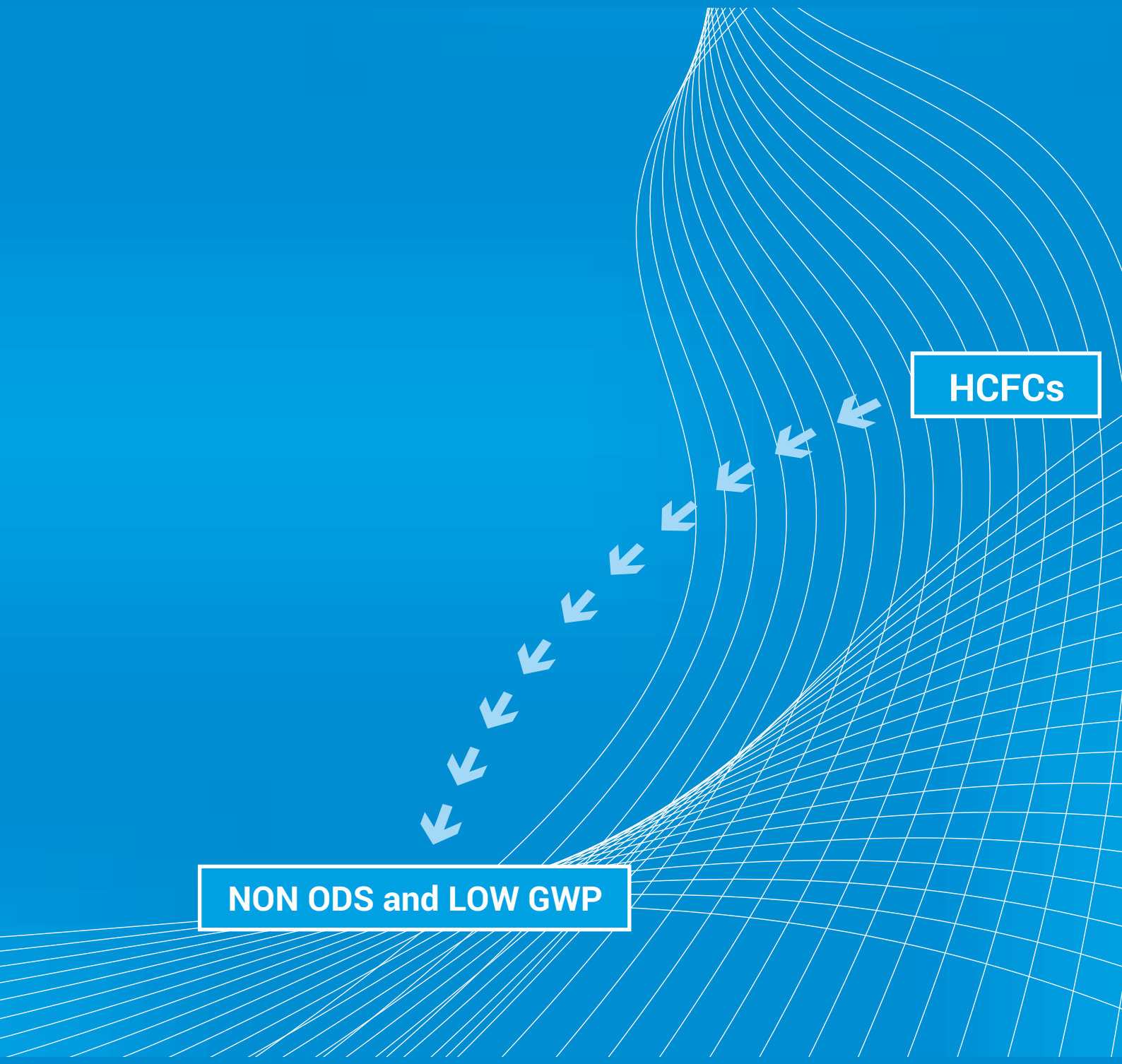
HCFC PHASE-OUT MANAGEMENT PLAN
STAGE-II



OZONE CELL
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA
NEW DELHI, INDIA
2017

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STAGE-II

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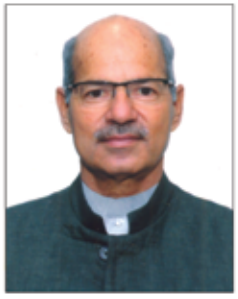
NEW DELHI, INDIA
MARCH, 2017

अनिल माधव दवे
Anil Madhav Dave

सत्यमेव जयते

राज्य मंत्री (स्वतंत्र प्रभार)
MINISTER OF STATE (INDEPENDENT CHARGE)
पर्यावरण, वन एवं जलवायु परिवर्तन
ENVIRONMENT, FOREST & CLIMATE CHANGE
भारत सरकार / GOVERNMENT OF INDIA



Message

The Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, having universal ratification, are recognized as the most successful international environmental treaties. The extraordinary international cooperation of Parties to the Montreal Protocol has led to not only the phase-out of production and consumption of several Ozone Depleting Substances (ODSs), but also to significantly contribute towards protection of the global climate system.

The developing countries took on the commitments for phasing out production and consumption of ODS with technical and financial assistance from the Multilateral Fund, set up under the Protocol. A robust and transparent mechanism was created under the Protocol for providing technical and financial assistance to assist developing countries meet their obligations. Recognition of common but differentiated responsibilities as in case of the Montreal Protocol, has served as an example of excellent international cooperation for addressing other environmental challenges.

India, as a Party to the Montreal Protocol and all its amendments has been successfully implementing the Country Program. India has set up a sound regulatory and fiscal incentive system in the country. This has ensured successful implementation of the programmes and achievement of all its commitments to the Protocol.

Wherever feasible, India has leapfrogged the transition from Ozone Depleting Substances to climate friendly refrigerants. The transition from HCFCs to environment-friendly, technically proven and economically viable alternatives in all the relevant sectors is a challenging task. India is committed to attainment of its development goals in an environmentally sustainable manner and is making efforts to transit to low GWP alternative technologies.

The phase-out of HCFCs in the HPMP Stage-II will be addressed through several technology conversions at a number of large, medium, small and micro enterprises in the polyurethane foam sector, a few large enterprises in the air-conditioning manufacturing sector, and activities in the Refrigeration and Air-Conditioning (RAC) servicing sector. India is committed to ensuring the smooth transition of these enterprises to new technologies, and values the interest of SMEs most. In the process targeted technical assistance and awareness programs will be implemented focused on SMEs during the HPMP Stage-II to ensure timely and sustainable phase-out of HCFCs.

It gives me great pleasure to dedicate the India's HPMP Stage-II to the twin global objective of protection of ozone layer and climate benefit to the Planet.

(Anil Madhav Dave)

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अजय नारायण झा
AJAY NARAYAN JHA, IAS

सचिव
भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
Secretary
Government of India
Ministry of Environment, Forest and Climate Change

सत्यमेव जयते

MESSAGE

The evolution of the Montreal Protocol has led the developed and developing countries including India, playing a vital role for meeting the challenging tasks of phasing-out of production and consumption of the Ozone Depleting Substances (ODSs). Countries across the globe have been making all efforts for early recovery of the Ozone layer to the pre-1980 level and to save the planet from lethal Ultra Violet-B radiations.

The Montreal Protocol has emerged as an excellent decision making platform for integrating scientific and technical evidences and resource mobilization for attainment of objectives.

India having ratified the Montreal Protocol, has met all the obligations of the Montreal Protocol by accessing technical and financial assistance from Montreal Protocol. The Indian industry has also been making all round efforts to phase-out production and consumption of Hydrochlorofluorocarbons (HCFCs) as per the accelerated phase-out schedule of HCFCs. The key attribute to India's success in implementation of ODS phase out programme is involvement of key stakeholders both at the planning as well as implementation stages.

India has made significant contribution in developing an inclusive narrative leading to historic Kigali Amendment in October, 2016. India has played its role in bringing out energy efficiency gains as an important element in the agreement. We look forward to intensive and innovative work in the field of incorporating energy efficiency as a key component in transition away from manmade ozone depleting and high GWP refrigerants to new environment friendly alternatives.

The HCFC Phase out Management Plan (HPMP) Stage-II implementation needs to be forward-looking, systematic and efficient. It has to be approached in an integrated and result-oriented manner in order to achieve the compliance targets as per the accelerated phase out schedule of the Montreal Protocol. Towards this endeavour, all the key stakeholders need to work closely following a consensus approach, as done in the past.

I wish all the success for implementation of the HPMP Stage-II.

Date: **03-3-2017**

(A.N. Jha)

Place: **New Delhi**

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LIST OF ABBREVIATIONS

CFCs	Chlorofluorocarbons
CP	Country Program
CTC	Carbon tetrachloride
DGCIS	Directorate General of Commercial Intelligence and Statistics
DGET	Directorate General for Employment and Training
DGFT	Directorate General of Foreign Trade
Ex-Com	Executive Committee of the Multilateral Fund
GIZ	Deutsche Gesellschaftfür Internationale Zusammenarbeit, Proklima, Government of Germany
GHG	Green House Gas
GWP	Global Warming Potential
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
HPMP	HCFC Phase-out Management Plan
IPUA	Indian Polyurethane Association
ITIs	Industrial Training Institutes
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MoEF&CC	Ministry of Environment, Forest and Climate Change
MOP	Meeting of the Parties to the Montreal Protocol
MT	Metric tons
OEM	Original Equipment Manufacturer
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
PMU	Project Management Unit
RAC	Refrigeration and Air-conditioning
RAMA	Refrigeration and Air-conditioning Manufacturers Association
MSMEs	Micro, Small and Medium Enterprises
TR	tons of Refrigeration
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

EXECUTIVE SUMMARY

India acceded to the Vienna Convention for the Protection of the Ozone Layer in March, 1991 and ratified the Montreal Protocol on Substances that Deplete the Ozone Layer in June 1992. India has also ratified all the amendments to the Montreal Protocol including London amendment in1992, Copenhagen and Beijing amendments in 2003. India is classified as a Party operating under Paragraph 1, Article-5 of the Montreal Protocol and thus is qualified for technical and financial assistance from the Multilateral Fund (MLF), established as the financial mechanism of the Montreal Protocol.

As a party operating under Article-5 of the Montreal Protocol, India is committed to phase-out Ozone Depleting Substances (ODSs) including Hydrochlorofluorocarbons (HCFCs) in 2030 in accordance with the accelerated phase out schedule of the Montreal Protocol. India has taken progressive measures to phase out designated controlled substances and is in compliance with the Montreal Protocol control schedule. This has been successfully accomplished through assistance from the MLF for the implementation of the Montreal Protocol by undertaking technology conversions, technical assistance, training and capacity building, information dissemination and awareness-raising, management and coordination. India has also established an effective policy and regulatory framework for ODSs. The regulatory frame work for ODSs is set forth in the Ozone Depleting Substances (Regulation and Control) Rules, 2000. The above rules have been amended in 2001, 2003, 2004, 2005, 2006, 2007 and 2014. The most recent amendment of the year 2014 was done for aligning with the accelerated phase-out of HCFCs.

India had taken proactive steps for implementation of the accelerated phase-out schedule of HCFCs, in line with the decision XIX/6 of the 19th Meeting of Parties of the Montreal Protocol held in September, 2007 at Montreal. India prepared a Roadmap as early as in the year 2009 describing the long term vision and action plan including the policy instruments for phase-out of production and consumption of HCFCs in the country. It took into account expected availability of technologies that are sustainable and have minimum cost impact on industry and consumers.

India has been successfully implementing the HCFC Phase-out Management Plan (HPMP) Stage-I approved by the Executive Committee (Ex-Com) of the MLF at its 66th meeting held in April 2012 to meet the freeze target of 2013 and 10 % phase-out targets of HCFCs in 2015 (detailed in Table 1). In line with the guidelines approved by the Ex-Com, India in HPMP Stage-I had prioritized phase-out of HCFC-141b in foam manufacturing sector, especially in the large HCFC consuming enterprises and initiated activities in the Refrigeration and Air-conditioning (RAC) Servicing sector. In addition, technical and financial assistance was secured for Systems Houses for developing HCFC-free polyol formulations with low-Global Warming Potential (GWP) for use as blowing agents, which would subsequently be used in HPMP Stage-II by Micro, Small and Medium Enterprises (MSME) enterprises.

The baseline consumption of the HCFCs as an average of the year 2009 and 2010 is as follows:

Substance	Annex	Group	Starting point for aggregate reductions in consumption (ODP tons)
HCFC-123	C	I	3.50
HCFC-124	C	I	13.50
HCFC-141b	C	I	865.50
HCFC-142b	C	I	123.70

Substance	Annex	Group	Starting point for aggregate reductions in consumption (ODP tons)
HCFC-22	C	I	602.00
Sub-total			1,608.20
HCFC-141b contained in imported pre-blended polyols	C	I	83.05
Total			**1,691.25**

The phase out schedule as agreed upon for HCFCs is as follows:

Table 1: HCFC Phase-out Limits for India

Montreal Protocol Maximum Allowable Consumption of Levels of Annex C Group 1 Substances	Consumption Limit (ODP tons)
Baseline (2009-2010 average)	1608.20
2013- Freeze on baseline levels	1608.20
2015- 90% of the baseline	1447.38
2020- 65% of the baseline	1045.33
2025- 32.5% of the baseline	522.67
2030- 2.5% of the baseline	40.21
2040- No consumption	0

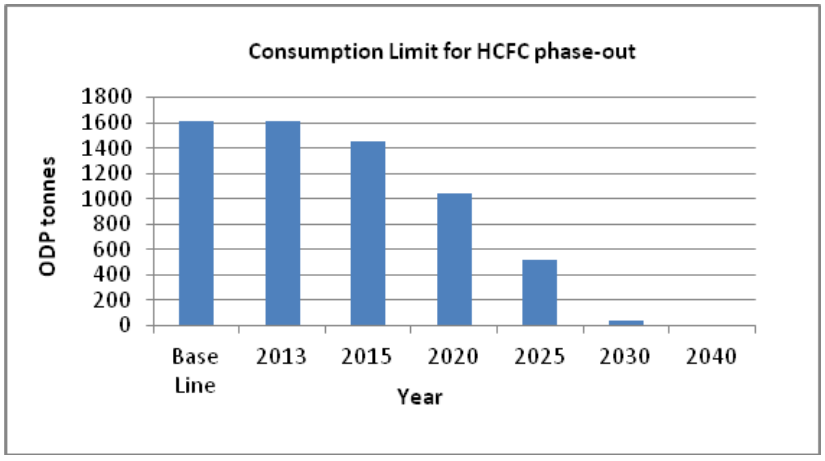


Fig. 1 Consumption Limits as per Montreal Protocol Schedule

Phase-out Targets:

The successful completion of the HPMP-I will lead to phase out of 341.77 ODP tons of HCFCs mainly in foam sector. The HPMP Stage-II of India has been prepared for assisting the country in achieving compliance with post 2020 control targets for consumption of Annex C Group 1 substances (HCFCs) of the Montreal Protocol with complete phase-out by 2020 of HCFC-141b, and phase out of HCFC-22 consumption in the air conditioning manufacturing sector in the country. In addition, HPMP Stage-II addresses phase-out of HCFC-22 in the RAC servicing sector, project activities, policy and regulations, and enforcement

trainings. The plan also includes activities that build on already implemented HPMP Stage-I activities. Through the HPMP Stage-II, India will be reducing HCFC consumption from the baseline of 1608.20 ODP tons to 48% by 2020, 50% by 2021, 56% by 2022 and 60% by 2023.

Funding for the implementation of HPMP-II

The Table 2 presents the summary of the total funding approved by Executive Committee of the MLF for the implementation of the Montreal Protocol in its 77th meeting, held in November, 2016 to meet the 2020 phase-out target and beyond up to 2023 as per the Montreal Protocol phase-out Schedule.

Table 2: Summary of Costs and Funding for HPMP Stage-II

Component	Agency	Actual phase-out Consumption		Eligible phase-out Consumption		Net Funding Request (US $)
		MT	ODP	MT	ODP	
Project Management Components	UNDP	N/A	N/A	N/A	N/A	2,400,000
Polyurethane Foam Sector Plan	UNDP	5,800	638.02	3,166	348.26	24,000,000
Air-conditioning Manufacturing Sector Plan	UNDP	1,140	62.72	1,140	62.70	12,511,459
Servicing Sector Plan	Germany	1,250	68.75	1,250	68.75	5,100,000
Enabling Activities	UNEP					900,000
Total		**8,190**	**769.499**	**5,556**	**479.71**	**44,911,459**

Outcome of HPMP Stage-II

Successful implementation of the HPMP-Stage-II will result in sustainable reductions of 8,190 MT or 769.49 ODP tons of HCFC consumption from the starting point of 1691.25 ODP tons in 2023, contributing to India's compliance well in advance with the control targets for Annex-C, Group-I substances (HCFCs) under the Montreal Protocol. In addition, the project will result in net direct CO2-equivalent emission reductions of about 8,530, 900 MT CO2 eq. per year from 2023 onwards.

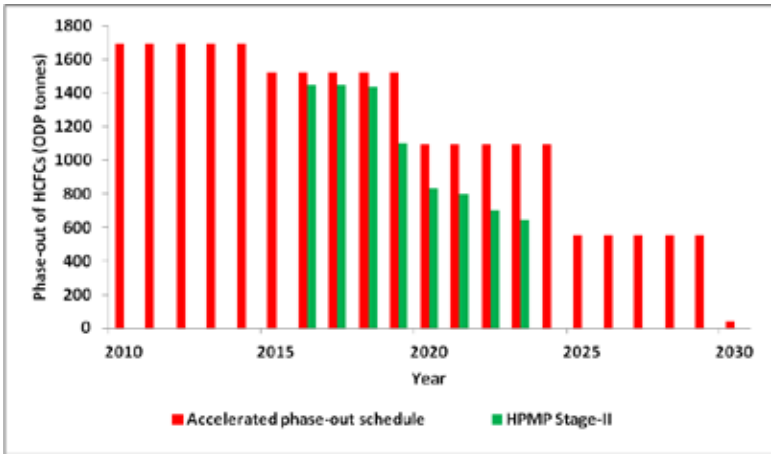


Fig. 2 Impact of HPMP Stage-II in terms of ODP tons

Implementing Agencies

United Nations Development Program (UNDP) is the lead implementing agency for HPMPs in India, the United Nations Environment Program (UNEP) and Deutsche GesellschaftfürInternationale Zusammenarbeit, (GIZ) Proklima, Government of Germany are the cooperating agencies. UNDP will be responsible for the coordinating activities between the agencies. All the activities relating to HPMP Stage-II implementation will be done in close cooperation with the stakeholders under the supervision of Ozone Cell, Ministry of Environment, Forest and Climate Change, Government of India.

INTRODUCTION

1. INTRODUCTION

1.1 OBJECTIVES

The objectives of India's HPMP-Stage-II are:

- To facilitate India's compliance with the Montreal Protocol 2020 control targets for consumption of Annex-C, Group-I substances (HCFCs) through complete phase-out of HCFC-141b consumption by 2020 and phase-out of HCFC-22 in room air conditioner manufacturing and servicing of refrigeration and air conditioning (RAC) sector.
- To achieve sustainable reductions in consumption of Annex-C, Group-I substances (HCFCs) through implementation of a combination of interventions for technology transfer, training and capacity-building, awareness, monitoring and management, in HCFC consuming sectors, and policy and regulatory actions.

1.2 BACKGROUND

1.2.1 Ozone Depleting Substances (ODS) phase-out activities in India

India is the second largest producer and consumer of ODS after china. India ratified the Vienna Convention for the Protection of Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer as early in 1991 and 1992 respectively. The dates of accession by India of the Montreal Protocol and its amendments were:

Table-3: Dates of Accession to Montreal Protocol and its Amendments

Agreement/Amendment	Ratification
Vienna Convention	18 March 1991
Montreal Protocol	19 June 1992
London Amendment	19 June 1992
Copenhagen Amendment	3 March 2003
Montreal Amendment	3 March 2003
Beijing Amendment	3 March 2003

India's Country Programme for phase-out of ODSs under the Montreal Protocol was developed in August 1993 with the assistance of United Nations Development Programme (UNDP), The Energy and Resources Institute (TERI) and representatives of various ministries, industries and scientific institutions.

India's Country Programme was approved at the 11th Meeting of the Executive Committee (Ex-Com) of the Multilateral Fund (MLF) for Implementation of the Montreal Protocol, held in November 1993. India's Country Programme implementation was contingent upon availability of adequate technical and financial assistance for mitigating the incremental costs of ODS phase-out.

India put in place policies and regulations including banning the use of Chlorofluorocrbons (CFCs) in manufacturing of new equipment from 1st January, 2003 that led to significant progress in controlling the production and consumption of ODS. The Country Programme forecasted an unconstrained demand for ODS of 96,000 metric tons by 2005, from a level of 10,370 metric tons in 1991, but successful

implementation of phase-out led to the actual demand of only about 9,000 metric tons in 2005. This was accomplished with proactive policy and regulatory actions by Government of India and technical and financial assistance from the Multilateral Fund along with the support from implementing and bilateral agencies. The ODSs phase-out activities in India from 1993 until December, 2016 are summarized in Table-4.

Table-4: MLF-supported ODS phase-out activities in India until December, 2016

Sector	Number of Projects	Funding (US$)	Phase-out (ODP tons)
Aerosols Sector (CFC)	38	13,705,006	1,702
Foams Sector (CFC)	163	37,880,185	5,074
Firefighting Sector (Halons)	21	5,176,701	2,719
Institutional Strengthening	8	2,738,166	31
Refrigeration & Air Conditioning Sector (CFC)	87	31,827,256	3,983
Solvents Sector (including CTC production)	41	61,358,042	12,966
Production Sector (CFC and Halons)	15	84,228,000	20,107
HPMP Stage-I Preparation	1	570,000	----
HPMP Stage-I (HCFC-141b and HCFC-22)	1	21,294,490	342
HPMP Stage-II Preparation	1	490,000	----
Demonstration Project in Foam Sector Preparation (HCFC-141b)	1	30,000	----
Survey on ODS Alternatives	1	180,000	----
HPMP Stage-II (HCFC-141b and HCFC-22)	1	44,911,459	769
Total	**379**	**304,389,305**	**47,693**

Source: MLF Secretariat – Inventory of approved projects.

All the projects and activities related to production and consumption of CFCs, CTC and halons have been successfully completed either on or ahead of schedule. The projects and activities related to HCFC phase-out which have been recently approved are under implementation. The sector wise phase-out of ODSs is given in Fig. 3

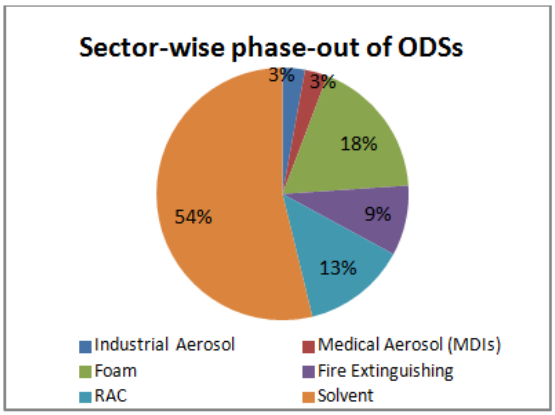


Fig 3 Sector-wise Phase-out of ODSs

1.2.2 Accelerated Phase-out of HCFCs

The 54th Meeting of the Ex-Com in April 2008, through Decision 54/39, adopted guidelines for preparation of HPMPs, which provided an indicative outline and content of the HPMPs. The key elements of the guidelines were:

a) Adoption of a staged approach for HPMPs within the context of an overarching strategy for HCFC reductions and phase-out as per the adjusted schedule. The HPMP (stage-I) focused on compliance with the 2013 freeze and 2015 reduction targets.

b) Prioritization of HCFCs for phase-out by ODP like HCFC-141b which has highest ODP among HCFCs to be phased out first and subsequently other HCFCs with lower ODP.

c) Commitments to achieve the 2013, 2015, 2020 and subsequent control milestones through performance-based agreements.

