated solvents |
| | | Hydrocarbons |
| Textile cleaning | CTC | Chlorinated solvents |
| | | HCFCs |
| | | Aqueous systems |
| | | Hydrocarbons based solvents |
| Chlorinated rubber | CTC | No substitutes currently available; 2 stage phase out required. |
| | | 1. New sealed system/recycling technology (zero emissions) |
| | | 2. New emerging technologies to be identified. |

## 3.7 Halons

Drop-in substitutes for Halons are not yet available. India will take the following steps for adopting alternatives, techniques and practices, and for Halon conservation. Some of the identified alternative technologies are ABC powder, foams, $CO_2$, inert gases, water fog/mist, fast response sprinklers, etc..

*India Country Programme, September 1993.*

Revision of national fire extinguisher codes and standards to promote non-Halon alternatives will be undertaken. To limit emissions and thus reduce the need for additional Halons production, a Halons conservation programme will be designed and implemented at the production/manufacturing stage, at the service/ maintenance level and at the user level. Feasibility of a Halon banking and management system will be studied. Essential uses of Halons, taking into account indigenous production and development of the Halon banking system, will be evaluated.

Based on estimated Halons consumption in 1996, it is expected, dependent on availability of substitutes for both Halon-1211 and Halon-1301, that their consumption would drop by 50% by year 2005 and that by year 2010 all Halons usage would have ceased, except for essential uses.

## 3.8 Aerosols

In order to phaseout the use of ODS, the Indian Aerosols industry will evaluate the switch over to Hydrocarbon Aerosol Propellant (blends of destenched LPG, Propane and n-Butane). In certain limited applications, dimethyl ether may be more suitable and cost-effective. Not-in-kind substitutes such as pumps and atomizers will be used. In case of electronic cleaners, the available substitutes are very expensive. For certain other uses such as pharmaceutical products, spinnerette sprays, aerosol applications on aircraft etc. effective substitutes are not yet available. In these applications, phaseout will occur as and when cost-effective alternatives become available.

Most aerosol filler units in India are equipped with machines that are not suitable for filling flammable propellant. Machine replacement is required together with plant modification for improved ventilation or open-air filling. Plants located in densely populated urban areas may need to be relocated. Since more than 75% of the aerosol fillers are in the informal sector, a program of support activities including technical training, information dissemination, safety measures training, etc. will be set up. For meeting the needs of the informal sector units, the option of using contract fillers will be evaluated. In addition retirement of very small fillers will also be assessed.

Production units for the manufacture of the alternate propellant will be established in India. These units will supply HAP of the required quality to various filler units throughout the country. Not-in-kind substitute production will also be encouraged for units that do not prefer to handle flammable alternatives.

Assuming the availability of the required financial assistance, the use of all ODS as aerosol propellant in India except for the residual uses listed above,

will be completely phased out by 1998. For these residual uses, phaseout will occur after 1998 as and when effective substitutes are available.

## 3.9 Small-scale and Informal Sector

Development of the SSI sector has occurred in a widely dispersed manner and, therefore, presents complex and diverse issues in respect of the phase out of ODS. The technology spectrum for product areas are so diverse that no single technology model can fit the needs of all the small scale and informal sector units in specific product areas because of cost, availability and adaptability.

As users of ODS, the small scale and informal sector units would need nursing for a change over to machines of new design and also new processes and substitutes of ODS. The training of entrepreneurs and training of the work force for adaptability to new design of machines, equipment and production processes will be necessary, along with accessibility and adaptation of technology and provision of capital costs, including operating costs.

Apart from technology related issues, and lack of availability of capital there will be other socio-economic issues involved for the phase out in the small scale informal sector. The sector has a large employment potential. Persons working in this sector are of low skill and hence will definitely require retraining while adapting to the substitute substances, technological requirements, and economic needs. The changed conditions are likely to result in loss of employment in large number of small enterprises which may have to wind up prematurely as a result of this enforced change. This is likely to be more pronounced in the Aerosol sector where the units may have to be relocated out of congested areas to avoid fire hazards and substantial investment will be required in new equipments suitable for use with flammable materials and in fire proofing of premises. These units will require skilled labor in view of hazards involved. Additional cost of plant/equipment and increased labor costs may result in higher product cost.

There is a significant involvement of the informal sector in servicing/repair of products using CFCs. A clearer picture will emerge only after a systematic survey is undertaken with regard to the consumption of CFC, substitute materials, techniques and incremental cost of substitution in the sector.

### *Technology status*

The small scale manufacturers of refrigeration equipment like Ice candy machines, refrigerated cabinets (Deep Freezers, Bottle Coolers etc.) are on a low rung of technology and use country methods for filling up gas resulting in lot of leakage and wastage of CFC gas. The case for the majority of the servicing units and

establishments is similar, especially in informal sector, where no effort is made to recycle or reclaim the gas and almost the entire charge is released to the atmosphere.

As regards the Aerosol sector, most of the units presently utilize hand filling machines and a few units, on a slightly higher rung of technology, utilize semi automatic filling machines. The Aerosol sector would have to undergo complete changes as the proposed substitute would be highly combustible (LPG) and would require total change of filling equipment and methodology apart from the need for relocating out of congested areas and necessity of fire protection of the premises.

There is a large number of small scale units as well as servicing establishments in the informal sector which utilize ODS as cleaning agents. These solvents are convenient to use and evaporate easily. The changeover from the present technology to alternate methods would require suitable attitudinal change and efforts. Awareness and training programmes will have to be undertaken to bring about these changes.

## *Implementation of ODS phaseout in the sector*

Government will have to play an important role in transition management as far as the small scale and informal sector is concerned. The transition phase will also involve socio-economic aspects viz loss of employment, relocation, use of higher skills, retraining etc. A strategy will have to be devised to ensure that the employment generating potential of this sector is not eroded due to technologies introduced during the changeover. It may also not be realistic to have the same phase out schedule for small and informal sector as for organized sector. It is difficult to spell out further details at this stage without carrying out a proper survey and analysis.

## *Transition management*

A smoother change over for the SSI Sector will have to be guided and planned through instruments of direct and indirect support. The components of such transition management will be as follows:

1. Survey/Estimation: These studies will be needed to estimate the characteristics, size and components of each of the subsectors as well as the technologies in use, investment levels, employment levels etc.. Such surveys will have to be carried out in each of the identified user sectors.

2. Awareness Programmes: In view of the dispersed nature of the units, awareness programmes would have to be undertaken. This will involve workshops, seminars, study tours, information dissemination, publications and training etc..

3. Technology Transfer: Institutional support would be required to facilitate technology transfer to individual SSI units. This will require creation of suitable technology funds to help technology restructuring of SSI units.

4. Demonstration Projects: Such projects can be set up to instill confidence and give an impetus to the process of technology restructuring. These demonstration projects can be encouraged with development of common support facility systems to provide technical and other related inputs to SSI.

5. Equipment/Project Imports: Transfer of technology will require import of appropriate plant and machinery as well as raw materials; tariff elements need to be included in the funding mechanism of Ozone fund.

6. Additional Costs of Technology: Technology transfer costs barriers may increase on account of patent laws and other reasons. Adequate concessions will have to be introduced to allow for transfer of technology to small scale industrial units at economic costs.

7. ODS Recovery and Recycling in High Density Sites: Centralized reclamation and recovery facilities may have to be installed. This will have to be undertaken as a developmental effort by appropriate agencies and institutions.

## *Institutional support*

The small scale and informal sector units would require wide support in several areas. Some of the important areas are enumerated below:

Units in all the sectors will have to be made aware of the importance and the time schedule for phase out. An awareness campaign will have to be mounted with regard to the availability of substitutes technologies and practices. The larger companies would generally be well aware regarding the availability of substitutes and in a position to make their own preferences. However, small companies will require substantial support in the selection process especially where more than one substitute is available. This will have to be facilitated through assessment centres, adaptation, workshops, seminars and training programmes.

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Technology transfer and technology management in the small scale and informal sector are dependent on technology tie-ups which may not be feasible for individual units nor such a proposal is likely to be of any commercial interest to providers of technology because of small scale operation. It may, therefore, be essential to create a technology bank which will have to be funded out of the Multilateral Fund. In several cases, imported technology would require adaptation to suit local conditions and the adaptation/absorption efforts will have to be funded from the Fund.

Product specific training will have to be imparted to the personnel in various sectors for which new facilities will have to be created. Demonstration projects at prominent locations will have to be set up which could require imported, or especially developed, plants and equipment as well as use of technology not available locally. Core groups will have to be created to study the availability of technology, adaptation and absorption under local conditions and to act as facilitating agents for the smooth and timely changeover. The core groups may have to be exposed to the technology prevalent in other countries and suitably trained to facilitate changes in the sector. Institutional support may also be required for the import of plant and equipment and raw materials not available indigenously and which are required for the changeover. Institutions would have to set up for these tasks.

## *Institutional Framework*

An integrated institutional framework has to be created to support the SSI units for phasing out ODS. This will have the following components:

1. Core Group: A core group will set up in the office of the DCSSI. It will be the interface between the Ozone Cell and the implementing agencies that would promote and monitor the ODS phaseout in Sector. The core group will have suitable representation and will be supported by secretariat with appropriate inputs. For efficient management among other things, it will undertake the following tasks:

(i)
- Development of training modules for all levels including government agencies, NGOs, Extension Staff and entrepreneurs.
- Organizing awareness campaigns, publication etc.
- Coordinating with R&D institutions, technical organizations and other agencies for various inputs.
- Establishing an effective information network and Database.

