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Islamic Republic of Pakistan

Ozone Cell, Ministry of Environment

HCFC Phase-out Management Plan

(Developed with the assistance of UNIDO and UNEP)

August 19, 2010

National Ozone Cell, Ministry of Environment,
Government of Pakistan, Islamabad

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1. GENERAL INFORMATION

1.1 Brief Country background

1.1.1 Location

Pakistan located in South Asia, shares an eastern border with India and a north-eastern border with China. Iran makes up the country's south-west border, and Afghanistan runes along its western and northern edge. The Arabian Sea is Pakistan's southern boundary with 1,064 km of coastline. The Latitude and Longitude of Capital City of Pakistan (Islamabad) is 33º 40' N, 73º 08' E.

1.1.2 Land and Geography

The variety of landscape divides Pakistan into six major regions including the North High Mountainous Region, the Western Low Mountainous Region, the Balochistan Plateau, the Potohar Uplands, the Punjab and the Sindh Plains.

Pakistan has more glaciers than any other land outside the North and South Poles. Pakistan's glacial area covers some 13,680 sq.km which represents an average of 13% of mountain regions of the upper Indus Basin.

1.1.3 Population, Labor, Employment & Administration

The population of Pakistan stood at 164 million in mid 2008-09. If the existing trend remains unchanged, it will reach 167 million by the year 2010 and 194 million by 2020 (*Source: NIPS)*. The density of population per person is 185 *(2003)*.According to 2007, province wise demographic estimates, Punjab was 55.46% of the total population of Pakistan, Sindh 22.92%

NWFP 13.73% and Balochistan is the least populous with 5.15% of population while Islamabad has 0.7% population and Federally Administered Tribal Areas (FATA) have 2.37%. Pakistan has a labor force of 51.78 million people out of which the women labor force is 10.96 million. Pakistan is divided into four provinces of Punjab, Sindh, Balochistan, NWFP and some other administrated areas like FATA, Gilgit & Gilgistan and AJK.

1.1.4 Climate

The well-marked four seasons in Pakistan are

- Cold season (December to March).
- Hot season (April to June).
- Monsoon season (July to September).
- Post-Monsoon season (October and November).

1.1.5 Economy

Pakistan's per capita real income has risen by 2.5 percent in 2008-09 as against 3.4 percent last year. Per capita income in dollar term rose from $ 1042 last year to $ 1046 in 2008-09. Public sector investment to GDP ratio was rising persistently from 4.0 percent in 2002-03 to 5.6 percent in 2006-07, however, declined to 4.9 percent in 2008-09. The national savings rate has increased to 14.4 percent of GDP in 2008-09 from 13.5 percent of GDP last year. Domestic savings has declined substantially from 16.3 percent of GDP in 2005-06 to 11.2 percent of GDP in 2008-09.

1.1.6 Chambers, Associations & HCFC consuming Industries

There are 46 Chambers of Commerce and Industries operating in Pakistan. 128 associations/ trading bodies in various classes are operational. The business associated with manufacturing of air conditioning, refrigeration and foam is centered in the established industrial estates as well as outside the approved industrial estates mainly in Lahore & Karachi. Limited activities are seen in Rawalpindi, Sialkot and Sahiwal.

1.2 Status of Pakistan with regard to Montreal Protocol

1.2.1 Ratification of Montreal Protocol and subsequent Amendment

Pakistan ratified the Montreal Protocol, Vienna Convention and the London amendment in 1992. Pakistan also ratified the subsequent amendments including Copenhagen amendment in 1995, Montreal amendment in 2005 and Beijing amendment in 2005.

Pakistan is Article-5 country as national average consumption of ODS chemicals is within 300 grams per capita. Pakistan does not produce any of these chemicals. However, these chemicals are imported from different countries of the world and are being used in the manufacturing as well as servicing sectors.

1.3 Review of CFC Phase out Activities, Projects & Lessons Learnt

1.3.1 Overview of Program Components and Implementing Agencies

The Ministry of Environment, (MoE) led the development and implementation of the national program to comply with Pakistan's obligations under the MP. MoE defined three program components, namely:

(i) The development of a phase out strategy;

(ii) Setting up of institutional arrangements to implement the strategy, and

(iii) An investment component comprising technical and financial assistance to enterprises for the adoption of non-ODS technologies.

Taking advantage of Pakistan's eligibility to receive MLF assistance, MoE sought support for the development and implementation of these components from the four MLF implementing agencies: the World Bank; United Nations Environment Program (UNEP); United Nations Development Program (UNDP); and the United Nations Industrial Development Organization (UNIDO).

1.3.2 Review of ODS Phase out Projects

In order to meet the obligations of Montreal Protocol, Pakistan has identified 69 investment as well as non-investment projects. List of these projects is provided as Annex-1. Out of these 69 projects 4 projects were canceled. Out of the remaining 65 projects 32 were non-investment projects The list of remaining 33 projects in investment sector involving phase out of 2,309 ODP ton of ODS substance has been implemented. The sector-wise split of these 33 investment projects is as under:

- 10 projects in foam sector. These projects call for the phase out of 866 ODP ton of CFCs
- 14 project in air conditioning and refrigeration sectors. These projects call for the phase out of 734 ODP ton of CFCs
- 9 projects in other sectors including CTC. These projects calls for the phase out of 709 ODP ton of ODS

1.3.3 Review of implemented CFCs Phase out Projects

The friendly technologies adopted for the phase out of CFCs in foam sector as well as in refrigeration and air conditioning sector included the use of HCFC-141b, Water/ Carbon dioxide in foam sector and HCFC-141b, HCFC-134a & Cyclo pentane in Air Conditioning and Refrigeration sector.

Investment Projects in Foam Sector from CFC-11 to HCFC 141b

The implemented projects specific to foam sector called for the phase out from 735 ODP ton of CFC to HCFC-141b. The list of these projects is provided in the tables below:

Code	Project Title	Chemical Phase out	
		From	To
PAK/FOA/41/INV/58	Phase out of the use of CFCs in remaining foam enterprises: Pakistan Insulation, Simpson Wire, HEPCO, Indus Plastic, Workman and Thermocraft Engineering	CFC-11	HCFC 141b, Butyl Acetate & Various Alternative Technologies
PAK/FOA/17/INV/06	Phase out of CFC-11 in the manufacture of flexible PUF molded and integral skin at Master Group: (Master Enterprises Ltd., Durafoam Ltd., Khyber Plastic and Polymer Industries Ltd., Procon En)	CFC-11	HCFC-141b

Code	Project Title	Chemical Phase out	
		From	To
PAK/FOA/23/INV/16	Conversion to CFC free Technology in the manufacture of integral skin polyurethane foam at Synthetic Products Enterprises (Pvt.) Ltd.	CFC-11	HCFC-141b
PAK/FOA/23/INV/20	Umbrella Project: Conversion to CFC free technology in the manufacture of rigid polyurethane foam (thermoware)	CFC-11	HCFC-141b
PAK/FOA/23/INV/22	Conversion of CFC free technology in the manufacture of polyurethane foam (flexible slabstock, flexible molded, rigid foam) at Diamond Group of Industries	CFC-11	HCFC-141b
PAK/FOA/25/INV/25	Terminal Umbrella: Conversion to HCFC-141b and water blown technology in the manufacture of rigid polyurethane foam (thermoware)	CFC-11	HCFC-141b

Investment Projects in AC & Refrigeration Sector from CFCs to HCFC 141b

The implemented projects specific to Air Conditioning and Refrigeration sector called for the phase out for 373 ODP ton of CFC to HCFC-141b. The list of these projects is provided in the tables below:

Code	Project Title	Chemical Phase out	
		From	To
PAK/REF/23/INV/18	Conversion to CFC free Technology in the manufacture of polyurethane foam at Kold Kraft Ltd.	CFC-11	HCFC-141b
PAK/REF/23/INV/19	Conversion to CFC free technology in the manufacture of polyurethane foam (domestic refrigeration) at Cool Industries Ltd. (Waves)	CFC-11, 12	HCFC-141b, HFC 134a
PAK/REF/25/INV/28	Elimination of CFC-11 and CFC-12 by converting to HCFC-141b and HFC-134a in the manufacture of commercial refrigeration equipment at Shadman Electronic Industries P. Ltd.	CFC-11, 12	HCFC-141b, HFC 134a
PAK/REF/32/INV/39	Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Pakistan Air-conditioning Engineering Co. P. Ltd., (PAECO)	CFC-11, 12	HCFC-141b, HFC 134a

Code	Project Title	Chemical Phase out	
		From	To
PAK/REF/32/INV/40	Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Mumtaz Engineers	CFC-11, 12	HCFC-141b, HFC 134a
PAK/REF/42/INV/59	Phase out of CFC-11 and CFC-12 in the manufacture of refrigeration equipment at Dawlance, United Refrigeration, Ice Age and at 20 small enterprises	CFC-11, 12	HCFC-141b, Cyclopentane & HFC-134a
PAK/REF/35/INV/43	Replacement of refrigerant CFC-12 with HFC-134a and foam blowing agent CFC-11 with HCFC-141b in the production of domestic refrigerators at Ideal Appliances, Ltd.	CFC-11, 12	HCFC-141b, HFC-134a

1.3.4 Review of Institutional Setup for Training Program and Certification in the Servicing Sector under RMP

Pakistan has Technical Institutes run by the government which have a "Three Year Diploma Program" in major disciplines like Mechanical, Electrical, Refrigeration & Air Conditioning etc. Besides, there are private technical training institutes also that provide the technical education/training to the candidates in refrigeration and air conditioning discipline. The diploma holders after completing their technical education more often switch to their own business and establish their workshops. Vocational training institutes also provide short terms training to the candidates and depending on the type of training the duration is varied from three to six months. In Punjab and Sindh, the Technical Educational and Vocational Training Authority (TEVTA) have its institutes all over. During the training program of RMP (for CFCs) the implementing agency contracted TEVTA to provide training throughout Punjab. In Sindh, Sindh Board of Technical Education (SBTE) provided training all over Sindh. For Balochistan and NWFP training to technicians was provided through National Institute of Science and Technical Education (NISTE) located in Islamabad. This institute also provided training to the technicians located in the capital area.

Pakistan Customs has well established training centers with professionals who are engaged in different training programs of their own. During the implementation of RMP their training centers in Lahore, Karachi and Islamabad provided training to the customs officers.

The table below provides the data on the number of trainees and their period of training in the servicing sector covered under the RMP program.

Description	No.	Period
Number of trainers for customs	16	2004
Number of customs officers trained	301	2008
Number of trainers for technicians	36	2004
Number of certified Training	21	2004
Number of technicians trained	3117	2007

1.3.5 Implemented Projects Review and Lessons Learnt

World Bank based on their report number ICR0000548 of September 2007 has reviewed 17 phase out projects. This review included both project specific and of wide general application and highlighted the following;

- During the implementation of the umbrella projects (where there were more than one enterprises involved) it would have been more appropriate that the selection of machinery be based on each individual enterprises' technical and working capability so that the equipment supplied would meet their working environment. This was not the case in the Thermoware project where one type of equipment was procured for a group of enterprises with different levels of capacity and resources to maintain and use the equipment properly.
- The Montreal Protocol provides for a CFC phase out schedule for Article 5 countries which is supported by MLF assistance to these countries. In most of the sub-projects, the enterprises also contributed counterpart funding because the grant was at times insufficient (due to cost effectiveness thresholds set by the MLF) and could not be used for specific equipment that enterprises selected (because of MLF eligibility rules). In these cases, it was found that enterprises were extremely pro-active in implementation and in making choices on technology options. There were cases; however, where no contribution was made by the enterprise (the grant covered the full incremental costs). It was found that these enterprises had less of a stake in the equipment and consequently were not as careful with using and maintaining the equipment. In projects that involve funding the private sector to transform a market, it is advantageous to have some counterpart contribution to ensure ownership.
- In cases where sub-project implementation was deliberately stalled because of a lack of enterprise commitment, it would have been helpful to the FI to have a "stick" to encourage enterprises to move forward in implementation. The Executive Committee did have a cancellation procedure for projects identified as having delays. Many of the Pakistan sub-projects entered the list and remained in the list until completion. However, they escaped cancellation due to steady, albeit slow progress.
- The early ODS conversion sub-projects generally were implemented apart from Government policies and rules to restrict the supply and demand of ODS. This was partly a result of the initial MLF approach to assist countries develop ODS strategies (Country Programs) and to then approve investment activities as stand-alone sub-projects in specific sectors without linking them to national or sector ODS consumption levels. Institutional strengthening and capacity building activities were also treated separately. Performance-based, sector or national approaches to CFC phase out which combine policy and investment measures in one project and provide for a project management unit within the Government has now become the norm in the MLF. The lessons drawn from the Pakistan ODS Phase-out Project support the findings that sustainable phase out hinges upon Government policy action early on and a project design that promotes Government involvement in implementation through capacity building and other support measures.
- Although an assessment of economic costs and benefits to the country to convert to non-ODS technology and to implement the MP was beyond the scope of the report, some broad conclusions can be made based on experiences from implementation of the ODS Project. The MLF covered the majority of the conversion costs; however, costs were incurred by the beneficiaries through duties and demurrage on equipment and short-term losses by enterprises that did convert and had to compete with the enterprises that continued using CFC. Some of the benefits were technological upgrades

which allowed enterprises to become more competitive and to expand their markets. They could also advertise that their products were ecologically sound.

- Project implementation took longer than originally planned for various reasons. Consequently, supervision efforts were conducted over a timeframe that was twice as long as had been originally envisioned, resulting in above average supervision costs. Delays in project implementation could have been reduced if the GOP had implemented early on some of the policies that it eventually implemented. However, these measures would have not sufficed to address other factors that affected project implementation, such as the events of 9/11. Additionally, the project's supervision costs could have been reduced if the FI's staff had been exhaustively trained in all aspects of project implementation. Still, efforts were made to reduce supervision costs, as supervision missions were reduced from five to a maximum of three, and after the national consultant had been hired, to a maximum of two.

While preparing the HPMP, these factors will be kept in mind to enhance the applicability of the plan especially in the following areas:

- The policy component should be initiated by the government from the very beginning so that the enterprises while conversion do not delay the implementation of the project.

- While taking into consideration umbrella projects, it would be appropriate to look into the capacity and capability of individuals so that the selection of equipment should be according to their specific requirements.

- To reduce the supervision cost and delay in implementation, it would be beneficial to both the enterprise as well as the agencies to act and train the supervision team to implement the projects in cost effective manner.

1.4 Summary of CFCs Phase out Projects to HCFCs

- Phase out of the use of CFCs in remaining foam enterprises: Pakistan Insulation, Simpson Wire, HEPCO, Indus Plastic, Workman and Thermocraft Engineering

  This project was intended to phase out 107 M ton of CFC. The project was approved by MLF in December 2003. The project was completed in December 2006 and phased out CFC as intended in the project for a cost effectiveness of 7.66 US$ per kg.

- Phase out of CFC-11 in the manufacture of flexible PUF molded and integral skin at Master Group: (Master Enterprises Ltd., Durafoam Ltd., Khyber Plastic and Polymer Industries Lte., Procon En)

  This project was intended to phase out 205 metric ton of CFC. The project was approved by MLF in July 1995. The project was completed in February 2005 and phased out CFC as intended in the project for a cost effectiveness of 8.14 US$ per kg.

- Conversions to CFC free Technology in the manufacture of integral skin polyurethane foam at Synthetic Products Enterprises (Pvt.) Ltd.

  This project was intended to phase out 14 metric ton of CFC. The project was approved by MLF in November 1997. The project was completed in January 2002 and phased out CFC as intended in the project for a cost effectiveness of 10.06 US$ per kg.

- Umbrella Project: Conversion to CFC free technology in the manufacture of rigid polyurethane foam (thermoware)

This project was intended to phase out 240 metric ton of CFC. The project was approved by MLF in November 1997. The project was completed in October 2006 and phased out CFC as intended in the project for a cost effectiveness of 6.02 US$ per kg.

- Conversion of CFC free technology in the manufacture of polyurethane foam (flexible slabstock, flexible molded, rigid foam) at Diamond Group of Industries

  This project was intended to phase out 64 metric ton of CFC. The project was approved by MLF in November 1997. The project was completed in February 2005 and phased out CFC as intended in the project for a cost effectiveness of 11.00 US$ per kg.

- Terminal Umbrella: Conversion to HCFC-141b and water blown technology in the manufacture of rigid polyurethane foam (thermoware)

  This project was intended to phase out 106 metric ton of CFC. The project was approved by MLF in July 1998. The project was completed in October 2006 and phased out CFC as intended in the project for a cost effectiveness of 5.27 US$ per kg.

- Conversion to CFC free Technology in the manufacture of polyurethane foam at Kold Kraft Ltd.

  This project was intended to phase out 12 metric ton of CFC. The project was approved by MLF in November 1997. The project was completed in December 2002 and phased out CFC as intended in the project for a cost effectiveness of 15.65 US$ per kg.

- Conversion to CFC free technology in the manufacture of polyurethane foam (domestic refrigeration) at Cool Industries Ltd. (Waves)

  This project was intended to phase out 118 M ton of CFC. The project was approved by MLF in November 1997. The project was completed in December 2006 and phased out CFC as intended in the project for a cost effectiveness of 11.42 US$ per kg.

- Elimination of CFC-11 and CFC-12 by converting to HCFC-141b and HFC-134a in the manufacture of commercial refrigeration equipment at Shadman Electronic Industries Ltd.

  This project was intended to phase out 16 metric ton of CFC. The project was approved by MLF in July 1998. The project was completed in November 2002 and phased out CFC as intended in the project for a cost effectiveness of 16.83 US$ per kg.

- Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Pakistan Air-conditioning Engineering Co. P. Ltd., (PAECO)

  This project was intended to phase out 20 metric ton of CFC. The project was approved by MLF in December 2000. The project was completed in August 2005 and phased out CFC as intended in the project for a cost effectiveness of 12.55 US$ per kg.

- Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Mumtaz Engineers

  This project was intended to phase out 14 metric ton of CFC. The project was approved by MLF in December 2000. The project was completed in November 2005 and phased out CFC as intended in the project for a cost effectiveness of 14.51 US$ per kg.

- Phase out of CFC-11 and CFC-12 in the manufacture of refrigeration equipment at Dawlance, United Refrigeration, Ice Age and at 20 small enterprises

  This project was intended to phase out 181 metric ton of CFC. The project was approved by MLF in April 2004. The project was completed in December 2006 and phased out CFC as intended in the project for a cost effectiveness of 12.09 US$ per kg.

- Replacement of refrigerant CFC-12 with HFC-134a and foam blowing agent CFC-11 with HCFC-141b in the production of domestic refrigerators at Ideal Appliances, Ltd.

  This project was intended to phase out 13 ODP ton of CFC. The project was approved by MLF in December 2001. The project was completed in July 2004 and phased out CFC as intended in the project for a cost effectiveness of 13.32 US$ per kg.

1.5 HCFC Usage

In Pakistan, the use of HCFC is found in manufacturing & servicing sector. Manufacturing sector covers Air conditioning, Refrigeration & Foam; servicing sectors includes transport, shipping, food & beverages, supermarkets etc. Pakistan neither produces nor exports HCFC to other countries.

2. LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

2.1 Institutional Framework

Following the approval of the institutional strengthening project at the 14th Executive Committee meeting, the "Ozone Cell" was established within the Federal Ministry of Environment. Ozone Cell was intended to coordinate all activities related to the Montreal Protocol in Pakistan between related Government institutions. At the 35th Executive Committee meeting a project of renewal of the original institutional strengthening project was also approved. This improves the capacity of the Ozone Cell to cope with the recent trend of country driven implementation of Montreal Protocol projects, including the RMP.

Ozone Cell has monitored and ensured implementation of the Montreal Protocol through various policies and regulatory measures with technical assistance from UNIDO in cooperation with Ministry of Environment, Ministry of Commerce, Federal Board of Revenue and other stakeholders. Ozone Cell has extended assistance to the local ODS-based industries for its conversion into Ozone friendly technology through the implementing agencies (UNIDO, UNEP, UNDP and World Bank) with the financial assistance of the Multilateral Fund.

Ozone Cell is located in Islamabad and is administered by the Ministry of Environment. National Program Manager of NOU is reporting to National Project Director/Joint Secretary, Ministry of Environment. NOU is responsible to coordinate with all the agencies and stakeholders to comply with the control measures/policies as formulated by the Ex.Com of Montreal Protocol.

2.2 Fiscal and Regulatory Measures

Government of Pakistan has undertaken the following measures to meet its obligation for the implementation of the protocol:

- Exemption from payment of custom and excise duties on capital goods.
- Extended the same facility for items of recurring use
- Tariff adjustment to promote ozone friendly substitutes
- Regulation and control through import quota

2.3 Legislative Framework

The Ozone Cell in close coordination with Ministry of Commerce formulated a National ODS Phase out Policy in November 2000. The policy was approved by the Economic Coordination Committee (ECC) of the Cabinet. This policy provided disincentives for the continued use of ODS in the form of higher tariff on ODS and components used for the manufacture of products using ODS. Moreover, restrictions were placed on the products using CFC with effect from December 31, 2003.

The proceedings were as under:

- Regulatory measures for licensing system for CFC in 1998. This system was intended to regulate import of CFC and implementation of control measures.

- The quota system for the import of CFC was introduced in August 2000 through public notice. The quota was allotted to 29 importers in Pakistan. This was intended to involve the stakeholders in the policy and regulatory regime.

- Regulatory measures for licensing system for CTC and Halons in 2004. This system was intended to regulate import of CTC & Halons through quota system. The quota was allotted to two importers for Halons and five for CTC.

- The import of CTC was banned in May 2007 and the quota was abolished to all the shortlisted quota holders.

- Imposition of ban on import of CFC based refrigerators and deep freezers with effect from fiscal year 2002-2003.