HCFCs are used in the foam manufacturing, refrigeration and air conditioning industry. During the implementation of the CFC phase-out under the Montreal Protocol, HCFCs were also introduced as transitional substitutes for ODSs wherever other non-ODS technologies were not available. Due to sustained economic growth experienced by developing countries, India in particular during all these years, the demand for consumer and industrial products using HCFCs increased rapidly.

Initially for Article 5 Parties (developing countries), the scheduled phase-out date for HCFCs was 01 January 2040. The XIX Meeting of the Parties (MOP) to the Montreal Protocol held in September 2007, in its Decision XIX/6, accelerated the phase-out schedule for HCFCs by 10 years. The accelerated schedule for phase out started with an interim control measure of freezing HCFC production and consumption at 2013 levels with first reduction of 10% on 1st. January 2015, against baseline years of 2009-2010 average consumption. Subsequent control steps are 35% reduction by 2020, 67.5% by 2025, 97.5% by 2030 and complete phase out from 1st January 2030. A service tail of 2.55 is allowed till 2040.

India being the second largest producer and consumer of HCFCs, with accelerated reduction in consumption and production of HCFCs will make significant contribution towards protection of the Ozone Layer and the Climate System.

1.3 STATUS OF IMPLEMENTATION OF HPMP STAGE-I

Considering the importance and challenges in implementation of the accelerated phase-out of HCFCs as per the Decision XIX/6 of accelerated phase-out of HCFCs, India initiated activities in 2009 with awareness programmes, collection and collation of data on consumption of HCFCs in various sectors, sectoral-strategy especially for foam, Refrigeration and Air Conditioning (RAC), and development of Roadmap for phase-out of HCFCs. The HPMP Stage-I was submitted for the consideration of the Ex-Com of the MLF at its 66th meeting held in April, 2012.

The Ex-Com of the MLF in its 66th meeting held in April 2012 approved the HPMP Stage-I for the period 2012 to 2015 for phase out HCFCs in the consumption sector to meet the 2013 and 2015 targets. The total project funding approved was US $ 23,011,537 (including the implementation agency support cost) to reduce 341.77 ODP tons of HCFCs from the starting point of 1691.25. This starting point was arrived at by addition of 1,608.2 ODP tones of consumption baseline for India (average consumption for 2009 and 2010) and 83.05 ODP tons of import of pre-blended polyol containing HCFC-141b in the baseline years, thus arriving at the starting point 1,691.25 ODP tones for HPMPs.

1.3.1 Phase-out activities in the Foam Manufacturing Sector

HPMP Stage-I has been implemented by conversion of 15 large enterprises in the foam manufacturing sector from HCFC-141b to non-ODS, cyclopentane technologies. The enterprises participating in the HPMP stage-I were the large consumer of HCFC-141b which were capable of handling the alternative technology based on cyclopentane as cyclopentane is a flammable blowing agent so due safety measures for storage, handling and use during manufacturing of foam needs to be put in place. These enterprises were from 3 subsectors, viz., domestic refrigeration (8 enterprises), Continuous Sandwich Panel (2 enterprises) and Discontinuous Sandwich Panel (5 enterprises) manufacturers. Successful implementation of HPMP Stage-I in close cooperation with the participating Industry and other stakeholders, line ministries and the implementing agencies has led to phase-out of HCFCs as per the agreement between Executive Committee of the MLF for the implementation of the Montreal Protocol and Government of India and 2013 Freeze and 2015, 10% reduction targets as per the Montreal Protocol schedule.

In addition, Technical Assistance (TA) has been provided to 15 Systems houses for developing HCFC-free polyol formulations with low-GWP blowing agents. The Systems Houses have used ecomate, cyclopentane and HFOs as blowing agents for developing pre-blended polyols. The indigenously developed low-GWP pre-blended polyols would be subsequently used by micro, small and medium enterprises (MSME). Although, the use of non-ODS pre-blended polyols is finding acceptability but its penetration would be determined by commercial factors.

The HPMP –I also initiated activities in the RAC servicing sector to reduce the use of HCFCs in the servicing sector. Enabling activities like awareness among the stakeholders, capacity building of enforcement officers, etc. have also been carried out to support the HCFC phase-out targets.

1.3.2 Phase-out activities in the RAC Servicing Sector

GIZ, Proklima and UNEP are the implementing agencies for implementation of activities under the servicing sector. The HPMP Stage-I for RAC Servicing Sector mainly focused on the Technicians Training, Institutional Strengthening, Reclamation Centers, and Monitoring and Evaluation. The technicians training were carried out with the support of 15 Training Partners. Each training partner had a minimum of 3 trainers. The 15 training partners were spread across the country to provide maximum geographic coverage. The training partners were provided standardized set of training equipment and tools for the purpose of training. HPMP Stage-I aimed for 10,200 technicians to be trained. This objective has

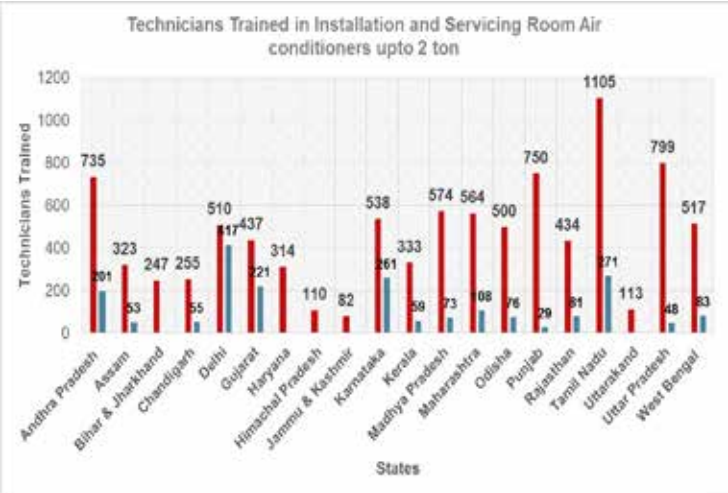


Fig:4 Number of technicians trained – State-wise details

been successfully achieved by a team of 15 Training Partners and 50 trained trainers in the field. The training was imparted to more than 11,000 RAC servicing technicians in 408 training programs. A total of 9,240 technicians were trained on good servicing practices through 332 training programs and a total 2,036 technicians were trained on good installation module through 76 training programs. The service technicians were trained on goods servicing and installation practices. The training programmes for service technicians were randomly monitored for assuring quality of training.

A pool of Trainers has also been developed by conducting Training of Trainers Programmes. Training programs were also organized for large institutional users in Government set up like Defence and Indian Railways. These institutions users have high consumption of refrigerants and large number of technical staff.

There are 597 vocational institutes in India which train about 12,000 technicians every year in RAC trade. Discussions with the Directorate General for Employment and Training (DGET) were initiated to upgrade the syllabus of Industry Training Institutes (ITIs), adapted to ODS-free servicing and Good Service Practices for HCFC based systems. Under HPMP Stage – I the 77 ITIs Instructors were trained through three training programs. In addition, promotion of recovery and reclamation of refrigerant on a pilot basis was also initiated. The details of projects implemented by GIZ in HPMP Stage-I and addresses of the training partners are given in Annexure-VI.

1.3.3 Enabling components (awareness and communication, enforcement training, capacity building and trade controls)

UNEP has been implementing activities under the enabling component for the servicing sector in close coordination with the Ozone Cell, UNDP and Lead Agency for servicing sector, GIZ. These activities include building sector interventions, enforcement training, trade controls, policy and regulation and awareness generation. The enabling component also includes awareness workshops, development of videos, publishing newsletter, developing and hosting a website (www.hpmp-ss.in) for the project and promoting / establishing the RAC servicing sector association. 6 RAC & refrigerant dealer awareness workshops, one national awareness workshop and 5 regional awareness workshops have been organised including printing of Posters & stickers for servicing enterprises and flyers for training promotions. Train the Trainers Workshop has been organsied from 21-23 December 2016 with 28 participants from India, Afghanistan, Bhutan, Bangladesh and Nepal. Participation of neighbouring countries strengthened south cooperation and India's leadership role in building capacity of customs officers from neighbouring countries. Refrigerant identifiers (28) worth US$142,000 were procured and supplied to the Customs. These identifiers are being used at priority custom ports, border checkpoints that would be used to prevent illegal trade of ODSs. India's customs and enforcement officers and Directorate of Revenue Intelligence (DRI) got the ECA Ozone Protection Award for the year 2013 and 2014 for seizure of illegal HCFCs tune to 241.3 MT and 58.72 MT respectively. Refrigeration and Air-conditioning Service Sector Society (RASSS) was established and registered as a society under the Societies Registration Act (XXI of 1860) at Chandigarh. Along with the headquarters of RASSS at Chandigarh, 5 branches/ chapters in the states of Punjab, Maharashtra, Uttarakhand, Haryana and Uttar Pradesh with over 400 members including 250 companies has been established.

Ozone Cell has collaborated with Energy Efficient Services Ltd. (EESL) to propose amendments for non-HCFC building components in National Building Codes, Energy Conservation Building Code and Green Rating for Integrated Habitat Assessment (GRIHA) and made awareness about it. A template has been prepared for amending the curriculum include ODS issues in the existing system.

The HPMP Stage-I activities have resulted in setting the platform for the Ozone Cell, Ministry of Environment, Forest & Climate Change, implementing partners, and industry and service sector to accelerate the move towards HCFC alternatives. The Ozone Cell with support from the implementing partners has been able to fulfil its Montreal Protocol commitments. The non-investment activities established the necessary enabling environment for India to successfully freeze the ODS baseline in 2013; and achieve 10% reduction in production and consumption of HCFCs by 2015 in line with the accelerated HCFC phase-out schedule.

1.3.4 Beneficial impacts of HPMP Stage-I

The HPMP Stage-I, has successfully phased-out a total of 341.77 ODP tons of HCFCs including 310.53 OPD tons of HCFC 141b in foam manufacturing and 31.24 ODP tons of HCFC-22 in RAC servicing sector respectively.

Fig.1.3 shows the phase-out of HCFCs under HPMP Stage-I in the country, the reduction in HCFC consumption is higher than the required amount to meet the target of freeze in 2013 and reduction of 10% in 2015.

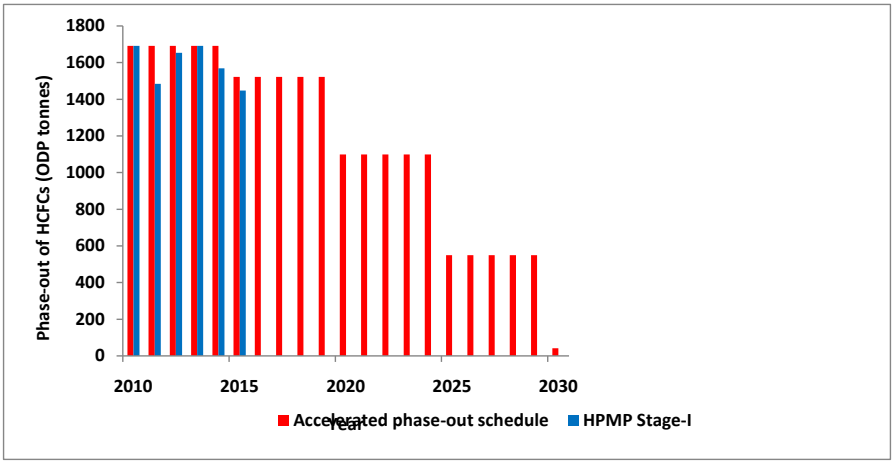


Fig.5 Phase-out of HCFCs during HPMP Stage-I

The successful implementation of HPMP-I has achieved a net direct emission reductions of 3,071,260.5 tons CO2 eq. per year in terms of indirect Green House Gas (GHG) emissions. The climate benefits on account of reduction in indirect GHG emissions on account of energy efficiency improvements has not been accounted for as that was not the objective of HPMP Stage-I.

2. INSTITUTIONAL AND REGULATORY FRAMEWORK FOR IMPLEMENTATION OF HPMPs

2. INSTITUTIONAL AND REGULATORY FRAMEWORK FOR IMPLEMENTATION OF HPMPs

2.1 INSTITUTIONAL FRAMEWORK

The Government of India has nominated the Ministry of Environment, Forest and Climate Change as the nodal Ministry for implementation of Montreal Protocol. The Government approved the Country Programme of phase out of Ozone Depleting Substances and setting up of Empowered Steering Committee, chaired by the Secretary, Ministry of Environment and Forests for implementation of the Protocol in 1994. The Ministry of Environment, Forest and Climate Change established Ozone Cell in the Ministry dedicated to managing and coordinating the implementation of the Montreal Protocol in India. The functions and responsibilities of the Ozone Cell include development and implementation of policies for achieving compliance under the Montreal Protocol, recommendations to the licensing authority for import and export of ODSs, registration of enterprises engaged in production, consumption, import and export of ODSs, maintaining and managing data on production, imports, exports and consumption of ODS, monitoring of implementation of Montreal Protocol activities, interacting with other line ministries on technical and financial matters pertaining to implementation of activities, liaising with scientific, technical and other public institutions for technical matters, representing India at various multilateral meetings and discussions, etc.

The Ministry has constituted an Empowered Steering Committee (ESC) under the Chairmanship of Secretary of the Ministry, comprising of representatives of various line ministries and other national stakeholders. The ESC is supported by two Standing Committees, namely the Technology and Finance Standing Committee (TFSC), and Standing Committee on Monitoring. The ESC is responsible for providing an overall policy direction for implementation of the Montreal Protocol, review of various policy and implementation options, project approvals and project monitoring.

The institutional arrangements for implementation of the Montreal Protocol in India are depicted in the figure below:

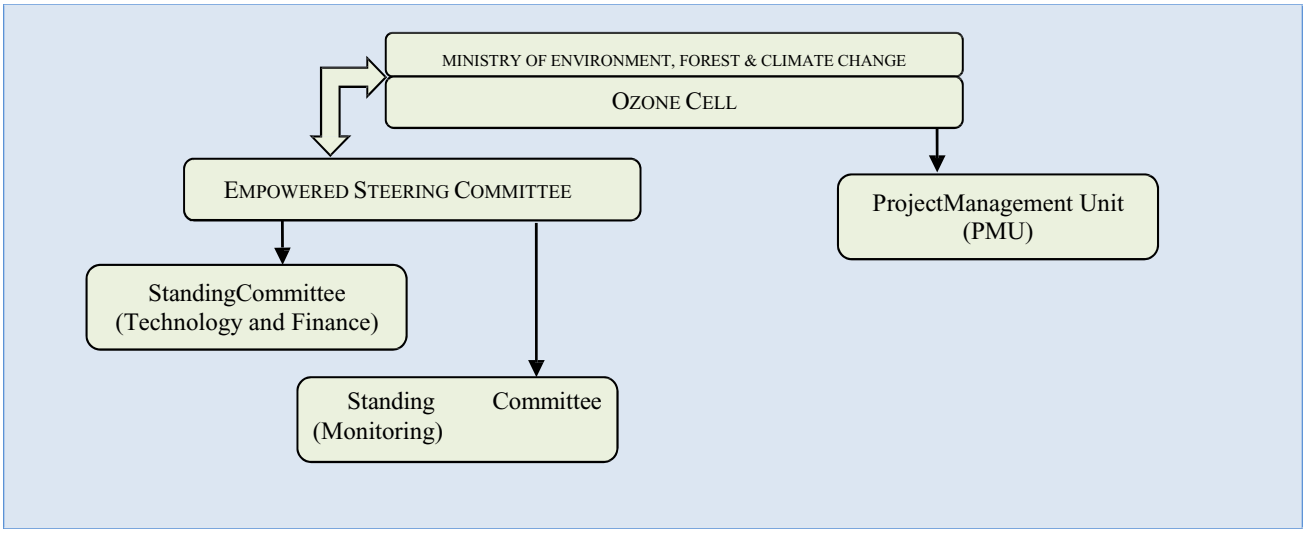


Figure 6: Institutional Framework

The Ozone Cell has a Project Management Unit (PMU) for assisting in implementation of phase-out activities.

2.2 POLICIES AND REGULATIONS

The guiding principles for various policies and regulations assimilating the national priorities are detailed in the Country Programme finalised in 1994. The important principles are as follows:

- To strengthen national institutions for monitoring and managing ODS phase-out
- To assist indigenous industries for conversion to non-ODS technologies through the Montreal Protocol financial mechanism, while ensuring that the MSMEs and other unorganized tiny enterprises are fully compensated for conversions, including retraining.
- To minimize economic dislocation either through closure of manufacturing units, loss of productive capacity or through major capital expenditure that could become obsolete in future.
- To maximize indigenous production by encouraging technology transfer for local production of non-ODS substitutes.
- To evaluate alternatives to ODS and the available substitute technologies on a continuing basis, so as to lead to wider adaptation and dissemination.
- To promote recycling, reclamation, retrofitting and drop in substitutes to prolong economic life of existing equipment, until new replacement technologies become mature, cost-effective and available.
- To institute decentralized management of ODS phase-out activities for smooth implementation.
- To facilitate development of new standards and certification systems for products and processes including those for safety.
- To integrate the ODS phase-out activities closely with the growth in the various industrial sectors, economic reforms and policies, etc.

2.2.1 Ozone Depleting Substance (Regulation and Control) Rules

Recognizing the importance of establishing an effective regulatory framework for the successful implementation of the ODS phase-out programme and meet the obligations of the Montreal Protocol, MoEF&CC initiated a forward-looking regulatory framework to support the various ODS phase out measures.

In exercise of the powers under Sections 6, 8 and 29 of the Environment (Protection) Act, 1986, Government of India formulated the ODS Rules, 2000, which were published in the Gazette of India in July 2000. The above rule was finalised after detailed consultation with the public and stakeholders. These rules since then have been amended six times (2001, 2003, 2004, 2005, 2006, 2007, and 2014) to provide for the emerging needs and developments for successful implementation of the Montreal Protocol.

The salient features of the ODS Rules are summarized as below:

ODS Production

- Prohibition on creating new capacity or expansion of capacity in non-feedstock use.
- Restriction on production levels as per “base level” and specified time-bound reductions.
- Allocation of annual production quota based on production share in baseline to each producing enterprise.

- Mandatory registration with the Ozone Cell, Ministry of Environment, Forest and Climate Change.
- Filing of returns to Ozone Cell at prescribed intervals.

ODS Consumption

- Ban on new capacity or expansion of capacity for manufacturing products and equipment containing designated ODS.
- Mandatory registration with designated authorities.
- Declaration requirement in prescribed format at the time of procurement of ODS.
- Restrictions on manufacturing of ODS-based products in various sectors.
- Filing of returns to Ozone Cell at prescribed intervals.

ODS Trade

- Mandatory registration for exporters & importers with designated authorities.
- Licensing of import of ODS and ODS containing equipment.
- Ban on trade with Non-Parties: export restricted to countries who are parties to the Montreal Protocol and amendments against quota.

Registration and Reporting

- Mandatory registrations for reclamation and destruction of ODS.
- Every entity that produces, uses, imports, sells, stocks, reclaims or destroys ODS has to maintain records and file reports as specified.
- Every entity, which has received technical and/or financial assistance from any international agency or financial assistance from Government of India including duty exemptions, is required to maintain records and file reports as specified.

2.2.2 Ozone Depleting Substance (Regulation and Control) Amendment Rules, 2014

The Ozone Depleting Substances (Regulation and Controls) Rules, 2000 have been amended in 2014 to align and cater to the needs of the accelerated phase-out of HCFCs. The Ozone Depleting Substances (Regulation and Control) Amendment Rules, 2014 was published in the Gazette of India on April, 2014. The salient features of these Rules are as follows:

- Control of production and consumption of HCFCs as per the accelerated phase-out schedule of HCFCs;
- Licensing system for import of HCFCs;
- Introduction of quota system for production and supply of HCFC to the domestic market for non-feedstock application for the domestic producers;
- Prohibition on import of pre-blended polyols containing HCFCs;
- Prohibition on import of blends containing ODSs including HCFCs from 1st. January, 2013;
- Prohibition on creation of new capacities to manufacture products with HCFCs from April, 2014;
- Prohibition on use of HCFCs in manufacturing of Domestic Refrigerators and Continuous Sandwich Panels after 1st January 2015;
- Prohibition on import of HCFC based Air-conditioners from 1st July, 2015;
- Prohibition on manufacturing of other Foam products using HCFCs from 1st January, 2020.
- Prohibition on manufacturing of Air-conditioners and RAC products with HCFCs from 1st January, 2025 to meet the 2025 phase-out target of 67.5%.

2.2.3 Licensing System for Import / Exports

India introduced the licensing system for Ozone Depleting Substances in 1996 based on recommendation of the Meeting of the Parties (MOP) at Vienna in 1995. Trade in ODS with non-party countries has been banned. Harmonized classification of commodity codes, consistent with international system has been developed and put in place. HCFCs are covered by an import licensing system. The ODS Rules list 38 HCFCs for which an application for import is to be made. Import is permitted only against an import license. The import/export license is issued by the Directorate General of Foreign Trade (DGFT), Ministry of Commerce and Industry, Government of India, based upon the recommendations of the Ozone Cell, MoEF&CC.

2.2.4 Import and Export of HCFCs

The Ozone Cell monitors and regulates the use of HCFC as per ODS (Regulation and Control) Rules, 2014. Also, even though, production sector guidelines for India have not been finalized by the Ex-Com, the MoEF&CC has issued an interim quota order for production of HCFC-22 for controlled uses in order to meet the compliance target for 2020.

Most notably, through regulatory and policy measures, India has successfully met the 2013 and 2015 compliance target of the accelerated phase-out schedule of the Montreal Protocol and achieved the phase-out targets in line with the approval of the Ex-Com of the MLF and the agreement between the Ex-Com of the MLF and the Government of India.

2.3 FISCAL MEASURES

- The Government of India provides for full exemption from Customs and Excise tariffs on capital goods required to implement ODS phase out projects funded by the MLF. This exemption has been extended to ODS phase-out projects, which were eligible for funding under the MLF, whether or not such enterprises actually sought assistance from the MLF. The provisions also covered projects submitted for retroactive financing. The benefit was available subject to the condition that enterprises should give a clear legal commitment to stop using ODS in all future manufacturing operations after the projects were implemented. The duty exemptions were also extended to items of recurring use, including non-ODS alternatives, for such duration for which, incremental operating costs were committed by the MLF in approved projects.
- The duty exemptions were also extended to capital goods required for establishing new capacity with non-ODS technology.
- Indian financial institutions were advised not to finance/refinance new ODS consuming enterprises.
- The Tariff Advisory Committee (a statutory body under the Insurance Act, 1938) decided to grant suitable discounts on fire insurance premiums if alternative agents are used to replace Halons.

3. HPMP STAGE-II PREPARATION

3. HPMP STAGE-II PREPARATION

3.1 HPMP STAGE-II PREPARATION FUNDING

In order to assist India for preparation of its HPMP Stage-II for meeting compliance targets for 2020, UNDP, on behalf of India, submitted a request for preparation funding to the 72nd meeting of the ExCom of the MLF in May 2014. The proposal was for preparation of overarching HPMP strategy and sector-level activities for achieving Stage-II compliance targets. The total funding approved by the Ex-Com was US$ 4,90,000. The funds approved for each implementing agency in preparation of India's HPMP is as follows:

Table 5: Implementing Agency-wise HPMP Stage-II Preparation Funding

Sector	Agency	Funding(US$)
Overarching Strategy (HCFC phase-out plan)	UNDP	50,000
Investment activities in polyurethane foam and RAC Sectors	UNDP	400,000
Servicing Sector	GIZ	20,000
Enabling component (awareness and communication, enforcement training, etc.)	UNEP	20,000
Total		**490,000**

3.2 ROLES OF IMPLEMENTING AND BILATERAL AGENCIES

UNDP is the lead agency for the preparation and implementation of the HPMP in India. UNEP and GIZ-Proklima are designated as the cooperating agencies. The Agency-wise allocation of sectors is as below:

Table 6: Allocation of sectors among Implementing Agencies in HPMP Stage-II

Sector	Agency
Lead Agency (including overall management, coordination and policy support)	UNDP
Consumption Sector	UNDP
Servicing Sector	GIZ
Enabling component (awareness and communication, enforcement training, capacity- building, trade controls, etc.)	UNEP

3.3 GOVERNMENT-INDUSTRY PARTNERSHIP FOR HPMP STAGE-II PREPARATION

Industry associations, namely, Refrigeration and Air-conditioning Manufacturers Association (RAMA) and Indian Polyurethane Association (IPUA), were involved in the preparation process of HPMP-II in order to ensure participation and ownership of HCFC phase-out by the Industry. The industry associations were responsible for carrying out sector-level surveys.