- Monitoring and review.

(ii) Field: At the State level, the Small Industries Service Institutes which are State Offices of the Office of the Development Commissioner, State Offices of National Small Industries Corporation (NSIC), Directorates of Industries of the State Governments, State Pollution Control Boards, will be identified as the nodal agencies for carrying out developmental/ promotional/monitoring review work. They will carry out training, awareness campaigns studies and monitoring of various programmes. NGO and Industry Associations would also be involved in these activities.

(iii) Technology/Specialized Agencies: The Core group will identify appropriate institutional agencies at various levels to develop and supply the required inputs. These agencies will be assigned specific functions and the requisite linkages will be created for them to interact with the field/promotion agencies.

## 3.10 Recovery and Recycling

For phasing out ODS and for management of the servicing of units using CFCs even after the phaseout, it would be necessary to have recovery/recycling/ reclamation operations. Broadly, recovery/recycling/reclamation would be needed in the following areas:

1. At the manufacturing units of companies in the organized sector, e.g. in the R&AC, foams and solvents sectors; and, at their dealer service stations in the case of consumer goods such as refrigerators and air-conditioners.

2. Manufacturers in the informal sector.

3. Service/repair shops in the informal sector.

4. Industrial and commercial users who maintain their own appliances; central AC and refrigeration plants; etc.

5. Recovery from appliances that have outlived their useful lives.

6. Recovery and recycling of halons.

Simple recovery devices based on mature technologies to extract CFCs from large facilities would be assessed. The recovered CFCs will be compressed, condensed and stored in pressure containers. The feasibility of banking recovered CFCs, which will be distilled to achieve required levels of purity, at a few

strategically located reclamation centres will be explored; along with destruction technologies and practices.

Various modalities for the implementation of these schemes will be explored. Large units can send the recovered CFCs from their units for purification to the reclamation centres and then recycle it themselves. Recovery from comparatively smaller units could be carried out by local entrepreneurs who can sell the recovered CFCs to the reclamation centre. This pool of recycled CFCs would be available in the market for use in facilities after CFC production has ceased. A feasibility study will be conducted to determine the more practicable options, or mix of options to meet local requirements.

## 3.11 Phaseout Scenario to Year 2010 and Implications for Production of ODS Substitutes

India will phaseout the production and consumption of the controlled substances within the time frame and limits specified for Article 5 countries in the Montreal Protocol. The consolidated phaseout profiles, along with the associated Protocol consumption limits for the four groups of ODS that are used in India are presented in Figures 8 to 11. These refer to groups I and II of Annex A, and groups II and III of Annex B, respectively. In all cases, consumption is less than specified by the Protocol limits.

The reductions in the consumption of ODS resulting from the phaseout schedule are listed in Table 9 for five target years (1996, 2000, 2005, 2007 and 2010), and represent the deviation of the phaseout profiles from the unconstrained demand profiles. They also reflect the magnitude of demand for ODS substitutes in these target years. The expected phaseout of production of ODS in India is shown in Table 10.

At present, it is not possible to uniquely identify the demand for each ODS substitute owing to the uncertainty of choice of substitute technologies in most ODS applications. The choice of ODS substitutes is most clear in the aerosol industry where 0.5 kg of LPG is expected to replace each kg of CFC used. In the R&AC sector, HCFC-22, HFC-134a, HFC-152a and various blends of HFCs and HCFCs are regarded as possible substitutes. Similarly, in most foam-blowing operations, HCFC-22/HCFC-142b, other HCFCs and certain hydrocarbon blends are being considered. The uncertainty regarding substitutes is greatest in the solvents sector where the wide range of operations makes it difficult to forecast the penetration pattern of ODS substitutes. Similar uncertainty prevails in the halons sector.