- Government of Pakistan through Ministry of Commerce, Ministry of Finance & Revenue has issued a number of Statutory Notifications (SROs) with regard to the ODS regulations from time to time including:

  - **SRO 489(I)/2000 dated July 17, 2000**

    Through this SRO restriction on the import of Ozone Depleting Substance including CFC's, Halons, CTC, Methyl Chloroform, HCFC 22 & Methyl Bromide was imposed. This SRO also prohibited the import of used compressor, air conditioners, refrigerators and other second hand household machines.

  - **SRO 634(I)/2004 dated July 22, 2004**

    Through this SRO, the list of banned items was extended to cover HCFC 142b.

  - **SRO 564(I)/2008 dated June 11, 2008**

    Through this SRO, the custom duty was exempted especially for the compressors using non-CFC or HCFC gases.

  - **SRO (I)/2007 dated May 28, 2007**

    Through this SRO, the import of CTC was banned. However, the existing importers of CTC were allowed to import any alternative substance that falls under the category of ozone friendly substance.

  - **SRO 981(I)/2007 dated September 25, 2007**

    Through this SRO, the custom duty on components or sub-components related to the refrigeration, air conditioning was exempted for Non-CFC or Non-HCFC gases.

  - **SRO 758(I)/2008 dated July 18, 2008**

    Through this SRO, the GOP instituted restriction on the import of ODS gases and this import shall be subject to the policy/ quota allocation to be laid by the Ministry of Environment.

  - **SRO 766(I)/2009 dated September 04, 2009**

    Through this SRO, the GOP instituted restriction on the import of ODS gases and this import shall be subject to the policy/ quota allocation to be laid by the Ministry of Environment.

The current legal framework has adequately addressed the phase out of CFC. However, with regard to the phase out of HCFC, the following additional legal framework shall be examined and implemented as appropriate.

- Establishment of exclusive HCFC and HCFC blends sales system and definition of consumption quotas to users
- Ban on import of products and equipment using or containing HCFC and HCFC blends
- Duty relaxation on non-HCFC based products and higher duties on HCFC based products and raw material.
- Ban of new enterprises producing refrigerators, air conditioning equipment and foam manufacturing material using HCFC and/ or HCFC blends
- Ban on investment in building new plants using HCFC and/or HCFC blends
- Ban on uncontrolled release of HCFC and HCFC blends during servicing
- Strict control of investment in new, enlarged or technically reformed enterprises consuming HCFC and HCFC blends
- Ban on import of HCFC and HCFC blends
- Compulsory reporting system of registered industrial and commercial importers of HCFCs
- Establish electronically-operated system for issuing and control of quotas and permits for trade of HCFCs and HCFC-based blends and equipment.

2.4 Stakeholder's involvement in the Policy and regulatory regime.

The stakeholders were involved in the formation of policy and regulatory regime. In this regard a large number of workshops were conducted in almost all major business center of Pakistan such as Lahore, Karachi, Faisalabad, Sialkot, Gujranwala, Wazirabad, Gujrat and Rawalpindi. The quota system for the import of CFC was also introduced in consultation with the stakeholders and through the public notices.

The Ozone Cell took the leading role in the public awareness program to inform the industries and the consumers on the ozone issues.

2.5 Government Initiatives for the Accelerated HCFC Phase out Plan

To achieve accelerated HCFC phase out targets, HCFC phase out needs to be initiated with immediate effect. It should be "Country Driven" and reflect strong commitment of the country and the Government in terms of formulating relevant policies, legislation institutional capacity building, training and awareness activities as well as undertaking investment projects to fulfill HCFC phase out obligations.

As a first step, the Ozone Cell, Ministry of Environment, Government of Pakistan is undertaking preparation of HCFC Phase out Management Plan (HPMP) which would provide an overall strategy for HCFC phase out in line with decision XIX/6 and specifically addressing 2013 and 2015 targets.

Current economic situation and energy crises in the country may affect the overall consumption of HCFCs in Pakistan. Therefore, the HCFCs consumption of 2009 and 2010 shall be assessed accurately, as it will form the basis for the Government interventions to meet the 2013 and 2015 targets.

2.6 Accelerated Phase out Schedule

In September 2007, the parties to the Montreal Protocol at their 19th meeting agreed to accelerate the phase out of HCFC by 10 years as per Decision XIX/6. The table below shows the accelerated phase out schedule for Article 5 countries.

Steps	Year
Baseline	2009-10
Freeze	2013
10% reduction	2015
35% reduction	2020
67.5% reduction	2025
97.5% reduction	2030
Average 2.5% for servicing tail only	2030-39
100%	2040

In Pakistan case, the September 2007 adjustments to the Montreal Protocol oblige the country to take action as soon as possible to freeze its base line for HCFC consumption levels (average of the years 2009-2010) in 2013 and reduce by 10 percent consumption of HCFCs by 2015. Further Pakistan was encouraged not only to take account of the ozone depleting potential of HCFCs but also the global warming implications of alternative substances and technologies and exploit any potential financial incentives and opportunities for additional resources.

3. DATA COLLECTION AND SURVEYS

3.1 General

In Pakistan the use of HCFC is found in manufacturing and servicing sectors. The manufacturing sector uses HCFC 141b and HCFC 22 whereas the servicing sector uses HCFC 22 only. HCFC 141b application is in the refrigeration sector for insulation (Rigid PU foam). This is used both in domestic as well as commercial refrigeration sub sectors. In the foam sector HCFC 141 b is used in the Rigid PU, Spray, Flexible and Integral Skin Foam sub-sectors.

HCFC 22 is used in the manufacturing of cooling system of domestic and commercial air conditioners. Pakistan neither produces nor exports the HCFC to other countries.

Pakistan imports HCFCs through commercial and industrial importers. Industrial importers are mainly large consumers of HCFCs in the manufacturing sector. Commercial importers have a network of supplying HCFCs all over the country. They supply HCFCs to the industries as well as to the workshops in the servicing sector.

3.2 Survey Methodology & Approach

A survey was conducted to establish the baseline of HCFC use in Pakistan. The following methodology & approach is adopted to estimate the baseline and future projections of HCFCs in Pakistan.

- Collection of HCFC Consumption data from the available sources including Federal Board of Revenue (FBR) and other sources like UN Comtrade.

- Industrial Sector Consumption

  - Study of industries already converted from CFC to HCFC under first stage conversion funded by Multilateral Fund (MLF) under the Montreal Protocol.

  - Identification of other HCFC users in industrial sectors through market research, coordination with Chambers of Commerce and Industries, Trading Bodies, study of Distribution Channels.

  - Comprehensive survey of identified industries using UNIDO questionnaire including verification of consumption data through the scrutiny of purchasing and selling documents.

- Servicing Sector Consumption

  Study of available data with regard to the number of workshops/enterprises currently using HCFC and its categorization against annual product-wise consumption. This assessment was based on a limited market research of around 100 service centers.

3.3 Overall view of HCFC Sector in Pakistan

3.3.1 HCFC Supply Scenario

The import data of HCFC was collected through two sources, one from Federal Board of Revenue, Government of Pakistan and other from UN Comtrade. The FBR system captures the import data of HCFC against each shipment on monthly basis. The data provides the trade value in US$ of each shipment but does not provide the quantities by weight. Further, the data

is available only from January 2006. However, the existing UN Comtrade system provides both the information regarding trade value as well as weight. Recognizing the requirement of the project, the data available in the UN Comtrade system for HCFC import in Pakistan was utilized and is provided in the table below:

Years	Trade Value (US$)	Weight (metric ton)	Annual %age Growth	Average Cost per Kg (US$)
2004	1,557,165	1,122		1.39
2005	2,629,693	1,875	67.1%	1.40
2006	4,505,677	3,249	73.3%	1.39
2007	5,182,926	3,463	6.6%	1.50
2008	5,251,333	2,794	-19.3%	1.88

Source: United Nations Statistics Division - Commodity Trade Statistics Database (COMTRADE)

Since Pakistan is neither producing nor exporting HCFC to other countries, this translates to the fact that the total annual consumption is equal to the total annual import of HCFC in the country. The analysis of the import data indicates the following:

- The data is captured against HCFC only against a single HS code and not separately for HCFC-22, HCFC-141b and HCFC-142b. However with the description of the trade registry the data can be segregated.
- The growth in 2008 has declined by 19.3% whereas the average annual growth during the last five (5) years is 31.9%.
- The average cost of HCFC during last five (5) years was US$ 1.51 per kg.
- Government of Pakistan has shown its concerns with regard to decline of HCFC import in 2008. The analysis of the available data indicates that refrigerators manufacturing has declined from 689,900 to 605,300 during July to February period for the year 2007-08 & 2008-09 representing 12.2% decrease. Similarly, manufacturing of Deep Freezers has declined from 113,500 to 93,400 during the same period representing 17.7% decrease.

  The reduction witnessed for these items is due to the current power & energy crises. The GOP believes that once this crisis is over, the customer's requirement has to be fulfilled to bridge the current gap created due to power shortage. Therefore, they believe it is imperative that this number shall be adjusted either at 2007 level or increased by 6.6% as observed during 2006-07. It is recommended that the consumption data shall be examined carefully whenever the next year's information is available.

In order to validate the import /consumption data, the system houses including ICI Pakistan, BASF, Master Chemicals, Simpson Wires and Bayer were contacted.

Besides the system houses, a large number of Commercial and industrial Importers were contacted. The data provided by these traders and manufacturers did not match with the total import figures. This seems to be result of two major reasons; 1) the data bank of these traders was not up to the mark and; 2) there are other traders who were shy to share the data.

3.3.2 Preliminary Survey of industries already converted from CFC to HCFC

UNEP initially contacted the industries that have already converted their process from CFC to HCFC under stage-1 through the financial assistance under Montreal Protocol in foam sector

as well as refrigeration and air-conditioning sector. Some of them have gone out of business due to recession and some other reasons.

3.3.3 Identification of other Industries consuming HCFC

Preliminary survey also identified the industries other than above that are users of HCFC, through the market surveys, contacts with CCIs, trading bodies, Industrial Estates, government offices and utilized other sources.

3.3.4 Survey of Industries

The industries stated above were surveyed in detail. The UNIDO designed questionnaires were utilized. The data pertaining to establishment, existing manufacturing processes, historical utilization of HCFC & other chemicals and production etc. was collected and tabulated.

3.3.5 Consumption Data for HCFC in Industries

The sector wise industries' consumption of HCFC was found as under:

a. Refrigeration & Air Conditioning Sector Data

The survey indicated that consumption of HCFC in Refrigeration & Air Conditioning Sector was as under:

Name	HCFC 141b		HCFC 22		Total Ton	
	M-Ton	ODP-Ton	M-Ton	ODP-Ton	Metric	ODP
United Refrigeration	294.9	32.4	0.0	0.0	294.9	32.4
Dawlance	203.7	22.4	35.4	1.9	239.0	24.3
Haier, Lahore	69.9	7.7	92.5	5.1	162.4	12.8
Cool Industries	106.0	11.7	40.0	2.2	146.0	13.9
Varioline, Lahore	47.7	5.2	0.0	0.0	47.7	5.2
Shadman Electronics	35.6	3.9	0.0	0.0	35.6	3.9
Mumtaz Engineers	8.0	0.9	0.0	0.0	8.0	0.9
Orient, Lahore	0.0	0.0	95.0	5.2	95.0	5.2
PEL, Lahore	0.0	0.0	60.0	3.3	60.0	3.3
Digital World Pakistan	0.0	0.0	20.0	1.1	20.0	1.1
Kentax, Lahore	0.0	0.0	15.1	0.8	15.1	0.8
New Allied Electronics	0.0	0.0	15.0	0.8	15.0	0.8
Shahab Industries	0.0	0.0	4.5	0.2	4.5	0.2
SABRO, Islamabad	0.0	0.0	40.0	2.2	40.0	2.2
SABRO, Rawalpindi	0.0	0.0	10.3	0.6	10.3	0.6
Petal Engineering	0.0	0.0	7.8	0.4	7.8	0.4
PARC	0.0	0.0	9.0	0.5	9.0	0.5

Name	HCFC 141b		HCFC 22		Total Ton	
	M-Ton	ODP-Ton	M-Ton	ODP-Ton	Metric	ODP
Waheed Engineering	0.0	0.0	3.0	0.2	3.0	0.2
MECO	0.0	0.0	1.1	0.1	1.1	0.1
Cool Point, Lahore	0.0	0.0	3.9	0.2	3.9	0.2
Age Co (Pvt.) Ltd.	0.0	0.0	2.9	0.2	2.9	0.2
PAECO	0.0	0.0	2.2	0.1	2.2	0.1
ANZ Insutech Enterprises	0.0	0.0	2.0	0.1	2.0	0.1
Total of Identified	**765.8**	**84.2**	**459.6**	**25.3**	**1225.4**	**109.5**

This translates to a figure of seven industries in refrigeration using HCFC 141b whereas 17 industries in air conditioning using HCFC 22. Three industries viz. Dawlance, Cool Industries and Haier, are using both HCFC 141b and HCFC 22 simultaneously. The reason is that they are producing air-conditioning as well as refrigerators and freezers.

b. Foam Sector Data

The survey indicated that consumption of HCFC in Foam Sector individually was as under:

Name	HCFC 141b		HCFC 22		Total Ton	
	M-Ton	ODP-Ton	M-Ton	ODP-Ton	Metric	ODP
Asif Zubair & Co.	40.0	4.4	0	0	40.0	4.4
Tropical Plastic	15.0	1.7	0	0	15.0	1.7
Zulquarnain Corp.	12.5	1.4	0	0	12.5	1.4
Delight Plastic	12.0	1.3	0	0	12.0	1.3
Mehran Plastic Ind	6.0	0.7	0	0	6.0	0.7
Arm Bros	6.8	0.7	0	0	6.8	0.7
Decent Plastic	1.0	0.1	0	0	1.0	0.1
Pifcom	3.0	0.3	0	0	3.0	0.3
Plasticrafter	10.0	1.1	0	0	10.0	1.1
Shoaibee Ind.	96.0	10.6	0	0	96.0	10.6
Pakistan Plastic Ind	12.5	1.4	0	0	12.5	1.375
Unique Plastic	5.0	0.6	0	0	5	0.55
Thermocraft Engg.	4	0.4	0	0	4	0.44
ANZ Insutech	2.5	0.3	0	0	2.5	0.3
Kold Kraft	11.0	1.2	0	0	11.0	1.2
Pakistan Insulation	45.0	5.0	0	0	45.0	5.0
PAECO	15.0	1.7	0	0	15.0	1.7
Islamuddin & Sons	2.0	0.2	0	0	2.0	0.2

Name	HCFC 141b		HCFC 22		Total Ton	
	M-Ton	ODP-Ton	M-Ton	ODP-Ton	Metric	ODP
Pak Motors	6.0	0.7	0	0	6.0	0.7
SMEs unidentified	24	2.6	0		24	2.64
Master Chemicals	80.0	8.8	0	0	80.0	8.8
Ittehad Insulation	11.5	1.3	0	0	11.5	1.265
Razi Sons	15.0	1.7	0	0	15.0	1.7
Simpson Wires	7.9	0.9	0	0	7.9	0.9
Tariq Engineering	6.0	0.7	0	0	6.0	0.7
Workman	3.5	0.4	0	0	3.5	0.385
Total of Identified	**453.2**	**49.9**	**0.0**	**0.0**	**453.2**	**49.9**

This translates to a figure of 26industries that are using HCFC 141b. 20 are in rigid PU sub sector, two in spray sub-sector, three in flexible molded and one in integral skin sub-sector.

3.3.6 Consumption Data for HCFC in Servicing Sector

In Pakistan the servicing sector is very large and scattered across the country. During the survey it has been observed that the servicing sector is consuming large amounts of HCFC-22 in the servicing of air-conditioning equipment. The service workshops may be categorized as small, medium and large.

Average consumption of the workshops in the servicing of air-conditioners in large cities like Karachi and Lahore was partially surveyed. It has been noted that workshops which have one to two technicians consume around 20 kg of HCFC-22 per month during season while this drops to 50% or less during the off season. The workshops which have more than two technicians consume around 40 to 50 kg of R-22 during the season. In fact the volume of the service work is doubled in the workshops which may be termed as medium-size workshops. There are contractors – some are fairly large that provide servicing to the industries/companies (such as food and textile). Normally they are hired for a year and if the company finds their performance satisfactory they continue with the same contractor or may change the contractor. Maya Corp. is one of the contracting firms which has contracts with large companies and provides servicing to customers. There are small contractors who get the contract of companies which do not want to have their own staff work on servicing of air-conditioners. Their contractors usually employ one/two technicians who are dispatched at the site and do the repair and maintenance work as and when required.

There are companies who have their own maintenance team within the organization for the maintenance of air-conditioning and refrigeration equipment.

During the survey, it has been observed that the copper tubes used in the evaporators are very thin. In order to keep the product cost effective and competitive in market, the industry is using these U tubes which, unfortunately, result in leakage of gas.

a. Assessment of Annual need for Servicing

The data on the serving sector consumption was not possible to collect through direct surveys. It could be done only based on certain valid and justifiable assumptions. The

data from survey conducted under RMP program in 2001 was utilized as a base for the number of service centers in Pakistan. The number was projected to 2009 figures using the growth in households connected to the power connections. As it is evident; no household without power can utilize air conditioning/refrigeration equipment. The province/region-wise projected number of the service centers is provided in the table below:

Province	Region	No. of Workshops	
		Survey	Projected 2009
Punjab	Lahore	1,247	1,976
	Faisalabad	548	869
	Rawalpindi	367	582
	Multan	286	453
	Gujranwala	156	247
	Islamabad	127	201
	Sargodha	91	144
	Bahawalpur	80	127
	DG Khan	54	86
	Sub-total	2,956	4,685
Sindh	Karachi	1,788	2,418
	Hyderabad	144	195
	Sukkur	80	108
	Nawabshah	35	47
	Larkana	34	46
	Mirpur Khas	33	45
	Sub-total	2,114	2,858
NWFP & FANA/ FATA	Peshawar	265	404
	Mardan	56	85
	Abbottabad	20	30
	Mansehra	17	26
	DI Khan	48	73
	Mingora	45	69
	Sub-total	451	688
Balochistan	Quetta	72	104
	Turbat	9	13
	Sibi	7	10
	Khuzdar	6	9
	Loralai	5	7
	Panjgur	4	6
	Dera Murad Jamali	2	3
	Sub-total	105	152
Total		5,626	8,383

The growth rates utilized for arriving at these figures are based on the customers connected to the power system in Pakistan's provinces. These workshops provide servicing to both refrigeration as well as air conditioning equipment.

Based on the number of households in each province/region for year 2009 the average households per workshop worked out is provided below:

Province/ Region	Number of Households	No. of Workshops	Household per Workshop
Punjab	14,169,538	4,685	3,024
Sindh	1,503,996	2,858	526
NWFP & others	2,814,186	688	4,092
Balochistan	482,421	152	3,167
Total	**18,970,142**	**8,383**	**2,703**

In order to assess the HCFC bank in the existing system, following assumptions were made:

- One air conditioner is installed at an average in each household connected to power system. The existing household number in Pakistan in 2008 was recorded as 18,970,100. Based on the available production and import data and life expectancy of various types, support the figure of one air conditioner per household as stated above.
- The percentage assumed in air conditioners currently in use in following four categories are as under :
  - Window-mounted: 20%
  - Non-ducted or duct free Split Residential and Commercial: 70%
  - Ducted Split Residential Air Conditioners: 07%
  - Ducted Commercial Split and Packaged Air Conditioners: 03%

  The percentages were arrived at after a survey of approximately 100 service centers.
- Assuming the percentage of product category as stated above and leak rate, product life, and average gas charging, the estimated HCFC-22 bank and expected annual need for servicing was worked out as below:

Product Category	Estimated Qty	Assumed Product Life (Years)	Av. Charge Kg	Estimated HCFC-22 Bank M ton	Assumed Leak Rate %age	Annual need for Servicing
Window-mounted	3,794,000	10	0.75	2,846	2.0%	57
Split Residential and Commercial Air Conditioners	13,279,100	15	1.28	16,997	5.0%	850
Ducted Split Residential Air Conditioners	1,327,900	20	3.40	4,515	5.0%	226
Ducted Commercial Split and Packaged Air Conditioners	569,100	20	11.35	6,459	5.0%	323
Total	18,970,100			30,817		1,455

The assumptions on annual charge, leakage rate are as per UNEP 2006 report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee.

b. Average consumption of HCFC in Workshop Category

The workshops were then segregated on the basis of their sizes and business volume. The segregation was done as Small, Medium and Large workshops. Based on a survey of limited workshops, it was concluded that the annual estimated HCFC used in servicing workshops for each product category in Pakistan is as under:

Workshop Category	Annual HCFC Usage M ton					%age Share	Average/ W/shop (Kg)
	Window Unit	Non-ducted Split	Ducted Split	Package Unit	Total		
Small	28.5	424.9	22.6	0.0	476.0	32.7%	103
Medium	22.8	339.9	90.3	161.5	614.5	42.2%	167
Large	5.7	85.0	112.9	161.5	365.0	25.1%	3,629
Total	**56.9**	**849.9**	**225.7**	**323.0**	**1,455.5**	**100%**	

The workshop population against each product category and average workshops per category is assessed as under:

Workshop		Product Category population				Total Population	Average/ W/shop (No.)
Category	Number	Window Unit	Non-ducted Split	Ducted Split	Package Unit		
Small	4,611	37,940	331,978	6,640	0	376,558	82
Medium	3,672	30,352	265,582	26,558	14,228	336,720	92
Large	101	7,588	66,396	33,198	14,228	121,410	1,207
Total	**8,383**	**75,880**	**663,965**	**66,396**	**28,456**	**834,688**	

The above two tables are based on the following assumptions that were arrived at after a limited workshop survey of around 100 workshops. The list of large service centers sponsored by the manufacturers is included as Annex-2.