3.4 HPMP STAGE-II PREPARATION PROCESS

The process of HPMP-II preparation consisted of the following steps:

- Formation of the team (assignment of stakeholder entities for carrying out the sector- level and national-level data collection and analysis work).
- Stakeholder consultations at national and sector level.
- Information dissemination and industry interaction (sector-level workshops and events).
- Data collection at the sector-level (and reconciliation with the national-level).
- Data analysis at the sector-level (and reconciliation at the national-level).
- Preparation of sectoral strategies and national strategy.
- Stakeholder interactions/consultations for finalization of strategy (national stakeholders workshop)
- Finalization of the HPMP Stage-II proposal

3.4.1 Formation of Team

Under the overall supervision and guidance of the Ozone Cell, MoEF&CC, the team for preparation of HPMP Stage II included:

- IPUA and RAMA, which were responsible for providing sector strategy inputs for achieving HPMP Stage-II targets. They also had the responsibility for carrying out survey of the Foams and RAC sectors, respectively and for the information out-reach at the sector-level.
- Implementing and bilateral agencies provided technical and policy inputs and guidance for HPMP preparation process.

3.4.2 Information dissemination and stakeholder interaction

In order to adequately inform the stakeholders of the challenges and opportunities in complying with the phase-out schedule for HCFCs, vis-a-vis the 2020 compliance targets and beyond, workshops were held in various locations in India. These workshops were organized with support from IPUA and RAMA for their respective sectors during 2015. The workshops were well-attended.

These workshops served as a platform for both information outreach and exchanging information with participants on data collection process for preparation of HPMP and prevailing policy guidelines for HPMP. Inputs were provided by technical experts on industry trends and status of alternatives for various applications.

3.4.3 Data Collection

Appropriate questionnaires and formats for reporting information and data were developed in cooperation with the implementing agencies. IPUA and RAMA were engaged for collecting data at sectoral/sub-sectoral level and for developing sector-level strategies and policy recommendations, for achieving reductions in HCFC consumption. IPUA and RAMA engaged professional survey agencies for data collection at enterprise-level.

At the national level, data reconciliation was carried out through interactions with Customs, DGFT and Directorate General of Commercial Intelligence and Statistics (DGCIS).

3.4.4 Data analysis

The data analysis at the sector level included classification based on historical and present HCFC consumption by sub-sector and application, eligible and ineligible enterprises and their consumption, projected growth trends until baseline and thereafter, required reductions in HCFC consumption for meeting the 2020 reductions and availability of deployable alternative technologies for each application.

3.4.5 Draft Sectoral Strategies

Based on the data analysis as described above, the following approach was adopted for prioritizing sub-sectors/applications for HCFC phase-out:

- Segregation of eligible and ineligible enterprises with their corresponding consumption levels.
- Availability of zero-ODP and low-GWP mature alternative technology options for each sub- sector/ application.
- Ability to implement the conversions within the available timeframe.

The prioritized sub-sectors strategy is to aim for complete phase-out of HCFC-141b in foam manufacturing sector, so as to enable targeted, effective and enforceable regulations without distorting the markets and which would be supported by the industry. The sector-level strategies proposes a timeline for required regulations based on the above and also incorporates estimates of resources needed for carrying out conversions, technical assistance, awareness and other activities to support the changeover.

3.5 STAKEHOLDER CONSULTATIONS

As mentioned earlier, the stakeholders both in industries and industry associations were periodically consulted for ensuring a transparent and participatory approach for developing the sector strategies. The strategy for phase out of HCFCs was developed based on the outputs of this bottoms-up approach with the involvement of all stakeholder representatives.

3.6 FINALIZATION OF THE HPMP STAGE-II PROPOSAL

The final HPMP Stage-II document was prepared after incorporating comments from the national stakeholder workshops with a focus on compliance with the 2020 targets, incorporating the sectoral and national strategies and technical inputs provided by the implementing agencies under the overall coordination of MoEF&CC. Accordingly, with the Government's endorsement, the final HPMP Stage-II proposal for India was submitted for consideration at the 77th meeting of the Ex-Com held from 28th November to 2nd December, 2016 at Montreal, Canada.

4. PRODUCTION AND CONSUMPTION OF HCFCs AND SECTORAL STRATEGIES

4. PRODUCTION AND CONSUMPTION OF HCFCs AND SECTORAL STRATEGIES

4.1 HCFC SUPPLY SCENARIO

4.1.1 Production of HCFC-22

India is a second largest producer of HCFCs after China in the world. India produces only HCFC-22. All other HCFCs, like HCFC-141b, HCFC-142b, HCFC-123, HCFC-124 etc. are imported. HCFC-22 produced is used for both, the feedstock and non-feedstock (controlled) uses. The annual production of HCFC-22 for controlled uses during 2009 to 2015 is given in Table 7. It is seen that the production of HCFC-22 has increased only by 11.87% in last 6 years, whereas, the production of HCFC-22 for controlled uses has come down by 31.97% during same period. There is a considerable increase in the production of HCFC-22 for feedstock applications during the reference period.

Table-7: India's HCFC Production during 2009-2015 (MT)

Substance / Year	2009	2010	2011	2012	2013	2014	2015
HCFC-22 Total	47,657	47,613	48,477	48,178	40,651	54,938	53,314
HCFC-22 for controlled uses	46,585	40,669	27,345	28,642	24,853	27,099	31,692
HCFC-22 for feedstock use	1,073	6,944	21,132	19,536	15,798	27,839	21,622

Source -Article-7 data reporting. All figures rounded off to the nearest one MT.

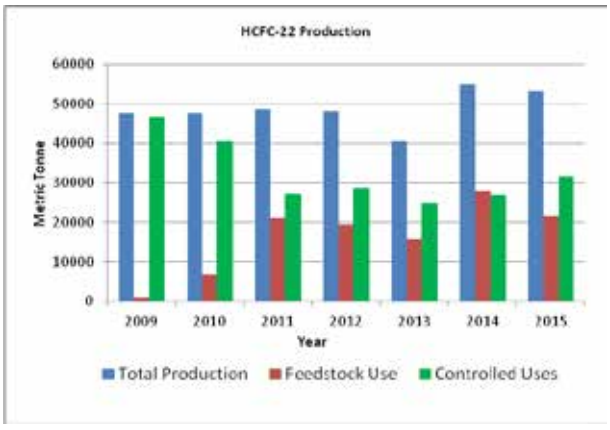


Fig. 7 Production of HCFC-22

It may be mentioned that all the HCFC-22 production facilities are swing plants, which were capable of producing both Chlorofluorocarbons (CFCs) and HCFC-22. Until 2008, the facilities produced both CFCs and HCFC-22. India ceased production of CFCs from 01 August 2007. Thus, production of HCFC-22 has increased from 2007 onwards, partly to serve the increased domestic demand, as well as to serve the export market. It may also be noted that as per current regulations in India, expansion of production facilities for controlled uses of HCFC-22 is prohibited. It may be noted the production for non-feed stock

use of HCFC-22, the only HCFC produced in India, has continued to decrease except for the year 2012 (where production is more or less at the same level as 2011) due to regulations controlling HCFC supply to the market for non-feedstock applications and the licensing and monitoring system that is in place. The production capacity of HCFC-22 was frozen by India as early as in July, 2000 much before Montreal Protocol control schedule requirements for limiting the production of HCFC-22, for the protection of the ozone layer.

4.1.2 Export of HCFC-22

India is a significant exporter of HCFC-22. The annual exports of HCFC-22 during 2009-2015 are tabulated below:

Table-8: India HCFC Exports 2009-2015

Substance/Year	2009	2010	2011	2012	2013	2014	2015
HCFC-22 (MT)	38,478	30,034	18,394	16,212	16,823	19,049	19,914

Source -Article-7 data reporting. All figures rounded off to the nearest one MT.

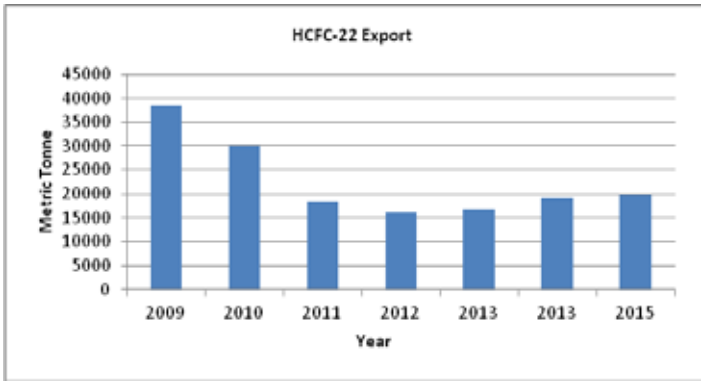


Fig. 8 Export of HCFC-22

4.1.3 Import of HCFCs

India imports its entire requirement of HCFC-141b, HCFC-142b, HCFC-123 and HCFC-124. The annual imports of HCFCs during 2009 to 2015 for controlled uses are shown below:

Table-9: India HCFC Imports 2009-2015 (MT)

Substance/Year	2009	2010	2011	2012	2013	2014	2015
HCFC-123	238	115	0	136	197	181	175
HCFC-124	620	603	289	69	0	0	0
HCFC-141b	7,900	7,837	7,924	6400	4,568	4,113	3,028
HCFC-142b	3,001	805	645	1,308	429	120	126
HCFC-22	1,280	1,868	1,316	3,217	0	0	0

Source - Article-7 data reporting. All figures in MT, rounded off to the nearest one MT.

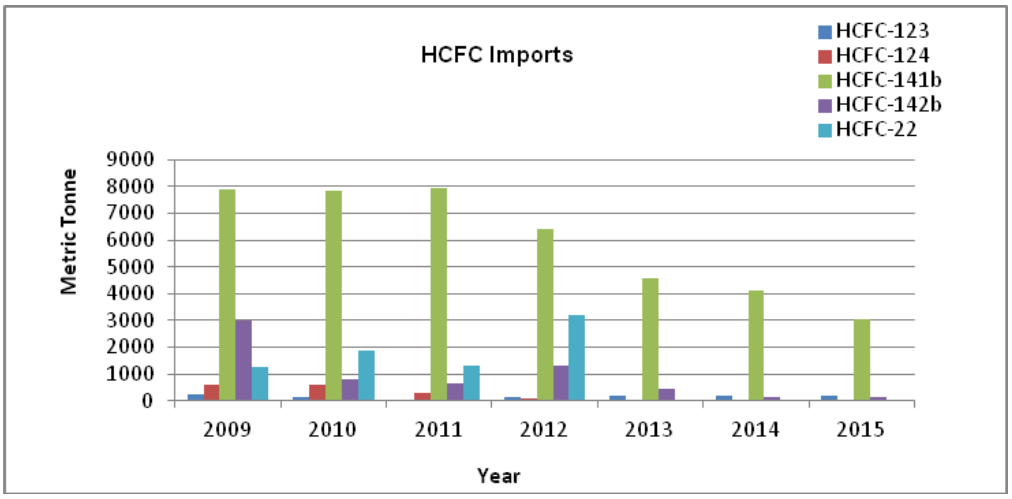


Fig. 10: Import of HCFCs

HCFC-22, HCFC-124 and HCFC-142b are imported mainly as components of refrigerant blends and mixtures such as R-401A, R-406A, R-409A, etc. The import of blends containing HCFCs as well as pre-blended polyols has been banned from 2014.

4.1.4 HCFC supply to the Domestic Market

The supply of HCFCs especially the domestically produced HCFC-22 to the domestic market takes place primarily through distributors and retailers. The HCFC-22 producers (and importers in case of other HCFCs) also supply directly to large users. HCFC-22 is subsequently sold through retailers and servicing establishments, including the dealer network of the Original Equipment Manufacturers (OEMs). In case of HCFC-141b, except for large users who import directly, the pre-blended polyols containing HCFC-141b are supplied by systems houses.

4.2 CONSUMPTION OF HCFCs

India's calculated HCFC consumption during 2009 to 2015 is tabulated below:

Table-10: India Calculated HCFC Consumption 2009-2015

Substance/Year	2009	2010	2011	2012	2013	2014	2015
HCFC-123	238	115	0	136	197	181	175
HCFC-124	620	603	289	69	0	0	0
HCFC-141b	7,900	7,837	7,924	6,400	4568	4,113	3,028
HCFC-142b	3,001	805	645	1,308	429	120	126
HCFC-22	9,386	12,503	10,266	15,647	8,029	8,050	11,778

Source -Article-7 data reporting. All figures in MT, rounded off to the nearest one MT.

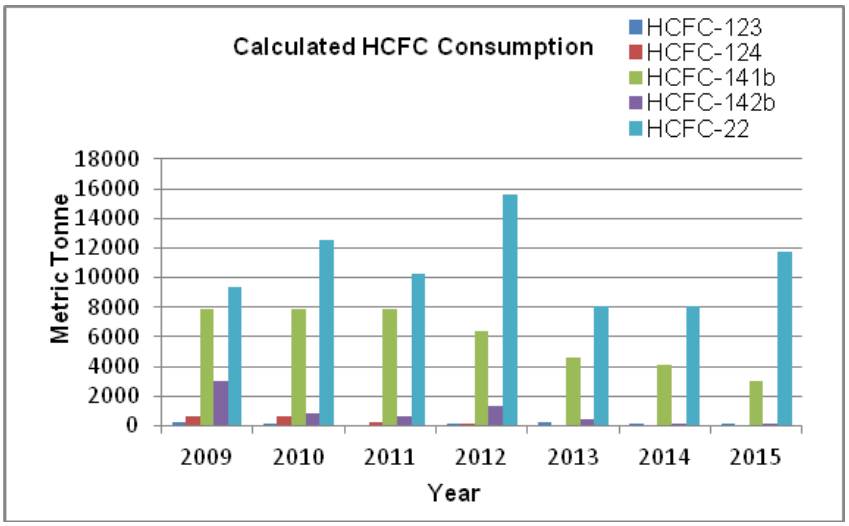


Fig. 10: Consumption of HCFCs

4.2.1 Application of HCFCs

Table-11: HCFCs Applications

Substance	Applications
HCFC-123	As a refrigerant in centrifugal chillers in new installations and servicing. Also used as a component of blends used in portable fire extinguishers.
HCFC-124	As a component of refrigerant blends for industrial refrigeration applications (R-401A, R-409A) and also as component of blends used in flooded fire extinguishing systems.
HCFC-141b	Mainly as a blowing agent in the manufacture of polyurethane and polyisocyanurate foams. Also used as a propellant in industrial aerosols and as a solvent and cleaning agent in specialized cleaning operations for precision metal, optical and electronic equipment.
HCFC-142b	As a physical blowing agent in the manufacture of extruded polystyrene foams. Also used as a component of refrigerant blends (R-406A, R-409A) for industrial refrigeration applications.
HCFC-22	Widely used a standalone refrigerant in air conditioning and medium-temperature refrigeration systems. Also used as a component of refrigerant blends (R-401A, R-406A, R-409A and R-415B).

5. FOAM, RAC MANUFACTURING AND SERVICING SECTORS

5. FOAM, RAC MANUFACTURING AND SERVICING SECTORS

5.1 FOAM SECTOR

Polyurethane Foams for diverse applications have been manufactured in India, since many decades. This sector has seen good growth in recent years, due to fast paced economic development and increase in purchasing power of people resulting in overall growth of different segment of the industry using rigid polyurethane foam in buildings and construction, cold chain stores, warehouses, appliances etc. This industry is dominated by MSMEs, which has also seen rise in entrepreneurship, while the large enterprises are relatively smaller in number.

5.1.1 Industry Structure

The industry structure is organized as given below:

- HCFC importers – through Licence
- Systems Houses
- Processing Equipment Suppliers
- Foam Manufacturers or processors of different products

There are a few chemical suppliers apart from Systems Houses who import HCFC-141b. India has about 20 identified Systems Houses producing or supplying customized polyols for various foam applications of which 15 are indigenously owned and 5 are multinational entities.

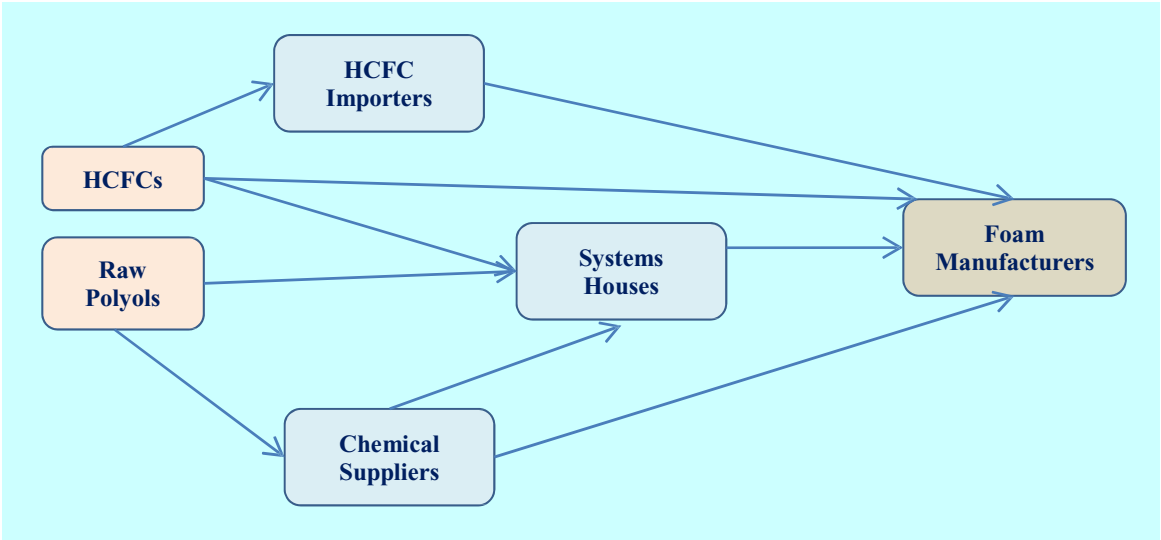


Fig. 11: Foam Sector Operation in India

5.1.2 Foam Manufacturing Sub sectors

HCFC-141b is the widely used foam blowing agent in India. The various sub sectors of the polyurethane foam which use HCFC-141b in the country are as follows:

- Commercial refrigeration
- Continuous panels
- Discontinuous panels
- Thermo ware
- Integral skins
- Spray foam
- General insulation

The sub-sector wise consumption of HCFC-141b in 2014 as per the survey conducted by the Indian Polyurethane Association (IPUA) is given in Table 12

Table 12: Sub-sector wise Consumption of HCFC - 141b in 2014

Segment	Consumption of Polyol (2014)	Consumption of HCFC-141b (2014)
Commercial refrigeration	3417	752
Continuous Panel	2567	565
Discontinuous Panel	7135	1570
General Insulation	3323	731
Integral Skin	2491	249
Spray Foam	1716	429
Thermoware	2157	539
Water Heaters	1999	500
XPS	150	33
Total	**24955**	**5367**

The sector wise percentage of consumption of HCFC-141b is given in figure 5.2. It may be noted that discontinuous panel contributes around 29% of the total HCFC-141b consumption followed by commercial refrigeration sector which is about 14%.

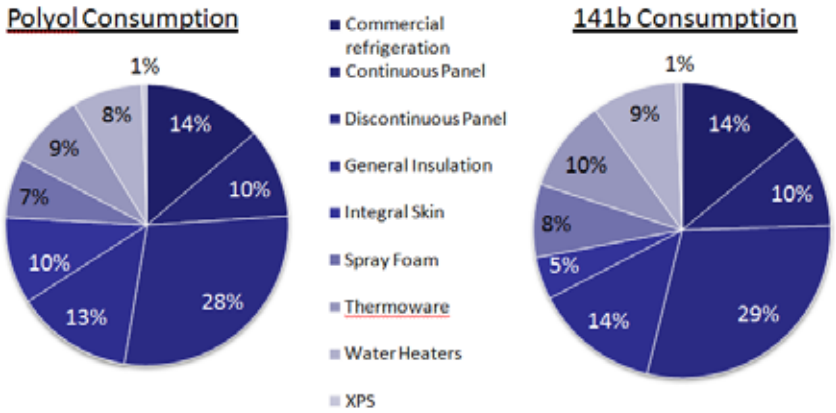


Fig. 12: Sub-sector wise Consumption of HCFC - 141b in 2014

Source: IPUA survey report 2016

Commercial Refrigeration

The Commercial Refrigeration (CR) sector significantly forms a large part of the temperature controlled supply chain segment and also a significant proportion of the food retail market. Needless to say, that the market for the frozen food products, ready to eat meals, fast-foods etc have increased exponentially. There are several food temperature levels to suit different types of products frozen, cold, chilled, medium – chilled are some of the nomenclatures with specified temperature ranges depending whether they are meat or vegetables, fruits or ice cream. Average rate of spending on packaged food has increased to 22% during the period from 2010 to 2015 due to economic prosperity, higher standards of living, convenience, and confidence on products. There has been remarkable growth and expansion of products in the Freezer space of modern retail outlets. Various types of products used in Commercial Refrigeration include:

- Deep Freezers
- Island coolers
- Visi Coolers
- Bar refrigeration
- Multi deckers
- Display cabinet
- Scooping cabinet
- Kitchen Refrigeration
- Cold rooms / cold storages
- Cold Chain Transportation

Discontinuous Panel

Insulated Discontinuous panel is a modern material utilizing the benefit of sandwich panel construction. They are a monolithic construction which is formed by injecting rigid foam insulation material between two metal claddings. These Discontinuous panels offer thermal and acoustic insulation properties in addition to being a modular, modern, multi-purpose construction element which also enhances design and engineering possibilities. The panels produced by this process have dimensional limitations with maximum length being at 6 meters. The principal of Discontinuous Panel production activities are conducted at one station as against a moving arrangement. There is a greater usage of raw materials and consumables as a result of manual handling during production. Panels are widely used in the construction of:

- Modern PE buildings
- Airtight climate controlled buildings
- Cold storage units
- Pharmaceutical clean rooms
- Food processing industry
- Porta Cabins
- Telecom shelters

- Refrigerated vehicles
- Partition Doors etc

Continuous Panels

Continuous Panel manufacturing process involves forming sheet metal profiles, creation of core foam, profiling, curing and finally cutting the product to length along the continuous conveyor line. Continuous Panel produces panels with high levels of uniformity of properties and dimensions which can be cut up to a length of maximum 12 meters. The achievable through put for Continuous Panel lines are significantly very high. The panels made by this technology have a advantages like higher uniformity in foam quality and better homogenous and architectural flatness. This technology also helps in reduction of overheads, labour costs, and overall production costs. Major industry units and other commercial segments are the important consumers of continuous panels.

General Insulation and Spray Foam

Effective insulation can reduce energy consumption by Spray Foam which is one of the effective methods for residential premises and commercial complexes. Insulation dramatically reduces levels of wasted energy and heat loss within the building as it protects against drafts, air leakage and offers a huge reduction in heating costs. Spray Insulation has undergone a lot of technological advancement both in terms of equipment and material formulation. Widely used in the construction industry, Spray Foam is most commonly used on roofs and walls to create a seamless superior insulation layer that prevents air loss, thermal leaks and moisture penetration. On roofs, it enhances the weather-proofing and has a durable finish. Spray Foam has caught up with the idea of architects, engineers, and energy economists in a big way and has found support from the Government side also.