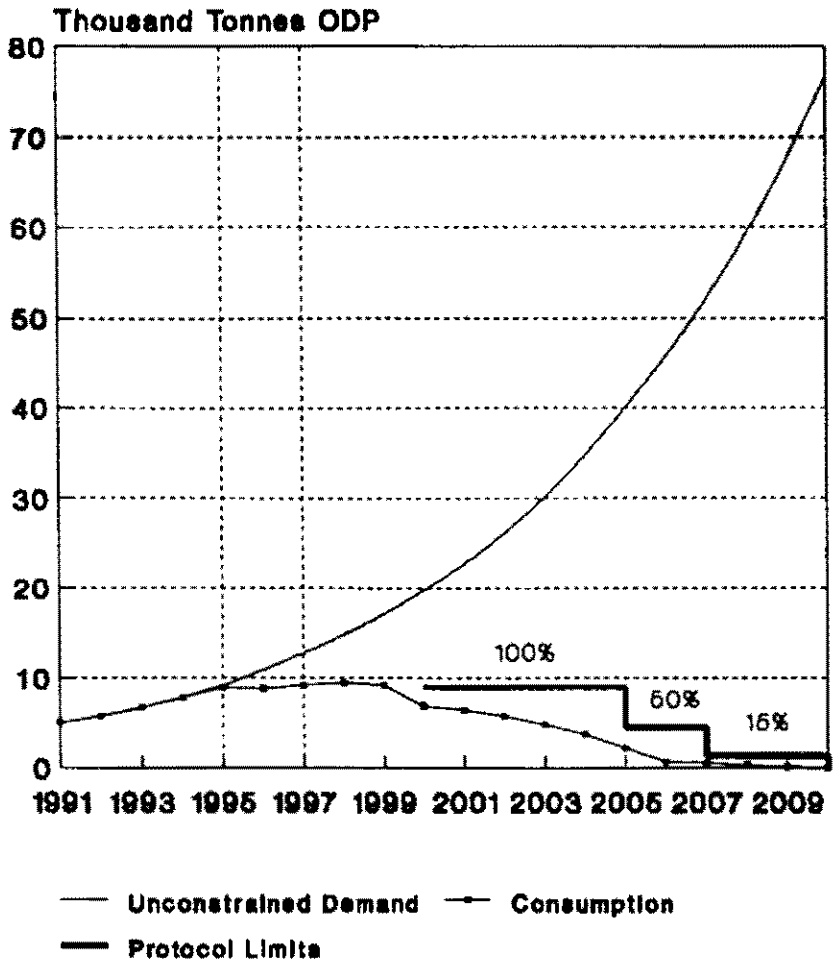


**Figure 8: Phaseout of Annex A Group I ODS (CFC-11, CFC-12 and CFC-113) in India.**

*India Country Programme, September 1993.*

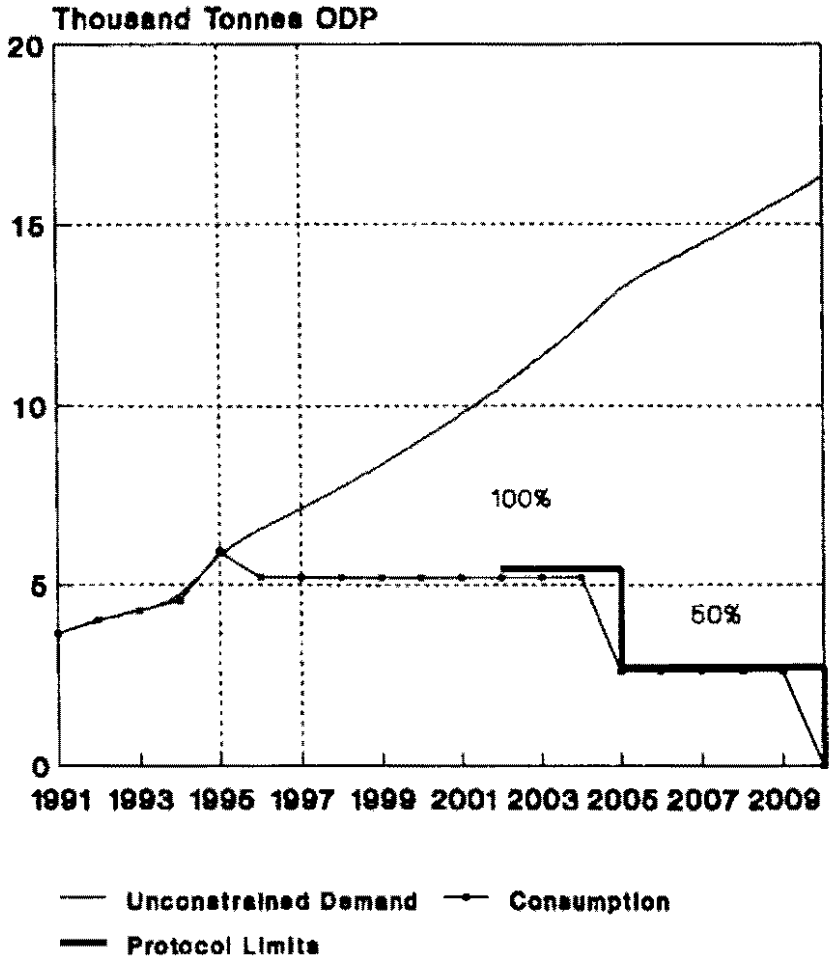


**Figure 9: Phaseout of Annex A Group II ODS (Halon-1211 and Halon-1301) in India.**

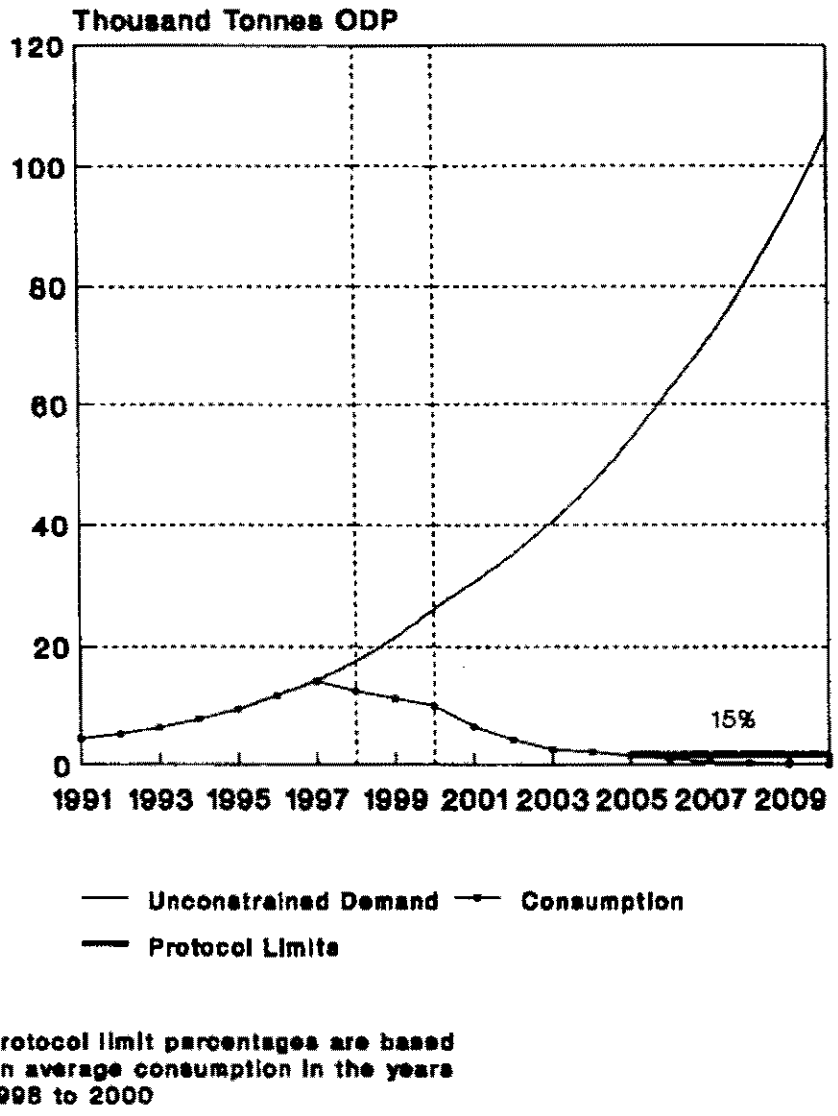


**Figure 10: Phaseout of Annex B Group II ODS (CTC) in India.**

*India Country Programme, September 1993.*

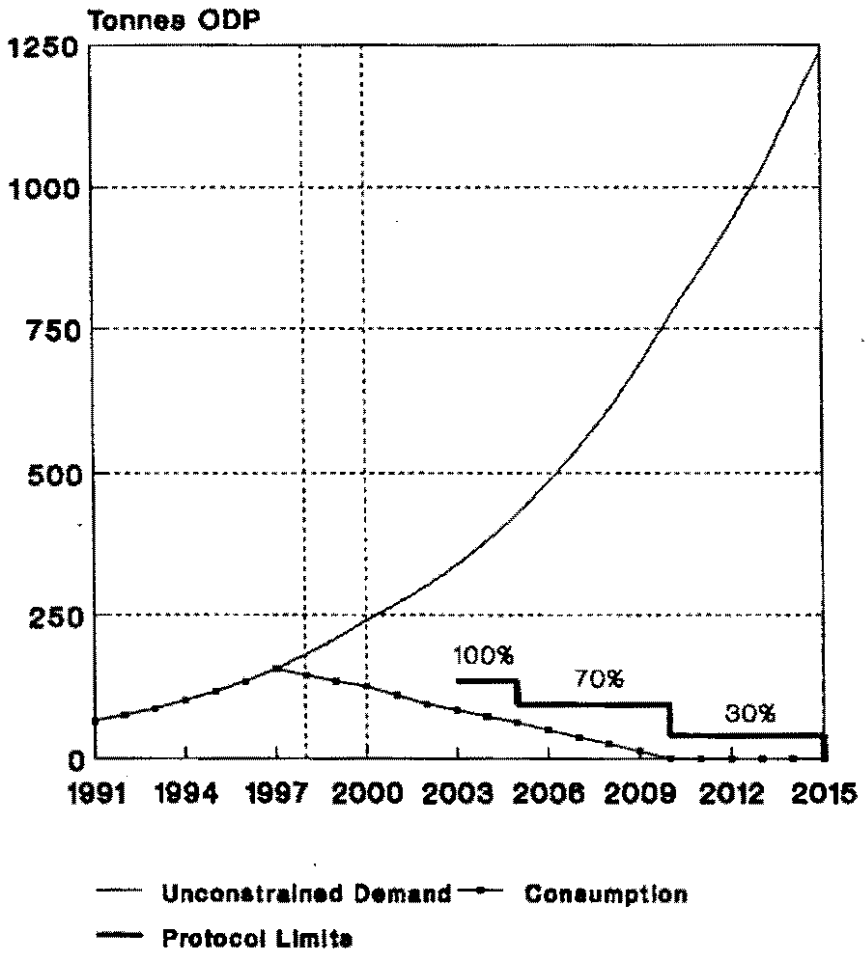


**Figure 11: Phaseout of Annex B Group III ODS (MCF) in India.**

Table 11 presents a preliminary estimate of demand, based on available substitutes, for various classes of ODS substitutes for the R&AC and the aerosols sectors. The demands of the solvents and the foams sectors have not been incorporated in Table 11. This table will be updated, expanded and elaborated in the years ahead as technology and substitute choices become clearer.

## 3.12 Action Plan

The Government Action Plan to implement the proposed strategy for ODS phaseout is based on the measures suggested by Task Force and specified in section 3.1 of the Country Programme. The Action Plan reflects the thrust of India's Ozone Layer Protection policy and includes the various measures required and the monetary agencies involved in the ODS phaseout. Table 12 lists the Government Action Plan to implement the proposed ODS phaseout strategy.

The administrative and management cost for implementing the government action plan are part of the incremental cost which should be financed by the Multilateral Fund. The cost of administrative activities that would have been carried out in the absence of the Protocol have been deducted from the total cost. The net administrative/management cost for implementation of the action plan would amount to US $ 750,000 per year, of which about $ 500,000 will be for managing the phaseout in the small-scale and informal sector.

## 3.13 Monitoring and Review

The Ozone Cell is responsible for reporting data on ODS production and consumption in India to the Ozone Secretariat in Nairobi. The MOEF will utilize the existing CPCB and State Pollution Control Boards for reporting ODS according to the reporting requirements of the Protocol. For small scale industrial units they will be assisted by the Offices of the DCSSI, which has a greater outreach. These organizations will also monitor the phaseout schedules in the enterprises.

Enterprises producing and consuming ODS will collect and report detailed data on their ODS production and consumption to the State Pollution Control Boards/DCSSI, industry associations will also be involved in the process. The process will be supervised by the Ozone Cell.

A format for the phaseout will be prepared, linked to the provision of assistance for meeting incremental costs. The producing enterprises will provide data including raw materials, categories and quantities of ODS products, supplies and sales, as well as the status of ODS substitutes production and quantities produced. ODS consuming enterprises will provide data including categories and quantities of ODS consumed per production unit, sources of ODS, production and

growth rates of ODS-containing products, market demand and development trends, and the status of products manufactured using ODS substitute technologies. The administrative authorities of concerned enterprises are responsible for the management of ODS data reporting systems for the corresponding enterprises which will be related to the provision of assistance; performance guarantees will be taken from the enterprises.

**Table 9: Reduction in ODS consumption due to phaseout (in tonnes of ODS)**

| | 1996 | 2000 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|
| **CFC-11** | | | | | |
| R&AC | 0 | 120 | 890 | 1470 | 2530 |
| Foams | 280 | 298 | 8180 | 10830 | 14170 |
| Aerosols | 550 | 2270 | 5190 | 7320 | 10500 |
| Sub total | 830 | 3170 | 14160 | 10170 | 27200 |
| **CFC-12** | | | | | |
| R&AC | 0 | 2500 | 10480 | 13190 | 21220 |
| Foams | 140 | 670 | 1060 | 1760 | 2220 |
| Aerosols | 820 | 3400 | 7790 | 10300 | 15670 |
| Solvents | 0 | 0 | 830 | 1250 | 2090 |
| Sub total | 960 | 6570 | 20700 | 27220. | 41200 |
| **CFC-113** | | | | | |
| Foams | 10 | 50 | 90 | 150 | 190 |
| Solvents | 0 | 910 | 3900 | 5880 | 10110 |
| Sub total | 10 | 960 | 3990 | 6030 | 10300 |
| **CTC** | | | | | |
| Solvents | 0 | 11220 | 46520 | 63570 | 96000 |
| **MCF** | | | | | |
| Solvents | 0 | 960 | 3030 | 4180 | 6400 |
| **H-1211** | | | | | |
| Fire-fighting | 450 | 750 | 1390 | 1710 | 2100 |
| **H-1301** | | | | | |
| Fire-fighting | 0 | 160 | 630 | 770 | 1000 |

*Phaseout of Ozone Depleting Substances Under the Montreal Protocol.*

**Table 10: Estimated production of ODS (tonnes)**

| | 1996 | 2000 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|
| CFC-11 | 3420 | 2430 | 1250 | 200 | 0 |
| CFC-12 | 4860 | 4000 | 790 | 170 | 0 |
| CFC-113 | 740 | 630 | 250 | 120 | 0 |
| H-1211 | 600 | 600 | 300 | 180 | 0 |
| H-1301 | 340 | 340 | 170 | 100 | 0 |
| CTC | 11660 | 13800 | 2590 | 960 | 0 |
| MCF | 1120 | 1050 | 530 | 40 | 0 |
| Total | 19190 | 16930 | 6110 | 910 | 0 |

Note: The table refers to production for indigenous consumption only, and does not include exports.