Workshop		%age share of Product Category			
Category	%age	Window Unit	Non-ducted Split	Ducted Split	Package Unit
Small	55%	50.0%	50.0%	10.0%	0.0%
Medium	44%	40.0%	40.0%	40.0%	50.0%
Large	1%	10.0%	10.0%	50.0%	50.0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

During the survey of workshops it was observed that these workshops are multi-task and gas charging in the air conditioners is one of the tasks they perform. They also carry out repairs, electrical/mechanical and sometimes other related works too.

3.3.7 Sectoral Distribution of HCFC Consumption

The summary of HCFC consumption among these sectors in 2009 is as under;

Sector	HCFC 141b		HCFC 22		Total Ton	
	Total M-Ton	ODP-Ton	Total M-Ton	ODP-Ton	Metric	ODP
Refrigeration Sector						
- Domestic Refrigeration PU Foam	674.5	74.2			674.5	74.2
- Commercial Refrigeration PU Foam	91.3	10.0			91.3	10.0
- Domestic A/C			417.4	23.0	417.4	23.0
- Commercial A/C			42.2	2.3	42.2	2.3
Total of Refrigeration Sector	**765.8**	**84.2**	**459.6**	**25.3**	**1225.4**	**109.5**
Foam Sector						
- Rigid Foam	329.3	36.2			329.3	36.2
- Spray Foam	91.5	10.1			91.5	10.1
- Flexible Molded Foam	28.9	3.2			28.9	3.2
- Integral Skin Foam	3.5	0.4			3.5	0.4
Total of Foam Sector	**453.2**	**49.9**	**0.0**	**0.0**	**453.2**	**49.9**
Servicing Sector			1455.5	80.1	1455.5	80.1
Total of Servicing Sector	**0.0**	**0.0**	**1455.5**	**80.1**	**1455.5**	**80.1**
Total consumption of HCFC	**1219.0**	**134.1**	**1915.1**	**105.3**	**3134.1**	**239.4**
%age Usage	39%	56%	61%	44%	100%	100%

3.4 User Companies' Profile

Companies identified as the HCFC users are listed below with their respective sector, year of establishment, implementing agency that carried out the previous project, the project number and year of conversion to HCFC:

Name	Sector	Year of Estb.	Implementing Agency	MLF Project No.	Year of Conversion
United Refrigeration	Domestic Ref	1980	IBRD	PAK/REF/25/INV/27	2006
Dawlance	Domestic Ref	1991	IBRD	PAK/REF/25/INV/26	2006
Haier, Lahore	Domestic Ref	2001	-	-	New
Cool Industries	Domestic Ref	1971	IBRD	PAK/REF/23/INV/19	1996
Varioline, Lahore	Commercial Ref	1995	-	-	New
Shadman Electronics	Commercial Ref	1984	IBRD	PAK/REF/25/INV/28	2002
Mumtaz Engineers	Commercial Ref	1986	IBRD	PAK/REF/32/INV/40	2005
Dawlance	Domestic A/C	1991	-	-	New
Haier, Lahore	Domestic A/C	2001	-	-	New
Cool Industries	Domestic A/C	1971	-	-	New

Name	Sector	Year of Estb.	Implementing Agency	MLF Project No.	Year of Conversion
Orient, Lahore	Domestic A/C	2005	-	-	New
PEL, Lahore	Domestic A/C	1956	-	-	New
Digital World Pakistan	Domestic A/C	2000	-	-	New
Kentax, Lahore	Domestic A/C	2002	-	-	New
New Allied Electronics	Domestic A/C	1989	-	-	New
Shahab Industries	Domestic A/C	1963	-	-	New
SABRO, Islamabad	Domestic A/C	2003	-	-	New
SABRO, Rawalpindi	Commercial A/C	1958	-	-	New
Petal Engineering	Commercial A/C	1990	-	-	New
PARC	Commercial A/C	1982	-	-	New
Waheed Engineering	Commercial A/C	1992	-	-	New
MECO	Commercial A/C	1956	-	-	New
Cool Point, Lahore	Commercial A/C	1999	-	-	New
Age Co (Pvt.) Ltd.	Commercial A/C	1988	-	-	New
PAECO	Commercial A/C	1971	IBRD	PAK/REF/32/INV/39	2005
ANZ Insutech Entrp.	Commercial A/C	1988	IBRD	PAK/FOA/25/INV/25	2005
Asif Zubair & Co.	Rigid	1983	IBRD	PAK/FOA/23/INV/20	2005
Tropical Plastic	Rigid	1988	IBRD	PAK/FOA/23/INV/20	2005
Zulquarnain Corp. (previously 3Z)	Rigid	2004	IBRD	PAK/FOA/23/INV/20	2005
Delight Plastic	Rigid	1994	IBRD	PAK/FOA/23/INV/20	2005
Mehran Plastic Ind	Rigid	1985	-	-	New
Arm Bros	Rigid	1983	IBRD	PAK/FOA/23/INV/20	2005
Decent Plastic	Rigid	1994	IBRD	PAK/FOA/25/INV/25	2005
Pifcom	Rigid	1975	IBRD	PAK/FOA/25/INV/25	2005
Plasticrafter	Rigid	1948	IBRD	PAK/FOA/23/INV/20	2005
Shoaibee Ind.	Rigid	1982	IBRD	PAK/FOA/23/INV/20	2005
Pakistan Plastic Ind	Rigid	1991	IBRD	PAK/FOA/23/INV/20	2005
Unique Plastic	Rigid	1982	IBRD	PAK/FOA/23/INV/20	2005
Thermocraft Engg.	Rigid	1988	IBRD	PAK/FOA/41/INV/58	2006
ANZ Insutech	Rigid	1996	IBRD	PAK/FOA/25/INV/25	2005
Kold Kraft	Rigid	1986	IBRD	PAK/REF/23/INV/18	2002
Pakistan Insulation	Rigid	1990	IBRD	PAK/FOA/41/INV/58	2006
PAECO	Rigid	1971	IBRD	PAK/REF/32/INV/39	2005
Islamuddin & Sons	Rigid	1980	IBRD	PAK/FOA/25/INV/25	2005
Pak Motors	Rigid	1953	IBRD	PAK/FOA/25/INV/25	2005

Name	Sector	Year of Estb.	Implementing Agency	MLF Project No.	Year of Conversion
SMEs unidentified*	Rigid	-	-	-	New
Master Chemicals	Spray	1984	-	-	New
Ittehad Insulation	Spray	2002	-	-	New
Razi Sons	Flexible Molded	1948	IBRD	PAK/FOA/18/INV/07	2002
Simpson Wires	Flexible Molded	1971	IBRD	PAK/FOA/41/INV/58	2006
Tariq Engineering	Flexible Molded	1973	-	-	New
Workman	Integral Skin	1980	IBRD	PAK/FOA/41/INV/58	2006

3.5 Validation of Data

The data provided by the respondent was validated by reviewing their following documents:

- Purchase documents of HCFC's
- Purchase documents of others chemicals especially in the PU foam products
- Selling documents of their products
- Energy Bills
- Plant capacity for annual production of each product

The individual parameter or combination thereof has been used to validate the data provided by the respondent during survey of manufacturing unit.

According to Federal Bureau of Statistics 10% of the total population of Pakistan is having one air conditioner that translates to a figure of around 18 million air conditioners in Pakistan. This support the assumption while estimating the number of workshops and HCFC bank in Pakistan.

4. EXPECTED TRENDS & FORECAST

4.1 Pakistan Data on HCFC

Government of Pakistan initiated providing data to Ozone Secretariat since 1993 regarding HCFC. The data submitted by the government for years 2000 onwards is as under:

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
ODP Ton	34.5	34.5	46.3	58.2	14.0	5.3	65.5	183.7	189.5

In addition to above Pakistan also started submitting data on segregated items of HCFC 141b and HCFC 22 from year 2007. The data submitted is as under:

Year	**HCFC 141b**		**HCFC 22**		**Total HCFC**	
	M-Ton	**ODP Ton**	**M-Ton**	**ODP Ton**	**M-Ton**	**ODP Ton**
2007*	613.0	67	2,113.8	116	2,726.80	183.69
2008*	1,101.9	121	1,241.4	68	2,343.25	189.48
2009	1,219.0	134	1,915.1	105	3,134.10	239.42

*This is the data already reported by Ozone Cell Ministry of Environment; Government of Pakistan to Ozone Secretariat, 2009 data is as per UNEP survey

4.2 HCFC Overall Consumption Trends

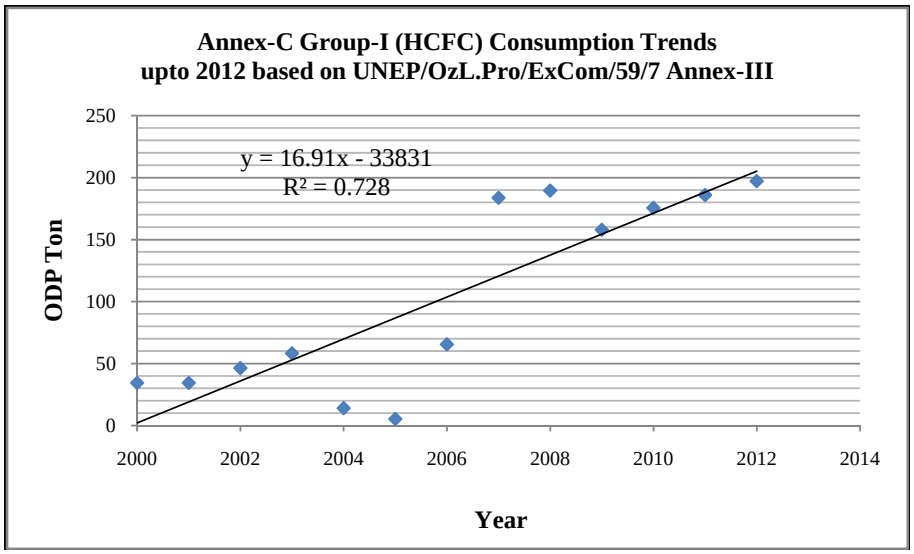
4.2.1 <u>As per Requirements of UNEP/OzL.Pro/ExCom 59/7 Annex-III</u>

The following requirements indicated in UNEP/OzL.Pro/ExCom/59/7 Annex III have been applied to see the consumption trends

- The consumption projection shall be based on the data reported starting from 2000 to 2008.
- Linear Least Square Method shall be applied for projection for the 2009 & 2010.
- 6% annual growth shall be considered for the year 2011 & 2012.
- establish baseline, freeze limit and 10% reduction in 2015

The data for the years 2000-2008 was projected up to year 2012 in accordance with UNEP/OzL.Pro/ExCom/59/7 Annex III. The resultant table and graph are produced below.

Year	2007	2008	2009	2010	2011	2012	2013	2015
HCFC ODP Ton	183.7	189.5	157.9	175.5	186.0	197.2	166.7	150.0



Analysis of the Calculation

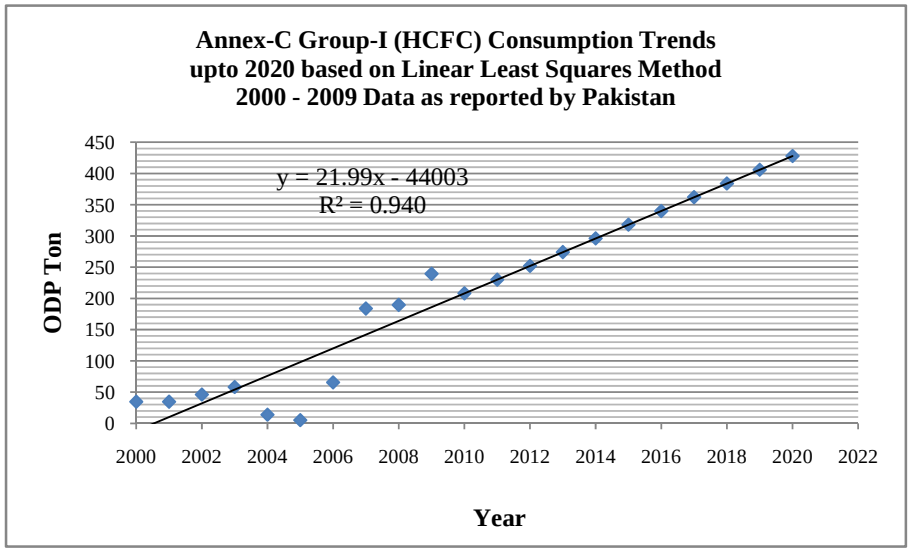
1. It appears that the consumption for the years 2004 and 2005 has inadvertently been reported low.
2. As per calculation under this method, the 2009 consumption turns out to 157.9, whereas UNEP survey of 2009 reveals that the consumption is 239.4. It is therefore understood that this method does not lead to the correct figures regarding future consumptions.
3. The 2010 figure of 175.5 arrived by this method is even less than the original 2008 figures of 189.5 reported by the Government of Pakistan and less than 2009 actual consumption of 239.4 as surveyed by UNEP.
4. Since the baseline, freeze limit and10% reduction in 2015 are hinging upon 2009 and 2010 consumption levels, therefore it is feared that MP target assessment for Pakistan based on this method shall not be correct. This consumption trend is therefore not being applied for preparation of HPMP.

4.2.2 Alternate Approaches

Seeing the failure of above method, the consumption data captured during 2009 survey and the anticipated growth in the years 2010-12 gathered from the manufacturing sector, various methods were employed to see the future trends. The methods employed include the following:

a) Consumption Trends up to 2020 based on Linear Least Squares Method. The data utilized for this study was 2000 - 2008 data as reported by Pakistan and 2009 UNEP survey data. The growth projected until 2020 indicate an average annual increase of 5.42%. The resultant table and graph is produced below.

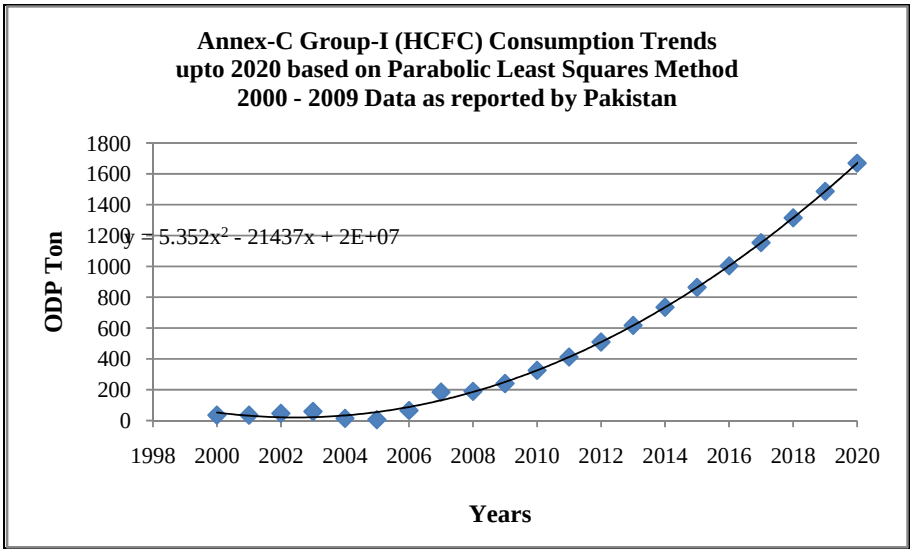
Year	2007	2008	2009	2010	2011	2012	2013	2015
HCFC ODP Ton	183.7	189.5	239.4	208.1	230.1	252.1	223.7	201.4



The result indicates that the 2010 and 2011 consumption figures are still lower than the figures gathered through UNEP survey

b) Consumption Trends up to 2020 based on Parabolic Least Squares Method. The data utilized for this study was 2000 - 2008 data as reported by Pakistan and 2009 UNEP survey data. This method shows average annual increase of 19.31%. The resultant table and graph is produced below.

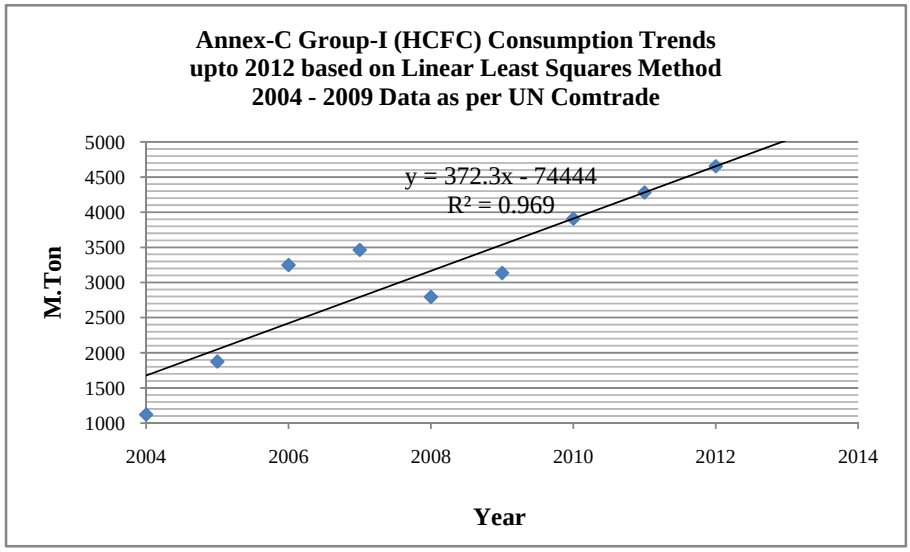
Year	2007	2008	2009	2010	2011	2012	2013	2015
HCFC ODP Ton	183.7	189.5	239.4	325.8	412.1	509.0	282.6	254.4



The result indicates that the 2010 and 2011 consumption figures are extremely higher than the figures gathered through UNEP survey

c) Consumption Trends up to 2012 using Linear Least Squares Method based on import data as reported by UNComtrade system during 2004-2008 and 2009 UNEP survey data. The data available in UNComtrade was in Metric Tons. The resultant table and graph is produced below.

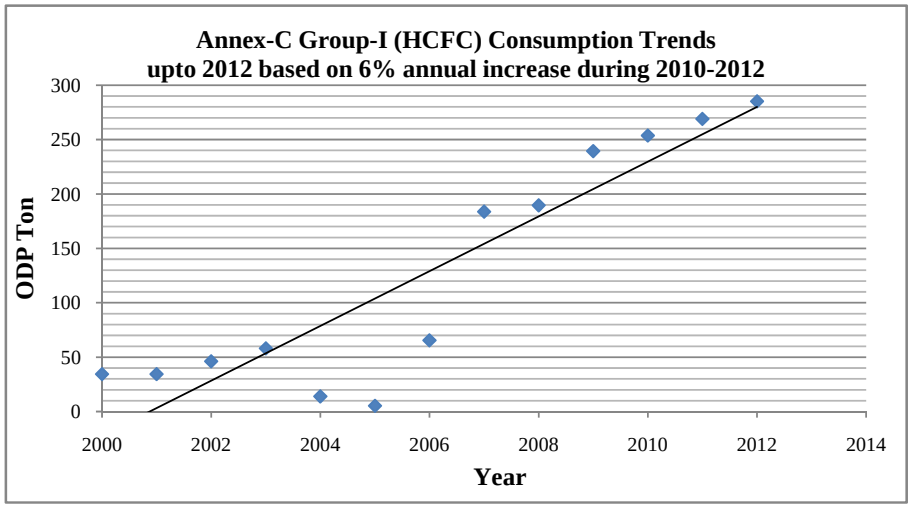
Year	2007	2008	2009	2010	2011	2012
HCFC M. Ton	3463	2794	3134	3909	4282	4654



The result indicates that the average annual growth during 2009 thru 2012 is 10.71%. Although this is not exceptional, yet it is understood that it is higher than normally anticipated.

d) Consumption Trends up to 2012 based on 6% annual increase during 2010-2012. The data utilized for this study was 2000 - 2008 data as reported by Pakistan and 2009 UNEP survey data. The resultant table and graph is produced below.

Year	2007	2008	2009	2010	2011	2012	2013	2015
HCFC ODP Ton	183.7	189.5	239.4	253.8	269.0	285.1	246.6	221.9



The result indicates that the 2010 and 2011 consumption figures are fairly close to the figures gathered through UNEP survey.

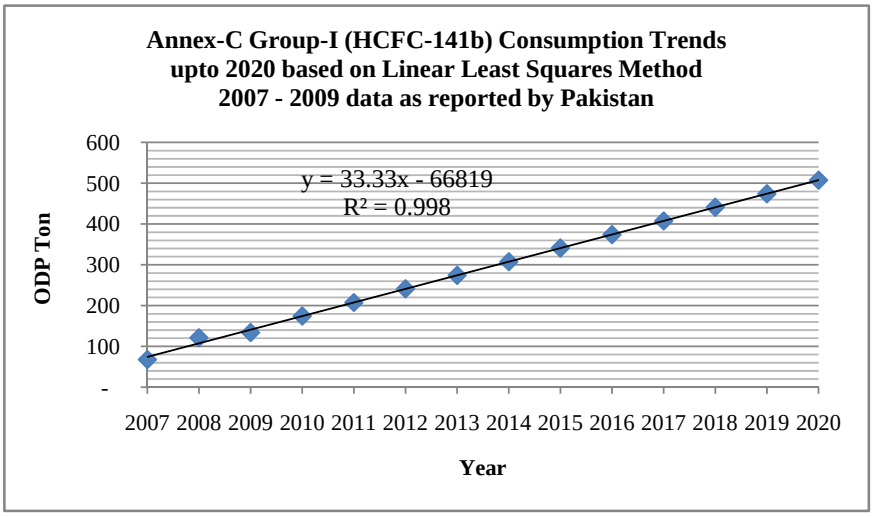
4.3 Chemical-Wise Projections

In Pakistan, the HCFC consumption is being reported as HCFC 141b and HCFC 22 to Ozone Secretariat since 2007. The segregated data for these chemicals is not available before this period. The chemical-wise projections based on the available data, are worked out as under:

4.3.1 HCFC 141b Consumption Trends

Consumption Trends up to 2020 based on Linear Least Squares Method. The data utilized for this study was 2007 - 2008 data as reported by Pakistan and 2009 UNEP survey data. The growth projected until 2020 indicate an average annual increase of 4.36%. The resultant table and graph is produced below.