Integral Skin Foam

This sub-segment of the Polyurethane industry has seen good growth and is a major consumer of the raw materials of Polyurethane. The growth is driven by automotive, commercial and office space utilization. The growth of the automotive segment in India is well known. Integral skin Foam (ISF) is supplied to all OEMs of automotive industry as well as aftermarket application. Key application areas are steering wheel, back-foamed dashboards, arm rests, grab handles etc. In furniture applications, it is used in arm rests, head rests etc.

Thermoware

The Thermo ware industry has seen a significant boom in the consumer goods segment. This is because of the significant number in the middle class segment with a demand for utility of household and portable items that makes life more comfortable. Climatic conditions being harsh and extreme, makes the preservation of Food and beverages extremely difficult. The convenience of carrying food products, aesthetics in terms of colors and design all made the Thermoware products very useful to the house hold segment. The insulation for the Thermoware products is provided by the injection process of polyurethane foam. The Thermoware segment also helps the growth of the plastic industry as a whole.

Water Geysers

The growth of water geysers has seen a good growth of about 15% during the 2010-2015 period. In earlier days water geyser manufacturers were using mineral wool for insulation. However, as newer technologies and ease of operations came in, polyurethane was the material of choice for insulation in water geysers. Water geysers are emerging as technologically upgraded and innovative in size and

shape. There has been an increasing awareness on safety, branding, energy consumption rating etc which are all driving the water geyser market to new heights.

5.1.3 Classification of enterprises

The surveyed enterprises are mix of large, medium and small enterprises having varying capacities. The classification of the enterprises has been done based on the HCFC-141b consumption of the particular enterprise. The classification is as follows:

Small (up to 20 MT)

Medium (21 to 50 MT)

Large (above 50 MT)

5.2 AIR CONDITIONING SECTOR

The Air-conditioning industry has not been growing consistently during the last 5 years due to global slowdown in economic growth and investments in infrastructure.

The industry can be broadly classified into large, medium and small/micro scale by sales turnover of RAC equipment by the enterprises. Most of the sub sectors are dominated by large enterprises and many medium scale enterprises working as sub-contractors supplying finished products to large enterprises under their brand. Small/micro enterprises are focused on specialty equipment, viz. process chilling, commercial refrigeration where the market size is not large. The products offered by the industry are of international quality in terms of performance, energy efficiency and features. The industry is, very actively, working with regulatory authorities in development of standards for energy efficiency, product certification according to Indian climatic conditions.

All large scale and many medium size manufacturers have world class product development, performance testing laboratories, mechanized manufacturing, and inspection facilities for producing high quality products of global standards. Most of the critical components, except some models of compressors and electronic controls, are manufactured in India.

Medium and small/micro scale enterprises that are predominantly manufacturing process chilling and commercial refrigeration equipment have not made much investment in facilities due to wide variety of product mix and low volume requirement. These enterprises, however, have elaborate product development, inspection and testing facilities.

5.2.1 RAC manufacturing sub Sectors:

RAC manufacturing sector, based on the application, is divided into following sub sectors

a) Split & Window Air-conditioners, Non-Ducted up to 3 tons of Refrigeration (TR)

b) Ducted /Packaged Air conditioners above 3 TR

c) Chillers – Air-Conditioning

d) Chillers – Process Cooling

e) Commercial Refrigeration – Water Coolers, Deep Freezers, Ice candy plants

f) Cold Storage (excluding ammonia based) and Condensing Units

g) Precision and Telecom air-conditioning, including Mobile Shelters

h) Rail Coach Air-Conditioning
i) Variable Refrigerant Flow (VRF) products
j) Bus Air conditioning
k) Transport Refrigeration
l) Others – Defence, Marine, etc.

There is marked decrease in consumption of HCFCs in some sub sectors due to market forces, availability of technically proven and commercially viable, including moderate / low GWP options.

Room Air conditioners sub sector is the largest consumption sub sector of HCFC-22. During last 3 years, non - ODS refrigerants are being used by select manufacturers in split air conditioners as given below:

- R-32 for fixed speed and inverter type
- R-290 for fixed speed type
- R-410A for inverter type

Use of HCFCs has been steadily declining in the following sub sectors:

- Ducted air conditioners above 3 TR capacity
- Chillers for air conditioning
- Commercial Refrigeration equipment
- Cold Storage (excluding ammonia based) and Condensing Units
- Precision and Telecom air-conditioning, including Mobile Shelters

HCFC use in following sub sectors has been completely phased out:

- VRF Products
- Rail Coach Air-Conditioning
- Bus Air conditioning
- Transport Refrigeration

Window & split air-conditioners including non-ducted up to 3TR:

Significant Trends:

- Sharp decline in market share of window air conditioners from 48% in 2009 to 10 - 20% in 2014-15 and expected to go down to 12% in the year 2020-21.
- Sharp increase in ratio of non- ODS split air conditioners from 1% in 2009 to 10 - 19% in 2014-15 and expected to increase to 49% in 2020-21.
- Sharp growth in demand for inverter type, high energy efficiency non- ODS air conditioners, from 1% in 2009 to 10 - 15% in 2014-15 and expected to increase to 27% in 2020-21 in split category.
- Demand for air conditioners is expected to grow from 3.8 million a year to 6.2 million in 2020-21 (increase of 63% Cumulative Annual Growth Rate (CAGR). However there will be marginal increase in demand for HCFCs from 3,112 MT to 3,527MT during the same period (increase of 13%). It is primarily due to manufacturing of around 49% split air conditioners with non- ODS refrigerants.

The Ducted and Packaged Air-Conditioners have a popular size of 3.0, 5.5, 8.5, 11.0, 17.0 and 22.0 TR. The product is available in Ceiling Suspended Split above false ceiling and Compressor, condenser coils in the Outdoor Section, Floor Mounted Systems with Compressor in the outdoor Section, a Remote

Condenser and a Packaged Water-Cool Floor Mounted System. These units are used for light commercial and commercial application. For distribution of air, a ducting network is attached to the Units.

Market Size of Ducted Split Air Conditioners

The market size has declined from 0.74 million TR in 2009-10 to 0.57 million TR in 2014-15. No market growth is expected during next 5 years. Almost entire production of ducted air conditioners is done in the country.

HCFC-22 Requirement & Availability

Entire production of ducted air-conditioners was with HCFC-22 till 2009-10. Actual production with non-ODS refrigerants was 12% in 2014-15 and is expected to go up to 25% in 2020-21. Ducted air conditioners accounted for 15% of HCFC consumption in 2014-15 and are expected to go down to 12% in 2020-21. HCFC-22 consumption in this sub-sector in 2014-15 was 572 MT and is expected to come down to 533 MT in 2020-21.

Chillers, Water & Air Cooled (Air conditioning):

The Chiller category can be classified as Air-Cooled and Water-Cooled, based on the heat rejection medium and Scroll, Reciprocating, Screw and Centrifugal, based on the type of the Compressor. The classification can also be done on the capacity of the Chiller, which is associated with the type of Compressors. Scroll Chillers are built up to 120 TR capacities, screw from 70 to 400 TR capacities, reciprocating from 40 to 200 TR capacity and centrifugal from 300 to more than 1000 TR capacity.

The Chillers produce chilled water, which is used for process application, or for comfort air-conditioning. In case of comfort air-conditioning, the chiller is coupled with the air handling unit. There are total of 44 manufacturers. Market share of the top 10 brands is over 90%. Rest of the manufacturing is done by small manufacturers and sold locally.

Chillers – HCFC-22 Requirement & Availability:

Chiller production using non-ODS refrigerants was 60% in 2009-10 which has sharply increased to 90% in 2014-15 and is expected to go up to 97% in 2020-21. Chillers accounted for 2.2% of HCFCs consumption in 2014-15 which is expected to go down to 0.8% in 2020-21. HCFC-22 and HCFC-123 consumption in 2014-15 was 46 and 25 MT respectively which is expected to come down to 26 and 27 MT in 2020-21 respectively.

Precision & Telecom Air-Conditioners:

The equipment is used for cooling applications of data centre cooling and telecom switch cooling unlike the packaged units. Apart from this major application, precision control machine units are used for instrument cooling, control rooms, etc. The units are designed for high sensible heat ratio, as latent heat load is negligible. The units have to be designed for 24x7 applications. Usually, a redundancy is built in the system.

Size of Telecom & Precision Air Conditioners:

Due to change in technology in the year 2009, demand of telepack air conditioners (HCFC-22 based) has come down drastically. Demand was 85K in 2009-10 which has come down to 27K in 2014-15 and is estimated to further fall to 12K in 2020-21. The demand for precision air conditioning (Hydrofluorocarbon (HFC) based) equipment is expected to continue to grow on an average of 5% per year.

There are total of eight manufacturers in this subsector. There are four large scale manufacturers and two each in small scale and medium scale manufacturers.

HCFC-22 Requirement and Availability:

Telecom and Precision Air Conditioners production with non- ODS refrigerants was 24% in 2009-10 which has sharply increased to 64% in 2014-15 and is expected to go up to 84% in 2020-21. The sub sector accounted for 1.0% of HCFCs consumption in 2014-15 which is expected to go down to 0.2% in 2020-21. HCFC-22 consumption in 2014-15 in this sub-sector was 41 MT which is expected to come down to 9 MT in 2020-21.

Water-Coolers, Deep Freezers &Visi-Coolers:

These products can be considered as unitary refrigeration products, and are used to maintain the required temperature for beverages, ice-creams and drinking water. In the process of phase-out of CFC refrigerant, R-134a refrigerant was adopted in deep freezers, visi-coolers and small capacity water-coolers. Large capacity storage water-coolers continue to use R-22 refrigerants.

Market Size of Water-Coolers, Deep Freezers & Visi-Coolers:

Overall market for the products in this sub sector has been stagnant during last 5 years. Modest growth is expected in the midterm. This sub sector is dominated by small scale manufacturers. Out of total of 46 manufacturers, there are four large scale, five medium scale while rest are small manufacturers.

HCFC 22 Requirements and Availability:

The sub sector accounted for 1.8% of HCFCs consumption in 2014-15 which is expected to go down to 0.9% in 2020-21. HCFC-22 consumption in 2014-15 was 72 MT which is expected to come down to 39 MT in 2020-21.

Industrial Refrigeration (Air Drier / Milk Chiller / Process Chillers):

These products, as the names suggest, air dryers are used for maintaining desired humidity levels in pharmaceutical and textiles industries; milk chillers are used by host of dairy product distributors; and process chillers are used in pharmaceutical, chemicals, and detergent industry.

Air dryers and milk chillers are manufactured in standard designs whereas process chillers are tailor made to the clients specific requirement. Major boost in demand for large capacity chillers is expected with growth of food processing industry. Small systems are based on R-22 whereas the large capacity systems are based on R-134a refrigerant.

This sub sector is dominated by small scale manufacturers with low investment in plant & machinery. There are host of Small Scale Industries (SSI) units manufacturing these equipment around textiles, pharmaceuticals and chemical manufacturing hubs.

HCFC-22 Requirements and Availability:

The sub sector accounted for 2.0% of HCFCs consumption in 2014-15 which is expected to go up to 2.4% in 2020-21. HCFC-22 consumption in 2014-15 was 79 MT which is expected to increase to 105 MT in 2020-21.

Cold Storage other than Ammonia:

The refrigeration equipment used is to maintain negative temperature of around -27°C and positive temperature of around +4°C for storage of food articles. Food-grains and vegetables are maintained

between 2 to 10 deg. C (medium temp) while frozen food articles like ice-cream, meat and fish are maintained at -10 to -30 deg. C (negative temp). The food articles are stored in thermally insulated rooms. The storage of food articles include prolonged storage, popularly known as controlled atmosphere storage and ripening chambers.

The refrigeration equipment comprises of an Indoor and Outdoor Unit with a compressor fitted in the Outdoor Unit. The Outdoor Unit rejects the heat in the atmosphere. The Indoor Units are designed for maintaining relative humidity of the desired level, apart from the temperature. The Units have to be reliable as the application is 24x7. R-22 is the predominant refrigerant, used today. Negative temp equipment are with non- ODS refrigerant.

This sub sector is also dominated by small scale manufacturers. Out of total of 21 manufacturers, there are five large scale, two medium scale while rest are small manufacturers.

HCFC-22 Requirement and Availability:

The sub sector accounted for 2.0% of HCFCs consumption in 2014-15 which is expected to go up to 2.6% in 2020-21. HCFC22 consumption in 2014-15 was 81 MT which is expected to increase to 114 MT in 2020-21.

Railway Coach Air-Conditioners:

As the name suggests, the equipment is specifically designed for Rail Coach Air-Conditioning. It is a Packaged Air-Conditioner with standardised size of 10TR, and is designed to be an integral part of the railway coach. The equipment has to work under harsh environment of temperature, rain and bump & jerks.

This sub sector is again dominated by total of ten medium and small scale manufacturers. There is no large scale manufacturer in this sub sector. There is no consumption of ODS refrigerant by the subsector since 2013-14.

Variable Refrigerant Flow (VRFs):

VRFs is evolution of Packaged Air-Conditioners, which gives flexibility in terms of operation, temperature control and zoning. It also overcomes the limitation of Packaged Air-Conditioners in terms of capacity. Capacities available are from 6 HP to 60 HP (5TR up to 50TR). Multiple Indoor Units can be connected to a single Outdoor Unit with flexibility to operate in a number of Indoor Units.

This is the fastest growth sub sector and dominated by multinational brands. During initial stages, VRF systems made in the country were with HCFC- 22. At present, entire production of VRF is with non-HCFC refrigerant.

Transport Air-conditioning:

The demand for air conditioned air buses is growing steadily. CAGR of 14% was achieved during the period 2009-10 to 2014-15 and CAGR of 12% is expected during the period 2015-16 to 2020-21. The demand during the year 2014-15 was of 65000 numbers, which is expected to nearly double to 120000 in 2020-21. The sub sector has switched over to non- ODS refrigerant in 2008-09.

Transport Refrigeration:

The demand for transport refrigeration equipment is growing rapidly due to huge demand for food processing. CAGR of 18% was achieved during the period 2009-10 to 2014-15 and CAGR of 20% is

expected during the period 2015-16 to 2020-21. The demand for the refrigerated vehicles for the year 2014-15 was 30000 which is expected to go to 90000 in 2020-21.

Compressors and Controls:

There are total 23 manufacturer / suppliers in this sub sector; however, there is negligible consumption of HCFCs for development and testing purposes.

Others – Defence, Marine, etc.:

There are total 12 manufacturers in small scale sector. There is sporadic demand for HCFCs for defence, marine maintenance contracts / suppliers but the total demand is in small quantities.

5.2.2 Sub-Sectors Distribution between Large, Medium and Small Players:

Room Air-Conditioners and Commercial Ducted Systems sub sectors are dominated by large manufacturers while a large number of manufacturers in small scale are in sub-zero and positive temperature refrigeration sub-sectors. Large numbers of small scale manufacturers in room air conditioner sub sector are contract manufacturers of large manufacturers.

The Chiller manufacturing and Cooling Solutions for special applications such as telecom sub sector are also dominated by large manufacturers except for the Process Chillers where large numbers of small scale manufacturers are present.

The table below gives number of manufacturing units in each sub sector. It may be noted that one enterprise may be present in more than one sub sector:

Table 13: RAC Sub-sector Manufacturing Enterprises

Sr. No.	Sub-Sector	Large	Medium	Small	Total
1	RAC and Non-Ducted Splits up to 3.0TR, including Window and Split Air-Conditioners	15	7	15	37
2	Ducted Splits above 3.0TR, including Cassette and Packaged Air-Conditioners	19	4	6	29
3	Precision, Telecom Air-Conditioning, including Mobile Shelters	4	2	2	8
4	Chillers (Chilled Water for Process and Air)	17	35	11	63
5	Industrial Refrigeration (Air Dryers, Milk Chillers)	2	20	35	57
6	Commercial Refrigeration: Water-Coolers, Freezers	3	15	18	36
7	Cold Storage (Refrigeration Equipment other than ammonia based)	8	10	20	38
8	Rail Coach Air-Conditioning	4	4	0	8
9	VRF Products	11	0	0	11
10	Others (Defence, Marine, etc.)	1	7	13	21
	Total	**84**	**104**	**120**	**308**

Note: Classification of large, medium and small/micro scale manufacturers in as per Government guidelines on investment made in plant & machinery as under:

		Rs/million
i.	Micro	0~2.5
ii.	Small Scale	2.5~50
iii.	Medium Scale	50~100
iv.	Large Scale	Above 100

Source: RAMA survey report for HPMP Stage-II 2015

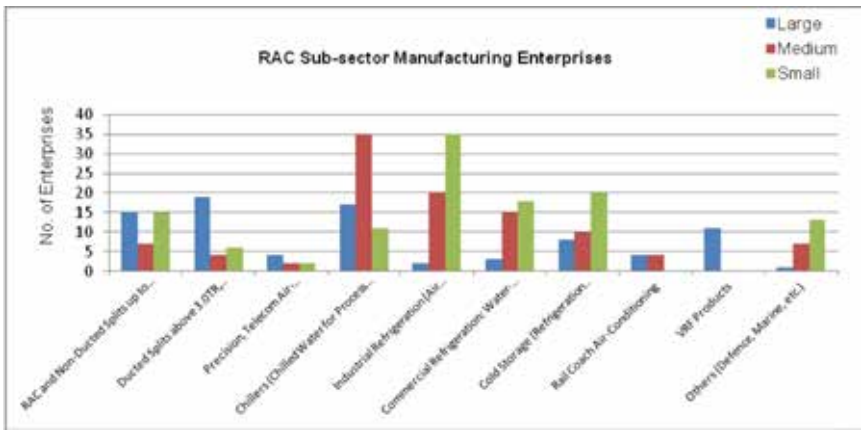


Fig. 13: RAC Sub-sector Manufecturing Enterprises

5.2.3 HCFC Consumption during 2009-2015

The table below presents the HCFC consumption during 2009-2015 in various RAC sub sectors

Table 14: HCFC-22 Consumption by Sub-Sector during 2009-2010 to 2014-2015 (MT)

S. No.	Sub Sector	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
1	Room Air Conditioners	2,747	3,218	3,136	2,985	3,069	3,112
2	Ducted Split	743	691	646	610	587	572
3	Chillers (R-22)	137	139	102	78	51	46
	Chillers (R-123)	NA	NA	20	19	21	25
4	Telecom & Precision	128	45	58	90	31	41
5	Industrial refrigeration	61	61	67	73	81	79
6	Commercial Refrigeration	56	63	69	65	64	72
7	Cold Chain	41	45	50	57	65	81
8	Rail Coach	8	9	11	13	8	0
9	VRF	9	13	9	0	0	0
10	Transport Air conditioning	0	0	0	0	0	0
11	Transport Refrigeration	36	44	26	30	0	0
	Total	**3,966**	**4,328**	**4,194**	**4,021**	**3,977**	**4,027**

Source: RAMA survey report for HPMP Stage-II 2015

Sub sectors of Room Air Conditioners, Ducted Splits and Chillers are the largest consumers of HCFC in Refrigeration and Air Conditioning (RAC) manufacturing sector, which account for around 93% of the total consumption during 2014-15 as shown in the figure below:

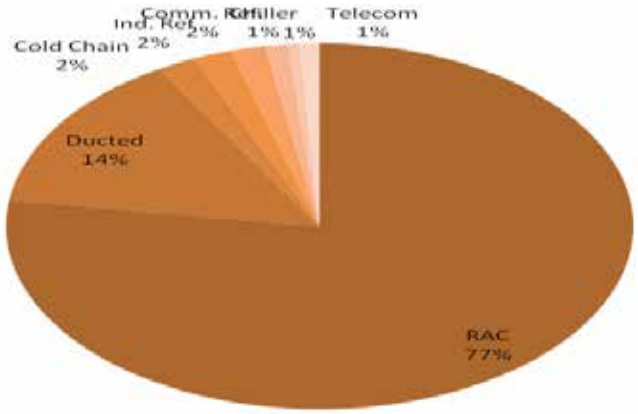


Fig. 14: Sub-Sector-wise Consumption of HCFC in RAC Sector

The table below presents the estimated demand of HCFC-22 and HCFC-123 from 2016-17 to 2020-21

Table 15: Estimated Demand of HCFC-22 and HCFC-123 during 2015-2016 to 2020-2021 (MT)

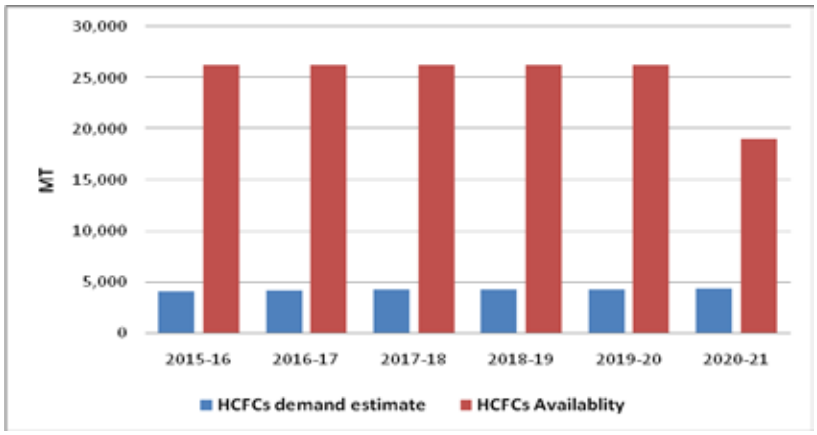
S. No.	Sub Sector	2016-17	2017-18	2018-19	2019-20	2020-21
1	Room Air Conditioners	3,360	3,481	3,480	3,490	3,527
2	Ducted Split	570	567	552	544	533
3	Chillers (R22)	41	38	34	22	26
	Chillers (R123)	25	26	27	27	27
4	Telecom & Precision	32	13	10	9	9
5	Industrial Refrigeration	72	79	87	95	105
6	Commercial Refrigeration	56	51	48	44	39
7	Cold Chain	89	91	98	106	114
8	Rail Coach	0	0	0	0	0
9	VRF	0	0	0	0	0
10	Transport Air conditioning	0	0	0	0	0
11	Transport Refrigeration	0	0	0	0	0
	Total	**4,245**	**4,346**	**4,336**	**4,337**	**4,380**

Source: RAMA survey report for HPMP Stage-II 2015

Based on the above, it is noted that the demand for HCFCs in 2020-21 is expected to increase by 8% as compared to actual consumption of 2014-15. Room air conditioners, ducted splits, industrial refrigeration and cold chain sub-sectors will be major consumers of HCFCs accounting for 97.7% of all HCFCs. Rail Coach, VRF, Transport Air conditioning and Transport Refrigeration sub sectors have already switched over to non-ODS refrigerants.

5.2.4 HCFCs demand vs availability: up to 2020

The figure below presents the demand vs availability of HCFC till the period 2020.



Source: RAMA survey report for HPMP Stage-II 2015

Fig. 15: HCFCs Demand vs Availability for the year 2015-2020

Under HPMP Stage-II, RAC manufacturing sector requirement is estimated to be 4,380 MT for the year 2020-21. Service sector requirement, considering CAGR of 5% from 2009, is estimated at 13,350 MT by the year 2021. The total requirement works out to 17,730 MT which is 93% of 19,006 MT of HCFC-22 equivalent entitlements from Jan. 01, 2020. There is small margin between estimated demand and total availability. Since certain quantity of HCFCs will be required by the Servicing Sector, it is desirable to prioritize subsectors which can switch over to non-ODS refrigerants.

5.3 SERVICING SECTOR

The RAC servicing sector in India is made up of a diverse range of establishments that provide maintenance services for all types of refrigeration and air conditioning systems. Manufacturers operate their own sales and service networks in the larger cities. In order to attend to customers in smaller cities and towns as well, manufacturers contract service workshops all over the country (so-called 'authorized' or 'franchised' service workshops). Besides, there is a considerably large informal service sector with no tie-up to manufacturers.