**Table 11: Preliminary estimate of ODS substitutes requirements (in tonnes of ODS)**

| | 1996 | 1998 | 2000 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|---|
| **R&AC** | | | | | | |
| HCFC-22 | 4000 | 5500 | 7300 | 15000 | 20000 | 32000 |
| Other Refrigerants (e.g. HFC-134a, blends, HFC-152, etc.) | 0 | 300 | 880 | 7600 | 10600 | 15500 |
| **AEROSOLS** | | | | | | |
| LPG | 800 | 1970 | 2840 | 6500 | 8600 | 13000 |

*India Country Programme, September 1993.*

Phaseout of ODS in enterprises that are assisted by the Fund will also be monitored independently by the financial institutions through which the assistance is provided.

Ministry of Environment & Forests has been designated as the National Authority, and is responsible for overall supervision and management of the production, import, export and consumption of ODS in India. MOEF, jointly with other related government authorities and industry associations, will establish a unified system for reporting ODS data to the Protocol's Ozone Secretariat in Nairobi, as per the requirements under the Protocol. MOEF will periodically gather ODS data from the ODS producing and consuming enterprises throughout the country and will assist the local authorities in establishing a similar data collection and reporting system.

An inspection and measurement centre for ODS and their substitutes will be considered. It will evaluate the predicted targets and results obtained using substitute technologies, and the applicability of the planned phaseout dates.

The underlying philosophy for the data collection and reporting system will be to develop a close understanding between the government authorities and the industry, so that the reporting by the industry is based on a clear understanding of long term benefits.

The MOEF will carry out regular inspections and assessments on the status of ODS production and consumption in India, according to the phaseout plan under the Country Programme, so as to revise the phaseout plan when needed and implement it effectively. MOEF will also submit regular reports on the use of Multilateral Fund assistance and the progress of the projects to the Executive Committee of the Fund.

A summary of the national action plan is presented in Table 12.

**Table 12: Action plan summary for India**

| Item | 1993-1997 | 1998-2000 | 2000-2010 |
|---|---|---|---|
| Country Programme | Elaborate and commence implementation | Reassess and adjust, then continue | Reassess, continue and complete |
| Restrictions | Review of assessment, regulation and monitoring arrangements. | Ban on new plants to produce ODS, except essential uses | Ban to import ODS and products using or containing ODS |
| | Study the feasibility of the steps for ODS phaseout in the small scale and informal sector | Set up institutional arrangements for the small scale and informal sector | Review arrangements for the small scale and informal sector. |
| | | Ban on aerosols using ODS, except essential ones | Emissions control of ODS during servicing |
| Management | Study and review the process specifications and standards related to substitutes, codes of good practice, training, etc. | Establish quality inspection and control centres, and national standards for equipment, testing procedures, certification etc. | Continue |
| Incentives | Feasibility study on fiscal mechanisms. | Notify policies | Continue |
| Awareness, education and technical information exchange | Carry out awareness and education on Ozone Layer protection through public media, such as newspapers, broad-casting, and TV programmes, so as to upgrade the environ-mental awareness of the public. | Continue the awareness and education hold technical workshops and public meetings | Continue |
| | Communicate key points of National Action Plan to the public | Announce new policies in advance of their introduction | |
| | Issue special bulletins on ozone layer protection, particularly to the small scale and informal sector | Inform the consumers about the premature retirement of refrigerators and refrigerant and air conditioning equipment | |
| Reward fund for ozone layer protection | Establish management institution for the funds and elaborate their management methods | | continue |

*India Country Programme, September 1993.*

| | | | |
|---|---|---|---|
| ECO-MARK | Elaborate and implement standards for issuing ECO-mark to qualified products. | Bureau of Indian Standards to enhance product range using ECO-MARK. Popularize and monitor. | continue |
| Technology transfer | Encourage projects for transfer and adaptation of technology for phaseout of ODS production and consumption | Conversion of manufacturing facilities for production, including ancillaries and servicing | continue |
| | Evaluation of substitutes and substitute technologies | Adaptation and test manufacture of non ODS substances and technologies | continue |
| | Develop cleaning processes | - do - | continue |
| | Review arrangements for transfer of technology | | |
| Recycle/Recovery , destroying technologies | Techno-economic feasibility status | Establish networks and sites for recycle/recovery and destruction, where appropriate | Continue activities beyond the last period |
| Monitoring | Develop a monitoring system for ODS imports | | Continue the activities beyond the last period. |
| | Define and divide responsibilities for supervision and management of the technical substitute projects among environmental protection agencies and agencies for dealing with the small scale and informal sector. | Review the arrangements for the identical units, particularly for the small scale and informal sector | |
| | Determine the phaseout plan for identical units. | Develop feedbacks on the requirements of finance and consumer protection | |
| | Report regularly on the progress of ODS phaseout. | | |

# 4. RESOURCE REQUIREMENTS

## 4.1 Technology Transfer and Adaptation

The specificity of existing production and consumer usage patterns, climate etc. in India would require that alternate technologies undergo a process of adaptation before being commercially deployed. Consequently, testing and evaluation centres would be set up in various applications where such adaptation and development would be promoted. These centres would logically be the first phase of larger phaseout projects.

The indigenous development of alternate technologies would be done through various incentives and appropriate regulations. In addition, development of indigenous substitutes and alternate technology would also be done.

Technology transfer and adaptation would cover the following activities:

(a) Conversion of existing facilities for the production and utilization of ODS.
(b) Establishment of new facilities for the production and utilization of ODS substitutes.
(c) Premature retirement or enforced idleness of production facilities.
(d) Acquisition of patents and design.
(e) Retraining of personnel.
(f) Research into adaptation of substitute technologies.
(g) Collection, management, recycling and destruction of ODS
(h) Technical assistance to the small scale and informal sector to facilitate phaseout.

## 4.2 Incremental Costs

The net incremental costs by sector to implement ODS phaseout within the Country Programme can be summarized in Table 13.

The following points will need regular review:

(a) The assessment of potential ODP tonnes to be phased out in the small-scale and informal sector and associated net incremental costs would await completion of the small-scale industry and informal sector ODS-usage survey that should be completed in 1994.

**Table 13: Net incremental cost of ODS phaseout**

| Sector | Incremental costs ($ million) | ODP phaseout tonnes | Unit phaseout (US $/kg) |
|---|---|---|---|
| Aerosols | 13 | 14366 | 0.90 |
| Foams | 150 | 14866 | 10.08 |
| Halons | 36 | 15208 | 2.37 |
| Domestic refrigeration | 295 | 5000 | 59.00 |
| Other refrigeration and AC | 120 | 11884 | 10.10 |
| Solvents | 104 | 69944 | 1.49 |
| Trade-in of refrigerators and other appliances | 325 | 200 | 1625 |
| Recovery and recycling | 50 | 2500 | 20 |
| Chemical producers | 466 | - | - |
| Small scale and informal sector | | | |
| Other R&AC | 105 | 4176 | 25.25 |
| Foams (non-refrigerator) | 84 | 1669 | 50.43 |
| Aerosols (fillers only) | 21 | 11754 | 1.75 |
| Solvents | 174 | 46629 | 3.73 |
| Fire-fighting | 6 | 1092 | 5.93 |
| Sub total | 390 | 65320 | 5.97 |
| Administrative cost | 15 | - | - |
| **Total** | **1964** | **199308** | **9.85** |

Note: 1. The above net incremental costs have been arrived at by computing the eligible costs on an annual basis upto the year 2010, at the 1993 value of US $.

2. In submitting projects for Multilateral Fund financing, it will be ensured that there is no double counting of costs, specially between the Chemical Producer Sector and the user sectors.

(b) Technology development, transfer and adaptation to provide for local production and circumstances.

The net incremental cost calculations have been based on sectoral and inter-sectoral analysis of project and programme needs comprising technology transfer, technical assistance, technical

training, establishment of testing and evaluation facilities for technology selection, pre-feasibility studies, investment projects, including technology development, transfer and adaptation, ODS recovery and recycling, and measures to facilitate ODS phaseout in small-scale and informal sector operations.

(c) The net incremental costs cover the category of projects specified in the Country Programme. This list will be expanded/amended over time to take into account both the emergence of newer and more technically effective ODS substitute technologies, both internal and external, especially in the refrigeration/AC sector as well as full coverage of ODS consumers in the small-scale and informal sector as data become more fully available on their actual ODS usage.