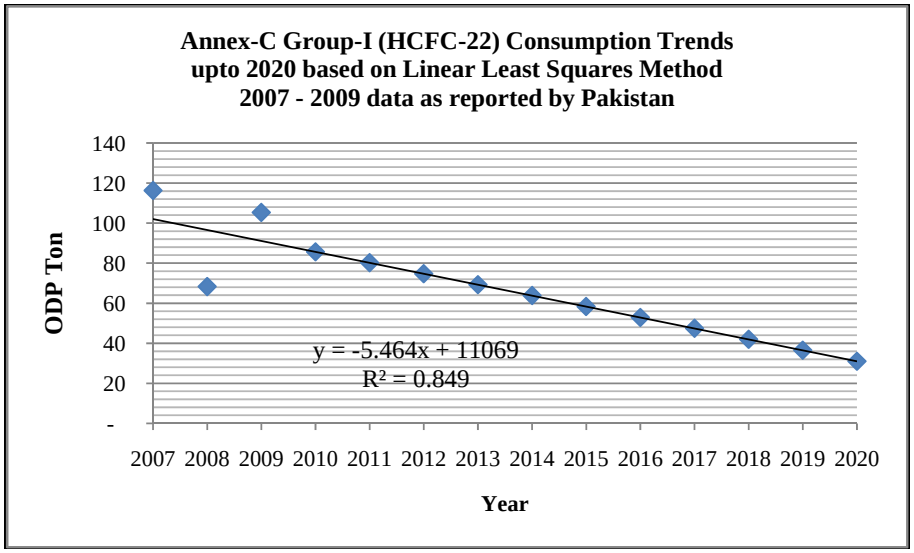
Year	2007	2008	2009	2010	2011	2012
HCFC 141b ODP Ton	67	121	134	174	208	241



4.3.2 HCFC 22 Consumption Trends

Consumption Trends up to 2020 based on Linear Least Squares Method. The data utilized for this study was 2007 - 2008 data as reported by Pakistan and 2009 UNEP survey data. The growth projected until 2020 indicate a negative growth which is contrary to ground realities. The resultant table and graph is produced below.

Year	2007	2008	2009	2010	2011	2012
HCFC 22 ODP Ton	116	68	105	86	80	75



The data period is short and it is difficult to derive a meaningful conclusion.

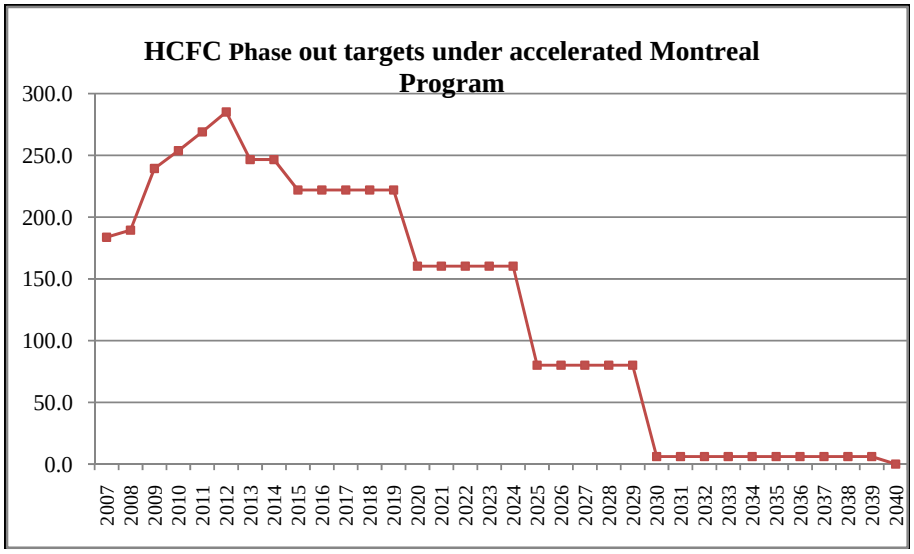
4.4 Forecast of HCFC Future Consumption

It is understood that 6% growth in consumption is reasonable to be adopted for HPMP and natably same percentage has already been used in development of the projects investment documents to be implemented under Stage-I. Actual baseline figures will be established as per 60th Ex.com decision after 2010 data is available

Based on this figure, the targets for Pakistan can be forecasted as under:

- The baseline is 246.6 ODPT based on the average of 2009 & 2010 consumption.
- The 2013 freeze limit is 246.6 ODPT
- The 2015 reduction level is 221.9 ODPT.
- The 2020 reduction level is 160.3 ODPT.
- The 2025 reduction level is 80.1 ODPT.
- The 2030 reduction level is 6.2 ODPT.
- These targets are used in the preparation of HPMP.

The graphical representation of it is as under



5. ALTERNATE TECHNOLOGIES

5.1 Overview of Alternate Technologies

As stated earlier, the manufacturing sector uses HCFC 141b in the refrigeration sector PU foam. HCFC 141b application is in both domestic as well as commercial refrigeration sub sectors. In the foam sector HCFC 141 b is used in the Rigid PU, Spray, Flexible and Integral Skin Foam sub-sectors. HCFC 22 is used in the manufacturing of cooling system of domestic and commercial air conditioners and servicing sector.

A number of viable substitute technologies for phasing out of HCFC's have been identified in the Foam & Refrigeration sectors. The alternative examined for foam and air conditioning / refrigeration sectors are discussed in the next sections.

5.2 HCFC 141b

5.2.1 Overview

HCFC-141b has been widely used as foam blowing agent for Rigid polyurethane foam, Flexible molded PU foam, Integral skin, semi flexible PU foam and Thermoplastic extruded foams. There are a wide range of alternatives available to replace the use of HCFC 141b. In these sectors, water-based chemicals and hydrocarbon blowing agents have already been proved and are widely applied in Article-5 countries. Several other foaming technologies are already being used (see the table below) that may replace HCFC-141b.

Technology	GWP of agent	Flamm-ability	Insulation perform-ance	Cost of blowing agent	Capital investment	Suitable application
HCFC-141b	713	no	++++	Medium	-	all
Cyclo-pentane	=<20	yes	+++-	Medium	high	continuous line
Cyclo-pentane/ iso-pentane Mixture 60/40	=<25	yes	++--	Medium	high	continuous line
n-pentane	=<25	yes	+---	Medium	high	continuous line
HFC-245fa	1030	no	++++	High	-	all
HFC-365mfc/227 mixt.	780	no	++++	Medium to high	-	all
HFC 152a/water	142	yes	++--	Medium		all
HFC 134a/water	1300	no	++--	Medium		all
Water	0	no	----	Low	low	Pour in place

5.2.2 Alternate Technologies

i. Hydrocarbon technology

Hydrocarbon technology has been mostly based on cyclopentane, either "pure" grade (95%) or "technical" grade (75%). There is no significant difference in their performance in practice. Both are easy to process in formulations that have been developed around them. Because of their flammability, extensive but now well established modifications to the foaming part of the factory to meet appropriate safety requirements are essential. These include a dedicated storage tank for the cyclopentane, pre-mixers, adapted high pressure dispensers, suitable

moulds (often water-cooled) plus process exhaust, hydrocarbon detectors, appropriate classification of electrical equipment, avoidance of static electricity and, above all, training of operating staff. These requirements make economic conversion to this technology, particularly in the cases of small factories, a difficult issue. However, in this sector most of the production units, even in developing countries, are large enough to make conversion to hydrocarbons an economic proposition. To extend the use of this technology to some areas, precautions would be necessary to comply with limits on the emissions of volatile organic compounds (VOCs).

In general, the conventional pentane and cyclopentane-based foams show an increase of the density, 15-18% above the HCFC-141b foams and, typically, the initial thermal conductivity is increased by 8% to about 20.5 mW/m°K (at 10°C) (HCFC 141b 19 mW/m°K). In the case of all these industries an additional increase of the foam density is not an issue.

Further development of hydrocarbon systems involves the use of blends which reduce the economic density penalty without strongly affecting the insulation performance and may even enhance it. For example, optimized cyclo/isopentane-based foam shows the overall density reduced to about 33-35 kg/m3. By using cyclopentane/isobutane blends, achieves the same improvement plus improvement in low temperature thermal insulation because of the higher gas vapor pressure in the foam cells. There is minor use of iso/normal pentane blends. This is in markets where cyclopentane is not available locally and the iso or normal isomers are used despite their deficiencies in terms of thermal conductivity.

The use of cyclo/isopentane mixtures with HFCs 245fa or HFC 365mfc (co-blowing agent for pentane systems) is a further option with the advantage of reducing the density of the rigid foam by about 10% below the HCFC 141b foams with enhanced physical properties related to thermal conductivity and compression strengths.

ii. HFC Technology

HFC blowing agents were developed as replacements for HCFCs. These agents include HFC 134a, HFC 152a, HFC 245fa, HFC 365mfc and mixtures of HFC 365mfc and HFC 227.

Foams based on HFC-134a/water are seen as a safeguard against the non-availability of liquid HFCs. The main issues are processing items because HFC-134a is a gas and has poor solubility in polyol formulations, increased frothing effect and the initial thermal conductivity of the foam can be increased by 10-20 % compared to HCFC 141b based foam, but it is not flammable.

Foams based on HFC 152a/water have the advantage of higher solubility of HFC 152a in polyol formulations and therefore reduced frothing effect by the production of PU panels. Thermal conductivity is similar to HFC 134a/water. HFC 152a is a flammable gas.

The blowing agents HFC-245fa and HFC 365mfc are technically viable blowing agents for these applications, giving similar densities to those of CFC-11-based foams. The initial thermal conductivity of the foam, at about 19.5 mW/m°K (at 10°C) is equivalent to those of HCFC-141b-based products and up to 10 – 15 % lower than for current hydrocarbon-blown foams. The boiling point of HFC 245fa (15.3°C) means that pressurized blending equipment would be necessary for its use, though evaluations reported to date suggest that HFC-245fa can be processed through foam equipment designed for use with CFC-11 and HCFC-141b in many cases. The good solubility in polyol formulations is a significant factor in its use.

The use of HFC 365mfc with a boiling point of 42°C is a true liquid and is used widely. Pure HFC 365mfc is a flammable liquid with a flash point at <-27°C. Commercially available mixtures contain HFC 227 to overcome the flash point issue. These mixtures are HFC 365mfc/227 with 93% or 87% 365 mfc as well as 7 and 13 % 227 respectively. Both mixtures

are non-flammable liquids with a bubble point of about 32°C and 28 °C respectively. The initial thermal conductivity of the PU rigid foam can reach values of about 19 mW/m°K. Furthermore, the density of the foam can be 10% lower than PU foam blown with HCFC 141b. In practice it is important considering that the mixture is non azeotropic and therefore, it is recommended to use HFC 365/227 in a closed production cycle. For 93%/7% mixtures direct injection systems, while for the 87%/13% mixtures premixed polyol systems are recommended.

Current evaluation indicates that processing, insulation, physical property and most flammability requirements would all be met by these blowing agents. Initial insulation properties would be similar to those of HCFC-141b with the advantage of reduced rates of aging.
The key issues relating to the acceptance of these HFC blowing agents are their prices, availability, their GWP and the resulting cost of the boards in an extremely cost sensitive market in which there are several potential substitute products.

For the future there are several proposed low GWP agents such as HFE-245, HFE 254, and very new the HFOs (fluorinated olefins e.g. HFO 1234) however, they are not commercially available yet. To extend the use of these technologies, precautions are necessary to comply with VOC emission limits.

iii. CO_2 (water)

CO2 generated by reaction of the added water with isocyanate can be used in applications where an increase in foam thickness (up to 50%) can be accepted to give equivalent insulation value. There is also a penalty of a density increase of about 30% for the lower density foams with around 32 kg/m3 but this penalty does not apply to those higher density foams used for example in PU steel sandwich applications. Another negative but very important point is the weak skin formation, which will negatively influence the adhesive properties of the PU foam/steel surface, meaning that normally it is not possible to use such PU-systems for sandwich panels.

iv. CO_2 (liquid)

Liquid CO2 technology is possible to use for continuously produced insulation boards. The thermal conductivity of the PU-rigid foam is very similar to pure water blown systems. The benefit for such PU system will be the lower consumption of isocyanate and therefore, a better skin formation in direction to more flexible ones. Negative impact is caused by the strong frothing effect, which often creates holes inside the PU rigid foam panel. Furthermore, high-pressure mixing devices are required.

5.3 HCFC-22

5.3.1 Overview

Review of alternative refrigerants to HCFC-22 is provided in the secretariat paper UNEP/OzL.Pro/ExCom/54/54 Add.1. The following aspects are important to assess the suitability of the different alternatives:

- Performance;
- Safety related aspects;
- Environmental aspects;
- Influence of the technology onto equipment cost;
- Capability to be used at high ambient temperatures.

In addition, the status of development and current availability of technology must be ensured in order for the selected refrigerant to contribute to achieving compliance with the 2013 and 2015 HCFCs consumption reduction requirements. Therefore, experience with the use of refrigerants in actual applications must be already available, and necessary requirements towards manufacturers and service companies are to be clarified. Likely availability of the refrigerant in the mid- and long term is also important.

The table below compares characteristics of already known alternative refrigerants to HCFC-22.

Refrigerant	Component	GWP (100y)	Safety Class	Temp. glide (K)	Condensing temp. at 26 bar (^{o}C)	Suitable AC application
HCFC-22	HCFC	1810	A1	0	63	all
HFC-134a	HFC	1,430	A1	0	80	screw chiller
R-407C	HFCs	1,800	A1	7.4	58	all
R-410A	HFCs	2,100	A1	0	43	all
R-404A	HFCs	3,900	A1	0.7	55	*
R-507A	HFCs	4,000	A1	0	54	*
R-290	Propane	20	A3	0	70	room AC
R-1270	HC, propylene	20	A3	0	61	-
R-600a	HC, isobutane	20	A3	0	114	**
R-717	Ammonia	0	B2	0	60	screw chiller
R-744	CO2	1	A1	0	-11	***

* commercial refrigeration
** domestic refrigerators
*** mobile air conditioners, heat pump for water heater

There are proposed “drop-in” replacements such as R-417A, R-422A and R-422D. They are mixtures of HFCs with a small amount of hydrocarbon to ensure oil circulation in the refrigeration cycle. However, they are not considered as alternatives for newly designed HVAC equipment. They have certain degree of compromises regarding the performance, and have only limited market experiences. Furthermore the system with these drop-in refrigerants with existing mineral oil lubricant may not provide sufficient lubrication on wearing surfaces in the compressor and the system durability would be badly influenced.

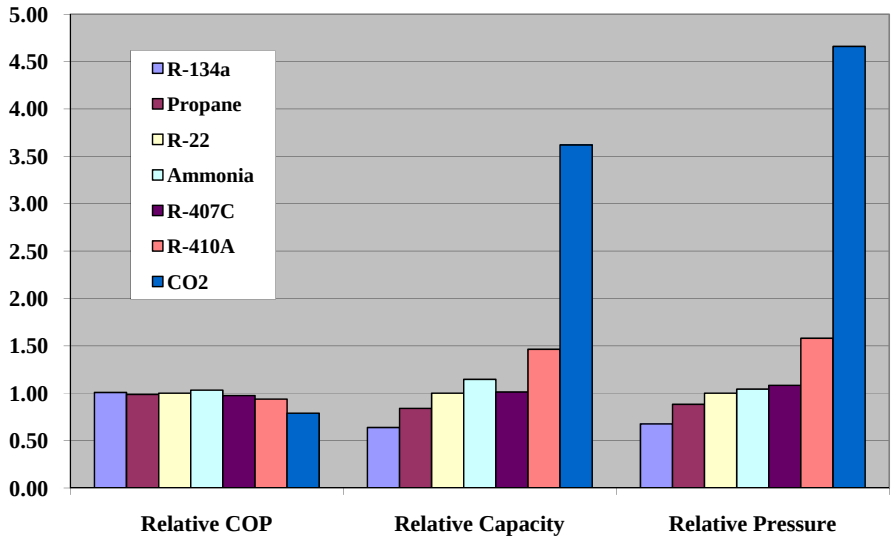
The components of HFC mixtures are summarized below.

Refrigerant	R-32	R-134a	R-125	R-143a	R-600a	GWP 100y
R-404A		4	44	52		3900
R-507A			50	50		4000
R-407C	23	52	25			1800
R-410A	50		50			2100
Drop-in						
R-417A		50	46.6		3.4 (R-600)	2300
R-422A		11.5	85.1		3.4	3100
R-422D		31.5	46.6		3.4	2700

R-404A and R-507A are developed for low-temperature application and not suitable for air-conditioning application. R-290 is flammable and may be used only for small equipment and

may be used as a potential replacement of HCFC-22 for vending machines. R-600a is a common refrigerant for domestic refrigerators. Ammonia (R-717) is used for big chillers, but its toxicity may limit the use. Carbon dioxide (R-744) is partially used for mobile air-conditioners. Heat pump to heat water with carbon dioxide refrigerant is becoming popular as its performance for heating operation is quite high. However, its low efficiency for cooling operation may limit the use in air-conditioning applications. Recently low-GWP HFCs are being proposed such as R-1234yf mainly for MAC applications, though their potential for unitary air-conditioning application is yet to be investigated.

Three key factors are important to determine performance of refrigerants, namely thermal efficiency (coefficient of performance, COP), volumetric efficiency (capacity) and operating pressure. Those of various potential alternatives to that of HCFC-22 are compared in the chart below.



Condition: 43°F (6.1°C) Evaporator Saturation Temperature, 5°F (-15°C) Evaporator Superheat
118°F (47.8°C) Condenser Saturation Temperature, 10°F (-12.2°C) Sub-cooling

5.3.2 Alternate Technologies

i. HFC-134a

HFC-134a is globally available. It can be used for smaller room air conditioners, as well as where previously CFC-12 has been used and where HCFC-22 has been only an interim solution. There is considerable practical experience in its use in Article 5 countries for refrigerators and freezers application.

HFC-134a operating pressure is 50% lower than that of HCFC-22. Compressors and heat exchangers with thinner walls are used. However, HFC-134a has lower volumetric efficiency than HCFC-22, requiring larger compressor to compensate for 35% loss of capacity, giving rise to higher cost. It has roughly the same thermal efficiency and heat transfer property to HCFC-22, while current HFC-134a systems are more efficient than that of HCFC-22, due to improved compressor and heat transfer technologies, and controlling mechanism.

In terms of long-term viability, HFC-134a is widely used for all chillers and large commercial systems as well as MAC, though it is being replaced in MAC application in Europe. There is substantial production worldwide and it is increasing. The direct greenhouse gas emissions are expected to be lower due to lower GWP, lower pressures and lower risk of pressure oscillations in the tubing compared to HCFC-22. Better emission control (leak tight and

charge reduction), and reclaim and destruction program will mitigate negative GWP argument of HFC-134a. HFC-134a is suitable for very high ambient temperatures.

ii. R-407C

HFC-407C has the closest performance characteristics to HCFC-22. It is a zeotropic blend of three refrigerants of different operating pressure. Temperature glide could occur and it is therefore not suitable for equipment with a large refrigerant filling or accumulators, such as condensing units, centralized systems and certain chillers. In other applications, the temperature glide still needs to be taken into consideration in design and service. Counter-flow heat exchanger can improve system efficiency by making use of temp glide.

It is used to retrofit HCFC-22 systems with minor loss of capacity and efficiency, for which it is needed to change lubricant from mineral to synthetic lubricants (POE). R-407C is widely used in Europe, but not popular in Americas and Asia, however, it is likely to be available in the medium to long term. The costs of manufacturing R-407C equipment are very similar to the costs for HCFC-22 equipment except for the higher costs for refrigerant and compressors with synthetic refrigeration oil. In case of very high ambient temperatures the equipment might have to be built for higher working pressures than standard. The GWPs of HCFC-22 and R-407C are similar; therefore the overall emissions of greenhouse gases attributed to the equipment should remain similar.

iii. R-410A

R-410A is a near a zeotropic blend of two high pressure refrigerants, and has better volumetric efficiency than HCFC-22. The high refrigerating capacity permits often small, more compact components to be used. A typical hermitic or semi-hermetic compressor designed for HCFC-22 cannot be used with HFC-410A, which might also be true for some other components in the system. R-410A compressor is 2/3 that of HCFC-22, reducing system charge. Though the theoretical thermal efficiency is slightly lower, it is inherently a more effective heat transfer medium. Current R-410A systems are more efficient than that of HCFC-22 due to compressor type, heat exchanger selection, airflow systems and controlling mechanism.

R-410A discharge pressure is 50% higher. Pressure limiting device used to enable standard copper tubes is to be applied. Compressors with thicker walls are used, but applicable to scroll, reciprocating and rotary compressors. Installer/service shops require high pressure gauge manifold, leak detector, and other service tools designed for high-pressure refrigerant.

Current system costs about 10%-15% higher than HCFC-22 equipment. Higher cost is due to higher R-410A refrigerant cost, high-pressure cutoff device, higher compressor cost because of thicker shell (though smaller). Higher cost also may be also due to lower production volumes and higher efficiency. The cost is expected to reduce when massive shift to R-410A systems is expected to occur after 2010 in some markets.

R-410A is not universally accepted for use in high ambient temperatures due to its elevated pressures and relatively low critical point, which might lead to lower energy efficiency at such temperatures as compared to e.g. HFC-134a or HC-290.