In India the average consumption of HCFC-22 for servicing in 2009 and 2010 was 5,042 metric tons this consumption was expected to exceed 10,000 metric tons by 2013 in a scenario with unconstrained growth. This could have been due to the high growth rate in particular in the room air-conditioner sub-sector. The demand projection for 2010-2030 clearly indicated that the servicing sector in the residential (room) air-conditioner sub-sector needs to be addressed in order to reduce India's consumption of HCFCs. The service sector in India has significant relevance as the total share of HCFC consumption in this sector is more than 40%. HCFCs has a range of applications however it is widely used in room air conditioners. Sustainable phase-out needs to include the service sector due to the risk of reverse conversions and to train the technicians in Good Servicing Practices leading to reduction in consumption and avoiding leaks of refrigerants to environment.

The Servicing Sector has a significant consumption of HCFCs, namely, HCFC-22, HCFC-123, HCFC124, HCFC142b (both used as blend components), due to the extensive and increasing population of RAC

equipment. The Servicing Sector caters to all sub-sectors of the Air Conditioning and Refrigeration Sectors.

The refrigerant consumption in the servicing sector not only depends on the installed base of RAC equipment, but also on product quality and the quality of service provided during product life cycle. The variability in product quality is fairly predictable and reasonably accurate rates of failures have been provided by manufacturers. With regard to the service quality there is a wide variation on failure rates depending on knowledge and skill levels of technicians, who are primarily from the unorganized sector without formal access to technology and training. Further, the age of the equipment has a direct impact on the HCFC consumption. Appropriate equipment, tools and skill levels are needed for the servicing of larger and more complex systems.

The total number of technicians in the servicing sector is about 200,000. During servicing, recovery of the refrigerant is not a common practice. The refrigerant is often simply vented out and after repair the equipment is completely recharged. Often the system also just gets topped up with refrigerant without proper leak detection and will continue to leak. There could be potentially significant savings in refrigerant use if proper recovery and good practices are implemented. The enterprises largely learn their service practices on job only and do not have experience and understanding of new generation flammable refrigerants.

In addition to HCFC-22, other HCFCs used in the servicing include HCFC-123 (mainly for centrifugal chillers), HCFC-124 and HCFC-142b (as blends) in industrial refrigeration applications.

The overall HCFC consumption in the Servicing Sector for 2015 is tabulated below:

Table-16: HCFC consumption in the Servicing Sector (2015) (MT)

Year/Substance	HCFC-123	HCFC-124	HCFC-142b	HCFC-22	Total
2015	144	0	97	6242	6483

Source: Country Program Progress Report Data 2015

From the above, the critical role of the Servicing Sector and its impact on future HCFC consumption in India is evident.

HCFC free related service jobs are typically still warranty-based and done for the most part through the official manufacturer branches or through the network of franchised repair workshops. These manufacturers are doing country wide - mainly in the bigger cities training for their technicians. The training is restricted to their products and primarily for installation to begin with as these equipment / appliances require safety precautions due to the properties of the new / alternate refrigerants.

During the implementation the ODS phase out projects in the servicing sector there are several learnings that can support effective implementation of HPMP Stage–II. These projects have demonstrated that good servicing practice, technical know-how and information w.r.t RAC sector can be successfully transferred to the huge and widespread informal sector at a reasonable cost. Achieving objectives of the project is possible through a well-knit system and the development of innovative processes for implementation. The following main factors for the successful implementation have been identified:

- Strategic project planning through a joint consultation process with the leading technical experts, industry and other stakeholders.
- Intelligent use of limited funds to reach out to a maximum number of enterprises and technicians.
- Development of an infrastructure and methodologies specifically tailored to the needs of the target group and creating synergies for all the components.
- Development of a network which effectively provides all the necessary support to the project during its entire implementation cycle and optimal utilization of project resources.
- Dedicated and experienced implementing agencies with a strong agenda and sufficient resources to support the project.
- Highly dedicated (lead) implementing agency with an efficient project management unit based in the country.
- Lean management structure with effective coordination and decision making body (Core Group).
- Continuous development of an accurate and relevant database for evidence based decision making.
- Regular review of the systems developed.

Good service practices on original equipment prioritized, not supporting retrofitting approaches, but preparing for market introduction and penetration of new alternative technologies is the thrust area to be focused during the HPMP Stage-II.

5.4 OVERALL HCFC CONSUMPTION IN INDIA BY SECTOR AND SUBSTANCE

The overall HCFC consumption in India is as follows:

Table-17: HCFC Consumption in India by Sector and Substance in 2015

Sector/Sub-sector/Substance	HCFC Consumption (MT)				
	R-22	R-141b	R-142b	R-123	Total
Aerosol	0	27.55	0	0	27.55
Foam	352.16	2758.21	29.37	0	3139.74
Refrigeration Manufacturing	5183.37	151.40	0	0	5334.77
RAC Servicing Sector	6242.19	0	96.63	143.69	6482.51
Solvent	0	90.84	0	0	90.84
Fire Fighting	0	0	0	31.18	31.18
Total	**11777.72**	**3028.00**	**126.00**	**174.87**	**15106.59**

Source: Country Program Progress Report Data 2015

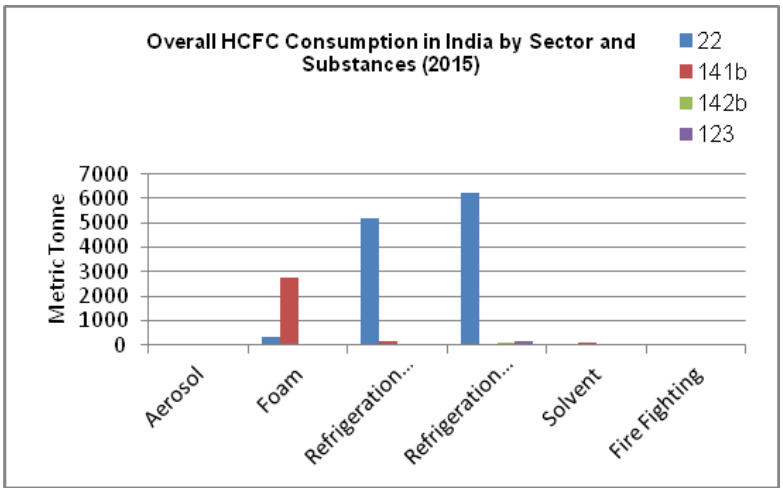


Fig. 16: Sector-wise Consumption of HCFCs

It must be noted that this demand is constrained by supply and capacity regulations of Government on HCFC based equipment production.

5.5 TECHNOLOGY

The selection of alternative technologies to HCFCs is governed by the following:

5.5.1 Requirements for the alternative substance

The alternative substance whether used as a refrigerant or blowing agent, should have following properties:

- Favourable physical and chemical properties for the concerned application
- Inert and stable
- Compatible with existing materials
- Preferably non-flammable
- Non-toxic
- Zero ODP and low GWP
- Easily available

5.5.2 Requirements for the technology

In addition to the availability of alternative substance, the phase-out of HCFCs requires plant and process conversions. Such conversions often bring additional requirements in terms of performance, operation, maintenance and safety.

Additional requirements that the overall conversion technology needs to fulfil are as below:

- Proven and reasonably mature technology
- End-product properties and performance should be maintained
- Cost-effective conversion with minimal disruption of current manufacturing operations

- Compliance with established local and international standards for health safety and environment
- Low overall direct and indirect CO2-equivalent emissions
- Implementable in a relatively short time frame

Due to the environmental and occupational impact of technologies in the ODS consuming sectors, the past two decades have been marked by constant uncertainties and changes as well as several technological innovations and investments to overcome them.

As more scientific and technical information on alternative technologies and their environmental impacts, as well as information on research on new alternatives becomes available, it is clear that the eventual choice of alternative technology will need to carefully take into account environmental impacts and focus more on long-term environmental and occupational sustainability. This will need resources to be directed towards innovative products and processes that minimize ozone and climate impacts, while remaining safe, efficient and affordable.

6. STRATEGY FOR HPMP STAGE-II

6. STRATEGY FOR HPMP STAGE-II

6.1 PRINCIPLES

The overarching strategy underlying the HPMP for India to meet the post 2020 compliance targets of the accelerated phase-out schedule for HCFCs is based on the following guiding principles:

- It should reflect national context, priorities, national policies and be country-driven;
- It should be based on developing and demonstrating a strengthened and proactive partnership between government and industry;
- It should draw upon the lessons learnt from functioning of institutional arrangements and operational mechanisms in implementation of ODS phase out in past;
- It should integrate and build upon existing infrastructures and introduce new mechanisms as needed;
- It should be dynamic and evolving, and be open for revisions and adaptation as necessary in response to evolving situations.

Apart from the above, the HPMP will be designed consistent with the policy principles enunciated as part of India's Country Programme for phasing out ODS.

6.1.1 APPROACH FOR COMPLIANCE

The baseline of HCFCs consumption for India is 1608.20 ODP tons against which the reduction target of the Protocol is to be achieved for compliance. Whereas, the 1691.25 ODP tons is the Starting Point (including 83.05 ODP tons of imported pre-blended polyols) which has to be phased out of consumption. The accelerated phase out schedule of HCFC has a target of 35% reduction in consumption from the baseline of 1608.20 ODP tons in the year 2020. This means a reduction of 562.87 ODP tons by that time. The successful implementation of HPMP-I has already resulted in phase out of 341.77 ODP tons of HCFCs. So, India in HPMP-II proposes to not only achieve the compliance targets of the year 2020 set under the protocol, but also work for expediting the transition of these sectors to low GWP non-ODS technologies.

The approach is based on understanding of the profiles of the various HCFC consuming sectors and sub-sectors, their current and forecasted consumption, and country's need for fast paced economic development. It also accounts for requirements of effective and efficient management and coordination in order to ensure a systematic transition with minimal disruption. The Stage-II period ranging from 2017 to 2020, will focus on converting foam manufacturing facilities and air-conditioning manufacturing facilities where HCFC is being used and where non-HCFC, zero-ODP and low-GWP technologies can be applied. To ensure that these conversions and the associated reductions in HCFC consumption remain sustainable, targeted and specific regulations will be promulgated, if required.

Keeping in view a large number of MSMEs being addressed in the foam sector, an action plan will be developed for adoption of appropriate strategy to ensure minimal dislocation in the sector and for enhancing the capacities of MSMEs in converting to low-GWP non-ODS technologies.

To control the growth of HCFC-22 consumption in the Servicing Sector, capacity-building programmes for technicians and servicing establishments will be carried out. A national enabling programme to

further support the sustainability of reductions to be achieved will be implemented by incorporating education, communication and outreach activities.

The strategy is to phase out completely the use of HCFC-141b in the foam manufacturing sector as on 1.1.2020.

During the period of 2017 to 2023, India will also take up the conversion of the 6 large Air Conditioning Manufacturing enterprises to low GWP non-ODS technology. The focus will also be on taking up training and enabling activities for reduction in consumption of HCFCs in servicing sector.

The required level of reduction in HCFCs consumption in the year 2020 as per the target under the Protocol and the allowable consumption of HCFCs in different years in the range of 2017 – 2023, as per the approved HPMP-II is given in table below.

The HPMP-I has phased out 341.77 ODP tons and it is proposed to phase out 804.10 ODP tons under HPMP-II. So the total phase out will be 1145.87 ODP tons against the starting point of 1691.25, leaving a balance of 545.38 ODP tons after completion of HPMP-II in 2023.

Table 18: Reductions for Compliance with 2020 and approved targets as per HPMP Stage-II

S.N.	Particulars	2016	2017	2018	2019	2020	2021	2022	2023	Total
1	Montreal Protocol Reduction Schedule (ODP tons)	1447.38	1447.38	1447.38	1447.38	1045.33	1045.33	1045.33	1045.33	
		90% of baseline	90% of baseline	90% of baseline	90% of baseline	65% of baseline	65% of baseline	65% of baseline	65% of baseline	
2	Maximum allowable consumption as per HPMP-II (ODP tons)	1447.38	1447.38	1433.63	1103.85	832.32	799.76	698.82	643.28	
		90% of baseline	90% of baseline	89.15% of baseline	68.64% of baseline	51.75% of baseline	49.73% of baseline	43.45% of baseline	40% of baseline	
3	Reductions Required (ODP tons)	-	-	13.75	329.78	271.53	32.50	100.94	55.54	**804.10**

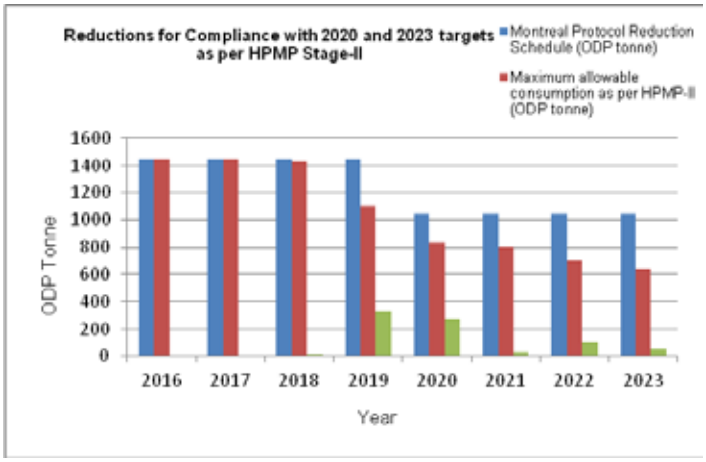


Fig. 17: Reductions for Compliance with 2020 and approved targets as per HPMP Stage-II

6.1.2 Subsequent Stages (beyond 2023)

The focus of actions for subsequent stages will be on further reductions in HCFC-22 in the remaining Air conditioning manufacturing facilities as well as HCFC-22 demand for servicing in line with the subsequent control targets for HCFC consumption. This will involve sustaining and strengthening infrastructures for effective and efficient management of HCFCs, introducing and strengthening decentralized enforcement mechanisms and further mainstreaming the implementation of the Montreal Protocol in national and local institutions.

6.2 STRATEGIC ISSUES

Two key strategic issues identified are as below:

- The time available to implement actions for achieving the objectives of Stage-II will introduce management and coordination challenges for government and industry. The actions will need to be forward-looking, systematic, effective and efficient, where both government and industry will need to dedicate strong focus and adequate resources to ensure that implementation is approached consistently and in a result-oriented and integrated manner.
- Aiming to maximize the environmental benefits in accordance with the guidance provided by MOP Decision XIX/6 for HCFC phase-out by introducing safe and sustainable low-GWP alternative technologies including natural refrigerants, taking into account national circumstances and industry needs.

6.3 RATIONALE AND PHASE-OUT STRATEGY

The rationale behind designing the phase-out strategy for compliance with the post 2020 targets is given below:

6.3.1 The Polyurethane Foam Sector

In accordance with the ODS (Regulation and Control) Amendment Rules 2014, the use of HCFC in manufacture of all foam products should be completely phase out by 1.1.2020. The HPMP Stage-II for the foam sector has been developed keeping in view the above. The Indian Polyurethane Industry in the country also feels the need for early phase-out of HCFC 141b due to the following reasons:

- HCFC 141b imports are becoming expensive. It is important to note that prices of HCFC 141b have started to rise steeply.
- Many units in China manufacturing HCFC 141b have been closed down and hence supplies are becoming more expensive and it is expected that in few months the prices are likely to rise further. Hence the industry should begin to look at alternates rather than continue with existing raw materials.
- The lead time appears sufficient to make the industry prepare for change over.

6.3.2 Phase-out strategy for large and medium enterprises

The large units are technologically up to date, and fully aware of what is happening in rest of the world with respect to raw materials and machinery with respect to foam industry. The medium scale units are also constantly upgrading themselves both in terms of plant and machinery as well as raw materials. However, their constraints are more to do with their reach to market, branding and other logistic issues. These segments will not have much of a problem in switch over to non-ODS alternate technologies given their volumes and consumption patterns.

6.3.3 Phase-out strategy for small enterprises

The small scale units in foam sector have many challenges in successful phase out of HCFC-141b. This is because of the fact that the units in the small scale sector are less resourceful and un organised. These units like other similarly placed units in other industrial sectors are affected by the shortage of working capital, reach to market, branding, and logistics. These units are also not fully aware of the chemistry involved and have to be always guided and led by the suppliers of chemicals and machinery manufacturers. To make these small scale units transit smoothly to new generation blowing agents require considerable investment of resources and time in retraining.

Competency enhancement of SMEs

Towards competency enhancement of the SMEs, awareness programmes on low GWP alternatives to HCFCs including adoption of such alternatives are planned. SMEs will also be facilitated for adequate integration of their activities and products by creating tie-ups with Systems Houses for manufacturing and marketing of their products. They will also need the facilities of high end laboratories available with Systems Houses or other organizations like MNCs for getting their material and products tested.

6.3.4 Air-conditioning Manufacturing Sector

In the Air-conditioning manufacturing sector, the HPMP-II has proposal for converting manufacturing lines in 6 large enterprises. These enterprises have opted for change to new low GWP technology. The conversion proposed is from HCFC-22 to HFC-32 in 10 manufacturing lines of these 6 enterprises. This will further strengthen the Indian market towards the use of low GWP alternative technologies. The enterprises proposed especially with manufacturing capacity of 100,000 units and more have the technical and financial capacity to successfully convert the facility and also have capacity of co-funding as per the need. This would not only give technology signal to the market but also ensure sustainability of this sector in the country.

6.3.5 RAC Servicing Sector

The rationale for the servicing sector under the HPMP Stage-II is as follows:

a) Phasing-out HCFC in the RAC servicing sector is inevitable to comply with upcoming phase out targets under the Montreal Protocol as refrigeration and air conditioning equipment remains in use for up to 10 - 15 years, a significant population of HCFC-based equipment is likely to be still in operation. Reduction of HCFC use before the complete phase-out can be achieved by better servicing (fewer leaks) and by recovery and recycling of HCFC at workshop level.

b) New refrigerant entail more demanding servicing and manufacturing practice. Technicians active in the RAC servicing sector must be trained to correctly handle the new low GWP refrigerants.

c) For most in RAC servicing sector, the only significant channels of information on new products or service practices are suppliers of refrigerants and spare parts. There is an urgent need to extend outreach through complementary means. Industry networks, public and private vocational training institutions of high repute and NGOs of proven track record need to be involved.

d) Transition to new technologies requires technology transfer and adaptation of equipment. Building-up and dissemination of local know-how and networking with related technical and non-technical sectors are important strategy elements. Mutual exchange of experience benefits an accelerated transition. Processes such as these require facilitation.

e) The upcoming years, when the servicing sector is bound to become increasingly confronted with alternative technologies / refrigerants, for which there is a need to develop approaches to sensitize the target group.

With the management systems / methodology, experience from the HPMP Stage-I, including the earlier MLF funded projects, contribution of servicing sector in the phase-out of HCFCs will be primarily through training on good servicing practices, leak prevention and introducing RAC servicing technicians to the appliances charged with alternative refrigerants, with particular emphasis on refrigerants with low or zero GWP, as appliances with such refrigerants are already in the market. The consumption in the servicing sector will be reduced mainly through training on better servicing practices and leak prevention but service technicians also need to be prepared on the introduction of alternatives like HC-290, HFC-32 and other alternatives like blends of HFCs and HFO/HFCs, in consultation with the stakeholders. Besides training/capacity building for the servicing technicians, additional activities viz. institutional strengthening, certification, and awareness activities are planned during HPMP Stage-II. Noting the volume of a) technical staff with institutions and b) the instructors with ITIs addressing their training requirements will be continued. With new refrigerants being introduced the syllabus revision for the ITIs will be taken up during Stage-II. On interacting with the technicians and stakeholders a need was expressed of Certification and a State of Art Training Institute. These two activities are exclusive and will be implemented on pilot scale in the country. To ensure that quality of technicians training program is maintained and to evaluate the impact – Monitoring & Evaluation and Impact Assessment will be carried out.

The capacity building / training activities proposed under HPMP Stage–II complement the National Skill Development Mission. Mission of the Government of India as the number of technicians to be trained under HPMP-II is high, new training partners would be identified and supported with requisite equipment and tools alongwith training of trainers on best practices and alternative refrigerant.

Doing more capacity building / training for technicians programs is inevitable considering the population of the equipment/appliances in the country, the refrigeration and air-conditioning requirement due to the climatic conditions varying from very hot to very cold across the country. Proportionately there are number of technicians in the RAC trade. The number of technicians trained during HPMP Stage - I is only about 6 % of the total population of technicians in India. Still a large number of technicians remains to be trained. The technicians are geographical wide spread across the country. The key issues to be addressed towards this are as follows:

- high population of technician's approx. 200000 nos.;
- ongoing cycles of training required to reach to maximum technicians;
- turnover of technicians – moving to other trades and new getting added is an ongoing cycle;
- India has a huge number of technicians undergoing formal vocational training through ITIs every year approx. 12000 nos. are trained;
- those trained few years back require training to understand Good Service Practices (GSP), upgrade their skills and knowledge / information to be in business / trade;

Awareness, outreach and communication component will primarily implement activities to enhance the outreach to various stakeholders, technicians from the RAC sector. The awareness workshops in specific for RAC spare parts and refrigerant dealers support disseminate information further down to

their customers/technicians. The printed material viz. newsletter, posters and flyers for technicians has been appreciated for their information content by the technicians and the stakeholders hence will be continued under HPMP Stage-II. The information about the equipment support scheme provided to the technicians will reach the technicians through workshops. Industry roundtable and technology exhibitions will provide a platform for information dissemination and knowledge exchange on the latest technology trends for HCFC alternatives.

GIZ will be the cooperating agency for the servicing sector plan, which will be implemented in close cooperation with the MoEFCC, Government of India.

6.3.6 Enabling component

The non-investment activities established the necessary enabling environment for India to successfully achieve the HPMP Stage-I compliance targets in line with the accelerated HCFC phase-out schedule. The HPMP Stage-I activities have resulted in setting the platform to accelerate the move towards HCFC alternatives by the Industry.

Decision XIX/6 of Meeting of the Parties to the Montreal Protocol also called for efforts "to minimize environmental impacts, in particular impacts on climate" while phasing out HCFCs as per the accelerated phase-out schedule. This would be a challenge for industries and policy makers in India. Even though there are many alternatives to HCFCs available in the market, most are only short- to medium-term solutions. The evolving nature of Montreal Protocol outlook to address global environment and climate challenges of HCFC phase-out in accordance with the advancements in refrigerant technologies makes it imperative that the HPMP Stage-II activities are dynamic, holistic and maximizes synergies with crosscutting themes.

The learning from Stage-I implementation has provided a clear vision for achieving the HPMP Stage-II compliance targets. UNEP has acquired extensive experience in awareness raising and training programs within the framework of Montreal Protocol implementation specifically capacity building of customs and enforcement officers, RAC technicians and others to follow good practice on servicing especially the handling of flammable refrigerants. National Cold Chain Development (NCCD), urban development, Energy Efficiency Services Ltd., a joint venture of Public Sector Undertakings of the Ministry of Power, Government of India will be closely involved during the implementation of HPMP Stage II activities.

Besides continuing and building on the activities initiated during the HPMP Stage-I, the enabling component during the HPMP Stage-II will primarily focus on implementation of activities to enhance the outreach to various stakeholders and will comprise customs training, public awareness, awareness workshops, publications, information dissemination, certification of RAC servicing technicians, activities towards strengthening of HCFCs license and quota systems, development of standards for RAC Sector in collaboration with Industry, Bureau of Indian Standards (BIS) and other related stakeholders.