(d) Incremental benefits, where identifiable and quantifiable, have been deducted from project costs. For individual projects submitted for approval, incremental benefits will be deducted for the same number of years for which operational costs are approved.

(e) In the refrigeration sector, the costs to users to service and refill the refrigerants will increase when non-ODS substitute refrigerants are utilized, such as HFC-134a, HFC-152a, and certain blends. These costs, including those for destruction, will be updated during the first update of the Country Programme when more empirical information on these costs will be available.

(f) The interest cost on bank loans (both domestic and foreign) needed for the ODS phaseout process have not been included in net incremental cost calculations but form part of total ODS phaseout calculations particularly for the small scale and informal sector.

(g) The costs associated with the premature retirement of ODS-using appliances during the latter part of the phaseout process (2000-2010) will be updated during the first update of the Country Programme.

(h) The small-scale and informal sectors account for about two-thirds of the total ODS consumption in India. Some of these have been identified, and costs of this phaseout have been incorporated in the reports of the sectoral groups. However, an appreciable ODS usage has not been identified. It is estimated that unidentified small and tiny units in the small scale and informal sectors account for 26% of consumption in R&AC sector (excluding domestic refrigeration); 10% in the foams sector; 45% in the aerosols sector; 40% in the solvents sector; and 6.7% in the fire-fighting sector. The unit costs of phaseout of these unidentified small and tiny units are estimated to

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*India Country Programme, September 1993.*

be 250% of the unit costs of the larger units. Consequently, a unit cost escalation factor of 2.5 for each sector has been assumed. These consumption and cost estimates would be revised after a survey of users.

(i) In the case of end-users for domestic refrigeration, costs of premature modification, replacement of refrigerators, and of recovery and recycling of ODS have been provided for in the incremental costs.

(j) In the case of producers of chemical substitutes, costs of patents and designs (estimated), retraining, research to adapt technology to local circumstances, and capital costs of conversion and establishment of new facilities (taking savings and benefits into account) have been included.

Table 14 shows the phasing of sectoral requirements for incremental cost financing by the Multilateral Fund based on available information. The requirement for funds is shown graphically in figure 12.

## 4.3 Total Phaseout Costs

The net incremental costs of the India Country Programme have been estimated at US $ 1964 million. In addition to these costs which would be covered by the Multilateral fund, there are other costs that will have to be covered by the country itself.

These other costs would include:

(a) Any uncovered project investment capital cost as well as uncovered project operational costs. This would include the cost of additional land needed for project implementation, land costs being very high in India.

(b) The reduced revenue from lower taxes on ODS substitutes as well as potential reductions in excise and customs duties for these ODS substitutes.

(c) The organization of technical support services by industry associations for the rapid dissemination of technical information on ODS substitutes.

(d) The cost of public awareness and other information dissemination campaigns not covered by the Multilateral Fund.

(e) Ministerial and Inter-Ministerial coordination expenditures at both the Central Government level and at State Government levels

covering implementation and monitoring of the ODS phaseout process.

(f) The costs to private sector industry in meeting those costs not covered by the Multilateral Fund, including the reduction of "normal" profit levels using ODS, and the non-reimbursement of interest and other financial costs.

(g) Certain costs to consumers not covered by the Fund.

It is expected that the Government of India, state governments as well as the concerned industrial enterprises will have to expend a significant level of internal funds for the implementation of the Country Programme phaseout plan, as mentioned above.

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*India Country Programme, September 1993.*

**Table 14: Phasing of incremental costs for the phaseout of Ozone depleting substance in India (all costs are in Millions of 1993 US $)**

| | Refrigeration and air-conditioning | | | Solvents | Aerosols | Foams | | | Fire extinguishing | Chemical producers | Recovery and recycling | Trade-in of fridges etc. | Administrative cost | Small scale and informal sector | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domestic Fridges | Others | Total | | | Domestic Fridges | Others | Total | | | | | | | |
| 1993 | | 1.0 | 1.0 | | | | | 0.0 | | | | | | | 1.0 |
| 1994 | 6.0 | 2.0 | 8.0 | 2.0 | 0.3 | | 2.5 | 2.5 | 1.0 | | | | | 8.0 | 21.8 |
| 1995 | 8.0 | 5.0 | 13.0 | 3.2 | 3.3 | 1.5 | 2.5 | 4.0 | 2.0 | 10.0 | | | | 10.0 | 45.5 |
| 1996 | 10.0 | 9.0 | 19.0 | 5.2 | 4.2 | 3.0 | 5 | 8.0 | 2.0 | 10.0 | | | 0.75 | 10.0 | 59.2 |
| 1997 | 60.0 | 11.0 | 71.0 | 10.0 | 3.1 | 3.5 | 7.5 | 11.0 | 2.0 | 15.0 | | | 0.75 | 15.0 | 127.9 |
| 1998 | 70.0 | 12.0 | 82.0 | 12.0 | 1.1 | 4.0 | 10 | 14.0 | 3.0 | 20.0 | 5.0 | | 0.75 | 23.0 | 160.9 |
| 1999 | 50.0 | 14.0 | 64.0 | 12.0 | 0.5 | 5.0 | 11.5 | 16.5 | 3.0 | 20.0 | 10.0 | | 0.75 | 29.0 | 155.8 |
| 2000 | 30.0 | 16.0 | 46.0 | 14.0 | 0.5 | 7.0 | 12.5 | 19.5 | 5.0 | 20.0 | 5.0 | | 0.75 | 29.0 | 139.8 |
| 2001 | 20.0 | 13.0 | 33.0 | 11.0 | | 8.0 | 12.5 | 20.5 | 2.0 | 20.0 | 3.0 | | 0.75 | 48.0 | 138.3 |
| 2002 | 10.0 | 10.0 | 20.0 | 10.0 | | 5.0 | 10 | 15.0 | 2.0 | 50.0 | 3.0 | | 0.75 | 67.0 | 167.8 |
| 2003 | 7.0 | 9.0 | 16.0 | 8.0 | | 4.0 | 7.5 | 11.5 | 5.0 | 80.0 | 3.0 | | 0.75 | 67.0 | 191.3 |
| 2004 | 5.0 | 7.0 | 12.0 | 4.0 | | 3.5 | 5 | 8.5 | 2.0 | 50.0 | 3.0 | | 0.75 | 48.0 | 128.3 |
| 2005 | 3.0 | 5.0 | 8.0 | 4.0 | | 2.0 | 2.5 | 4.5 | 2.0 | 50.0 | 3.0 | 60.0 | 0.75 | 19.0 | 151.3 |
| 2006 | 2.0 | 3.0 | 5.0 | 4.0 | | 1.5 | 2.5 | 4.0 | 1.0 | 75.0 | 3.0 | 80.0 | 0.75 | 10.0 | 182.8 |

*Phaseout of Ozone Depleting Substances Under the Montreal Protocol.*

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 2.0 | 2.0 | 4.0 | 4.0 | | 1.0 | 2.5 | 3.5 | 1.0 | 26.0 | 3.0 | 80.0 | 0.75 | 2.0 | 124.3 |
| 2008 | 2.0 | 1.0 | 3.0 | 0.2 | | | 2.5 | 2.5 | 3.0 | 20.0 | 3.0 | 50.0 | 0.75 | 2.0 | 84.5 |
| 2009 | 2.0 | | 2.0 | 0.2 | | | 2.5 | 2.5 | | | 3.0 | 30.0 | 0.75 | 1.0 | 39.5 |
| 2010 | 2.0 | | 2.0 | 0.1 | | | 2 | 2.0 | | | 3.0 | 25.0 | 0.75 | 1.0 | 33.9 |
| 2011 | 2.0 | | 2.0 | 0.1 | | | | 0.0 | | | | | 0.75 | 1.0 | 3.9 |
| 2012 | 1.0 | | 1.0 | | | | | 0.0 | | | | | 0.75 | | 1.8 |
| 2013 | 1.0 | | 1.0 | | | | | 0.0 | | | | | 0.75 | | 1.8 |
| 2014 | 1.0 | | 1.0 | | | | | 0.0 | | | | | 0.75 | | 1.8 |
| 2015 | 1.0 | | 1.0 | | | | | 0.0 | | | | | 0.75 | | 1.8 |
| Incremental cost (Million $) | 295.0 | 120.0 | 415.0 | 104.0 | 13.0 | 49.0 | 101.0 | 150.0 | 36.0 | 466.0 | 50.0 | 325.0 | 15.0 | 390.0 | 1964.0 |
| ODP phaseout (tonnes) | 5000 | 11884 | 16884 | 69944 | 14366 | 9878 | 5008 | 14886 | 15208 | - | 2500 | 200 | - | 65320 | 199308 |
| Unit phaseout cost ($/kg ODP) | 59.00 | 10.10 | 24.58 | 1.49 | 0.90 | 4.96 | 20.17 | 10.08 | 2.37 | - | 20.00 | 1625.00 | | 5.97 | 9.85 |

Note: This Table indicates the disbursal schedule. The schedule may change depending on resolution of issues related to identification, availability and adaptation of technology.