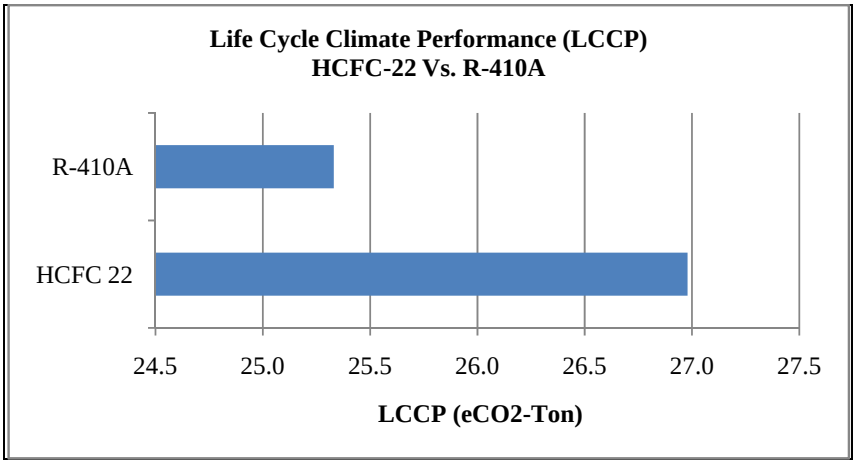
R-410A equipment has been commercially available within the capacity range of 2 kW to 175 kW from major manufacturers for a number of years. It is likely that this refrigerant will be available in the medium to long term. In terms of long term viability, no better alternative exists at present compared to R-410A.
Continuous improvement in better emission control (leak tight and charge reduction) as well as reclaim/recycle/destruction program will mitigate negative GWP argument of R-410A by

reducing direct emission of refrigerant during equipment manufacture, operation and at the equipment disposal.

Global warming implication

The environmental performance of alternative technologies is assessed by calculating life cycle climate performance (LCCP). LCCP is composed of CO_2 emission due to refrigerant manufacturing, direct emission of refrigerant (through leakage during operation and emission at the equipment disposal) and indirect CO_2 emission due to the use of electricity.

LCCP figures (in equivalent CO_2 emission-kg) of representative unitary equipment with R410A alternative technology were examined as a typical case and the results are presented below:



The assumptions made for this examination are as under:

GWP of HCFC 22	100 years	1800
GWP of R-410A	100 years	2100
Cooling capacity of Split Air Conditioner	KW	4
Average charge	Kg	1.28
Assumed product life	Years	10
Assumed leakage rate during manufacturing	%age	2%
Assumed leakage rate during service	%age	2%
Assumed leakage rate during end of life	%age	40%
Average annual usage of product	hours	5040
Annual Load Factor	%age	23.0%
Emission intensity for Grid Connecting P/S Pakistan	CO_2 Kg/ KWh	0.56
Min. Increase in efficiency of R-410A tech. than R-22	%age	4%
Max. Increase in efficiency of R-410A tech. than R-22	%age	15%
Avg. increase in efficiency of R-410A considered for study	%age	7%

5.4 Suitability Review of Alternatives

Considering above review of alternate technologies of HCFC (141b & 22), the following technologies have been adopted for various sectors/sub-sectors after consultation with the enterprises:

Sector/Sub sectors	Adopted Alternative
Refrigeration Sector	
- Domestic Refrigeration PU Foam	Cyclopentane
- Commercial Refrigeration PU Foam	Cyclopentane
- Domestic A/C	R410A
- Commercial A/C	R410A
Foam Sector	
- Rigid Foam	Cyclopentane
- Spray Foam	Water based/(water/CO_2)/Methyl Formate
- Flexible Molded Foam	Water based/(water/CO_2)/Methyl Formate
- Integral Skin Foam	Water based/(water/CO_2)/Methyl Formate

5.5 Servicing Sector Considerations

The number of workshops, scattered all over the country, is estimated to have increased by almost 50% between 2001 and 2009. As a result, the consumption in the servicing sector has been on increase. Around 75% of HCFC 22 and 33% of all HCFCs used in Pakistan are currently consumed by the servicing sector. Two main reasons for this are aging air conditioning units in the country that are more vulnerable to leakage, and new HCFC-22 based air-conditioners (locally manufactured as well as imported mainly from China and Thailand) which, when installed, will scale up the servicing demand of HCFC-22. By and large, this sector requires special attention to ensure sustainable implementation of the HCFC phase out programme.

The RMP for the phase out of CFCs included a number of actions including the training of custom officers and technicians. The other aspects were equipping and updating of the training centers, establishment of monitoring units, recovery/recycling of refrigerants, retrofit and replacement activities in the existing equipment. It is understood that being similar in nature, this program for HCFC phase out shall also include these activities.

Government employees normally get transferred after a certain period. This may be due to the promotion or transfers as per rules of the government. Due to this reason most of the customs officers already trained under RMP program have already been moved to other positions. As such, very few of the officers trained for CFC are still in their position to be effective for this plan. Most of them have either retired or assigned to new positions. It is therefore imperative to introduce fresh training program for custom officers/staff.

As a general practice the technicians attend the problems in the workshops and the system for collection of gas is provided under RMP for CFC. There can be some isolated cases where technicians attend such problems at the customer premises, where gas collection is not practice, however this kind of cases are rare in Pakistan.

Unlike other Article 5 countries, preventive maintenance of appliances is not a common practice in Pakistan. This increases the probability of gas leaks in the appliances. The regular preventative maintenance and repair system can significantly reduce the rate of leakage in the appliances. This shall be addressed while implementing the HPMP for phase out of HCFC.

While addressing requirements and conversion to alternatives in the industry, the Refrigerant Management Plan must continue. This will promote recycle and reuse and with the training

and awareness rising, the consumption of HCFCs in the servicing sector will be considerably reduced. It will also strongly assist in meeting the compliance target as this sector will reduce the consumption of virgin HCFCs by the promotion of recycling and reuse, thus saving environment and meeting compliance.

5.6 Change of technology during implementation

Historically an average conversion project takes around 36 month for its implementation. It is anticipated that during this time, new technologies may evolve. It is therefore recommended strongly to take care of this aspect and if at the time of implementation, some better technology is available in the market, it must be considered for implementation for the projects.

In such case, the project content will be subject to the Executive Committee consideration as per already available decisions.

6. STRATEGY & PLAN FOR IMPLEMENTATION OF HCFC PHASE OUT

6.1 Phase out Strategy

A comprehensive strategy and action plan including a list of potential projects and estimated costs to achieve the required phase out is designed while preparing the HPMP for Pakistan. Through this approach the identified projects shall be implemented in stages. This staged approach is adopted as at present there are a number of non-ODP alternatives that are available for several HCFC uses. These alternatives vary in key respects including available maturity of the technologies, cost effectiveness, energy efficiency and other environmental considerations. This consists of developing both an over arching programmatic review of the entire process and a comprehensive plan to be implemented in number of stages until specific HCFC phase out activities for meeting the initial freeze and 10% reduction step under stage-1.

In term of broad view, a long term strategy that provides an overall direction including list of critical actions has been adopted. The approach is such that it provides sufficient lead time for remaining policy issues to be resolved at Fund and National level. A concrete approach to stage-1 is expected to elaborate and address specifically and comparatively how the freeze & initial HCFC control will be met in 2013 and 2015. This stage is taking into account the most cost effective and sustainable HCFC phase out current technologies as well as considering the potential future options.

After the implementation of investment projects, for example, manufacturing of HCFC based equipment in the refrigeration sector (foam operation) will be stopped. This would be possible only if all the refrigeration industry using HCFC-141b in the foam operation is converted to HC or other ozone friendly technology which is cost effective. It would be appropriate to mention here that for the consistency of the program and for complete phase out in the refrigeration foam operation, consideration of both, new projects as well as the projects that were previously funded from MLF, should be given due attention. However, air-conditioning sector will continue with the use of HCFC based equipment till viable and cost effective alternatives are available in the market. Local air conditioning industry will follow and will have guidance from their Principals (mostly Chinese) and as soon as the changes are brought by the principals these will be followed. The conversion on the commercial air conditioners and chiller manufacturers will be customer driven. These manufacturers are technically strong and as soon as they will be required by the customers to supply non-HCFC based equipment they will do that in order to meet the demand of the market and to remain in the business.

The strategic objectives of this plan is to ensure that the Pakistan's obligation is met in terms of the Montreal Protocol's control measures by reducing HCFC consumption in manufacturing & servicing sectors. The conditions & constraints of this plan in Pakistan are described below:

- The industry & business related to HCFC must be developed in a sustainable manner
- Employment must be kept in all related industries, particularly in small entrepreneurs' that play a major role in the refrigeration servicing sectors. Even more employment may be created as a result of successful implementation of the program.
- The requirement of HCFC refrigerant appropriate for quality servicing sector must be ensured for servicing and maintenance of the existing HCFC based air conditioners during the period until the complete phase out is implemented as schedule.
- Recognizing the period of HCFC phase out in the servicing sector and frequent change out of business in the SME's sectors, an effort shall be made to ensure training of technicians on regular basis.

- Implement legislative framework component that are either not implemented under CFC phase out or required otherwise for the HCFC phase out program.
- Availability of the cost effective, environmental friendly and energy saving alternative technology for environment similar to Pakistan to ensure its acceptance by the enterprises.

6.2 HCFC Consumption Control Target

The present consumption scenario has been projected to year 2040. The freeze and reduction targets have been identified and marked. The staged programs shall ensure meeting the target reductions. This shall identify the yearly requirement of HCFC in the country. Ozone Cell would make legal, institutional and other possible actions to ensure that the demand of HCFC is adequately met and the reduction targets achieved as per table below:

Year	Target Quantity (ODP ton)	Freeze-Reduction Targets
2013	246.6	Freeze Limit
2015	221.9	10% Reduction
2020	160.3	35% Reduction
2025	80.1	67.5% Reduction
2030	6.2	97.5% Reduction
2040	0	100% Reduction

6.3 Action Plan for HCFC Phase out

The action plan foreseen for the HCFC phase out is provided in the table below:

Item	Action		
	2010-2015	2016-2030	2031-2040
Country Program	Update baseline & freeze limit Complete elaboration and commence implementing projects identified under stage-1	Reassess new technologies & solutions and adjust programs, then continue with the subsequent stages (2,3&4) of the agreed plan	Reassess, continue and complete
Legal System	Examine present legal system for ODS management and improve where necessary for HCFC Management. Identify additional regulatory measures for HCFC Management and implement Identify, and modify as seen necessary, legislation/ regulations that may prohibit or restrict specific non-HCFC alternatives	Continue	Continue

Item	Action		
	2010-2015	2016-2030	2031-2040
Exclusive sales and quotas of HCFC	Investigate thoroughly HCFC consumption status and their input channels, monitor and control HCFC sales networks and establish exclusive HCFC sales system Define consumption quotas to users, control the quotas and supplies according to quotas under a licensing system (from 2011)	Continue	Continue
Bans	Ban on new enterprises producing refrigerators, air conditioning equipment and foam material using HCFC Ban on import of products and equipment using or containing HCFC (from 2011)	Ban on import of HCFC and continue ban on import of HCFC products using or consuming HCFC Ban on uncontrolled release of HCFC during servicing.	Continue
Financial Incentives	Assess the existing import tariffs and continue the reduced import tariffs on equipment and materials required for implementation of HCFC phase out projects Assess the existing tax policies on HCFC and implement policies that will promote the use of non-HCFC based products through incentives provided in the form of duty relaxation and higher duties on HCFC based products Revision of SRO 564 (I)/2008 in which customs duties are exempted for the compressors using HCFC gases	Continue	Continue
Investment Control	Ban on investment in building new plants using HCFC Strict control of investments in new, enlarged or technically reformed enterprises consuming HCFC	Continue	Continue
Awareness, education and technical information exchange	Raise awareness on HCFC phase out among key stakeholders: Primary and Secondary Target Audiences. Initiate a study on knowledge,	Continue awareness and education activities. Inform consumers about the premature	Continue

Item	Action		
	2010-2015	2016-2030	2031-2040
	attitude and practices and behavior (KAPB) of the key target audiences to customize information materials to suit their needs. Carry out awareness and education on ozone layer protection through public media, such as newspapers, broadcasting and TV programs. Hold awareness workshops. Produce/ translate and disseminate information materials on HCFC phase out. Participate in trade and industry events to promote the issues among the industry. Engage “multipliers”, including the media, academia, students, NGOs, consumers and general public	obsolescence of refrigerators and refrigerant and air conditioning equipment based on HCFC	
Enforcement	Strengthened trade registry monitoring of HCFC, HCFC blends, and HCFC containing products/ equipment using HS 2012 codes within the general Customs administration Capacity building of customs and other enforcement officials as well as local government officials Compulsory reporting system of registered industrial and commercial importers of HCFCs. Electronically-operated system for issuing and control of quotas and permits for trade of HCFCs, HCFC blends and HCFC containing products/ equipment. Regional and cross-border networking for improved implementation of national licensing systems	Continue	Continue

Item	Action		
	2010-2015	2016-2030	2031-2040
Recycle/ recovery of HCFC	Establish networks and sites for recycle/ recovery and operate them	Continue activity from the previous period	Continue activity from the previous period
Good Practices training	Capacity building of refrigeration technicians in good practices	Continue	Continue
Monitoring	Define and divide responsibilities for supervision and management of technical substitution projects among environmental protection agencies and various sectors and industries and commence monitoring activities Determine the phase out plan, start a reward and punishment strategy Report regularly on the progress of HCFC phase out	Continue	Continue

6.4 Description of Planned Activities

6.4.1 Investment Projects related Activities

a. Activities under Staged Program

Pakistan has adopted a staged approach to phase out HCFC in the manufacturing sector. To achieve the freeze and reduction targets four stages are planned. The activities under these stages shall include:

- Approval of investment projects (individual or umbrella)
- Working arrangement with stakeholders
- Preparation of TORs for respective projects
- Bidding documents preparation/approval & bidding process
- Modification of foaming line, installation (practical work)
- Staff training
- Safety certification
- Project completion report issuance

b. Targets to be met through Stage-1 Projects

Keeping in view the freeze target as well as 10% reduction in 2015, five industries in refrigeration PU foaming sector were identified under Stage-1. These industries included United Refrigeration Industries, Hyderabad, Dawlance, Karachi, HNR Company (Haier), Lahore, Varioline Intercool Pakistan, Lahore and Shadman Electronics, Karachi. The project investment document for stage-1 was submitted to ExCom60. The Ex. Com approved implementation of five investment projects amounting to US$ 4,840,849 to phase out 71.7 ODP tons (651.8 MT).

Based on the present consumption data, and projections, it is desired that by 2015, Pakistan should reduce the consumption by 63.2 ODP tons of HCFC. This stage-1 program is expected to achieve a reduction of 71.7OPD tons of HCFC which shall translate to an effective target achievement. The stage-1 cost is worked out to US$4.84 million. Details of its costs are provided in section 7.2.1

The remaining projects in manufacturing sector have been divided in three (3) other stages (Stage-2 to Stage-4) that shall meet the targeted reductions under the accelerated program.

6.4.2 Servicing Sector related activities

a. Activities under Servicing Sector Program

The Stage-5 program shall achieve its target reduction in the servicing sector. It is envisaged that the activities in this stage shall be undertaken in the year 2011 to ensure 10% target reduction schedule for 2015 in the HCFC accelerated program. The activities in this stage shall include:

- Approval of HCFC RMP
- Working arrangement with stakeholders
- Preparation of TORs for respective projects
- Bidding documents preparation/approval & bidding process
- Legislation
- Customs' Staff training
- Technicians training
- Technical assistance
- Retrofitting (practical work)
- Monitoring
- Project completion report issuance

b. Justification of implementing servicing sectors related activities during 2010-15

For the smooth implementation of investment projects, it is necessary that the policies for the phase out of HCFCs should be formulated and rules and regulations enforced from the beginning. It is therefore imperative that policy formulation, awareness raising, customs training and technicians training under the non-investment components should start from the beginning of the implementation for investment projects under stage-1. This will not only create an enabling environment for phase out in foam sector but assist that the phase out in foam sector is not wiped out by increase in consumption in the other manufacturing sector like RAC that will be addressed post 2015.

The Stage-5 program shall cover the training of technicians, customs capacity building, strengthening of RAC associations, licensing system of the technicians and building capacity of the local governments will continue in this stage. Under this stage and during 2010-2015 sixty (60) custom officer and six hundred (600) workshop technicians shall be trained. NoU will also explore the mechanism for better monitoring and follow up of the trained technicians with refreshers training, etc. It will also explore the possibility of building the capacity of local government in the districts that will effectively follow up with registration of technicians' workshops.

After the approval of HPMP and the implementation of stage-1 investment projects, the strategy would be to provide training and awareness-raising opportunities to the technicians and Customs officers. The training to the technicians will create awareness/understanding about Code of Good Practices in handling HCFCs with added knowledge on their recovery and recycling, which will help them not only reduce the

consumption of virgin gasses by this sector, but will also help in reducing their servicing cost thus getting better profit.

This Program of HPMP, besides implementing the investment projects, will be an added effort in reducing the consumption and uncontrolled emission of HCFCs and will help Pakistan in reducing the consumption of HCFCs in the servicing sector. Registration of the workshops and further regulation on the recovery and recycling would be implemented in the second phase where the servicing sector would be provided with R/R equipment for the recovery and reuse of ODS. The justification of implementing servicing sector from year 2011 is provided in the table below:

Item	2011	2015	Remarks
Recovery	If a country starts in 2011 they can train many technicians on recovery saving a large quantity of Refrigerant of service sector emission, which otherwise they will release in air (approx 60%). Significant part of this amount can be saved by starting training in 2011.	Out of expected consumption in a country during 2011-15, technicians will be able to recycle only 20% of the refrigerant. Rest will be released to the atmosphere which needs to be recovered/reused thus reducing overall consumption of HCFC-22.	During servicing, recovery is not a common practice. Training on recovery of R-22 is critical as yet limited no. of technicians are skilled, rest all are unskilled or do not know the loss to environment. Also they can be provided with Recovery Machines at subsidized rates. Unlike in refrigerators where charge quantity is small, in case of AC nearly 1 kg of gas is present in standard1.5Tr AC. A major portion of this gas can be recycled.
Reclamation	Technicians are not aware that Reclamation of refrigerant is possible. This concept needs to be popularized to maximum number of Technicians.	Few know about Reclamation Centers in many countries, rest do not know & they use the refrigerant like shown in the picture. With this kind of bad practice, the five year span will make almost all air conditioners less energy efficient.	This will get popularized through the training programs that before charging the same R-22, they can get it reclaimed so that energy efficiency of the machine must remain same as specified.
Top-up/ leakage due to poor brazing	Training courses can teach technicians good brazing skills. Technicians are lagging behind on this front. If Brazing joint quality is good it will lead to fewer emissions. This has been a lesson from the CFC phase out. Technicians need good focused training on brazing skills.	If this capacity building starts after 5 years, lot of wastage will be there via leakages.	Future training manuals should focus on building capacity on brazing skills
Good Servicing Practices	As is widely known that in informal sector, a hit & trial methodology is widely adopted which slowly can change via trainings	Technicians in the country will be deprived of this skill up gradation for 5 years. Further the skills learnt during the past few years of CFC phase out will be lost if there is a gap of five years.	New manuals for good service practices need to be developed urgently to focus on HCFCs and blends.
Informal Sector	OEMs technicians are updated by them, but informal technicians are lagging behind without proper knowledge	Another 5 years means again countries will be left behind. Further informal sector needs more work and more efforts over a longer period of time.	

Item	2011	2015	Remarks
Tools & Equipment	In training they are always updated with latest tools & equipment.	Same as above	A list of tools & equipment required for air-conditioning for one training cell needs to be prepared taking into account country situation.
Retrofitting	This is an area where some countries are lagging behind with a 100% = refrigerant as drop in retrofit. This is a negative point to start in 2011.	Cost effective and better solutions of drop in and retrofit may be available in the next five years.	Refrigeration and Air conditioning Institutes will need to charge one AC with R-407c & R-290 as alternate to get hands on experience & then disseminate the experiences to technicians.
Scrap Dealers	Through technicians we can address this issue that when they sell the air conditioner either they must remove the refrigerant or tell the scrap dealer to contact reclamation centre.	This kind of institutional setup is needed to be started now rather than in 2015.	Possible act if we start early.
Regulatory Measures	Technicians can come to know within 2011 about HCFC phase out & other regulatory measures	Late start can create confusion.	
Technical publications	Technical journals like the ones being brought out by China, India, Iran once every quarter or six month can have really good impact on RAC community.	This practice has been started in a few countries and infrastructure is in place. If funding for servicing sector starts in 2015, this will be lost.	

6.4.3 Institutional/Legal Activities:

Government of Pakistan is enforcing rules and regulations laid down under the Pakistan Environment Protection Act 1997. Recently, Pak Environment Protection Agency (Pak EPA) has advertised to the public for their views for the ambient air quality standards. After receiving the comments from the public, the same will be forwarded for approval from the Pakistan Environment Protection Council.

Ozone Cell is already monitoring the import of HCFCs, and all the importers are required to seek permissions to import of HCFCs from the Ministry of Commerce in coordination with the Ozone Cell. A quota system for the import and control of HCFCs will be implemented as soon as the licensing system is finalized. In due process, all commercial and industrial importers of HCFCs are being registered. Also, a new Trade Policy is being implemented to ban the import of HCFC based equipment.

The Ozone Cell shall examine present legal/institutional system for ODS management and improve where necessary for HCFC Management. In this course it shall consult and coordinate with stakeholders including Ministry of Commerce & Trade, Trade Associations, commercial Importers, manufacturers etc. As part of institutional work, the action to be taken by Ozone Cell could include:

- Establish a Help Desk for assistance to stakeholders
- Design and establish Website for guidance of stakeholders, masses and info seekers
- Make institutional arrangement for an easy access to alternative supplies
- Coordinate HCFC plan with climate change, chemical management & energy policies
- Identify additional regulatory measures for HCFC Management and implementation. These measures are provided in detail in the above table for action plan.