The policy and enforcement framework has been key for achieving compliance in India. It would play a more important role in achieving the Stage-II compliance levels in 2025. Therefore it is important that the Ozone Cell is supported for developing institutional partnerships and policy development leadership in: promotion of non-ODS technologies, and Climate & Energy-Use linkages of HCFC phase-out. Some of the thematic areas that the Ozone Cell will be supported under the HPMP Stage-II strategy are sector based policy & enforcement capacity building frameworks, whilst continuing and strengthening the present frameworks that were established under HPMP Stage-I activities. The focus of HPMP Stage-I

policy & enforcement related activities were towards ODS import & licensing systems and capacity building of enforcement officers. Whilst these activities represent the core enabling instruments for a robust ODS control regime, there are synergies in specific sectors, where additional policy formulation and capacity building efforts would be essential to restrict demand of ODS based systems at the end-user. The thrust will be on the following new initiatives during the HPMP Stage-II implementation.

a) Facilitate development of policies to assist in prioritizing the procurement of 'Green' RAC systems (e.g. Non-ODS, Energy Efficient etc.) through the Directorate General for Supplies & Disposal (DGS&D) under the Ministry of Commerce & Industry, the nodal agency for public procurement in India.

b) Facilitate development of building Codes for handling HCFC alternatives based equipment and for non-HCFC alternatives, with minimum climate impact for insulations and foams.

c) Promote HCFC alternatives that can maximize climate and energy-use benefits in the cold chain sector

d) Promote energy efficiency norms, lower energy-use technologies for new refrigeration systems and enhance competencies of the RAC servicing sector technicians on the energy efficiency standards and labelling system in India.

e) Facilitate development of national level standards for installation, transportation, storage, operation and maintenance of such refrigerants in RAC system for easy transitioning to non-HCFC technologies.

UNEP will be the cooperating agency for the servicing sector plan, which will be implemented in close cooperation with the MoEFCC, Government of India.

6.4 STRATEGY COMPONENTS AND COSTS

The strategy for compliance with the Stage-II targets for compliance with the post 2020 phase-out targets is comprised of the following components:

6.4.1 Policies, Regulations, Project Management, Coordination and Monitoring

Policies, Regulations

The implementation of ODS (Regulation and Control) Amendment Rules 2014 will be strengthened through introducing suitable technology interventions for effective management and monitoring of Registration, Licensing System, Production, Import and Export of HCFCs.

Management, Coordination and Monitoring

The PMU, established during the HPMP Stage-I will be strengthened. During HPMP Stage-II, the PMU would put in place the necessary project initiation procedures, agreements, etc., the earliest date by which field-level activities can commence is by the first quarter of 2017. Before signing the agreement with the participating enterprises, a physical verification of the units will be undertaken. A strategy for addressing phase-out of HCFCs in the SMEs in foam Sector will be finalised after consultation with stakeholders and implementing agencies. This will make the task of management and coordination of activities very challenging. Adequate resources would need to be allocated, to support the additional costs of management, coordination and monitoring. The outlay on this is US$ 2,400,000.

6.4.2 Polyurethane Foam Sector Plan

The Polyurethane Foams Sector Plan will aim to completely phase out HCFC 141b consumption in various sub-sectors by 1.1.2020. The successful implementation of this plan will contribute phase out of 5,800 MT (638 ODP tons) of HCFC-141b. The investment planned in this sector is US$ 24,000,000.

6.4.3 Air-conditioning Manufacturing Sector Plan

The Air-Conditioning Manufacturing Sector Plan will aim to phase out 1,140 MT (62.70 ODP tons) of HCFC-22 in 10 lines of 6 enterprises by1.1.2023. The investment planned in this sector is US$ 12,511,459.

6.4.4 Servicing Sector Plan

Specific technical assistance and capacity-building interventions will be needed to control the growth of HCFC consumption in servicing to acceptable levels. Successful implementation of this plan will result in contributing to reductions in HCFC-22 consumption of 1,250 MT (68.75 ODP tons) by 1.1.2023. The investment planned in this sector is US$ 5,100,000.

6.4.5 Enabling Activities

The implementation of the HPMP Stage-II will need effective enforcement of existing and proposed regulations. In addition, considering the large size of the country and large number of stakeholders' public will need to be engaged actively, to ensure their support for the phase-out. Further, linkages between stakeholders and partners engaged in programmes for energy efficiency, standards, building codes, cold chain and product life cycle management will need to be leveraged, to ensure that sustainable technology options are implemented. The investment planned in these activities is US$ 900,000.

6.5 SUMMARY OF COSTS AND FUNDING

The total costs and requested funding for HPMP Stage-II to achieve complete phase-out of HCFC-141b (638 ODP tons) consumed exclusively in the foam sector, 62.70 ODP tons of HCFC-22 in the air-conditioning manufacturing sector and 68.75 ODP tons of HCFC-22 in the RAC servicing sector are summarized below.

Table 19: Summary of Phase out and Funding for HPMP Stage-II

Component	Agency	Actual phase-out Consumption		Eligible phase-out Consumption		Net Funding Approved (US$)
		MT	ODP	MT	ODP	
Project Management Components	UNDP	N/A	N/A	N/A	N/A	2,400,000
Polyurethane Foam Sector Plan	UNDP	5,800	638.02	3,166	348.26	24,000,000
Air-conditioning Manufacturing Sector Plan	UNDP	1,140	62.72	1,140	62.70	12,511,459
Servicing Sector Plan	Germany	1,250	68.75	1,250	68.75	5,100,000
Total		**8,190**	**769.49**	**5,556**	**479.71**	**44,911,459**

6.6 MANAGEMENT ARRANGEMENTS

The implementation of the HPMP (Stage-II) will need to be closely aligned and coordinated with the various policy, regulatory, fiscal, awareness generation and capacity-building actions by the Ministry of Environment, Government of India. This will require continuance of various steps being taken and new initiatives in future ensuring consistency with national priorities. The Ministry will have the overall coordination role. UNDP is the designated Lead Implementing Agency for India's HPMP and UNEP and Germany are the Cooperating Agencies. The Project Management Unit will undertake day-to-day implementation, supervision and project management.

6.7 MONITORING

An implementation plan along with timelines will be worked out in consultation with the implementation agencies and the stakeholders. The Ministry will monitor the implementation closely on a periodic basis as per the implementation framework developed. All efforts will be made to ensure timely implementation, leading towards successful phase out of HCFCs as per the commitments made under the Protocol.

6.8 ENVIRONMENTAL IMPACT

6.8.1 Ozone Layer Protection

Successful implementation of the HPMP Stage-II in India will result in a sustainable phase-out of 769.49 ODP tons of HCFCs.

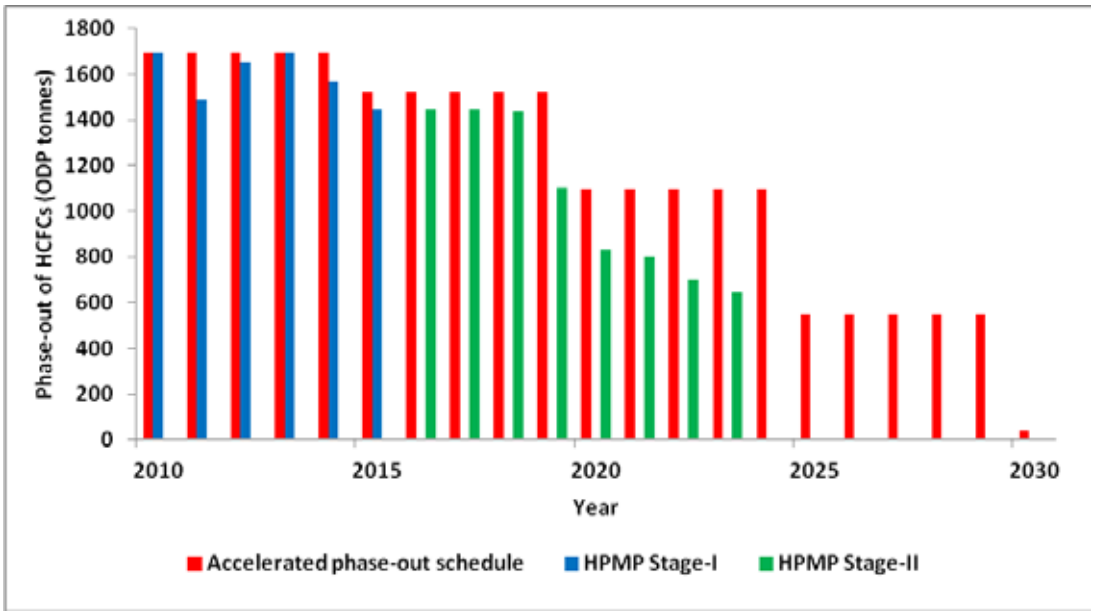


Fig. 18: Impact of HPMP Stage-I And HPMP Stage-II in Phase-out of HCFCs

6.8.2 Direct GHG emissions

Due to the relatively high GWP of HCFCs, their phase-out will result in reduced direct GHG emissions. The net impact would be the difference in the direct emissions between HCFCs and the alternatives introduced to replace them as below:

GHG emissions before conversion

Sector/Substance	HCFC-22	HCFC-141b
Foams (MT)	0	5,800
Air-conditioning Manufacturing	1,140	0
Servicing	1,250	0
Total (MT)	2,390	5,800
GWP*	1810	725
Impact (CO2-eq.tons)	4,325,900	4,205,000
Total impact (CO2-eq. tons/y	**8,530,900**	

GHG emissions after conversion

Sector/Substance	HCFC-22	HCFC-141b	Alternative Technology
Foams (MT)	0	5,800	HC
Air-conditioning Manufacturing	1,140	0	HFC-32
Servicing	1250	0	0
Total (MT)	2,390	5,800	-
GWP*	675	11	-
Impact (CO2-eqtons)	769,500	63,800	-
Net Impact (CO2-eq tons)/y	833,300		

The net contribution towards reduction of direct CO2 emissions due to successful implementation of HPMP Stage-II are 4,262,100 MT CO2 Eq. per year from 2020 and 7, 697, 600 MT CO2 Eq. per year from 2023.

6.8.3 Indirect GHG emissions

Energy efficiency improvements are not the primary objective of this plan therefore the impact of indirect GHG emissions cannot be estimated.

6.8.4 Health and Safety

The HPMP (Stage-II) will be implemented taking into account considerations for safeguarding health and safety in line with local and international regulations and guidelines.

ANNEXURES

ANNEXURE-I

DECISION XIX/6: ADJUSTMENTS TO THE MONTREAL PROTOCOL WITH REGARDS TO ANNEX- C, GROUP- I, SUBSTANCES (HYDROCHLOROFLUOROCARBONS)

The Parties agree to accelerate the phase-out of production and consumption of hydrochlorofluorocarbons (HCFCs), by way of an adjustment in accordance with paragraph 9 of Article 2 of the Montreal Protocol and as contained in annex III to the report of the Nineteenth Meeting of the Parties, on the basis of the following:

1. For Parties operating under paragraph 1 of Article 5 of the Protocol (Article 5 Parties), to choose as the baseline the average of the 2009 and 2010 levels of, respectively, consumption and production; and

2. To freeze, at that baseline level, consumption and production in 2013;

3. For Parties operating under Article 2 of the Protocol (Article 2 Parties) to have completed the accelerated phase-out of production and consumption in 2020, on the basis of the following reduction steps:

   (a) By 2010 of 75 per cent;

   (b) By 2015 of 90 per cent;

   (c) While allowing 0.5 per cent for servicing during the period 2020–2030;

4. For Article 5 Parties to have completed the accelerated phase-out of production and consumption in 2030, on the basis of the following reduction steps:

   (a) By 2015 of 10 per cent;

   (b) By 2020 of 35 per cent;

   (c) By 2025 of 67.5 per cent;

   (d) While allowing for servicing an annual average of 2.5per cent during the period 2030–2040;

5. To agree that the funding available through the Multilateral Fund for the Implementation of the Montreal Protocol in the upcoming replenishments shall be stable and sufficient to meet all agreed incremental costs to enable Article 5 Parties to comply with the accelerated phase-out schedule both for production and consumption sectors as set out above, and based on that understanding, to also direct the Executive Committee of the Multilateral Fund to make the necessary changes to the eligibility criteria related to the post-1995 facilities and second conversions;

6. To direct the Executive Committee, in providing technical and financial assistance, to pay particular attention to Article 5 Parties with low volume and very low volume consumption of HCFCs;

7. To direct the Executive Committee to assist Parties in preparing their phase-out management plans for an accelerated HCFC phase-out;

8. To direct the Executive Committee, as a matter of priority, to assist Article 5 Parties in conducting surveys to improve reliability in establishing their baseline data on HCFCs;

9. To encourage Parties to promote the selection of alternatives to HCFCs that minimize environmental impacts, in particular impacts on climate, as well as meeting other health, safety and economic considerations;

10. To request Parties to report regularly on their implementation of paragraph 7 of Article 2F of the Protocol;

11. To agree that the Executive Committee, when developing and applying funding criteria for projects and programmes, and taking into account paragraph 6, give priority to cost-effective projects and programmes which focus on, inter alia:

    (a) Phasing-out first those HCFCs with higher ozone-depleting potential, taking into account national circumstances;

    (b) Substitutes and alternatives that minimize other impacts on the environment, including on the climate, taking into account global-warming potential, energy use and other relevant factors;

    (c) Small and medium-size enterprises;

12. To agree to address the possibilities or need for essential use exemptions, no later than 2015 where this relates to Article 2 Parties, and no later than 2020 where this relates to Article 5 Parties;

13. To agree to review in 2015 the need for the 0.5 per cent for servicing provided for in paragraph 3, and to review in 2025 the need for the annual average of 2.5 per cent for servicing provided for in paragraph 4 (d);

14. In order to satisfy basic domestic needs, to agree to allow for up to 10% of baseline levels until 2020, and, for the period after that, to consider no later than 2015 further reductions of production for basic domestic needs;

15. In accelerating the HCFC phase-out, to agree that Parties are to take every practicable step consistent with Multilateral Fund programmes, to ensure that the best available and environmentally-safe substitutes and related technologies are transferred from Article 2 Parties to Article 5 Parties under fair and most favourable conditions;

(Decision XIX/6)

ANNEXURE-II

GUIDELINES FOR THE PREPERATION OF HCFC PHASE-OUT MANAGEMENT PLANS INCORPORATING HCFC SURVEYS

Executive Committee decided to adopt the following guidelines:

(a) Countries should adopt a staged approach to the implementation of an HCFC phase-out management plan (HPMP), within the framework of their over-arching-strategy;

(b) As soon as possible and depending on the availability of resources, countries should employ the guidelines herein to develop, in detail, stage one of the HPMPs, which would address how countries would meet the freeze in 2013 and the 10 per cent reduction in 2015, with an estimate of related cost considerations and applying cost guidelines as they were developed;

(c) The elaboration of stage one of the HPMP and subsequent stages should be developed as follows:

(i) For countries with consumption in the servicing sector only:

a. To be consistent with existing guidelines for the preparation of RMPs/RMP updates pursuant to decisions 31/48 and 35/57; and, if applicable, with the preparation of TPMPs pursuant to decision 45/54;

b. To contain commitments to achieve the 2013 and 2015 HCFC control measures and include a performance-based system for HPMPs based on the completion of activities in the HPMP to enable the annual release of funding for the HPMP;

(ii) For countries with manufacturing sectors using HCFCs, HPMPs should contain a national performance-based phase-out plan (NPP) with one or several substance or sector-based phase-out plans (SPP) consistent with decision 38/65 addressing consumption reduction levels sufficient to achieve the 2013 and 2015 HCFC control measures and provide starting points for aggregate reductions, together with annual reduction targets;

(d) For countries that chose to implement investment projects in advance of completion of the HPMP:

(i) The approval of each project should result in a phase-out of HCFCs to count against the consumption identified in the HPMP and no such projects could be approved after 2010 unless they were part of the HPMP;

(ii) If the individual project approach was used, the submission of the first project should provide an indication of how the demonstration projects related to the HPMP and an indication of when the HPMP would be submitted;

(e) Consideration should be given to providing funding for assistance to include HCFC control measures in legislation, regulations and licensing systems as part of the funding of HPMP preparation as necessary and confirmation of the implementation of the same should be required as a prerequisite for funding implementation of the HPMP;

(f) In cases where there were multiple implementing agencies in one country, a lead agency should be designated to coordinate the overall development of stage one of the HPMP;

(g) HPMPs should contain cost information at the time of their submission based on and addressing:

(i) The most current HCFC cost guidelines at the time of submission;

(ii) Alternative cost scenarios based on different potential cut-off dates for new capacity if a specific cut-off date had not yet been decided, for funding eligibility of manufacturing facilities as specified in decision 53/37(k), as well as the current policy for a 25 July 1995 cut-off date;

(iii) Alternative cost scenarios for the operational and capital costs for second conversions;

(iv) The incremental costs of regulating import and supply to the market of HCFC dependent equipment once proven alternatives were commercially available in the country and describing the benefits to the servicing sector of associated reduced demand;

(v) Cost and benefit information based on the full range of alternatives considered, and associated ODP and other impacts on the environment including on the climate, taking into account global-warming potential, energy use and other relevant factors;

(h) Countries and agencies were encouraged to explore potential financial incentives and opportunities for additional resources to maximize the environmental benefits from HPMPs pursuant to paragraph 11(b) of decision XIX/6 of the Nineteenth Meeting of the Parties;

HPMPs should address:

(i) The use of institutional arrangements mentioned in decision 53/37 (e) and (f);

(ii) The roles and responsibilities of associations of refrigeration technicians and other industry associations and how they could contribute to HCFC phase-out; and

(j) HPMPs should, as a minimum, fulfil the data and information requirements, as applicable, listed in the indicative outline for the development of HPMPs, as set out in Annex XIX to the present report.

(Decision 54/39)

ANNEXURE-III

FUNDING GUIDELINES FOR HCFC CONSUMPTION SECTOR FOR HPMP STAGE-II

Executive Committee decided, in determining criteria for funding HCFC phase-out in the consumption sector for stage II of the HCFC phase-out management plans (HPMPs) in Article 5 countries:

Cut-off date

(a) Not to consider any projects to convert HCFC-based manufacturing capacity installed after 21st. September 2007;

Second-stage conversion

(b) To apply the following principles in respect of second-stage conversion projects:

(i) Full funding of eligible incremental costs of second-stage conversion projects would be considered in those cases where an Article 5 Party clearly demonstrated in its HPMP that such projects:

a. Were necessary to comply with the Montreal Protocol HCFC targets up to and including the 35 per cent reduction step by 1 January 2020; and/or

b. Were the most cost-effective projects measured in ODP tons that the Party concerned could undertake in the manufacturing sector in order to comply with those targets; and/or

c. Would make the transition to low global-warming potential (GWP) alternatives;

(ii) Funding for all other second-stage conversion projects not covered under sub-paragraph (b) (i) above would be limited to funding for installation, trials, and training associated with those projects;

Eligible incremental costs of HCFC phase-out projects

(c) To apply the following principles in respect of eligible incremental costs of HCFC phase-out projects for stage II of HPMPs, subject to a review in 2020:

(i) The current cost-effectiveness threshold values used for CFC phase-out projects in paragraph 32 of the final report of the 16th meeting of the Executive Committee (document UNEP/OzL. Pro/ExCom/16/20), to be measured in metric kilograms, and a cost-effectiveness threshold of US $7.83/metric kilogram for rigid insulation refrigeration foam, should be used as guidelines during the development and implementation of the second and subsequent stages of HPMPs;

(ii) Article 5 countries would have the flexibility to allocate the approved funding from incremental operating costs to incremental capital costs and to allocate up to 20 per cent of the approved funding for incremental capital costs to incremental operating costs, as long as the use of the flexibility did not change the intent of the project. Any reallocation should be reported to the Executive Committee;

(iii) Funding of up to a maximum of 25 per cent above the cost-effectiveness threshold would be provided for projects when needed for the introduction of low-GWP alternatives; however, for small and medium-sized enterprises (SMEs) in the foam sector with consumption of less than 20 metric tons, the maximum would be up to 40 per cent above the cost-effectiveness threshold;

HCFC phase-out in the foam sector

(iv) Incremental operating costs for projects in the polyurethane foam sector would be considered at US $1.60/metric kilogram for HCFC-141b; however, for projects that make the transition to low-GWP alternatives, incremental operating costs would be considered at up to US $5.00/metric kilogram;

(v) Incremental operating costs for projects in the extruded polystyrene foam sector would be considered at US $1.40/metric kilogram for HCFC-142b, HCFC-142b/HCFC-22, or HCFC-22 consumption to be phased out at the manufacturing enterprise;

(vi) For group projects linked to systems houses, incremental operating costs would be calculated on the basis of the total HCFC consumption to be phased out for all downstream foam enterprises;

(vii) When it was clearly demonstrated that low-GWP alternatives with incremental operating costs as indicated in sub-paragraph (c) (iv) above were not feasible, the Executive Committee would fund higher levels of incremental operating costs when needed for the introduction of low-GWP alternatives by SMEs;

HCFC phase-out in the refrigeration and air-conditioning manufacturing sector

(viii) Incremental operating costs for projects in the air conditioning sub-sector would be considered at US $6.30/metric kilogram of HCFC consumption to be phased out at the manufacturing enterprise;

(ix) Incremental operating costs for projects in the commercial refrigeration subsector would be considered at US $3.80/metric kilogram of HCFC consumption to be phased out at the manufacturing enterprise;

(x) Consistent with decision 31/45 of the Executive Committee, incremental operating costs would not be considered for enterprises in the refrigeration equipment assembly, installation and charging subsector category;

HCFC phase-out in the refrigeration servicing sector, including servicing for all the relevant refrigeration and air-conditioning subsectors

(xi) Article 5 countries with total HCFC consumption of up to 360 metric tons, and former low-volume-consuming (LVC) Article 5 countries with HCFC consumption in the refrigeration servicing sector only above 360 metric tons, must include in their HPMPs, as a minimum:

a. A commitment to meeting, without further requests for funding at least the 35 per cent reduction step in 2020, and, if the country so decided, the 67.5 per cent reduction step in 2025 or the complete phase-out of HCFCs in line or ahead of the Montreal Protocol schedule. This should include a commitment by the country to restrict imports of HCFC-based equipment if necessary to achieve compliance with the reduction steps and to support relevant phase-out activities;

b. Mandatory reporting, by the time funding tranches for the HPMP were requested, on the implementation of activities undertaken in the refrigeration servicing sector and in the manufacturing sector when applicable, in the previous year, as well as a thorough and comprehensive annual work plan for the implementation of the activities associated with the next tranche;

c. A description of the roles and responsibilities of major stakeholders, as well as the lead implementing agency and the cooperating agencies, where applicable;

(xii) Article 5 countries with total HCFC consumption of up to 360 metric tons would be provided with funding consistent with the level of consumption in the refrigeration servicing sector, as shown in the table below, on the understanding that project proposals would still need to demonstrate that the funding level was necessary to achieve the 2020 and 2025 phase-out targets, or if the country so decided, later reduction targets:

Consumption (mt)*	Funding (US $) (**)		
	Up to 2020	Up to 2025	Total phase-out
>0 <15	205,625	396,500	587,500
15 <40	262,500	506,250	750,000
40 <80	280,000	540,000	800,000
80 <120	315,000	607,500	900,000
120 <160	332,500	641,250	950,000
160 <200	350,000	675,000	1,000,000
200 <320	560,000	1,080,000	1,600,000
320 <360	630,000	1,215,000	1,800,000

(*) Level of HCFC baseline consumption in the refrigeration servicing sector

(**) This represents the maximum funding eligible, including funding already provided

(xiii) Article 5 countries with HCFC consumption in the refrigeration servicing sector only above 360 metric tons would be provided with funding for phase-out activities at US $4.80/metric kilogram;

(xiv) Article 5 countries with total HCFC consumption in the servicing sector only of up to 360 metric tons would have flexibility in utilizing the resources available to address specific needs that might arise during project implementation to facilitate the smoothest possible phase-out of HCFCs, consistent with Executive Committee decisions;

(xv) Article 5 countries with total HCFC consumption of up to 360 metric tons, used in both the manufacturing and refrigeration servicing sectors, could submit HCFC phase-out investment projects in accordance with the policies and decisions of the Executive Committee, in addition to funding for addressing HCFC consumption in the servicing sector;

(xvi) Article 5 countries with total HCFC consumption above 360 metric tons used in both the manufacturing and refrigeration servicing sectors should prioritize consumption in the manufacturing sector to meet the reduction steps in 2020, where possible. Activities in the refrigeration servicing sector for such countries would be calculated at US $4.8/ metric kilogram, to be deducted from their starting point for aggregate reductions in HCFC consumption;

HCFC phase-out in the aerosol, fire extinguisher and solvent sectors

(xvii) The eligibility of incremental capital and operating costs for HCFC phase-out projects in the aerosol, fire extinguisher, and solvent sectors would be considered on a case-by-case basis; and

(d) The Executive Committee would be open to considering projects to promote transition to not-in-kind technologies in relevant sectors.