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*India Country Programme, September 1993.*

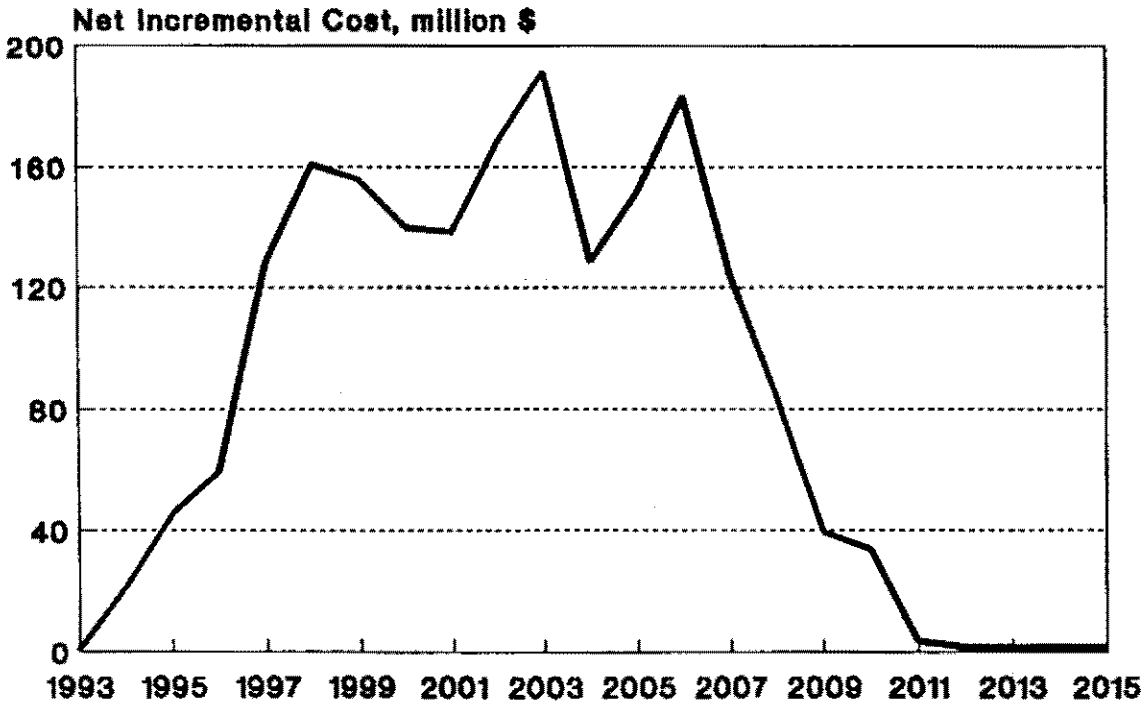


**Figure 12: Phasing of incremental cost requirements.**

# Annexure 1

## Indicative List of Categories of Projects

### *Chemical Substitutes*

**Transfer of patents and designs, capital cost of establishing new production facilities**

(a) for the manufacture of HFC-134a, HFC-152a, HFC-23, HFC-32/143, HCFC 141b/142b, HCFC-123 and HCFC 124/125.
(b) for the manufacture of new lubricants for HFC-134a.
(c) for the manufacture of substitutes for Halons.

**Conversion**

(a) from CFC-11/12 to HCFC-22

**Rationalization**

(a) of HF capacity.
(b) of chloromethanes capacity.

**Destruction/disposal**

(a) transfer of patents and design and capital cost for establishment of destruction/disposal/conversion facilities.

**Enforced idleness and premature retirement**

(a) Enforced idleness of CFC capacity
(b) idleness/closure of methyl chloroform plant.
(c) idleness/closure of CTC capacity.
(d) Idleness/closure of halons plants.

**Research into adaptation of technologies**

(a) Technology assessment and adaptation centres

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Note: 1. H.A.P. production project has been excluded from this list. It is shown under the Aerosols Sector.

2. This is not an exhaustive list due to lack of clarity regarding projects.

**Research into adaptation of technology**

(a) Technology testing and evaluation facilities

(b) Redesign of the appliances and components

(c) Reduction of emissions of CFCs through better manufacturing and service practices.

**Transfer of patents and designs**

(a) Recovery, recycling and reclamation.

(b) Substitution of CFC technologies by proven non-CFC technologies available and in use.

(c) Retrofitting, drop in substitutes and new substances.

Each of the above areas require adaptation, development, training, engineering and establishing manufacturing processes. A comprehensive R&D strategy is therefore proposed with the following objectives:

- Technology transfer, development and absorption.
- Assessment of various alternative substances, lubricating oils and materials.
- Testing, evaluation and adaptation of equipment.
- Development of recovery and recycling methods and systems.
- Considering that promising substitute substances and technologies are changing rapidly and new substances may be added in the list of 'controlled substances' under the Protocol, it is felt necessary that a Technology Assessment Centre in this area be established.

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*India Country Programme, September 1993.*

## *Foams*

### Institutional Strengthening

- Evaluation and assessment of substitute blowing agents for various applications, such as for flexible slabstock applications and for rigid PUF insulation.

### Research into technology adaptation

- CFC-free/CFC-reduced polyol system

### Transfer of patents, designs and technology

- Conversion of polyol manufacturing facilities
- Conversion/retrofit of flexible slabstock industries for ODS reduction and safety.
- Conversion of flexible moulded and rigid PUF insulation manufacturing facilities.

## *Solvents*

### Institutional strengthening

- Testing and evaluation facilities for each subsector would be established to facilitate technology selection.

- Projects identified for good housekeeping would enable rapid reduction of ODSs at minimum costs. These include creating and improving awareness with respect to good operating practices, setting up of technology infrastructure base, collation and dissemination of information and services for recovery and recycling of ODSs in the sector. Such projects would be highly beneficial to the numerous informal, small and medium scale sector units which pose a unique difficulty for phaseout in this particular sector.

### Research into technology adaptation

- Lead or beacon projects would be implemented in identified user subsectors, from which the experience gained would be available for large scale implementation.

### Transfer of patents, designs and technology

- Acquisition of technology, supply of design and drawings and verification of existing/new programmes in the subsectors would facilitate the phaseout process. Specific projects would have to be designed for the informal sector. Production of substitutes through transfer of patent and design, where appropriate, would be undertaken.

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*India Country Programme, September 1993.*

## *Halons*

**Institutional strengthening**

- Training, education, seminar, study-trips for country programme implementation.
- Addition and revision of standards and codes and their circulation.
- Halon banking and management study.
- Halon-like chemical replacement study.

**Research into technology adaptation**

- Identification and evaluation of alternative technology for fixed fire extinguishing systems.

**Transfer of patents and designs; establishment of new facilities**

- Production of chemical substitutes.
- Change-over of portable fire extinguishers.
- Halon conservation activity (filling, recovery, recycling, etc.).
- Production of alternative fixed fire protection systems.
- Simulation packages.

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*India Country Programme, September 1993*

# *Aerosols*

## Overview of Sub-projects

Sub-projects in Aerosol sector to phaseout use of CFC 11/12 as a propellant in Aerosol products includes *inter alia*:

## Alternative propellant producers sub-projects

For Aerosol products, other than inhalant pharmaceutical spray, the most suited and cost-effective alternative propellant is Hydrocarbon Aerosol Propellant (HAP). In some specific applications, DME would be suitable and cost effective. Production facilities of alternative propellants would be set up.

## Aerosol fillers sub-projects

Most Aerosol filling units are not equipped with the facilities for using flammable propellants. Investment projects for conversion of Aerosol filling plants to safe filling standards will be developed.

## Aerosol cans manufacturer sub-projects

This includes equipment and quality control for suitable necking of the Aerosol cans.

## Not-in-kind substitute sub-projects

This includes manufacturing facilities for atomizers and trigger pumps.

## Inhalant spray manufacturers sub-projects

This will include projects for which substitutes are available.

## Support activities sub-projects

This includes workshops, safety audits and training programmes.

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*India Country Programme, September 1993.*

(a) Institutional strengthening and linkages for diffusion and absorption of technologies.

(b) Pilot studies, awareness, prototyping projects.

(c) Unit level components

(d) Vendor level components

(e) Compensation for machines and labor dropouts

(f) Training components on technology, materials, products/prototypes etc.

(g) Full transition management and database generation cost apart from full cost of technology, consultancy, training and awareness etc.

(h) Research to adapt technologies for use in the small-scale and informal sector.

(i) Premature retirement and enforced idleness of units.

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*India Country Programme, September 1993.*

## *End-Users*

- Premature retirement of equipment, such as domestic refrigerators.
- Retrofitting of CFC-based equipment to accept ODS substitutes.
- Development and dissemination of drop-in substitutes.
- Recovery, reclamation and recycling of CFCs to extend the life of CFC based equipment.
- Technical assistance to reduce consumption and unintended emissions of ODS.

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*India Country Programme, September 1993.*

# ADDENDUM - INDIA COUNTRY PROGRAMME

1. The sub-titles of the chapters mentioned below be read as follows:

   CHAPTER - 3 NATIONAL STRATEGY AND ACTION PLAN
   CHAPTER - 3.1 STRATEGY
   CHAPTER - 3.2 PRINCIPLES FOR PROJECT SELECTION
   CHAPTER - 3.3 PRODUCTION OF SUBSTITUTES

2. Page 5, Chapter 1.2. Support from the Multilateral Fund through UNDP for the Country Programme was US$ 200,000.

3. Page 8, Table 1. Details on export and import are that CFC-113 was imported primarily from the US and Japan. CFC-11 was largely imported as polyol systems. Halons were imported from US, UK and Germany. India exports its CFC to the South East Asia and West Asia.