- Investigate thoroughly HCFC consumption status and their input channels, monitor and control HCFC sales networks and establish exclusive HCFC sales system

In addition, the regular monitoring and periodic evaluation of Communication Strategy activities is a must. The NOU has a strong track record of awareness-raising and outreach, which will certainly benefit HCFC, related Communication Strategy activities. For monitoring and evaluation of HPMP, the following is proposed:

- NOU will convene an informal working group, comprising of a few key stakeholders that meet occasionally to review and advise the NOU on awareness and outreach activities.
- An external evaluation of Communication Strategy and outreach activities undertaken after activity implementation in 2011 and 2012, which can recommend improvements for 2013 and beyond.

6.4.4 Policy and Enforcement Capacity-building activities

In the initial phases of the HPMP implementation in particular, policy development and enforcement will play a critical role in ensuring the country's compliance with the Montreal Protocol phase out obligations. The upmost urgency and importance among proposed actions under this area of work is enforcement of quota based licensing system. From 2011, consumption quotas to users will be determined and supplies will be controlled according to quotas under a licensing system. A compulsory reporting system of registered industrial and commercial importers of HCFCs will be designed and implemented during Stage 1. For implementation of the licensing system with higher efficiency and accuracy, the HCFC database at Ozone Cell and the HCFC licensing system itself will be switched to an electronically-operated system. Also, the trade registry at the general administration of the Customs should be strengthened for closer monitoring and control of HCFC, HCFC blends, and HCFC containing products/ equipment by introducing HS 2012 codes of the World Customs Organization (WCO) and any necessary national sub-codes. Better and more frequent information exchange between Ozone Cell and its Customs counterpart is highly desirable as part of this work.

To further limit supply and demand of HCFCs, the feasibility of using fiscal measures will be investigated (e.g. higher duties on the import of non-HCFC based equipment and tax relaxation for the import of alternatives of HCFCs). Also, as part of this component, legislation/ regulations that may have prohibited or restricted non-HCFC alternatives will be identified and modified as seen possible and feasible.

As to training for Customs officers and other enforcement partners, a series of training courses and seminars will be carried out. For the Customs, efforts will be made to institutionalize training on HCFC trade control as part of the Customs core curriculum, using a well established network of training centers in the country, including the ones in Lahore, Karachi and Islamabad. A special customs training to address the illegal re-entry of HCFCs into Pakistan – Afghanistan, through Afghan Transit Trade, will be delivered also. Preparation and distribution of training/informative material in Urdu and some of other 9 official languages of Pakistan will be one of key activities in this area.

Pakistan also will take more active part in cross-border and international control mechanisms that would enhance the implementation of national licensing systems. Pakistan has boundaries with its neighbors Iran, India, Afghanistan and China. There is immense need of cross border cooperation between the neighboring countries, especially with Afghanistan where there are possible ways of illegal transportation of imported goods. This irregularity can be minimized by close co-operation with the customs officers of both the countries and frequent meetings and knowledge sharing on the HCFCs issues between the ozone cells/NOUs of both the countries. The same cooperation will also be required with the other neighboring countries –

Iran, India and China. The community of "Informal Informed Prior Consent (iPIC)" is another useful platform for mutual help. During the phase out of CFCs, iPIC played an effective role in the control of illegal import. It is worth mentioning that illegal import of CFCs was prevented by the timely intervention of iPIC and their query to the government has helped Pakistan in controlling illegal import. This has also prevented others not to follow the illegal means of import.

Through Afghan Transit Trade the goods are imported for Afghanistan and transported from Karachi port. There is sufficient evidence that the imported goods which are for Afghanistan do return back to Pakistan. Similarly, HCFCs imported for Afghanistan may be sold in Pakistani market. Strict monitoring and control will be required by the customs officers for the control of illegal re-entering of HCFCs into Pakistan.

Among partners for the implementation of Policy/ Enforcement Capacity-building activities are: Pakistan Customs; line ministries, such as the Ministry of Commerce, the Ministry of Finance and Revenue/ Federal Board of Revenue; environmental officers in Provincial Governments and City Districts, and non-traditional enforcement partners (e.g. the military and members of the judiciary system [e.g. judges and prosecutors]).

The Policy and Enforcement Capacity-building activities as part of HPMP is described in Annex-3.

6.4.5 **Awareness Activities**

Since HCFCs are used in a wide range of application, and there is limited options as non-HCFC technology or low ODP alternatives to HCFCs, phasing out of HCFCs will require firm commitment from industries, importers, and the general public, etc.

The Communication and Awareness Strategy as part of HPMP is also described in Annex-3. The strategy draws from the Strategic Action Plan for Information, Education and Communication (IEC) Activities for Asia and the Pacific Region, 2008 – 2010, adopted by the UNEP OzonAction Programme as a framework for IEC activity implementation by NOUs and the OzonAction Communication Strategy for Global Compliance with the Montreal Protocol, 2010.

The country has recognized the significance of IEC activities when it embarked upon the Country Programme (CP) incorporating the national strategy and action plan for phasing out ODS in accordance with the Montreal Protocol and its amendments. Among the key learning from CFC Phase out is how the IEC activities targeted at end-user industry and general consumers helped in the faster adoption of non-ODS technologies. These activities have been led by the Ozone Cell, Ministry of Environment (National Ozone Unit of Pakistan) which has the overall responsibility for the implementation of the Montreal Protocol in Pakistan.

This Communication and Awareness Strategy will guide the communication process in Pakistan's effort to freeze its level of HCFC by 2013 with the aim of total phase-out by 2040. With a focus on consumer outreach, this campaign aims to use the public's voice to influence key industry players and decision makers. There is also an effort to influence commercial consumers, such as real estate developers, to exercise their choice of HCFC-free appliances as well materials.

The strategy mainly targets public and commercial consumer groups through a communication mix of traditional and new media, public activities, awareness workshops, trade and industry events and delivery of results to industry leaders.

Awareness activities will take place throughout the Stage-5. This plan initially engages the primary target groups through tightly focused activities and then gradually expands activities to include the second tier audience group. A mid-term evaluation of activities within this 5-year time frame will determine Communication Strategy activities in the long term: 2015 – onwards, focusing on further reduction until 2040 when HCFCs are completely phased-out.

6.4.6 Proposed Plan to Eliminate the HCFC Bank

Details about servicing sector have been provided in section 3.3.6, including HCFC bank size and other details. The plans to eliminate this estimated bank through stage-5 program are shown below:

Year	Estimated Bank before implementation		Annual need for Servicing		MT Phase out through			Estimated Bank after implementation		Total Import requirement	
	MT	ODPT	MT	ODPT	Re-use	Destruction	Total	MT	ODPT	MT	ODPT
2009	29,361	1,614.9	1,456	80.1	-	-	-	30,817	1,694.9	1,456	80.1
2010	30,817	1,694.9	1,528	84.0	-	-	-	32,345	1,779.0	1,528	84.0
2011	32,345	1,779.0	1,603	88.2	200	-	200	33,748	1,856.1	1,403	77.2
2012	33,748	1,856.1	1,673	92.0	300	-	300	35,121	1,931.6	1,373	75.5
2013	35,121	1,931.6	1,741	95.8	400		400	36,462	2,005.4	1,341	73.8
2014	36,462	2,005.4	1,807	99.4	500		500	37,769	2,077.3	1,307	71.9
2015	37,769	2,077.3	1,872	103.0	600	-	600	39,042	2,147.3	1,272	70.0
2016	39,042	2,147.3	1,935	106.4	700	-	700	40,277	2,215.2	1,235	67.9
2017	40,277	2,215.2	1,997	109.8	800	-	800	41,474	2,281.1	1,197	65.8
2018	41,474	2,281.1	2,056	113.1	900	-	900	42,630	2,344.6	1,156	63.6
2019	42,630	2,344.6	2,113	116.2	1,000	-	1,000	43,743	2,405.9	1,113	61.2
2020	43,743	2,405.9	2,168	119.3	1,100	-	1,100	44,811	2,464.6	1,068	58.8
2021	44,811	2,464.6	2,221	122.2	1,200	900	2,100	44,933	2,471.3	1,021	56.2
2022	44,933	2,471.3	2,227	122.5	1,300	1,050	2,350	44,810	2,464.5	927	51.0
2023	44,810	2,464.5	2,221	122.2	1,400	1,300	2,700	44,331	2,438.2	821	45.2
2024	44,331	2,438.2	2,198	120.9	1,500	1,500	3,000	43,529	2,394.1	698	38.4
2025	43,529	2,394.1	2,158	118.7	1,550	1,700	3,250	42,437	2,334.0	608	33.4
2026	42,437	2,334.0	2,104	115.7	1,600	2,000	3,600	40,940	2,251.7	504	27.7
2027	40,940	2,251.7	2,029	111.6	1,650	2,200	3,850	39,120	2,151.6	379	20.9
2028	39,120	2,151.6	1,939	106.7	1,700	2,400	4,100	36,959	2,032.8	239	13.2
2029	36,959	2,032.8	1,832	100.8	1,700	2,500	4,200	34,591	1,902.5	132	7.3
2030	34,591	1,902.5	1,715	94.3	1,700	2,600	4,300	32,006	1,760.3	110	6.1
2031	32,006	1,760.3	1,587	87.3	1,700	2,600	4,300	29,293	1,611.1	100	5.5
2032	29,293	1,611.1	1,452	79.9	1,700	2,650	4,350	26,395	1,451.7	90	5.0
2033	26,395	1,451.7	1,308	72.0	1,700	2,700	4,400	23,303	1,281.7	80	4.4

Year	Estimated Bank before implementation		Annual need for Servicing		MT Phase out through			Estimated Bank after implementation		Total Import requirement	
	MT	ODPT	MT	ODPT	Re-use	Destruction	Total	MT	ODPT	MT	ODPT
2034	23,303	1,281.7	1,155	63.5	1,700	2,800	4,500	19,958	1,097.7	70	3.9
2035	19,958	1,097.7	989	54.4	1,700	2,900	4,600	16,348	899.1	60	3.3
2036	16,348	899.1	810	44.6	1,700	2,900	4,600	12,558	690.7	50	2.8
2037	12,558	690.7	623	34.2	1,700	2,900	4,600	8,581	471.9	40	2.2
2038	8,581	471.9	425	23.4	1,700	2,900	4,600	4,406	242.3	30	1.7
2039	4,406	242.3	218	12.0	1,700	2,924	4,624	0	0.0	20	1.1
2040	0	0.0	0	0.0	0	0	0	-	-	-	-

6.5 Time Table for Implementation

The Overall Implementation Schedule is provided as under:

Stage	Years																												
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Stage-1																															
Stage-2																															
Stage-3																															
Stage-4																															
Stage-5																															

Stage-1 shall include Five Projects in Commercial & Domestic Refrigeration Foam Sector and planned to be completed during the years 2010-2012. The expected reduction as a result of this stage shall be 71.7 ODP tons (2009 base). Implementation plan for this stage is as under:

Activities	Years					
	2010		2011		2012	
Approval						
Working arrangement						
Preparation of TORs						
Bidding						
Modification of foaming line, installation						
Staff training						
Safety certificate						
Project completion						

Stage-2 shall include 2 Projects in Commercial & Domestic Refrigeration Foam Sector & 19 Projects in Rigid Polyurethane Foam Sector and planned to be completed during the years 2017-2019. The expected reduction as a result of this stage shall be 48.8ODP tons (2009 base). Implementation plan for this stage is as under:

Activities	Years					
	2017		2018		2019	
Approval						
Working arrangement						
Preparation of TORs						
Bidding						
Modification of foaming line, installation						
Staff training						
Safety certificate						
Project completion						

Stage-3 shall include 2 Projects in Spray Foam, 3 in Flexible & 1 in integral Skin Foam Sector and planned to be completed during the years 2022-2024. The expected reduction as a result of this stage shall be 13.6 ODP tons (2009 base). Implementation plan for this stage is as under:

Activities	Years					
	2022		2023		2024	
Approval						
Working arrangement						
Preparation of TORs						
Bidding						
Modification of foaming line, installation						
Staff training						
Safety certificate						
Project completion						

Stage-4 shall include 9 Projects in Commercial & 10 Projects in Domestic Air-conditioning Sector and planned to be completed during the years 2026-2028. The expected reduction as a result of this stage shall be 25.2 ODP tons (2009 base). Implementation plan for this stage is as under:

Activities	Years					
	2026		2027		2028	
Approval						
Working arrangement						
Preparation of TORs						
Bidding						
Modification of line, installation						
Staff training						
Safety certificate						
Project completion						

Stage-5 shall include the Servicing Sector and planned to be continued during the years 2011-2040. The expected reduction as a result of this stage shall be 80.1ODP tons (2009 base).). Implementation plan for this stage is as under:

Activities	Years																														
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Approval																														
Working arrangement																														
Preparation of TORs																														
Bidding																														
Legislation																														
Custom training																														
Technicians training																														
Technical assistance																														
Monitoring																														
Project completion																														

6.6 Stakeholders Identification

In order to formulate a smooth conversion strategy for the accelerated phase out of HCFCs, Ozone Cell has provided information to all the stakeholders such as refrigeration and foam producers, importers (commercial & industrial), air conditioner manufacturers (domestic & commercial), chiller manufacturers and service sector through brochures and advertisement in newspapers.

Ozone cell also organized a workshop in Karachi in June last year where all the stakeholders including officials from Ministry of Commerce and Customs were invited. Second workshop is being planned in Lahore. Ozone cell has also arranged a separate consultative meeting with the commercial importers related to the accelerated HCFC phase out and the government's future action plan including quota system that would be imposed for the import of gradual phase out of HCFCs.

6.7 Climate Co-benefits as per MOP XIX/6 (to be co-financed)

The government is well aware of the environmental issues related to climate change and would prefer to implement the phase out program and the conversion technologies which do not affect the climate. For the implementation of the investment projects, GoP will ensure that the options available for the investment projects are in line with the MP and which will not only help in the protection of ozone layer but will also help in reducing the global warming affects i.e. with zero ODP and low GWP.

Pakistan has initiated a Standards and Labeling Programme (SLP) recently and has included compact fluorescent light bulb (CFLs) into it as of now. The programme needs to be deepened as well as broadened to synergize the twin objectives of ODS reduction as well as enhanced energy efficiency. With co-financing to be sought, a strengthened SLP (SSLP) project will be implemented in order to overcome the barriers associated with energy efficient products. With an associated outreach and awareness programme, SSLP could also stimulate market transformation in favour of these equipments. This strategy could also integrate the ODS phase out objectives as they too have the effect of increasing the price of the equipments.

SLP could be a good instrument to ensure that all new products manufactured or imported in Pakistan conform to energy efficiency and low ODP standards. The comparative labels, with proper outreach and information dissemination could leverage the consumer demand to ensure the transformation of the market.

The Framework for Efficient and Low HCFC Economic Development (FELHED) will be the second pillar of ozone-climate linkage in the present HPMP. FELHED will include promotion of market based accelerated replacement of almost 18 million AC units in the country and other energy and HCFC using equipments.

Details of these energy efficiency initiatives as well as associated capacity-building and financial needs are shown in Annex-4.

7. COST CALCULATIONS

7.1 HCFC Users Profiles in Manufacturing Sectors

Users identified during the UNEP survey of manufacturers using HCFC, were studied. The profile of these users along with sector involved, year of establishment, capacity, production level, ODS consumption level, baseline equipment etc. is provided in Annex-5.

7.2 Non Investment Activities and Investment activities in the Refrigeration servicing sector

The cost framework for the non-investment activities as well as the investment activities in the refrigeration servicing has calculated for the whole implementation period of HPMP based on the proposed activities following the rules and decisions set by the ExCom. The details are provided under section 7.3.5.

7.3 Staged Program

Based on the provisions of UNEP/OzL.Pro/ExCom/54/53 PART I, a staged approach have been adopted. Keeping in view the freeze target as well as 10% reduction in 2015, five industries in refrigeration PU foaming sector were identified under Stage-I. These industries included United Refrigeration Industries, Hyderabad, Dawlance, Karachi, HNR Company (Haier), Lahore, Varioline Intercool Pakistan, Lahore and Shadman Electronics, Karachi. The project investment document for stage-I was submitted to ExCom60. The remaining projects have been divided in four other stages that shall meet the targeted reductions under the accelerated program. The detail of each stage is given below:

7.3.1 Stage-1 Projects in Manufacturing Sector

The five industries were considered under this stage. The selection of alternate technology was based on their cost effectiveness, sustainability, environmental impact including on climate change and energy efficiency. The annual production profile and material consumption during 2006-09 is provided below:

Sr. #	Name of Industry	Annual Production			
		2006	2007	2008	2009
1	United Refrigeration Industries	321,787	342,857	345,484	373,401
2	Dawlance, Karachi	185,627	233,823	248,696	238,949
3	HNR Company (Haier), Lahore	52,382	65,074	73,923	74,846
4	Varioline Intercool Pakistan, Lahore	29,131	43,341	64,838	78,890
5	Shadman Electronics, Karachi	19,540	23,270	28,590	30,832

The annual production includes the number of fridges, freezers, visi coolers of various models & sizes.

Sr. #	Name of Industry	Annual Consumption of PU (M Ton)			
		2006	2007	2008	2009
1	United Refrigeration Industries	2,611	2,766	2,787	2,982
2	Dawlance, Karachi	1,304	1,594	2,029	2,059

Sr. #	Name of Industry	Annual Consumption of PU (M Ton)			
		2006	2007	2008	2009
3	HNR Company (Haier), Lahore	415	537	665	707
4	Varioline Intercool Pakistan, Lahore	149	185	328	482
5	Shadman Electronics, Karachi	234	278	335	360

The PU material includes Polyol and isocyanate

Sr. #	Name of Industry	Annual Consumption of 141b (M Ton)			
		2006	2007	2008	2009
1	United Refrigeration Industries	258.2	273.5	275.7	294.9
2	Dawlance, Karachi	129.0	157.7	200.6	203.7
3	HNR Company (Haier), Lahore	41.0	53.1	60.9	69.9
4	Varioline Intercool Pakistan, Lahore	14.7	18.3	32.5	47.7
5	Shadman Electronics, Karachi	23.1	27.5	33.2	35.6

The alternative technologies considered in Stage-1 projects were cyclopentane and 245fa.This stage is planned to be implemented before December 31, 2012 to achieve the freeze limit.

i. Cyclopentane

Based on the cyclopentane as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below:

Sr. #	Name of Industry	HCFC to be phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	United Refrigeration Industries	294.9	1,464,100	-1,607	1,462,493
2	Dawlance, Karachi	203.7	1,282,600	-1,110	1,281,490
3	HNR Company (Haier), Lahore	69.9	757,900	-381	757,519
4	Varioline Intercool Pakistan, Lahore	47.7	825,000	-260	824,740
5	Shadman Electronics, Karachi	35.6	514,800	-194	514,606
Total of above cost			4,844,400	-3,551	4,840,848
Cost Effectiveness US$/ Metric Kg					7.43

The detail of ICC and IOC for each of the companies covered under stage-1 is provided in Annex-6A and 6B respectively. Refer Annex-5 for baseline equipment for stage 1 companies.