(Decision 74/50)

ANNEXURE-IV

EXECUTIVE COMMITTEE DECISION 77/43 APPROVING INDIA'S HPMP STAGE-II

(Extract from the report of the 77th meeting of the ExCom)

India: HCFC phase-out management plan stage II - first tranche (UNDP/UNEP/Germany)

The Executive Committee decided:

(a) To approve, in principle, stage II of the HCFC phase-out management plan (HPMP) for India for the period 2016 to 2023 to reduce HCFC consumption by 60 per cent of the country's baseline, in the amount of US $48,315,261, consisting of US $38,911,459, plus agency support costs of US $2,723,802 for UNDP; US $900,000, plus agency support costs of US $109,000 for UNEP; and US $5,100,000, plus agency support costs of US $571,000 for the Government of Germany;

(b) To note the commitment of the Government of India to:

  (i) Reduce HCFC consumption by 60 per cent by 2023;

  (ii) Issue a ban on the import and use in all sectors of HCFC-141b, pure or contained in pre-blended polyol, upon completion of the conversion of all the eligible enterprises and no later than 1 January 2020;

(c) To deduct 769.49 ODP tons of HCFCs from the remaining HCFC consumption eligible for funding

(d) With regard to the polyurethane (PU) foam sector plan:

  (i) To request UNDP to include in request for the second tranche and future tranches an updated list of PU foam enterprises assisted, and to be assisted, by the Multilateral Fund under stage II, including the HCFC-141b consumption to be phased-out, the estimated incremental cost of conversion, the sub-sector, the baseline equipment, where applicable, and the technology to be adopted;

  (ii) To note that if, during the implementation of the PU foam sector plan, the tonnage to be phased out in eligible enterprises was found to be less than the 3,166 metric tons of HCFC 141b approved for phase-out under the stage II HPMP, funding for stage II of the HPMP would be reduced to account for that reduced tonnage, at a rate of $7.58/kg;

(e) With regard to the air-conditioning manufacturing sector:

  (i) To note that no further funding for heat exchangers at the assisted enterprises would be provided in future stages of the HPMP;

  (ii) That, for air-conditioning manufacturing enterprises that received funding in the stage II of the HPMP to convert some but not all HCFC-22-based manufacturing lines, any increase in consumption on the non-converted line, in relation to the level of consumption at the time of signature of the memorandum of agreement between the enterprise and the Government, would not be funded by the Multilateral Fund, and the Government will request the enterprises to avoid any growth in HCFC-22 consumption after the time of signature;

(f) To approve the Agreement between the Government of India and the Executive Committee for the

reduction in consumption of HCFCs, in accordance with stage II of the HPMP, contained in Annex XIX to the present report; and

(g) To approve the first tranche of stage II of the HPMP for India, and the corresponding tranche implementation plans, in the amount of US $10,623,880, consisting of US $9,256,000, plus agency support costs of US $647,920 for UNDP, US $300,000, plus agency support costs of US $36,333 for UNEP, and US $345,000, plus agency support costs of US $38,626 for Germany.

(Decision 77/43)

EXTRACTS FROM THE REPORT (DOCUMENT 77/76) OF THE 77th MEETING OF THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND HELD IN NOVEMBER, 2016 AT MONTREAL, CANADA REGARDING INDIA'S HPMP-II

Tranche –I (Project Costs: 9,901,000 USD and Agency Support Costs: 386,546 USD)

S.N	Projects	Phase out (ODP tons)	Investment	Non-Investment	Agency Support	Total USD
1	HCFC-22 Phase out in air conditioning manufacturing sector	25	4,500,000			4,500,000
2	HCFC-141b Phase out in foam sector	114	4,500,000			4,500,000
3	HCFC-22 Phase-out in RAC Servicing Sector (GIZ)	4		345,000		345,000
4	Refrigeration Servicing Sector Plan, UNEP	3.4		300,000		300,000
5	Project Management & Monitoring			256,000		256,000
6	UNDP Support Cost Air Conditioning Manufacturing Sector				315,000	315,000
7	UNDP Support Cost Foam sector				315,000	315,000
8	UNDP Support Cost PMU				17,920	17,920
9	GIZ Support Cost				38,626	38,626
10	UNEP Support Cost				36,333	36,333
	Total	**143**	**9,000,000**	**901,000**	**722,879**	**10,623,879**

ANNEXURE-V

AGREEMENT BETWEEN THE GOVERNMENT OF INDIA AND THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE REDUCTION IN CONSUMPTION OF HYDROCHLOROFLUOROCARBONS IN ACCORDANCE WITH STAGE II OF THE HCFC PHASE-OUT MANAGEMENT PLAN

(Reference: ExCom Document UNEP/OzL.Pro/ExCom/66/38, Annex-XXVII)

Purpose

1. This Agreement represents the understanding of the Government of India (the "Country") and the Executive Committee with respect to the reduction of controlled use of the ozone depleting substances (ODS) set out in Appendix 1-A ("The Substances") to a sustained level of 643.28 ODP tons by 1 January 2023 in compliance with Montreal Protocol schedule.

2. The Country agrees to meet the annual consumption limits of the Substances as set out in row 1.2 of Appendix 2 A ("The Targets, and Funding") in this Agreement as well as in the Montreal Protocol reduction schedule for all Substances mentioned in Appendix 1-A. The Country accepts that, by its acceptance of this Agreement and performance by the Executive Committee of its funding obligations described in paragraph 3, it is precluded from applying for or receiving further funding from the Multilateral Fund in respect to any consumption of the Substances that exceeds the level defined in row 1.2 of Appendix 2-A as the final reduction step under this Agreement for all of the Substances specified in Appendix 1-A, and in respect to any consumption of each of the Substances that exceeds the level defined in rows 4.1.3, 4.2.3, 4.3.3, 4.4.3, 4.5.3 and 4.6.3 (remaining consumption eligible for funding).

3. Subject to compliance by the Country with its obligations set out in this Agreement, the Executive Committee agrees, in principle, to provide the funding set out in row 3.1 of Appendix 2-A to the Country. The Executive Committee will, in principle, provide this funding at the Executive Committee meetings specified in Appendix 3-A ("Funding Approval Schedule").

4. The Country agrees to implement this Agreement in accordance with the stage II of the HCFC phase-out management plan (HPMP) approved ("the Plan"). In accordance with sub-paragraph 5(b) of this Agreement, the Country will accept independent verification of the achievement of the annual consumption limits of the Substances as set out in row 1.2 of Appendix 2-A of this Agreement. The aforementioned verification will be commissioned by the relevant bilateral or implementing agency.

Conditions for funding release

5. The Executive Committee will only provide the Funding in accordance with the Funding Approval Schedule when the Country satisfies the following conditions at least eight weeks in advance of the applicable Executive Committee meeting set out in the Funding Approval Schedule:

   (a) That the Country has met the Targets set out in row 1.2 of Appendix 2-A for all relevant years. Relevant years are all years since the year in which this Agreement was approved. Years for which there are no due country programme implementation reports at the date of the Executive Committee meeting at which the funding request is being presented are exempted;

(b) That the meeting of these Targets has been independently verified for all relevant years, unless the Executive Committee decided that such verification would not be required;

(c) That the Country had submitted a Tranche Implementation Report in the form of Appendix 4-A ("Format of Tranche Implementation Reports and Plans") covering each previous calendar year; that it had achieved a significant level of implementation of activities initiated with previously approved tranches; and that the rate of disbursement of funding available from the previously approved tranche was more than 20 per cent; and

(d) That the Country has submitted a Tranche Implementation Plan in the form of Appendix 4-A covering each calendar year until and including the year for which the funding schedule foresees the submission of the next tranche or, in case of the final tranche, until completion of all activities foreseen.

Monitoring

6. The Country will ensure that it conducts accurate monitoring of its activities under this Agreement. The institutions set out in Appendix 5-A ("Monitoring Institutions and Roles") will monitor and report on implementation of the activities in the previous Tranche Implementation Plans in accordance with their roles and responsibilities set out in the same appendix.

Flexibility in the reallocation of funds

7. The Executive Committee agrees that the Country may have the flexibility to reallocate part or all of the approved funds, according to the evolving circumstances to achieve the smoothest reduction of consumption and phase-out of the Substances specified in Appendix 1-A:

(a) Reallocations categorized as major changes must be documented in advance either in a Tranche Implementation Plan as foreseen in sub-paragraph 5 (d) above, or as a revision to an existing Tranche Implementation Plan to be submitted eight weeks prior to any meeting of the Executive Committee, for its approval. Major changes would relate to:

(i) Issues potentially concerning the rules and policies of the Multilateral Fund;

(ii) Changes which would modify any clause of this Agreement;

(iii) Changes in the annual levels of funding allocated to individual bilateral or implementing agencies for the different tranches;

(iv) Provision of funding for activities not included in the current endorsed Tranche Implementation Plan, or removal of an activity in the Tranche Implementation Plan, with a cost greater than 30 per cent of the total cost of the last approved tranche; and

(v) Changes in alternative technologies, on the understanding that any submission for such a request would identify the associated incremental costs, the potential impact to the climate, and any differences in ODP tons to be phased out if applicable, as well as confirm that the Country agrees that potential savings related to the change of technology would decrease the overall funding level under this Agreement accordingly;

(b) Reallocations not categorized as major changes may be incorporated in the approved Tranche Implementation Plan, under implementation at the time, and reported to the Executive Committee in the subsequent Tranche Implementation Report;

(c) Any enterprise to be converted to non-HCFC technology included in the Plan and that would be found to be ineligible under the policies of the Multilateral Fund (i.e., due to foreign ownership or establishment post the 21 September 2007 cut-off date), would not receive financial assistance. This information would be reported as part of the Tranche Implementation Plan;

(d) The Country commits to examining the possibility of using pre-blended systems with low-global warming potential blowing agents instead of blending them in-house, for those foam enterprises covered under the Plan, should this be technically viable, economically feasible and acceptable to the enterprises;

(e) The Country agrees, in cases where HFC technologies have been chosen as an alternative to HCFCs, and taking into account national circumstances related to health and safety: to monitor the availability of substitutes and alternatives that further minimize impacts on the climate; to consider, in the review of regulations standards and incentives adequate provisions that encourage introduction of such alternatives; and to consider the potential for adoption of cost-effective alternatives that minimize the climate impact in the implementation of the HPMP, as appropriate, and inform the Executive Committee on the progress accordingly in tranche implementation reports; and

(f) Any remaining funds held by the bilateral or implementing agencies or the Country under the Plan will be returned to the Multilateral Fund upon completion of the last tranche foreseen under this Agreement.

Considerations for the refrigeration servicing sector

8. Specific attention will be paid to the execution of the activities in the refrigeration servicing sector included in the Plan, in particular:

   (a) The Country would use the flexibility available under this Agreement to address specific needs that might arise during project implementation; and

   (b) The Country and relevant bilateral and/or implementing agencies would take into consideration relevant decisions of the Executive Committee on the refrigeration servicing sector during the implementation of the Plan.

Bilateral and implementing agencies

9. The Country agrees to assume overall responsibility for the management and implementation of this Agreement and of all activities undertaken by it or on its behalf to fulfil the obligations under this Agreement. UNDP has agreed to be the lead implementing agency (the "Lead IA"). UNEP and the Government of Germany have agreed to be the cooperating implementing agencies (the "Cooperating IAs") under the lead of the Lead IA in respect of the Country's activities under this Agreement. The Country agrees to evaluations, which might be carried out under the monitoring and evaluation work programmes of the Multilateral Fund or under the evaluation programme of the Lead IA and/or Cooperating IAs taking part in this Agreement.

10. The Lead IA will be responsible for ensuring co-ordinated planning, implementation and reporting of all activities under this Agreement, including but not limited to independent verification as per sub-paragraph 5 (b). The Cooperating IAs will support the Lead IA by implementing the Plan under the overall co-ordination of the Lead IA. The roles of the Lead IA and Cooperating IAs are contained in Appendix 6-A and Appendix 6-B, respectively. The Executive Committee agrees; in

principle, to provide the Lead IA and the Cooperating IAs with the fees set out in rows 2.2, 2.4 and 2.6 of Appendix 2 A.

Non-compliance with the Agreement

11. Should the Country, for any reason, not meet the Targets for the elimination of the Substances set out in row 1.2 of Appendix 2-A or otherwise does not comply with this Agreement, then the Country agrees that it will not be entitled to the Funding in accordance with the Funding Approval Schedule. At the discretion of the Executive Committee, funding will be reinstated according to a revised Funding Approval Schedule determined by the Executive Committee after the Country has demonstrated that it has satisfied all of its obligations that were due to be met prior to receipt of the next tranche of funding under the Funding Approval Schedule. The Country acknowledges that the Executive Committee may reduce the amount of the Funding by the amount set out in Appendix 7-A ("Reductions in Funding for Failure to Comply") in respect of each ODP kg of reductions in consumption not achieved in any one year. The Executive Committee will discuss each specific case in which the Country did not comply with this Agreement, and take related decisions. Once decisions are taken, the specific case of non-compliance with this Agreement will not be an impediment for the provision of funding for future tranches as per paragraph 5 above.

12. The Funding of this Agreement will not be modified on the basis of any future Executive Committee decisions that may affect the funding of any other consumption sector projects or any other related activities in the Country.

13. The Country will comply with any reasonable request of the Executive Committee, and the Lead IA and the Cooperating IAs to facilitate implementation of this Agreement. In particular, it will provide the Lead IA and the Cooperating IAs with access to the information necessary to verify compliance with this Agreement.

Date of completion

14. The completion of the Plan and the associated Agreement will take place at the end of the year following the last year for which a maximum allowable total consumption level has been specified in Appendix 2-A. Should at that time there still be activities that are outstanding, and which were foreseen in the last Tranche Implementation Plan and its subsequent revisions as per sub-paragraph 5 (d) and paragraph 7, the completion of the Plan will be delayed until the end of the year following the implementation of the remaining activities. The reporting requirements as per sub-paragraphs 1 (a), 1 (b), 1 (d), and 1 (e) of Appendix 4-A will continue until the time of the completion of the Plan unless otherwise specified by the Executive Committee.

Validity

15. All of the conditions set out in this Agreement are undertaken solely within the context of the Montreal Protocol and as specified in this Agreement. All terms used in this Agreement have the meaning ascribed to them in the Montreal Protocol unless otherwise defined herein.

16. This Agreement may be modified or terminated only by mutual written agreement of the Country and the Executive Committee of the Multilateral Fund.

APPENDICES

APPENDIX 1-A: THE SUBSTANCES

Substance	Annex	Group	Starting point for aggregate reductions in consumption (ODP tons)
HCFC-123	C	I	3.50
HCFC-124	C	I	13.50
HCFC-141b	C	I	865.50
HCFC-142b	C	I	123.70
HCFC-22	C	I	602.00
Sub-total			1,608.20
HCFC-141b contained in imported pre-blended polyols	C	I	83.05
Total			**1,691.25**

APPENDIX 2-A: THE TARGETS, AND FUNDING

Row	Particulars	2016	2017	2018	2019	2020	2021	2022	2023	Total
1.1	Montreal Protocol reduction schedule of Annex C, Group I substances (ODP tons)	1,447.38	1,447.38	1,447.38	1,447.38	1,045.33	1,045.33	1,045.33	1,045.33	n/a
1.2	Maximum allowable total consumption of Annex C, Group I substances (ODP tons)	1,447.38	1,447.38	1,433.63	1,103.85	832.32	799.76	698.82	643.28	n/a
2.1	Lead IA (UNDP) agreed funding (US$)	9,256,000	0	14,608,000	0	12,045,500	0	3,001,959	0	38,911,459
2.2	Support costs for Lead IA (UNDP) (US$)	647,920	0	1,022,560	0	843,185	0	210,137	0	2,723,802
2.3	Cooperating IA (UNEP) agreed funding (US$)	300,000	0	300,000	0	210,000	0	90,000	0	900,000
2.4	Support costs for UNEP (US$)	36,333	0	36,333	0	25,433	0	10,900	0	109,000
2.5	Cooperating IA (Germany) agreed funding (US$)	345,000	0	2,000,000	0	1,500,000	0	1,255,000	0	5,100,000

Row	Particulars	2016	2017	2018	2019	2020	2021	2022	2023	Total
2.6	Support costs for Germany US$)	38,626	0	223,922	0	167,941	0	140,511	0	571,000
3.1	Total agreed funding (US$)	9,901,000	0	16,908,000	0	13,755,500	0	4,346,959	0	44,911,459
3.2	Total support costs (US$)	722,880	0	1,282,815	0	1,036,560	0	361,548	0	3,403,802
3.3	Total agreed costs (US$)	10,623,880	0	18,190,815	0	14,792,060	0	4,708,507	0	48,315,261
4.1.1	Total phase-out of HCFC-123 agreed to be achieved under this Agreement (ODP tons)									0.00
4.1.2	Phase-out of HCFC-123 to be achieved in the previous stage (ODP tons)									0.00
4.1.3	Remaining eligible consumption for HCFC-123 (ODP tons)									3.50
4.2.1	Total phase-out of HCFC-124 agreed to be achieved under this Agreement (ODP tons)									0.00
4.2.2	Phase-out of HCFC-124 to be achieved in the previous stage (ODP tons)									0.00
4.2.3	Remaining eligible consumption for HCFC-124 (ODP tons)									13.50
4.3.1	Total phase-out of HCFC-141b agreed to be achieved under this Agreement (ODP tons)									554.97
4.3.2	Phase-out of HCFC-141b to be achieved in the previous stage (ODP tons)									310.53
4.3.3	Remaining eligible consumption for HCFC-141b (ODP tons)									0.00
4.4.1	Total phase-out of HCFC-142b agreed to be achieved under this Agreement (ODP tons)									0.00
4.4.2	Phase-out of HCFC-142b to be achieved in the previous stage (ODP tons)									0.00
4.4.3	Remaining eligible consumption for HCFC-142b (ODP tons)									123.70
4.5.1	Total phase-out of HCFC-22 agreed to be achieved under this Agreement (ODP tons)									131.47
4.5.2	Phase-out of HCFC-22 to be achieved in the previous stage (ODP tons)									31.24
4.5.3	Remaining eligible consumption for HCFC-22 (ODP tons)									439.29
4.6.1	Total phase-out of HCFC-141b contained in imported pre-blended polyols agreed to be achieved under this Agreement (ODP tons)									83.05
4.6.2	Phase-out of HCFC-141b contained in imported pre-blended polyols to be achieved in the previous stage (ODP tons)									0.00
4.6.3	Remaining eligible consumption for HCFC-141b contained in imported pre-blended polyols (ODP tons)									0.00

**Date of completion of stage I as per stage I Agreement: 31 December 2017*

APPENDIX 3-A: FUNDING APPROVAL SCHEDULE

1. Funding for the future tranches will be considered for approval at the second meeting of the year specified in Appendix 2-A.

APPENDIX 4-A: FORMAT OF TRANCHE IMPLEMENTATION REPORTS AND PLANS

2. The submission of the Tranche Implementation Report and Plans for each tranche request will consist of five parts:

(a) A narrative report, with data provided by tranche, describing the progress achieved since the previous report, reflecting the situation of the Country in regard to phase out of the Substances, how the different activities contribute to it, and how they relate to each other. The report should include the amount of ODS phased out as a direct result from the implementation of activities, by substance, and the alternative technology used and the related phase-in of alternatives, to allow the Secretariat to provide to the Executive Committee information about the resulting change in climate relevant emissions. The report should further highlight successes, experiences, and challenges related to the different activities included in the Plan, reflecting any changes in the circumstances in the Country, and providing other relevant information. The report should also include information on and justification for any changes vis-à-vis the previously submitted Tranche Implementation Plan(s), such as delays, uses of the flexibility for reallocation of funds during implementation of a tranche, as provided for in paragraph 7 of this Agreement, or other changes;

(b) An independent verification report of the Plan results and the consumption of the Substances, as per sub-paragraph 5 (b) of the Agreement. If not decided otherwise by the Executive Committee, such a verification has to be provided together with each tranche request and will have to provide verification of the consumption for all relevant years as specified in sub-paragraph 5 (a) of the Agreement for which a verification report has not yet been acknowledged by the Committee;

(c) A written description of the activities to be undertaken during the period covered by the requested tranche, highlighting implementation milestones, the time of completion and the interdependence of the activities, and taking into account experiences made and progress achieved in the implementation of earlier tranches; the data in the plan will be provided by calendar year. The description should also include a reference to the overall Plan and progress achieved, as well as any possible changes to the overall Plan that are foreseen. The description should also specify and explain in detail such changes to the overall plan. This description of future activities can be submitted as a part of the same document as the narrative report under sub-paragraph (b) above;

(d) A set of quantitative information for all Tranche Implementation Reports and Plans, submitted through an online database; and

(e) An Executive Summary of about five paragraphs, summarizing the information of the above sub paragraph1(a) to 1(d).

3. In the event that in a particular year two stages of the HPMP are being implemented in parallel, the following considerations should be taken in preparing the Tranche Implementation Reports and Plans:

(a) The Tranche Implementation Reports and Plans referred to as part of this Agreement, will exclusively refer to activities and funds covered by this Agreement; and

(b) If the stages under implementation have different HCFC consumption targets under Appendix 2-A of each Agreement in a particular year, the lower HCFC consumption target will be used as reference for compliance with these Agreements and will be the basis for the independent verification.

APPENDIX 5-A: MONITORING INSTITUTIONS AND ROLES

1. The monitoring process will be managed by Ozone Cell, Ministry of Environment, Forest and Climate Change, with the assistance of the Lead IA.

2. The consumption will be monitored and determined based on official import and export data for the substances recorded by relevant government departments.

3. The Ozone Cell, the Ministry of Environment, Forest and Climate Change, shall compile and report the following data and information on an annual basis on or before the relevant due dates:

   (a) Annual reports on consumption of the substances to be submitted to the Ozone Secretariat; and

   (b) Annual reports on progress of implementation of HPMP stage-II to be submitted to the Executive Committee of the Multilateral Fund.

4. The consumption will be monitored annually throughout the implementation of HPMP stage-II and accordingly reflected in the progress report on the implementation of the HPMP stage-II.

5. The Ozone Cell, Ministry of Environment, Forest and Climate Change shall endorse the final report and the Lead IA shall submit the same to the relevant meeting of the Executive Committee along with the annual implementation plan and reports.