4. Page 11, Table 3. The quantity of CFC-12 for recharge is less compared to the initial charge in the domestic Refrigeration Sector because of the high growth rate in this sub sector and relatively new population of refrigerators. The current annual production of refrigerators consumes more CFC than the amount required for recharge because of small population of refrigerators requiring recharge i.e. 10% of the 5 year old refrigerators are only considered.

5. Page 24, chapter 2.3. The words "less than half" be replaced by "approximately 45%" and in last para, last line "after HCFC-22" the words "and blends" be added.

6. Page 25 under the head domestic refrigerators the following be added:

   "The production capacity of this fast-growing sector including three plants commissioned recently is 2.5 million units per annum. About 1.4 millions units of refrigerators were manufactured in 1991. The population of domestic refrigerators in India in 1991 was estimated to be about 8.3 million units."

7. Page 28-31, chapter 2.4. Copies of orders outlining constitution and terms of reference of the existing committees and the procedure for approval of projects, at present, are enclosed. These may be suitably modified in future.

8. Page 39, chapter.3.4. The title of table 6 be read as "CFC substitutes under consideration for R & AC sector". The sub-head "currently known alternatives" be read as "currently evolving alternatives".

9. Page 40-41, the acronyms HR, IS and RIM be expanded to 1) High resilience, 2) Integral Skin and 3) Reaction Injection Moulding.

10. Page 47, The Technology fund will be an investment project in itself.

11. Page 50, chapter 3.11, para 2, after the words "demands profile" the following be added "material phase out is to occur only from 1996 because of the time lag after Country Programme preparation in the project preparation, approval and implementation."

12. Page 55, The administrative cost is institutional strengthening cost.

13. Page 59, Table 12 The time frame indicated is the outer limit for compliance and this could be achieved earlier provided sufficient funds are made available and required technologies are transferred in accordance with the provisions of the protocol.

14. Page 61, chapter 4.2, the following explains the methodology for calculation of incremental cost: In all sectors, the evaluation of incremental costs is based on the advice of the UNDP experts, the project cost estimates provided by Indian Industry and comparison with other similar large Country Programmes. The methodology adopted in each sector is different. In Foams, Aerosols and R & AC, comparisons with other projects approved by the Executive Committee were made. In the Solvents sector, the unit ODP phase out costs for the various sub-sectoral applications were considered. In the case of Chemical Producers, the estimates were largely based on the assessment by industry.

contd..p.3

15. Page 64, chapter 4.3, at the end of the first line, an * and the following foot note be added:

"The figures of US $ 390 million for small scale might change after survey."

**COMMENTS**

1. A list of projects by sector with indication of phase out of ODS tonnes and associated incremental cost has not been provided. India has all the ODS producer and user industry in the private sector and in a liberalised economy industries will willingly commit scares resources only when the frame work and strategy for phase out is clearly spelt out and approved. It is only after the approval of the Country Programme that industries will consider project preparation. However, the outer limits for the phase out will be adhered to by the industries and the Country will honour its commitment of phasing out ODS with in the stipulated time frame. By 1995 it is hoped that unit wise project will be ready in each of the sectors.

2. The base year for phase out has not been taken as 1991, because the protocol provides for unrestricted consumption till year 1996, for all calculations 1996 has been taken as the base year.

F.No.4/34/92 IC-I
Government of India
Ministry of Environment & Forests
(OZONE CELL)

Paryavaran Bhawan,
CGO Complex,
Lodi Road,
New Delhi-110003.

Dated the 20th September, 1993.

O R D E R

Following the accession of India to the Montreal Protocol on the Substances that deplete the ozone layer it became necessary to take action to implement the terms of the protocol. The Ministry of Environment & Forests which is coordinating the subject, has decided to set up an empowered Steering Committee to approve all project proposals to be sent to the Montreal Protocol Executive Committee for grants and for reviewing implementation of the Protocol.

2. In continuation of earlier order of even no. dated 10.9.93, the empowered Steering Committee shall consist of the following:

| | | |
|---|---|---|
| i) | Secretary (Environment & Forests) | Chairman |
| ii) | Secretary (Finance) | Member |
| iii) | Secretary (Chemicals & Petrochemicals) | Member |
| iv) | Secretary (Industrial Development) | Member |
| v) | Secretary (Commerce) | Member |
| vi) | Secretary (Petroleum & Natural Gas) | Member |
| vii) | Secretary (Science & Technology) | Member |
| viii) | Director General, CSIR | Member |
| ix) | Development Commissioner (SSI) | Member |
| x) | Chairman, CPCB | Member |
| xi) | Maximum of four eminent persons from outside Government representing Environment, Technology & Finance to be nominated by the Ministry of Environment & Forests | Member |

a) Dr. S. Varadrajan
b) Dr. S. Mundle Director, National Institute of Public Finance and Policy

xii) Maximum of four industry representatives (who will not have a direct interest) to be nominated by the Ministry of Environment & Forests — Member
   a) Representative of CII
   b) Representative of ICMA

xiii) Additional Secretary/Joint Secretary Ministry of Environment & Forests — Member-Secretary

The Steering Committee would be responsible to the Ministry of Environment & Forests for its overall functioning. It will devise its own rule of procedure for grants & implementation of the Protocol:

4. The Committee will ensure that projects are properly prepared and reviewed, choosing where necessary an appropriate agency but in a manner that does not cause unnecessary delay.

5. The procedure to be followed by the Committee would be notified.

( ANIL AGARWAL )
DEPUTY SECRETARY (OZONE)

To

All Members of the Committee

NO.4/34/92-IC

GOVERNMENT OF INDIA

MINISTRY OF ENVIRONMENT AND FORESTS

OZONE CELL

Paryavaran Bhawan
CGO Complex, Lodi Road
New Delhi - 110 003.

New Delhi, 13th September, 1993.

**O R D E R**

In continuation of earlier office order of even no. dated 23rd July, 1993, the Technology and Finance Standing Committee of the Steering Committee on the Montreal Protocol will now consists of the following persons.

1. Dr. S. Varadarajan - Chairman
   4-A, Girdhar Apartments
   28, Feroze Shah Road
   New Delhi-1.

2. Secretary, Min. of Finance or - Member
   his Representative

3. Dr. A.V. Rama Rao - Member
   Director
   Indian Institute of Chemical Technology
   Director
   Indian Institute of Chemical Technology
   Hyderabad - 500 007.

4. Dr. K.V. Swaminathan - Member
   Director,
   Asia & Pacific Centre for
   Transfer of Technology, UN,
   Adjoining Technology Bhawan,
   Off New Mehrauli Road,
   New Delhi-110 016.

5. Representative of IDBI - Member

6. Representative of Confederation - Member
   of Indian Industry

7. Representative of Indian Chemical Manufacturers Association - Member

8. Representative of Engineers India Ltd. Member

9. Dr. S. Agarwal
Indian Institute of Technology
Delhi. Member

10. Dr. S. Mundle
Director
National Instt. of Public Finance & Policy
(or his representative) Member

11. Representative of Dept. of Chemicals and Petrochemicals Member

12. Representative of Dept. of Industrial Development Member

13. Representative of DC,SSI Member

14. Deputy Secretary (Ozone)
MOEF Member-Secretary

Serial 11, 12 and 13 have been added as decided in the fourth meeting of the Steering Committee held on 21.8.93. Reamaining part of earlier order is reproduced below.

"Convenors/Representatives of the Sectoral Groups may be invited whenever considered necessary when projects of that sector are being discussed.

The Group will deal with the following aspects:

i) Evaluation, Prioritization and Selection of appropriate technologies for production of replacement chemicals as well as different applications and trial including improvement and dissemination of such technologies.

ii) Evaluation of proposals for modernisation, upgrading of equipments, supporting manpower and services.

iii) Identifying technologies and equipment/components and chemical materials which are locally available and potentially available and suggesting the manner in which they can be used for self-sufficiency.

iv) Involvement of research institutions/universities including in-house R&D set ups in private sector, research groups and consultancy engineering design organisations with a view to develop indigenous capabilities.

v) Fiscal measures for promotion and development of technology, determining costs, etc.

vi) This Group will also recommend the panel of Indian consultants who will help the enterprises in preparing the project proposals. ( As EIL is a member of this committee, it is presumed that EIL will not undertake this activity).

2. The Group will be a Standing Committee of the Steering Committee. It may co-opt other experts. The Group will continuously look at implementation of the Montreal Protocol.

3. This is issued as approved by the Steering Committee in its Third Meeting."

( ANIL AGARWAL )
DEPUTY SECRETARY TO THE GOVT. OF INDIA

Distribution

1. Dr. S. Varadarajan, 4A, Girdhar Apartments, 28, Feroze Shah Road, New Delhi-1.

2. Secretary, Ministry of Finance or his representative.

3. Dr. A.V. Rama Rao, Director, Indian Institute of Chemical Technology, Hyderabad - 500 007.

4. Dr. K.V. Swaminathan, Director, APCTT, UN, Adjoining Technology Bhawan, Off New Mehrauli Road, New Delhi-16.

5. Representative of IDBI.

6. Representative of Confederation of Indian Industry.

7. Representative of Indian Chemical Manufacturers Association.

8. Representative of Engineers India Ltd.

9. Dr. S. Agarwal, IIT, Delhi.

10. Dr. S. Mundle, Director, National Institute of Public Finance and Policy (or his representative).

11. Mrs. Lalita B. Singh, Adviser, Deptt. of Chemical and Petrochemicals

12. Shri Bimal Julka, Director, Deptt. of Industrial Development

13. DC,SSI

NO.4/34/92-IC-I

GOVERNMENT OF INDIA

MINISTRY OF ENVIRONMENT AND FORESTS

OZONE CELL

New Delhi, 13th September, 1993.