While making the calculation for IOC, the following cost permitted under UNEP/OzL.Pro/ExCom/55/47 Annex III Appendix I are not included:

- Incremental maintenance of 5% of net incremental investment
- Incremental insurance of 0.5% of net incremental investment
- Additional energy cost associated with extra power of dispenser, pre-mixer and ventilation

Cyclopentane alternate technology shall bring a net reduction of 454,995 M. Ton of CO_2 per year in Stage-1 as shown below:

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
United Refrigeration Industries, Hyderabad	HCFC 141b	713	294.94	210,290
Dawlance, Karachi	HCFC 141b	713	203.67	145,217
HNR Company (Haier), Lahore	HCFC 141b	713	69.87	49,817
Varioline Intercool Pakistan, Lahore	HCFC 141b	713	47.70	34,010
Shadman Electronics, Karachi	HCFC 141b	713	35.61	25,393
Total CO_2 emission in M tonnes			651.79	464,727
After Conversion				
United Refrigeration Industries, Hyderabad	Cyclo-pentane	25	176.96	4,424
Dawlance, Karachi	Cyclo-pentane	25	122.20	3,055
HNR Company (Haier), Lahore	Cyclo-pentane	25	41.92	1,048
Varioline Intercool Pakistan, Lahore	Cyclo-pentane	25	28.62	716
Shadman Electronics, Karachi	Cyclo-pentane	25	21.37	534
Total CO_2 emission in M tonnes			391.07	9,777
Net Impact				-454,950

ii. HFC 245fa

Based on the HFC -245a as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below:

Sr. #	Name of Industry	HCFC to be phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	United Refrigeration Industries,	294.9	115,500	5,866,021	5,981,521
2	Dawlance, Karachi	203.7	99,000	4,050,796	4,149,796
3	HNR Company (Haier), Lahore	69.9	88,000	1,389,651	1,477,651

Sr. #	Name of Industry	HCFC to be phased out M ton	Estimated cost US$		
			ICC	IOC	Total
4	Varioline Intercool Pakistan, Lahore	47.7	88,000	948,712	1,036,712
5	Shadman Electronics, Karachi	35.6	88,000	708,323	796,323
Total of above cost			478,500	12,963,502	13,442,002
Cost Effectiveness US$/ Metric Kg					20.62

HFC 245fa alternate technology shall add 303,963 M. Ton of CO_2 to global warming per year

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
United Refrigeration Industries, Hyderabad	HCFC 141b	713	294.94	210,290
Dawlance, Karachi	HCFC 141b	713	203.67	145,217
HNR Company (Haier), Lahore	HCFC 141b	713	69.87	49,817
Varioline Intercool Pakistan, Lahore	HCFC 141b	713	47.70	34,010
Shadman Electronics, Karachi	HCFC 141b	713	35.61	25,393
Total CO_2 emission in M tonnes			651.79	464,727
After Conversion				
United Refrigeration Industries, Hyderabad	HFC 245fa	1030	337.70	347,834
Dawlance, Karachi	HFC 245fa	1030	233.20	240,198
HNR Company (Haier), Lahore	HFC 245fa	1030	80.00	82,401
Varioline Intercool Pakistan, Lahore	HFC 245fa	1030	54.62	56,255
Shadman Electronics, Karachi	HFC 245fa	1030	40.78	42,001
Total CO_2 emission in M tonnes			746.30	768,690
Net Impact				303,963

7.3.2 Stage-2 Projects in Manufacturing Sector

Twenty one (21) industries and some other small entrepreneurs were included in this stage. One of these is involved in PU rigid foam in domestic refrigeration, one in PU rigid foam in commercial refrigeration, nineteen (19) remaining are in Rigid Polyurethane. The selection of alternate technology was once again based on their cost effectiveness, sustainability, environmental impact including on climate change and energy efficiency. The alternative technologies considered in Stage-2 projects were cyclo pentane, water based and 245fa.This stage is planned to be implemented before December 31, 2019 to achieve the target reduction in HCFC consumption for year 2020. Currently cyclo pentane being a preferred option and since Pakistan has previous experience in it, is being adopted.

i. Cyclo pentane

Based on the cyclo pentane as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below:

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	Cool Industries- Domestic Refrigeration	106.0	687,500	63,888	751,388
2	Mumtaz Engineers- Commercial Refrigeration	8.0	302,500	33,179	335,679
3	Asif Zubair & Co.- Rigid Polyurethane	40.0	253,000	28,990	281,990
4	Tropical Plastic - Rigid Polyurethane	15.0	253,000	29,125	282,125
5	Zulquarnain Corp.- Rigid Polyurethane	12.5	198,000	24,676	222,676
6	Delight Plastic - Rigid Polyurethane	12.0	198,000	24,679	222,679
7	Mehran Plastic Ind.- Rigid Polyurethane	6.0	198,000	24,711	222,711
8	Arm Bros - Rigid Polyurethane	6.8	198,000	24,707	222,707
9	Decent Plastic - Rigid Polyurethane	1.0	198,000	24,738	222,738
10	Pifcom - Rigid Polyurethane	3.0	198,000	24,727	222,727
11	Plasticrafter - Rigid Polyurethane	10.0	198,000	24,690	222,690
12	Shoaibee Ind. - Rigid Polyurethane	96.0	253,000	28,688	281,688
13	Pakistan Plastic Ind. - Rigid Polyurethane	12.5	198,000	24,676	222,676
14	Unique Plastic - Rigid Polyurethane	5.0	198,000	24,717	222,717
15	Thermocraft Engg. - Rigid Polyurethane	4	198,000	24,722	222,722
16	ANZ Insutech Enterprises- Rigid Polyurethane	2.5	198,000	24,730	222,730
17	Kold Kraft- Rigid Polyurethane	11.0	198,000	24,684	222,684
18	Pakistan Insulation- Rigid Polyurethane	45.0	253,000	28,963	281,963
19	PAECO- Rigid Polyurethane	15.0	209,000	25,555	234,555
20	Islamuddin & Sons- Rigid Polyurethane	2.0	198,000	24,733	222,733
21	Pak Motors- Rigid Polyurethane	6.0	198,000	24,711	222,711
22	Small Entrepreneurs unidentified- Rigid Polyurethane	24	412,500	42,018	454,518
Total of above cost			5,395,500	626,309	6,021,809
Cost Effectiveness US$/ Metric Kg					13.58

The detail of ICC and IOC for each of the companies covered under stage-2 for this technology is provided in Annex-7A & 7B respectively.

While making the calculation for IOC, the following cost permitted under UNEP/OzL.Pro/ExCom/55/47 Annex III Appendix I were included

- Incremental maintenance of 5% of net incremental investment
- Incremental insurance of 0.5% of net incremental investment
- Additional energy cost associated with extra power of dispenser, pre-mixer and ventilation

Cyclo pentane alternate technology shall bring a net reduction of 302,014 M. Ton of CO_2 per year in Stage-2

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
Cool Industries- Domestic Refrigeration	HCFC 141b	713	106.00	75,578
Mumtaz Engineers- Commercial Refrigeration	HCFC 141b	713	8.00	5,704
Asif Zubair & Co.- Rigid Polyurethane	HCFC 141b	713	40.00	28,520
Tropical Plastic - Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Zulquarnain Corp.- Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Delight Plastic - Rigid Polyurethane	HCFC 141b	713	12.00	8,556
Mehran Plastic Ind.- Rigid Polyurethane	HCFC 141b	713	6.00	4,278
Arm Bros - Rigid Polyurethane	HCFC 141b	713	6.80	4,848
Decent Plastic - Rigid Polyurethane	HCFC 141b	713	1.00	713
Pifcom - Rigid Polyurethane	HCFC 141b	713	3.00	2,139
Plasticrafter - Rigid Polyurethane	HCFC 141b	713	10.00	7,130
Shoaibee Ind. - Rigid Polyurethane	HCFC 141b	713	96.00	68,448
Pakistan Plastic Ind. - Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Unique Plastic - Rigid Polyurethane	HCFC 141b	713	5.00	3,565
Thermocraft Engg. - Rigid Polyurethane	HCFC 141b	713	4.00	2,852
ANZ Insutech Enterprises- Rigid Polyurethane	HCFC 141b	713	2.50	1,783
Kold Kraft- Rigid Polyurethane	HCFC 141b	713	11.00	7,843
Pakistan Insulation- Rigid Polyurethane	HCFC 141b	713	45.00	32,085
PAECO- Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Islamuddin & Sons- Rigid Polyurethane	HCFC 141b	713	2.00	1,426
Pak Motors- Rigid Polyurethane	HCFC 141b	713	6.00	4,278

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
SMEs unidentified- Rigid Polyurethane	HCFC 141b	713	24.00	17,112
Total CO_2 emission in M tonnes			443.30	316,073
After Conversion				
Cool Industries- Domestic Refrigeration	Cyclo-pentane	25	63.60	1,590
Mumtaz Engineers- Commercial Refrigeration	Cyclo-pentane	25	4.80	120
Asif Zubair & Co.- Rigid Polyurethane	Cyclo-pentane	25	60.00	1,500
Tropical Plastic - Rigid Polyurethane	Cyclo-pentane	25	22.50	563
Zulquarnain Corp.- Rigid Polyurethane	Cyclo-pentane	25	18.75	469
Delight Plastic - Rigid Polyurethane	Cyclo-pentane	25	18.00	450
Mehran Plastic Ind.- Rigid Polyurethane	Cyclo-pentane	25	9.00	225
Arm Bros - Rigid Polyurethane	Cyclo-pentane	25	10.20	255
Decent Plastic - Rigid Polyurethane	Cyclo-pentane	25	1.50	38
Pifcom - Rigid Polyurethane	Cyclo-pentane	25	4.50	113
Plasticrafter - Rigid Polyurethane	Cyclo-pentane	25	15.00	375
Shoaibee Ind. - Rigid Polyurethane	Cyclo-pentane	25	144.00	3,600
Pakistan Plastic Ind. - Rigid Polyurethane	Cyclo-pentane	25	18.75	469
Unique Plastic - Rigid Polyurethane	Cyclo-pentane	25	7.50	188
Thermocraft Engg. - Rigid Polyurethane	Cyclo-pentane	25	6.00	150
ANZ Insutech Enterprises- Rigid Polyurethane	Cyclo-pentane	25	3.75	94
Kold Kraft- Rigid Polyurethane	Cyclo-pentane	25	16.50	413
Pakistan Insulation- Rigid Polyurethane	Cyclo-pentane	25	67.50	1,688
PAECO- Rigid Polyurethane	Cyclo-pentane	25	22.50	563
Islamuddin & Sons- Rigid Polyurethane	Cyclo-pentane	25	3.00	75
Pak Motors- Rigid Polyurethane	Cyclo-pentane	25	9.00	225
SMEs unidentified- Rigid Polyurethane	Cyclo-pentane	25	36.00	900
Total CO_2 emission in M tonnes			562.35	14,059
Net Impact				-302,014

ii. Water Based

Based on the Water Base system as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below:

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	Cool Industries- Domestic Refrigeration	106.0	687,500	63,888	751,388
2	Mumtaz Engineers- Commercial Refrigeration	8.0	302,500	33,179	335,679
3	Asif Zubair & Co.- Rigid Polyurethane	40.0	60,500	139,789	200,289
4	Tropical Plastic - Rigid Polyurethane	15.0	60,500	52,421	112,921
5	Zulquarnain Corp.- Rigid Polyurethane	12.5	27,500	43,685	71,185
6	Delight Plastic - Rigid Polyurethane	12.0	27,500	41,937	69,437
7	Mehran Plastic Ind.- Rigid Polyurethane	6.0	27,500	20,969	48,469
8	Arm Bros - Rigid Polyurethane	6.8	27,500	23,765	51,265
9	Decent Plastic - Rigid Polyurethane	1.0	27,500	3,496	30,996
10	Pifcom - Rigid Polyurethane	3.0	27,500	10,485	37,985
11	Plasticrafter - Rigid Polyurethane	10.0	27,500	34,948	62,448
12	Shoaibee Ind. - Rigid Polyurethane	96.0	60,500	335,492	395,992
13	Pakistan Plastic Ind. - Rigid Polyurethane	12.5	27,500	43,685	71,185
14	Unique Plastic - Rigid Polyurethane	5.0	27,500	17,474	44,974
15	Thermocraft Engg. - Rigid Polyurethane	4	27,500	13,980	41,480
16	ANZ Insutech Enterprises- Rigid Polyurethane	2.5	27,500	8,738	36,238
17	Kold Kraft- Rigid Polyurethane	11.0	27,500	38,443	65,943
18	Pakistan Insulation- Rigid Polyurethane	45.0	60,500	157,262	217,762
19	PAECO- Rigid Polyurethane	15.0	60,500	52,421	112,921
20	Islamuddin & Sons- Rigid Polyurethane	2.0	27,500	6,990	34,490
21	Pak Motors - Rigid Polyurethane	6.0	27,500	20,969	48,469
22	Small Entrepreneurs unidentified- Rigid Polyurethane	24	330,000	83,874	413,874
Total of above cost			2,007,500	1,247,891	3,255,391
Cost Effectiveness US$/ Metric Kg					7.34

Water based alternate technology shall bring a net reduction of 313,869 M. Ton of CO_2 per year in Stage-2.

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
Cool Industries- Domestic Refrigeration	HCFC 141b	713	106.00	75,578
Mumtaz Engineers- Commercial Refrigeration	HCFC 141b	713	8.00	5,704
Asif Zubair & Co.- Rigid Polyurethane	HCFC 141b	713	40.00	28,520
Tropical Plastic - Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Zulquarnain Corp.- Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Delight Plastic - Rigid Polyurethane	HCFC 141b	713	12.00	8,556
Mehran Plastic Ind.- Rigid Polyurethane	HCFC 141b	713	6.00	4,278
Arm Bros - Rigid Polyurethane	HCFC 141b	713	6.80	4,848
Decent Plastic - Rigid Polyurethane	HCFC 141b	713	1.00	713
Pifcom - Rigid Polyurethane	HCFC 141b	713	3.00	2,139
Plasticrafter - Rigid Polyurethane	HCFC 141b	713	10.00	7,130
Shoaibee Ind. - Rigid Polyurethane	HCFC 141b	713	96.00	68,448
Pakistan Plastic Ind. - Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Unique Plastic - Rigid Polyurethane	HCFC 141b	713	5.00	3,565
Thermocraft Engg. - Rigid Polyurethane	HCFC 141b	713	4.00	2,852
ANZ Insutech Enterprises- Rigid Polyurethane	HCFC 141b	713	2.50	1,783
Kold Kraft- Rigid Polyurethane	HCFC 141b	713	11.00	7,843
Pakistan Insulation- Rigid Polyurethane	HCFC 141b	713	45.00	32,085
PAECO- Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Islamuddin & Sons- Rigid Polyurethane	HCFC 141b	713	2.00	1,426
Pak Motors - Rigid Polyurethane	HCFC 141b	713	6.00	4,278
SMEs unidentified- Rigid Polyurethane	HCFC 141b	713	24.00	17,112
Total CO_2 emission in M tonnes			443.30	316,073
After Conversion				
Cool Industries- Domestic Refrigeration	Cyclo-pentane	25	63.60	1,590
Mumtaz Engineers- Commercial Refrigeration	Cyclo-pentane	25	4.80	120
Asif Zubair & Co.- Rigid Polyurethane	Water based	1	60.00	60
Tropical Plastic - Rigid Polyurethane	Water based	1	22.50	23

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Zulquarnain Corp.- Rigid Polyurethane	Water based	1	18.75	19
Delight Plastic - Rigid Polyurethane	Water based	1	18.00	18
Mehran Plastic Ind.- Rigid Polyurethane	Water based	1	9.00	9
Arm Bros - Rigid Polyurethane	Water based	1	10.20	10
Decent Plastic - Rigid Polyurethane	Water based	1	1.50	2
Pifcom - Rigid Polyurethane	Water based	1	4.50	5
Plasticrafter - Rigid Polyurethane	Water based	1	15.00	15
Shoaibee Ind. - Rigid Polyurethane	Water based	1	144.00	144
Pakistan Plastic Ind. - Rigid Polyurethane	Water based	1	18.75	19
Unique Plastic - Rigid Polyurethane	Water based	1	7.50	8
Thermocraft Engg. - Rigid Polyurethane	Water based	1	6.00	6
ANZ Insutech Enterprises- Rigid Polyurethane	Water based	1	3.75	4
Kold Kraft- Rigid Polyurethane	Water based	1	16.50	17
Pakistan Insulation- Rigid Polyurethane	Water based	1	67.50	68
PAECO- Rigid Polyurethane	Water based	1	22.50	23
Islamuddin & Sons- Rigid Polyurethane	Water based	1	3.00	3
Pak Motors - Rigid Polyurethane	Water based	1	9.00	9
SMEs unidentified- Rigid Polyurethane	Water based	1	36.00	36
Total CO_2 emission in M tonnes			562.35	2,204
Net Impact				-313,869

iii. HFC 245fa

Based on the HFC -245a as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below for Stage-2:

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	Cool Industries- Domestic Refrigeration	106.0	687,500	63,888	751,388
2	Mumtaz Engineers- Commercial Refrigeration	8.0	302,500	33,179	335,679
3	Asif Zubair & Co.- Rigid Polyurethane	40.0	66,000	788,565	854,565
4	Tropical Plastic - Rigid Polyurethane	15.0	66,000	295,712	361,712
5	Zulquarnain Corp.- Rigid Polyurethane	12.5	33,000	246,427	279,427
6	Delight Plastic - Rigid Polyurethane	12.0	33,000	236,570	269,570

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
7	Mehran Plastic Ind.- Rigid Polyurethane	6.0	33,000	118,286	151,286
8	Arm Bros - Rigid Polyurethane	6.8	33,000	134,057	167,057
9	Decent Plastic - Rigid Polyurethane	1.0	33,000	19,715	52,715
10	Pifcom - Rigid Polyurethane	3.0	33,000	59,143	92,143
11	Plasticrafter - Rigid Polyurethane	10.0	33,000	197,142	230,142
12	Shoaibee Ind. - Rigid Polyurethane	96.0	66,000	1,892,553	1,958,553
13	Pakistan Plastic Ind. - Rigid Polyurethane	12.5	33,000	246,427	279,427
14	Unique Plastic - Rigid Polyurethane	5.0	33,000	98,571	131,571
15	Thermocraft Engg. - Rigid Polyurethane	4	33,000	78,857	111,857
16	ANZ Insutech Enterprises- Rigid Polyurethane	2.5	33,000	49,286	82,286
17	Kold Kraft- Rigid Polyurethane	11.0	33,000	216,856	249,856
18	Pakistan Insulation- Rigid Polyurethane	45.0	66,000	887,135	953,135
19	PAECO- Rigid Polyurethane	15.0	66,000	295,712	361,712
20	Islamuddin & Sons- Rigid Polyurethane	2.0	33,000	39,429	72,429
21	Pak Motors- Rigid Polyurethane	6.0	33,000	118,286	151,286
22	Small Entrepreneurs unidentified- Rigid Polyurethane	24	330,000	473,139	803,139
Total of above cost			2,112,000	6,588,936	8,700,936
Cost Effectiveness US$/ Metric Kg					19.63

HFC 245fa alternate technology shall add 194,406 M. Ton of CO_2 to global warming per year

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
Cool Industries- Domestic Refrigeration	HCFC 141b	713	106.00	75,578
Mumtaz Engineers- Commercial Refrigeration	HCFC 141b	713	8.00	5,704
Asif Zubair & Co.- Rigid Polyurethane	HCFC 141b	713	40.00	28,520
Tropical Plastic - Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Zulquarnain Corp.- Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Delight Plastic - Rigid Polyurethane	HCFC 141b	713	12.00	8,556
Mehran Plastic Ind.- Rigid Polyurethane	HCFC 141b	713	6.00	4,278
Arm Bros - Rigid Polyurethane	HCFC 141b	713	6.80	4,848

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Decent Plastic - Rigid Polyurethane	HCFC 141b	713	1.00	713
Pifcom - Rigid Polyurethane	HCFC 141b	713	3.00	2,139
Plasticrafter - Rigid Polyurethane	HCFC 141b	713	10.00	7,130
Shoaibee Ind. - Rigid Polyurethane	HCFC 141b	713	96.00	68,448
Pakistan Plastic Ind. - Rigid Polyurethane	HCFC 141b	713	12.50	8,913
Unique Plastic - Rigid Polyurethane	HCFC 141b	713	5.00	3,565
Thermocraft Engg. - Rigid Polyurethane	HCFC 141b	713	4.00	2,852
ANZ Insutech Enterprises- Rigid Polyurethane	HCFC 141b	713	2.50	1,783
Kold Kraft- Rigid Polyurethane	HCFC 141b	713	11.00	7,843
Pakistan Insulation- Rigid Polyurethane	HCFC 141b	713	45.00	32,085
PAECO- Rigid Polyurethane	HCFC 141b	713	15.00	10,695
Islamuddin & Sons- Rigid Polyurethane	HCFC 141b	713	2.00	1,426
Pak Motors- Rigid Polyurethane	HCFC 141b	713	6.00	4,278
SMEs unidentified- Rigid Polyurethane	HCFC 141b	713	24.00	17,112
Total CO_2 emission in M tonnes			443.30	316,073
After Conversion				
Cool Industries- Domestic Refrigeration	Cyclo-pentane	25	63.60	1,590
Mumtaz Engineers- Commercial Refrigeration	Cyclo-pentane	25	4.80	120
Asif Zubair & Co.- Rigid Polyurethane	HFC 245fa	1030	60.00	61,800
Tropical Plastic - Rigid Polyurethane	HFC 245fa	1030	22.50	23,175
Zulquarnain Corp.- Rigid Polyurethane	HFC 245fa	1030	18.75	19,313
Delight Plastic - Rigid Polyurethane	HFC 245fa	1030	18.00	18,540
Mehran Plastic Ind.- Rigid Polyurethane	HFC 245fa	1030	9.00	9,270
Arm Bros - Rigid Polyurethane	HFC 245fa	1030	10.20	10,506
Decent Plastic - Rigid Polyurethane	HFC 245fa	1030	1.50	1,545
Pifcom - Rigid Polyurethane	HFC 245fa	1030	4.50	4,635
Plasticrafter - Rigid Polyurethane	HFC 245fa	1030	15.00	15,450
Shoaibee Ind. - Rigid Polyurethane	HFC 245fa	1030	144.00	148,320
Pakistan Plastic Ind. - Rigid Polyurethane	HFC 245fa	1030	18.75	19,313
Unique Plastic - Rigid Polyurethane	HFC 245fa	1030	7.50	7,725
Thermocraft Engg. - Rigid Polyurethane	HFC 245fa	1030	6.00	6,180

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
ANZ Insutech Enterprises- Rigid Polyurethane	HFC 245fa	1030	3.75	3,863
Kold Kraft- Rigid Polyurethane	HFC 245fa	1030	16.50	16,995
Pakistan Insulation- Rigid Polyurethane	HFC 245fa	1030	67.50	69,525
PAECO- Rigid Polyurethane	HFC 245fa	1030	22.50	23,175
Islamuddin & Sons- Rigid Polyurethane	HFC 245fa	1030	3.00	3,090
Pak Motors- Rigid Polyurethane	HFC 245fa	1030	9.00	9,270
SMEs unidentified- Rigid Polyurethane	HFC 245fa	1030	36.00	37,080
Total CO_2 emission in M tonnes			562.35	510,479
Net Impact				194,406

iv. Comparison of Alternates Technologies for Stage-2 projects

The cost comparison for each of the identified options for industries covered under Stage-2 is provided below. The summary comparison for IOC and ICC under various alternate technologies is provided below:

Sr. #	Alternate Technologies	ICC	IOC	Total
1	Cyclo-pentane System	5,395,500	626,309	6,021,809
2	Water based System	2,007,500	1,247,891	3,255,391
3	HFC 245fa System	2,112,000	6,588,936	8,700,936

7.3.3 Stage-3 Projects in Manufacturing Sector

Six (6) industries were included in this stage. Two of these are involved in PU spray foam, three in flexible foam and one in integral skin. The selection of alternate technology was once again based on their cost effectiveness, sustainability, environmental impact including on climate change and energy efficiency. Based on the analysis carried out for Stage-2 projects, and results achieved therein, two alternate technologies i.e. water based and Methyl Formate; were considered. Both technologies have advantages and are available, however water base is considered for adaptation at the moment. Before implementation the case should be reviewed and finalized. This stage is planned to be implemented before December 31, 2024 to achieve the target reduction in HCFC consumption for year 2025.