APPENDIX 6-A: ROLE OF THE LEAD IMPLEMENTING AGENCY

1. The Lead IA will be responsible for a range of activities, including at least the following:

   (a) Ensuring performance and financial verification in accordance with this Agreement and with its specific internal procedures and requirements as set out in the Country's HPMP;

   (b) Assisting the Country in preparation of the Tranche Implementation Reports and Plans as per Appendix 4 A;

   (c) Providing independent verification to the Executive Committee that the Targets have been met and associated tranche activities have been completed as indicated in the Tranche Implementation Plan consistent with Appendix 4-A;

   (d) Ensuring that the experiences and progress is reflected in updates of the overall plan and in future Tranche Implementation Plans consistent with sub-paragraphs 1(c) and 1(d) of Appendix 4-A;

   (e) Fulfilling the reporting requirements for the Tranche Implementation Reports and Plans and the overall plan as specified in Appendix 4-A for submission to the Executive Committee, and should include the activities implemented by the Cooperating IAs;

   (f) In the event that the last funding tranche is requested one or more years prior to the last year for which a consumption target had been established, annual tranche implementation reports and, where applicable, verification reports on the current stage of the Plan should be submitted until all activities foreseen had been completed and HCFC consumption targets had been met;

   (g) Ensuring that appropriate independent technical experts carry out the technical reviews;

   (h) Carrying out required supervision missions;

(i) Ensuring the presence of an operating mechanism to allow effective, transparent implementation of the Tranche Implementation Plan and accurate data reporting;

(j) Co-ordinating the activities of the Cooperating IAs, and ensuring appropriate sequence of activities;

(k) In case of reductions in funding for failure to comply in accordance with paragraph 11 of the Agreement, to determine, in consultation with the Country and the Cooperating IAs, the allocation of the reductions to the different budget items and to the funding of the Lead IA and each Cooperating IA;

(l) Ensuring that disbursements made to the Country are based on the use of the indicators;

(m) Providing assistance with policy, management and technical support when required;

(n) Reaching consensus with the Cooperating IAs on any planning, co-ordination and reporting arrangements required to facilitate the implementation of the Plan; and

(o) Timely releasing funds to the Country/participating enterprises for completing the activities related to the project.

2. After consultation with the Country and taking into account any views expressed, the Lead IA will select and mandate an independent entity to carry out the verification of the HPMP results and the consumption of the Substances mentioned in Appendix 1-A, as per sub-paragraph 5(b) of the Agreement and sub-paragraph 1(b) of Appendix 4-A.

APPENDIX 6-B: ROLE OF THE COOPERATING IMPLEMENTING AGENCIES

1. The Cooperating IAs will be responsible for a range of activities. These activities are specified in the Plan, including at least the following:

(a) Providing assistance for policy development when required;

(b) Assisting the Country in the implementation and assessment of the activities funded by the Cooperating IA[s], and refer to the Lead IA to ensure a co-ordinated sequence in the activities;

(c) Providing reports to the Lead IA on these activities, for inclusion in the consolidated reports as per Appendix 4-A; and

(d) Reaching consensus with the Lead IA on any planning, co-ordination and reporting arrangements required to facilitate the implementation of the Plan.

APPENDIX 7-A: REDUCTIONS IN FUNDING FOR FAILURE TO COMPLY

1. In accordance with paragraph 11 of the Agreement, the amount of funding provided may be reduced by US $116.73 per ODP kg of consumption beyond the level defined in row 1.2 of Appendix 2-A for each year in which the target specified in row 1.2 of Appendix 2-A has not been met, on the understanding that the maximum funding reduction would not exceed the funding level of the tranche being requested. Additional measures might be considered in cases where non-compliance extends for two consecutive years.

2. In the event that the penalty needs to be applied for a year in which there are two Agreements in

force (two stages of the HPMP being implemented in parallel) with different penalty levels, the application of the penalty will be determined on a case-by-case basis taking into consideration the specific sectors that lead to the non-compliance. If it is not possible to determine a sector, or both stages are addressing the same sector, the penalty level to be applied would be the largest.

APPENDIX 8-A: SECTOR SPECIFIC ARRANGEMENTS

1. Polyurethane (PU) foam sector plan:

   (a) UNDP is requested to include in the submission of the second tranche and future tranches an updated list of polyurethane foam enterprises assisted and to be assisted by the Multilateral Fund under stage II in accordance with current Multilateral Fund guidelines, including their HCFC-141b consumption to be phased-out, estimated incremental cost of conversion, subsector, baseline equipment, where applicable and technology to be adopted; and

   (b) If during the implementation of the PU foam sector plan, the tonnage to be phased out in eligible enterprises was found to be less than the 3,166 metric tons of HCFC 141b approved for phase-out under the stage II of the HPMP, funding for stage II of the HPMP would be reduced to account for that reduced tonnage at a rate of $7.58/kg

2. Air-conditioning manufacturing sector:

   (a) No further funding for heat exchangers at the assisted enterprises would be provided in future stages of the HPMP; and

   (b) For those air-conditioning manufacturing enterprises that received funding in the stage II of the HPMP to convert some but not all HCFC-22-based manufacturing lines any increase in consumption of the non-converted line relative to that at the time of signature of the memorandum of agreement between the enterprise and the Government will not be funded by the Multilateral Fund, and the Government will request the enterprises to avoid any growth in HCFC-22 consumption after the time of signature.

ANNEXURE-VI

DETAILS OF PROJECTS IMPLEMENTED UNDER HPMP-I

DETAILS OF HPMP-I PROJECTS

A. Conversion Projects: UNDP

S.N	ENTERPRISE	HCFC-141 b ODP phased out (tone)	Sector	Amount (USD)
1	Applicomp India Ltd.	12.1	Domestic Refrigeration	1,031,007
2	Empire Home Appliances Ltd.	9.02	Domestic Refrigeration	768,569
3	Haier Appliances (India) Pvt. Ltd.	10.23	Domestic Refrigeration	871,670
4	Techno Electronics Ltd.	17.05	Domestic Refrigeration	1,452,783
5	Value Industries Ltd.	6.93	Domestic Refrigeration	590,486
6	Videocon Industries Limited	11.77	Domestic Refrigeration	1,002,889
7	Whirlpool of India Ltd., Pune (25% A 5 ownership)	69.30	Domestic Refrigeration	633,549
8	Whirlpool of India Ltd, Faridabad (25% A 5 ownership)	42.35	Domestic Refrigeration	660,835
9	Sintex Industries Ltd.	15.29	Continuous Panel	1,265,183
10	Synergy Telecommunication	34.32	Continuous Panel	1,430,811
11	Industrial Foams Pvt. Ltd.	6.60	Discontinuous Panel	562,368
12	Blue Star Limited	11.29	Discontinuous Panel	899,788
13	Isolloyd Engineering Technologies Ltd.	7.81	Discontinuous Panel	665,468
14	Lambda Eastern Telecommunication Ltd.	8.91	Discontinuous Panel	759,196
15	Rinac India Ltd	6.93	Discontinuous Panel	590,486
	TOTAL	**269.90**		**13,185,088**

B. Technical Assistance to Systems Houses: UNDP

S.N	ENTERPRISE	HCFC-141 b ODP phased out (tone)	Category	Amount (USD)
1	Expanded Polymers System Pvt. Ltd.	4.49	Large	559,885
2	Industrial Foams Pvt. Ltd.	4.49	Large	559,885
3	Manali Petrochemical Limited	4.49	Large	559,885
4	Amrit Chem	2.06	Medium	256,614
5	Bestopuf	2.06	Medium	256,614
6	Gomti Impex Pvt. Limited	2.06	Medium	256,614
7	Manya International	2.06	Medium	256,614
8	Royal Industries	2.06	Medium	256,614
9	Shakun Industries	2.06	Medium	256,614
10	Tandy Innovative Chemicals Pvt. Ltd.	2.06	Medium	256,614
11	Jai Durga Poyurethane Industries	1.02	Small	127,490
12	Organometalic Industries	1.02	Small	127,490
13	Pine Resin and Chemicals	1.02	Small	127,490
14	Shiv Polymers	1.02	Small	127,490
15	Shivathene Linopack	1.02	Small	127,490
	TOTAL	**33**		**4,113,403**

RAC Servicing Sector: GIZ

Phase out (ODP tone) : 31.24 (568 MT)

Amount (USD): 1,990,000

S.N	Activity	Number
1	Training of technicians Two days technicians training on "Good Servicing Practices (GSPs), Leak Prevention and Introduction to Alternate Refrigerants for Refrigeration & Room Air-conditioning Appliances up to 2 ton' and one day training on Installation of Room Air-conditioners up to 2 ton.	Trained total 11276 through 408 training programs (expected to be trained was 10200) Servicing - Trained total 9240 through 332 training programs Installation - Trained total 2036 through 76 training programs
	Institutional Strengthening	
2	ITIs RAC teaching staff –	3 Training Completed - ATI Vidyanagar 28 and 21 participants ATI Howrah – 23 participants
3	Training of institutional users like Defence and Railways	One training for Defence at Secunderabad completed – 25 4 training programs for Indian Railways completed. Each at Lucknow (28), Delhi (29), Mumbai (25) and Chennai. (28)
4	Promotion of Recovery and Reclamation Centers on Pilot basis	Initial meetings with the reclamation centre entrepreneurs done 2 Reclamation Centre Awareness workshops completed. One each at Ludhiana and Ahmedabad

The list of 15 Training Partners:

S.N	Name and Address of Trainers
1	Mr. T. Veerender Nath Maega Services 3-3-780/B, Kuthbiguda, Esamia Bazaar, Hyderabad -500 027
2	Mr. D. Talukdar Kuwality Coolers Das Complex, R.G.Barua Road, Guwahati-781 024
3	Bihar & Jharkhand have to identify new training partner
4	Anant Enterprises 5397/1, Modern Residential Complex, Manimajra, Chandigarh-160 101
5	Mr. Aditya Mittal Mittal Refrigerations 7, Netaji Subhash Marg, Darya Ganj, New Delhi-110 002
6	Mr. Naranbhai M. Patel Kirti Freeze Kirti House, Ashirwad Complex, Ashram Road, Ahmedabad-380 009
7	Mr. C.J. Mathew Dewpoint Appliances (P) Ltd. 808, 10th A main, 1st Stage, Indiranagar, Bangalore-560 038
8	Mr. V. Vijayakumar V.R. Enterprises 1-A, Apple Heritage, Koithara Road, Panampilly Nagar South, Ernakulam, Kochi-682 036
9	Mr. Arun Mishra Divyansh Services 19, Swadesh Nagar, Behind Ashoka Garden Police Station, Bhopal-462 023
10	Mr. Mathew Abraham Max Cooling Systems 2, Butte Patil Residency, 363/5 Shivaji Nagar, Pune -411 005
11	Mr. L. N. Dash B-12, BJB Nagar, Bhubaneshwar-751 014
12	Mr. Surendra Bohra Bohra Services 60 Gem Enclave, Pradhan Marg, Malaviya Nagar, Jaipur- 302 017
13	Mr. R. Kamala Kannan M/s Sakthi Refrigeration & Air- conditioning Enterprises 0/1,-Kanakkar Street, (Near) Venkateswara Theatre, Thiruvottiyur, Chennai-600 019
14	Mr. Rajesh Misra Isha Enterprises A-1/3, Sector-B, Aliganj, Opp. Aliganj Post Office, LUCKNOW - 226 024
15	Mr. Navin Lamba Crystal Refrigeration Company 7, A.J.C. Bose Road; Kolkata 700017

Enabling Components: UNEP

S.N	Activities	Amount (USD)
1	Awareness generation of Stakeholders	540,600
	Awareness Generation in Service Technicians (3 workshops at Mumbai, Chennai, Guwahati for dealers and servicing technicians in RAC sector; 2 Regional Workshops at Bhopal and Ahmedabad; one National Workshop at New Delhi)	
	Development of website for HPMP-I	
	Facilitating establishment of association of service technicians	
	Posters, flyers, stickers for training promotion	
	Production of videos and news letter for awareness generation for service technicians (Vigyan Prasar)	
2	Enforcement Training of customs officials (4 for Training of Trainers and 10 for custom officers) (NACEN) and Study on Enforcement and campaign with Directorate of Revenue Intelligence on illegal ODS trade.	157,500
3	Procurement of Refrigerant Identifiers (28)	142,500
4	Development of amendments for non-HCFC building components in NBC, ECBC and GRIHA and seminar with MoUD, MNRE, and BEE and Template for amending curriculum in Architectural colleges to include ODS issues	21, 000
	Total	**861,600**

ANNEXURE-VII

DETAILS OF PROJECTS PROPOSED TO BE IMPLEMENTED UNDER HPMP-II

PROJECTS UNDER HPMP-II

Air Conditioning Sector (HCFC-22)

S.N	ENTERPRISES	Lines to be converted / total lines	Technology Opted	PHASE OUT (ODP tons)	AMOUNT (USD)
1	Blue Star	2 / 3	HFC - 32	7.31	1,785,917
2	E-Vision	2 / 4	HFC - 32	6.21	1,574,300
3	Lloyd Electric & Engg. Ltd.	3 / 5	HFC - 32	7.78	1,868,372
4	Voltas Ltd. (the second line is on HFC-410A)	1 / 1	HFC - 32	29.13	4,303,695
5	Videocon Industries Limited	1 / 1	HFC - 32	8.99	1,817,975
6	Zamil Air conditioners	1 / 2	HFC - 32	3.3	1,161,200
	Total			**62.72**	**12,511,459**

Foam Sector (HCFC-141b)

Proposal was for phase out of 4814 ODP Metric tons or 529.54 ODP tons against which the Ex-Com approval is for 3166 Metric tons and 348.26 ODP tons, which is 65.76%. The revision has been done in figures of consumption and funding accordingly.

Large (> 50 Metric tons consumption per year)

S.N	Enterprises	Sub-sector	Technology adopted	Phased out (ODP tons)	Amount (USD)
1	Blue Star	CR	CP	3.66	252,221
2	Jindal Mectec Pvt. Ltd, Unit -III	C	CP	17.12	1,179,573
3	Industrial Foam Pvt. Ltd	C	CP	10.35	712,799
4	Zeco Aircon Ltd	C	CP	13.38	922,152
5	Flowell Industries	D	CP	5.35	368,362
6	Hicon Engineering Co. Pvt. Ltd.	D	CP	4.45	306,591
7	Jindal Mectec Pvt. Ltd. Unit III	D	CP	4.45	306,931
8	Isolloyd Engineering Technologies Ltd.	D	CP	5.11	352,013

S.N	Enterprises	Sub-sector	Technology adopted	Phased out (ODP tons)	Amount (USD)
9	Industrial Foams Pvt Ltd.	D	CP	7.88	543,322
10	Newgen Speciality Plastics	D	CP	4.87	335,565
11	Sintex	D	CP	4.38	301,569
12	Gomati Impex Pvt Ltd	GI	CP	4.77	328,984
13	Neelkamal Ltd.	GI	CP	6.32	435,356
14	Suraksha Transport System Pvt. Ltd.	GI	CP	7.23	498,461
15	Feeda Synthetic Pvt. Ltd	IS	CP	3.62	249,230
16	Anjani Insulation	SF	CP	4.52	311,538
17	Cellotech Insulation	SF	HFO	4.52	311,538
18	Global Insulation	SF	CP	4.52	311,538
19	Industrial Foams	SF	HFO	3.98	274,153
20	NCR Insulation Systems	SF	HFO	5.61	386,308
21	Syntex	TH	CP	7.41	510,922
22	Bajaj Electricals	WH	CP	8.14	560,768
23	Crompton Greaves	WH	CP	7.23	498.461
24	Raccold Thermo Limited	WH	CP	5.97	411,230
	Total		**1407.59 (MT) 154.84 ODP**		**10,669,585**

CR: Commercial refrigeration, D: Discontinuous Panel, C: Continuous Panel, IS: Integral Skin, SF: Spray Foam, TH: Thermoware, WH: Water Heater, GI: General Insulation

CP: Cyclopentane, HFO: Hydrofluoroolefins, MF: Methyl Formate

Medium (20 to 50 MT HCFC-141b consumption per year)

S.N	Enterprises	Sub-sector	Technology adopted	Phased out (ODP tons)	Amount (USD)
1	Divya Aerosols and Inter	CR	CP	1.59	109,661
2	Excell Refrigeration Service	CR	CP	2.86	197,390
3	Glacier Refrigeration	CR	MF	2.60	179,446
4	Benson Refrigeration and Air Conditioning System	D	CP	2.67	184,231
5	Flourobond Industries	D	MF	3.58	246,738

S.N	Enterprises	Sub-sector	Technology adopted	Phased out (ODP tons)	Amount (USD)
6	Icemake Refrigeration Pvt. Ltd	D	CP	2.31	159,001
7	Jindal Mectec Pvt. Ltd. Unit III	D	CP	2.55	175,831
8	Lisa Fabritech Pvt. Ltd	D	CP	1.91	131,596
9	Lloyd Insulation	D	CP	1.61	110,758
10	Altif Telecommunication Pvt. Ltd.	D	HFO	2.02	139,270
11	Mitasho Countel Ltd	D	CP	1.46	100,888
12	Mongia & Company (mfg. div)	D	CP	2.51	172,719
13	Mukesh Restyle Pvt. Ltd	D	CP	1.60	110,264
14	Shakti Matador Pvt. Ltd	D	CP	2.39	164,492
15	Zep Infratech Ltd	D	CP	1.83	126,110
16	Cellotech Insulation	GI	HFO	3.18	219,323
17	Llyod Insulation	GI	MF	1.89	130,499
18	Industrial Foams Pvt. Ltd	GI	MF	2.04	140,366
19	Malanpur Entech Pvt. Ltd	GI	CP	1.93	132,690
20	Omkar Puf Insulation Pvt. Ltd	GI	CP	3.60	247,835
21	Syntex	GI	CP	1.75	120,628
22	Surface Systems	GI	HFO	2.68	184,430
23	T.A. Prefab	GI	HFO	2.60	179,446
24	Premrose Multiplast Pvt. Ltd.	IS	CP	1.99	137,078
25	Access Impex	TH	HFO	1.54	105,923
26	Bhatia Enterprises	TH	HFO	3.47	239,261
27	Bhatia Plastics	TH	HFO	2.21	152,030
28	Jayson Industries	TH	MF	1.46	100,440
29	Jigar Plast India	TH	HFO	1.92	132,092
30	Varivar Plast Product Pvt. Ltd	TH	HFO	1.63	112,154
31	Modern Techno	TH	HFO	3.26	224,307
32	Polyrub Industries	TH	HFO	2.15	148.292
33	Singer India Ltd	WH	CP	3.07	211,846
	Total		**689.58 MT 75.85 ODP**		**5,227,038**

Small Enterprises (< 20 MT HCFC-141 b consumption per year)

S.N.	Enterprises Number	Phase out ODP tons	Amount (USD)
1	356	1068.83 MT / 117.57 ODP	8,103,377

CR: Commercial refrigeration, D: Discontinuous Panel, C: Continuous Panel, IS: Integral Skin, SF: Spray Foam, TH: Thermoware, WH: Water Heater, GI: General Insulation
CP: Cyclopentane, HFO: Hydrofluoroolefins, MF: Methyl Formate

GIZ: RAC Servicing Sector

Phase out of HCFC-22 (ODP tones) : 68.75 ODP (1250 MT)

Amount (USD) : 5,100,000

S.N.	Activities
1	Capacity Building / Technicians Training
2	Institutional Strengthening Training of staff of Defense, Railways, and revision of syllabus of ITIs
3	Technicians Certification System
4	State of Art RAC Training Centre
5	Technical Assistance: Workshops for industry, inviting experts (including international experts)
6	Impact Monitoring

UNEP: Enabling Component

Amount (USD): 900,000

1. Policy and Enforcement Capacity-building			
	i) ODS Trade Control		
	Frame National Standards for RAC Sector (flammable refrigerants) in collaboration with Industry, Bureau of Indian Standards (BIS) and other related stakeholders, publication and printing including workshops	1	15,000
	Stakeholders workshops includes resource persons to assist in the development of related standards based on the national priorities and needs (Travel, per diem and fees)	2	10,000
	ii) Enforcement Capacity Building		
	Training of Customs officers/enforcement on Montreal Protocol and HCFCs control including arrangements for safe disposal of seized / confiscated refrigerants		100,000
	Border Dialogue	3	30,000
	Capacity building and risk profiling, iPIC with DRI	1	50,000
	Sub Total		**205,000**

2. Sector Based ODS Policy development			
	i) Public Procurement policies for non-HCFC alternatives		
	Developing bid evaluation tool and capacity building of procurement agencies	1	10,000
	Awareness and printing material for HCFC and non-HCFC based equipment	1	10,000
	Consultation workshops for stake holders including resource persons. Preparation of a policy paper on public procurement on non HCFC alternatives	3	30,000
	ii) Building sector interventions		
	Inclusion of non-HCFC alternatives in building codes and Syllabus and training module for architectural colleges	3	30,000
	Capacity building and awareness workshops for architecture colleges, contractors and policy makers through promoting HCFC phase-out and Energy efficiency linkage	5	50,000
	iii) Cold Chain Sector		
	Capacity building of National Cold Chain Development on standards/ codes to consider the standard development for environmentally refrigerants i.e. Ammonia	3	30,000
	Knowledge products for cold chain (like newsletter, videos and others)	6	30,000
	iv) Energy Efficiency in RAC Service Sector Practices		
	Capacity building of stakeholders in linkage to Standards and labelling programme of India and improving energy efficiency of equipment through better maintenance	6	30,000
	Publication and print material for RAC technicians on "Energy Efficiency and Good Servicing practices" and "lower energy-use technologies for new refrigeration systems"	6	30,000
	Sub Total		**250,000**
3. Strengthening of the RASSS			
	Facilitating Refrigeration and Air-conditioning Servicing Sector Society (RASSS) to expand in 10 states and collection of data about service enterprises/ technicians in the state	4	45,000
	Awareness workshop for e-learning and certification system developed by GIZ Proklima covering all India	4	20,000

	Collaboration with the industry and service sector – interactive workshops	2	10,000
	Sub Total		**75,000**
4. Awareness, outreach and communication			
	i) Awareness workshops		
	Awareness Workshop for RAC Dealers and relevant stakeholders through GIZ Training Partners Network (3 workshop / year) focusing energy efficiency, handling of flammable refrigerants and standards to aware 1500 stakeholders which will include new target audience like MSME, SME association, BIS, ISHRAE, BEE, ASHRAE	18	54,000
	ii) Knowledge products		
	Design and printing of posters focusing energy efficiency, handling of flammable refrigerants and standards with good servicing practices.	6	15,000
	Design and printing of flyers for recruitment of RAC technicians for RAC training workshops	6	15,000
	Design and printing of stickers for RAC technicians for distribution during RAC training workshops	6	12,000
	Pocket handbook "Quick guide" for GSP and handling of flammable refrigerants	6	15,000
	iii) Industry roundtable & technology exhibition		
	Collaboration with ISHRAE and other National Associations for industry roundtable on technologies including resource persons (Travel, per diem and fees)	3	45,000
	iv) Project Website		
	Project website developed under HPMP Stage I will be continued in HPMP Stage II.	6	4,000
	Sub Total		**160,000**
5. Project Management Unit (PMU)			**210,000**
	Total		**900,000**

Note: *The figures in Annexure VII are subject to verification and are calculated prorata based on approval of Ex-Com.*

ANNEXURE-VIII

DETAILS OF PROJECTS IMPLEMENTED IN PRODUCTION SECTOR IN INDIA UNDER MONTREAL PROTOCOL

PRODUCTION SECTOR PROJECTS

CFC: 29th EX. COM, November 1999

S.N.	Enterprises	Amount (USD)
1	SRF Limited	34,480,000
2	Gujarat Fluorochemicals Ltd.	26,816,000
3	Navin Flourine International Ltd	13,480,000
4	Chemplast Sanmar Ltd	5,224,000
	Total	**80,000,000**

Accelerated CFC Production Sector Phase-out: 56th EX. COM, November 2008

S.N.	Enterprises	Amount (USD)
1	SRF Limited	951,000
2	Gujarat Fluorochemicals Ltd.	951,000
3	Navin Flourine International Ltd	951,000
4	Chemplast Sanmar Ltd	317,000
	Total	**3,170,000**

CTC: 40th EX. COM, July 2003

S.N.	Enterprises	Amount (USD)
1	SRF Limited	9,375,000
2	Gujarat Alkalies and Chemicals	9,375,000
3	Chemplast Sanmar Ltd	9,375,000
4	NRC Limited	132,375
5	Sri Ram Rayons	242,625
	Total	**28,500,000**

WHOM TO CONTACT TO LEARN MORE ABOUT OZONE

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