# O R D E R

In continuation of earlier office order of even no. dated 23rd July, 1993, regarding constituation of Standing Committee on Small Scale, Tiny and unorganised industries of Steering Committee on the Montreal Protocol, the Standing Committee will now consists of the following persons.

| | | |
|---|---|---|
| 1. | Development Commissioner, Small Scale Industries | - Chairman |
| 2. | Representative of Ministry of Finance | - Member |
| 3. | Representative of Ministry of Information & Broadcasting | - Member |
| 4. | Representative of Director, National Productivity Council | - Member |
| 5. | Representative of National Small Industries Corporation | - Member |
| 6. | Dr. S. Mundle, Director, National Institute of Public Finance and Policy (or his representative) | - Member |
| 7. | Representative of Confederation of Indian Industry | - Member |
| 8. | Representative of SIDBI | - Member |
| 9. | Representative of IDBI | - Member |
| 10. | Representative of CSIR | - Member |
| 11. | Representative of Deptt. of Chemicals and Petrochemicals | - Member |
| 12. | Deputy Secretary (Ozone) MOEF | Member-Secretary |

Serial 10 and 11 have been added as decided by the Steering Committee in its Fourth meeting held on 21.8.93. The remaining part of the earlier order is reproduced below:

"The Group will deal with the following aspects:

i) To survey and investigate the number and present status, geographical location, etc. of industries using ODS.

ii) To assess the path of conversion from ODS to non-ODS.

iii) To suggest phase out options, evaluation, assessment and selection of appropriate technologies relevant to small scale, tiny and unorganised sectors. Demonstration, Dissemination, promotion of these technologies and practices & generation of awareness relating to ODS phase out.

iv) To prepare proposals for giving assistance to such industries.

v) To train personnel of all categories involved in different activities in these sectors.

vi) Facilitating project formulation and reviewing and also monitoring the implementation of phase out in these sectors.

2. The Group will be a Standing Committee of the Steering Committee. It may co-opt other experts. The group will continuously look at the implementation of the Montreal Protocol.

3. This is issued as approved by the Steering Committee in its Third Meeting held on 23rd July, 1993."

( ANIL AGARWAL)
Deputy Secretary (Ozone)

GOVERNMENT OF INDIA

MINISTRY OF ENVIRONMENT AND FORESTS

OZONE CELL

New Delhi, 13th September, 1993.

**O R D E R**

In continuation of office order of even no dated 23rd July, 1993, regarding constitution of the Standing Committee on Monitoring of the Steering Committee on the Montreal Protocol, the Standing Committee will now consists of the following persons.

| | | |
|---|---|---|
| 1. | Chairman, CPCB | - Chairman |
| 2. | Representative of Ministry of Chemicals | - Member |
| 3. | Representative of Ministry of Indl. Development | - Member |
| 4. | Representative of Confederation of Indian Industry | - Member |
| 5. | Representative of Development Comissioner, Small Scale Industries | - Member |
| 6. | Representative of ICMA | - Member |
| 7. | Representative of IDBI | - Member |
| 8. | Representative of SIDBI | - Member |
| 9. | Representative of CSIR | - Member |
| 10. | Deputy Secretary (Ozone) | Member-Secretary |

Serial 9 has been added as decided by the Steering Committee in its Fourth meeting held on 21.8.93. The remaining part of the earlier order is reproduced below.

"Representatives of Sate Governments/State Pollution Control Boards may be invited for the meeting, when projects pertaining to that State are taken up for monitoring.

The Group will deal with the following aspects:

i) To set up a data base on unit consuming ODS.

ii) To prepare a statistical data base on production, import and export of each of the controlled substances according to Article 7 of the Montreal Protocol.

iii) To exchange this data with Development Commissioner, Small Scale Industries, who are monitoring units in Small Scale, tiny and unorganised sectors.

iv) To monitor timely execution of investment projects and ODS phase out, etc.

v) To publish this data and disseminate to various Ministries, Industry associations, State Governments and others.

2. Maintenance of data base should be in the proforma prescribed by the Montreal Protocol.

3. The group will be a Standing Committee of the Steering Committee. It may co-opt other experts. The Group will continuously look at implementation of the Montreal Protocol.

4. This is issued as approved by the Steering Committee in its third meeting held on 23rd July, 1993."

( ANIL AGARWAL )
Deputy Secretary ( Ozone )

**Approved Procedure for Submission and Approval of Projects for the Phase out of ODS within the Ministry after incorporating the views of Technology & Finance Standing Committee**

1. The enterprise will prepare a project document in brief indicating the project concept its consistancy with the Country Programme, the baseline and phaseout scenarios and the order of total and incremental costs involved. The format for the brief project document may be prescribed. The format used by IDBI for similar review may be adopted with suitable modifications. The initial proposal should be accompanied by audited annual reports of the enterprise for the immediate past three years, copies of agreements on technology transfer, copies of project reports submitted to the financial institutions, if the proposed project is a part of a bigger project along with statements of project costs. The enterprise should also indicate how the difference of total and incremental costs is to be met including the effect of taxes and duties existing as on date. The proposal should come under the signature of a full time Director of the Board or Company Secretary/Partners duly certifying all the documents.

2. The proposal will be received in the Ozone Cell. The enterprise will be given a receipt. A copy of the proposal will be sent to the EIL or another designated agency and members of the Technology & Finance Committee for review. It should be possible for EIL or another designated agency to give comments within two weeks. The comments of the Expert institutions (EIL etc.) will be sent to all the members of the Technology and Finance Standing Committee and also to the enterprise so that it can offer necessary clarification.

3. Senior executives from Finance as well as technical personnel connected with implementing the project will be invited for discusion by the Technology and Finance Standing Committee on a date to be given to them at a time of submission of proposal. To ensure a timely decision, a calendar of dates for meetings of the Technology & Finance Standing Committee will be prepared in advance. It is expected that within four weeks of submitting the proposal, the Committee will be ready for discussion with the enterprise.

4. After the discussions the Committee will decide on the basis of the Country Programme whether to prima facie accept project concept or not. This decision will also be based on the extent to which the project fulfils obligations of the Government of India under the Montreal Protocol including the time period involved and quantity of ODS being phased out. In some cases a large number of proposals having similar or identical objectives may be received. If they clearly add up to volumes and sizes of production far in excess of total expected demand for substitutes coordination/verification/confirmation has to take place to avoid wasteful expenditure and effective utilisation of Multilateral Fund grant to meet the objectives. The clearance of the proposal will be for preparing a detailed project report for scrutiny and approval and will not constitute approval of the project.

5. An implementing agency will be identified for the project. The implementing agency will be requested to have the Techno-Economic Feasibility report prepared with the help of National consultants. The report should be prepared as if the enterprise is seeking loan from a financial institutions duly incorporating the information required by the Montreal Protocol Executive Committee. The enterprise can also prepare the project report on their own or hire a consultant of their choice and submit the report to Implementing Agency for review. We should not be too involved in suggesting a consultant to the enterprises for preparation of project reports. Only if the enterprise requires a consultant to be engaged, we may suggest a panel of consultants in each sector/sub-sector. The project report should also provide date-wise targets for implementation of the project to facilitate its monitoring. How the old equipment is to be prevented from being re-used has to be clearly spelt out.

6. The implementing agency will be requested to send to the Ozone Cell a copy of the project report along with their comments as well as the comments of their external reviewer. At this stage the comments of Expert institutions (EIL etc.) will be obtained. These comments will be sent to the enterprise for offering necessary clarification. The project report along with all the comments will be considered in detail by the Technology & Finance Standing Committee and if necessary enterprise will be requested to make a presentation. Subsequently the comments of the Ministries etc. will be considered in the Project Screening Committee. The project will be approved in the Steering Committee. It is expected that from the date of receipt of the project report from the implementing agency, we should be able to clear the project within six weeks and send it to the Montreal Protocol Executive Committee for approval.

7. For the National consultants and the Expert institution to be able to respond quickly the key personnel in their institution with whom the Ozone Cell will interact will be identified.

8. The enterprise will submit their proposal to the Ozone Cell either personally or through registered post. The enterprise will not discuss details with individual officers of the Cell/Ministry. They may state their views in the discussions in the Technology & Finance Committee.

9. Different Ministries/Organisations will be requested to nominate their representative in such a manner that continuity of participation in the meeting is obtained.

10. This procedure will be followed to the extent possible. In special cases, different committees will have necesary authority to make appropriate modifications. The objective will be to ensure that projects are properly prepared and reviewed without causing unnecessary delay.

11. The preparation, scrutiny, monitoring etc. of projects will involve financial expendititure. This should be included in the project cost and aportioned among different agencies appropriately. The role of different agencies e.g. EIL, IDBI, Monitoring Committee etc. should also be suitably defined so as to avoid gaps/overlaps. However, it should be noted that there is no provision of such expenses in the existing procedure of the Multilateral Fund. The implementing agencies get some money for the purpose. The issue will have to be taken up with the Fund Secretariat and the implementing agencies. There is no budgetary support from the government for this purpose.