Based on the Water Base system as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below for Stage-3 projects:

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	Master Chemicals- Spray Foam	80.0	99,000	279,577	378,577
2	Ittehad Insulation- Spray Foam	11.5	55,000	40,190	95,190

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
3	Razi Sons - Flexible Foam	15.0	60,500	52,421	112,921
4	Simpson Wires - Flexible Foam	7.9	27,500	27,609	55,109
5	Tariq Engineering - Flexible Foam	6.0	27,500	20,969	48,469
6	Workman - Integral Skin	3.5	82,500	103,348	185,848
Total of above cost			352,000	524,115	876,115
Cost Effectiveness US$/ Metric Kg					7.07

The detail of ICC and IOC for each of the companies covered under stage-3 for this technology is provided in Annex-8A & 8B respectively.

Water based alternate technology shall bring a net reduction of 88,237M. Ton of CO_2 per year in Stage-3 as calculated in the table below.

Name of Industry	Substance	GWP	MT per year	CO2-eq (MT per year)
Before Conversion				
Master Chemicals- Spray Foam	HCFC 141b	713	80.00	57,040
Ittehad Insulation- Spray Foam	HCFC 141b	713	11.50	8,200
Razi Sons - Flexible Foam	HCFC 141b	713	15.00	10,695
Simpson Wires - Flexible Foam	HCFC 141b	713	7.90	5,633
Tariq Engineering - Flexible Foam	HCFC 141b	713	6.00	4,278
Workman - Integral Skin	HCFC 141b	713	3.50	2,496
Total CO_2 emission in M tonnes			123.90	88,341
After Conversion				
Master Chemicals- Spray Foam	Water based	1	48.00	48
Ittehad Insulation- Spray Foam	Water based	1	6.90	7
Razi Sons - Flexible Foam	Water based	1	22.50	23
Simpson Wires - Flexible Foam	Water based	1	11.85	12
Tariq Engineering - Flexible Foam	Water based	1	9.00	9
Workman - Integral Skin	Water based	1	5.25	5
Total CO_2 emission in M tonnes			103.50	104
Net Impact				-88,237

7.3.4 **Stage-4 Projects in Manufacturing Sector**

Nineteen (19) industries were included in this stage. Nine (9) of these are involved in commercial air conditioners whereas ten (10) in domestic air conditioners. The selection of alternate technology was once again based on their cost effectiveness, sustainability, environmental impact including on climate change and energy efficiency. Based on the analysis carried out for Stage-1 to Stage-3 projects and results achieved therein, only one alternate technology i.e. R410A; was considered that was found feasible for adaptation for the time being. This stage is planned to be implemented before December 31, 2028 to achieve the target reduction in HCFC consumption for year 2030.

Based on the R410A system as alternate technology, the ICC & IOC for each industry and overall cost effectiveness is provided below for Stage-4 projects:

Sr. #	Name of Industry	HCFC phased out M ton	Estimated cost US$		
			ICC	IOC	Total
1	SABRO, Rawalpindi - Commercial AC	10.3	400,000	36,000	436,000
2	Petal Engineering - Commercial AC	7.8	400,000	36,000	436,000
3	PARC - Commercial AC	9.0	400,000	36,000	436,000
4	Waheed Engineering - Commercial AC	3.0	400,000	36,000	436,000
5	MECO - Commercial AC	1.1	400,000	36,000	436,000
6	Cool Point, Lahore - Commercial AC	3.9	400,000	36,000	436,000
7	Age Co (Pvt.) Ltd. - Commercial AC	2.9	400,000	36,000	436,000
8	PAECO - Commercial AC	2.2	400,000	36,000	436,000
9	ANZ Insutech Enterprises - Commercial AC	2.0	400,000	36,000	436,000
10	Dawlance - Domestic AC	35.4	425,000	327,646	752,646
11	Haier - Domestic AC	92.5	425,000	857,348	1,282,348
12	Cool Industries (Waves) - Domestic AC	40.0	425,000	370,745	795,745
13	Orient, Lahore - Domestic AC	95.0	425,000	880,519	1,305,519
14	PEL, Lahore - Domestic AC	60.0	425,000	556,117	981,117
15	Digital World Pakistan - Domestic AC	20.0	425,000	185,372	610,372
16	Kentax, Lahore - Domestic AC	15.1	425,000	139,493	564,493
17	New Allied Electronics - Domestic AC	15.0	425,000	139,029	564,029
18	Shahab Industries - Domestic AC	4.5	425,000	41,709	466,709
19	SABRO, Islamabad - Domestic AC	40.0	425,000	370,745	795,745
Total of above cost			7,850,000	4,192,723	12,042,723
Cost Effectiveness US$/ Metric Kg					26.20

The global warming potential of R410a is 2100 compared to 1800 for HCFC 22.However based on the life cycle climate performance (LCCP), R410A gives lower LCCP for the equipment life when compared with HCFC 22. The typical calculations for a specific case in Pakistan environment is provided in section 5.3.2 (iii). It is estimated that adopting this refrigerant, the annual GWP net reduction is around 59,000 CO_2-eq M tonnes.

7.3.5 Stage-5 Servicing Sector

Details about servicing sector have been provided in section 3.3.6, including estimated number of workshops separated into groups (small, medium, large), estimated number of related technicians and their education, baseline equipment, estimated average annual consumption of HCFC22 per workshop of each group, estimated HCFC bank size etc.

A separate comprehensive Refrigeration Management Plan (RMP) shall be devised for this purpose. However the budgetary costs for various components of the program are provided below including Non-investment costs and Training equipment:

Non-investment Component Costs for stage-5 (2011-2040)

The non investment activities cover legislation, customs' training, public awareness through media campaign, conferences, workshops, dedicated websites, stakeholders consultation, publications, information dissemination, training of technicians, providing technical assistance and monitoring of the proceedings.

The itemized cost of each activity for the non-investment component for the period 2011-2040 is estimated as under:

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost US$
1	**Policy and Enforcement Capacity-building**				
	Resource persons (Travel, per diem and fees)	Visit	6	5,000	30,000
	Development of electronically-operated license and quota management system (including cost of technical assistance, one consultation meeting, one set of computer and software)	No	1	20,000	20,000
	Development of Training Curriculum for HCFC trade control module at the Customs Training Centers (including consultation meetings, training material preparation, logistics arrangement, certificates, translation, and one round at least of revision. Excluding equipment)	Centers	3	20,000	60,000
	Identifiers for Training Centers and key ports/ check points	No	46	3,500	161,000
	Training workshop with local governments	No	10	12,000	120,000
	Participation in regional/ cross-border enforcement cooperation meetings	No	10	10,000	100,000
	Contingency	%	10%		49,100
	Sub-Total				**540,100**

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost US$
2	**National Project for Training Service Technicians**				
	Resource persons (Travel, per diem and fees)	Visits	3	5,000	15,000
	Development of Training Curriculum with Training of Trainers Centres (including consultation meetings, training material preparation, logistics arrangement, certificates, translation, and one round at least of revision. Excluding equipment)	No	10	20,000	200,000
	Delivery of Training of Trainers (3 rounds for 60 trainers; average 20 persons/ workshops; including rental, logistics, register of participants, invitations, etc)	No	180	250	45,000
	Delivery of Training (average 15 persons/ workshops; including rental, logistics, register of participants, invitations, etc)	No	5,000	80	400,000
	Development of a long-term servicing technician certification programme (including establishment of examination and certification procedure, development of electronic database, cost of issuing of certificates [approx. US$25/person; 5,000 certified technicians])	No.	1	220,000	220,000
	Specialized Training Workshops (Support for outstation trainees, Material Preparation, drafting, translation, printing, Fee for teachers, certification, arrangement) and strengthen the refrigeration association	No	30	10,000	300,000
	Meeting of RAC Association(s) to promote Code of Good Practices	No	4	12,000	48,000
	Development of standards/ Code of Good Practices (including at least one review, and printing and distribution of 4,000 kits)	No	4,000	50	200,000
	Contingency	%age	10%		142,800
	Sub-Total				**1,570,800**
3	**National Recovery and Recycling Project**				
	Establishment of 42 recycling centers at 42 training centers				
	Training of recovery center staff	No	160	1,000	160,000
	Contingency	%	10%		16,000
	Sub-Total				**176,000**
4	**Awareness**				
	Strategy Design				20,000

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost US$
	Research and Analyses				15,000
	Stakeholder Engagement/ Workshops				180,000
	Media Campaign				580,000
	Contingency	%	10%		79,500
	Sub-Total				**874,500**
	TOTAL				**3,161,400**

Servicing Sector Training Equipment Component Costs stage-5 (2011-2040)

The itemized cost of each training equipment component is estimated as under:

Sr. #	Description	Unit	Qty	Unit Cost US$	Total Cost US$
1	**Equipment for training centre**				
	Teaching aids	Each	40	500	20,000
	Training rigs	Each	40	1,000	40,000
	Recovery machine	Each	40	600	24,000
	Recycling machine to be used for both training and recycling in R&R project	Each	40	7,000	280,000
	Recovery Cylinders, 13kg	Each	80	30	2,400
	Vacuum pumps	Each	80	200	16,000
	Refrigerant identifier	Each	40	3,500	140,000
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	40	400	16,000
	Leak detector	Each	40	300	12,000
	Sub-Total				**550,400**
2	**Equipment from national recovery and recycling centre**				
	Recycling machine with air purge function	Each	10	8,000	80,000
	Recovery Cylinders, 13kg	Each	160	30	4,800
	Storage cylinders	Each	40	200	8,000
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	40	400	16,000
	Leak detector	Each	20	300	6,000
	Sub-Total				**114,800**
3	**Equipment from service shops**				
	Recovery Machine	Each	1216	600	729,600

Sr. #	Description	Unit	Qty	Unit Cost US$	Total Cost US$
	Recovery bag	Each	1216	30	36,480
	Vacuum pump	Each	2431	200	486,200
	Recovery Cylinders, 13kg	Each	2431	30	72,930
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	2431	400	972,400
	Sub-Total				**2,297,610**
4	**Mobile training facilities for remote areas**				
	Mobile training facilities	Each	4	30,000	120,000
	Sub-Total				120,000
	Total of 1 to 4				**3,082,810**
	Contingencies on total 1 to 4	%age	10%		**308,281**
	Grand Total				**3,391,091**

The number of equipments is based on the following assumptions/bases

Total no. of Customs training centers	3
Total no. of servicing workshops assumed in 2009	8,383
No. of servicing workshops per training centre	200
No. of servicing workshops per NR&RC	200
%age of workshops to be supplied training equipment	29%
Training of newly recruited customs officers on HCFC control (by 2020) in %age	100%
Proposed no. of training centres	40
Proposed no. of servicing technician Train the Trainers centers	10
Proposed no. of servicing technician ToT instructors and trainers (3 persons/ ToT centre; 1 person/other centre)	60
Proposed no. of servicing technician training sessions per trainer	3
Proposed no. of service workshops with at least one trained technician (approx 60% of all servicing workshops assumed)	5000
Proposed no. of technicians to be certified	5000
Proposed no. of National recovery & recycling centres	40
Proposed no. of service shops planned for supply of equipment	2431
Proposed no. of mobile training facilities	4

The servicing sector cost including non-investment and training equipment cost for the period 2011-2015 is provided in the table below:

Non-investment Component Costs for stage-5 (2011-2015)

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost
1	**Policy and Enforcement Capacity-building**				
	Resource persons (Travel, per diem and fees)	Visit	2	5,000	10,000

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost
	Development of electronically-operated license and quota management system (including cost of technical assistance, one consultation meeting, one set of computer and software)	No	1	20,000	20,000
	Development of Training Curriculum for HCFC trade control module at the Customs Training Centers (including consultation meetings, training material preparation, logistics arrangement, certificates, translation, and one round at least of revision. Excluding equipment)	Centers	3	20,000	60,000
	Identifiers for Training Centers and key ports/ check points	No	12	3,500	42,000
	Training workshop with local governments	No	0	12,000	0
	Participation in regional/ cross-border enforcement cooperation meetings	No	0	10,000	0
	Contingency	%			13,200
	Sub-Total				**145,200**
2	**National Project for Training Service Technicians**				
	Resource persons (Travel, per diem and fees)	Visits	2	5,000	10,000
	Development of Training Curriculum with Training of Trainers Centres (including consultation meetings, training material preparation, logistics arrangement, certificates, translation, and one round at least of revision. Excluding equipment)	No	3	20,000	60,000
	Delivery of Training of Trainers (3 rounds for 60 trainers; average 20 persons/ workshops; including rental, logistics, register of participants, invitations, etc)	No	20	250	5,000
	Delivery of Training (average 15 persons/ workshops; including rental, logistics, register of participants, invitations, etc)	No	600	80	48,000
	Development of a long-term servicing technician certification programme (including establishment of examination and certification procedure, development of electronic database, cost of issuing of certificates [approx. US$25/person; 5,000 certified technicians])	No.	0	220,000	0
	Specialized Training Workshops (Support for outstation trainees, Material Preparation, drafting, translation, printing, Fee for teachers, certification, arrangement) and strengthen the refrigeration association	No	0	10,000	0

Sr. #	Activities of Project Component	Unit	Qty	Unit Cost US$	Total Cost
	Meeting of RAC Association(s) to promote Code of Good Practices	No	1	12,000	12,000
	Development of standards/ Code of Good Practices (including at least one review, and printing and distribution of 4,000 kits)	No	1,000	50	50,000
	Contingency	%age			18,500
	Sub-Total				**203,500**
3	**National Recovery and Recycling Project**				
	Establishment of 42 recycling centers at 42 training centers				
	Training of recovery center staff	No	0	1,000	0
	Contingency	%			0
	Sub-Total				**0**
4	**Awareness**				
	Strategy Design				10,000
	Research and Analyses				5,000
	Stakeholder Engagement/ Workshops				18,000
	Media Campaign				50,000
	Contingency	%			8,300
	Sub-Total				**91,300**
	TOTAL				**440,000**

Servicing Sector Training Equipment Component Costs Stage-5 (2011-2015)

Sr. #	Description	Unit	Qty	Unit Cost US$	Total Cost
1	**Equipment for training centre**				
	Teaching aids	Each	14	500	7,000
	Training rigs	Each	15	1,000	15,000
	Recovery machine	Each	15	600	9,000
	Recycling machine to be used for both training and recycling in R&R project	Each	14	7,000	98,000
	Recovery Cylinders, 13kg	Each	-	30	-
	Vacuum pumps	Each	15	200	3,000
	Refrigerant identifier	Each	3	3,500	10,500

Sr. #	Description	Unit	Qty	Unit Cost US$	Total Cost
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	15	400	6,000
	Leak detector	Each	14	300	4,200
	Sub-Total				**152,700**
2	**Equipment from national recovery and recycling centre**				
	Recycling machine with air purge function	Each	-	8,000	-
	Recovery Cylinders, 13kg	Each	-	30	-
	Storage cylinders	Each	-	200	-
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	-	400	-
	Leak detector	Each	-	300	-
	Sub-Total				-
3	**Equipment from service shops**				
	Recovery Machine	Each	-	600	-
	Recovery bag	Each	-	30	-
	Vacuum pump	Each	-	200	-
	Recovery Cylinders, 13kg	Each	-	30	-
	Service tools, piercing valve, high pressure gauge manifold etc.	Each	-	400	-
	Sub-Total				-
4	**Mobile training facilities for remote areas**				
	Mobile training facilities	Each	-	30,000	-
	Sub-Total				-
	Total of 1 to 4				**152,700**
	Contingencies on total 1 to 4	%age			**15,300**
	Grand Total				**168,000**

Summary of Servicing Sector Costs satge-5

Description	Cost in US$	
	2011-40	**2011-15**
Cost of Non-Investment Activities	3,161,400	440,000
Cost of Training Equipment	3,391,091	168,000
Total Cost	**6,552,491**	**608,000**

The cost permissible on page no. 7 of UNEP/OzL.Pro/ExCom/60/46 dated 11 March 2010 allows funding of US$ 4.5/ metric Kg to phase out HCFC 22 in the servicing sector. Based on the annual HCFC requirement of 1455.5 metric ton in the servicing sector, the cost of US$ 6,549,750 is permissible. The first phase of training will start from 2011 and will continue till 2015.

7.4 Overall Summary of Stages

The overall cost involved in staged program is provided below:

Stages	Sector	HCFC phased out M ton	Estimated cost US$			Cost Effectiveness
			ICC	IOC	Total	
Stage-1	Manufacturing	651.8	4,844,400	-3,551	4,840,849	7.43
Stage-2	Manufacturing	443.3	5,395,500	626,309	6,021,809	13.58
Stage-3	Manufacturing	123.9	352,000	524,115	876,115	7.07
Stage-4	Manufacturing	459.6	7,850,000	4,192,723	12,042,723	26.20
Stage-5	Servicing	1,455.5			6,552,491	4.50
Total		**3,134.1**	**18,441,900**	**5,339,595**	**30,333,986**	**9.68**

8. PROJECT COORDINATION AND MANAGEMENT

8.1 Implementation Structure

The National Ozone Cell, Ministry of Environment, Government of Pakistan (MoE GOP) is responsible for the overall project controlling, coordination, and assessment and monitoring. The National Ozone Unit will have Memorandum of Agreements (MOA) with the industry to ensure that funds for implementation are authorized/ released by GOP as per the TOR (which are part of MOA between GOP MoE Ozone Cell (OC) and the concerned industry/enterprise) when the agreed implementation milestones (as per TOR) are accomplished. For this purpose, MoE OC will scrutinize the required documents, provided by the industry and would also inspect, physically, for verification of the conversion progress as per the MOA and TOR under the supervision by the NOU, UNIDO and UNEP as the implementing agencies are responsible for the financial management of the respective grant. UNIDO is also to assist the enterprise in equipment procurement, technical information update, monitoring the progress of implementation, and reporting to the ExCom. The enterprise is responsible to achieve the project objective by providing financial and personnel resources required for the success of the project implementation. Financial management will be administered by UNIDO following UNIDO's Financial Rules and Regulation.

UNEP as cooperating agency will be responsible for the non-investment component which relates to the policy formulation, co-ordination with NoU for the implementation of rules and regulation, training to technicians for good servicing practices and to the customs officers for better control of the import of HCFCs. UNEP will also train the staff of NoU so that they get acquainted with the MP policies for better control and monitoring with strict enforcement of rules and regulations.

8.2 Working arrangement for implementation

After the approval of the project by ExCom, the above parties will sign the working arrangement and MOA/TORs, where the roles and responsibilities of each party are detailed.

8.3 Modification of production process

Procurement of equipment required for the production line modification will be done through an international bidding process organized by UNIDO. Smaller equipment and parts may be procured locally, if local procurement is found to be more economical. Local procurement will also be done based on UNIDO's Financial Rules and Regulations. This applies also for contracting with contractors for provision of technical services. Terms of references and technical specifications for the procurement of contracts and equipment will be prepared by UNIDO in consultation and agreement with the enterprise and the NOU.

8.4 Project monitoring

Project monitoring is done by GoP MoE Ozone Cell and UNIDO/ UNEP through regular missions to the project sites and continuous communications through e-mails and telephone. Occasional Regular, subject and time schedule concerning visits, communication and monitoring of conversion progress by the NOU are also to be done to ensure adequate project implementation.

8.5 Project completion

Project completion report will be submitted by UNIDO/UNEP within 6 months after project completion. Necessary data and information for the preparation of the project completion report is to be provided by the enterprise/NOU.

8.6 Timetable for implementation

The Implementation Schedule has been discussed in section 6.5

The Stage-I of the overall program is planned to be implemented according to the below timetable. It is important to note that the project will be completed before end 2012 to ensure its contribution to the 2013 country obligation to freeze and the reduction in 2015 HCFC consumption.

Activities	Years					
	2010		2011		2012	
Approval						
Working arrangement						
Preparation of TORs						
Bidding						
Modification of foaming line, installation						
Staff training						
Safety certificate						
Project completion						

In conformity with the Montreal Protocol Executive Committee's decision 23/7 on standard components on monitoring and evaluation, milestones for project monitoring are proposed as follows:

Sr. #	Milestone	Months
1	Project approval	-
2	Start of implementation	1
3	Grant agreement submitted to beneficiary	2
4	Grant agreement signature	3
5	Bids prepared and requested	9
6	Contracts awarded	14
7	Equipment delivered	20
8	Commissioning and trial runs	22
9	De-commissioning/destruction of redundant baseline equipment	24
10	Submission of project completion report	24-30

Expected approval date of:

Stage-1 Manufacturing Sector projects	2nd quarter of 2010
Stage-2 Manufacturing Sector projects	2nd quarter of 2017
Stage-3 Manufacturing Sector projects	2nd quarter of 2022
Stage-4 Manufacturing Sector projects	2nd quarter of 2026
Stage-5 Servicing Sector	4th quarter of 2010

8.7 Cash Flow Estimates

The annual cash flow for all the stages and the complete program has been worked out and is attached as Annex-9.

The funds required to meet the phase out targets of HCFC in the manufacturing as well as servicing sectors is summarized in the below table:

Activities	Funds required to meet the reduction target					
	10% (2015)	35% (2020)	67.5% (2025)	97.5% (2030)	100% (2040)	Total
Manufacturing Sector	4,840,848	6,021,809	876,115	12,042,723	-	23,781,495
Servicing Sector and other non investment activities	608,000	3,722,641	1,050,000	800,000	371,000	6,551,641
Total of the Program	**5,448,848**	**9,744,450**	**1,926,115**	**12,842,723**	**371,000**	**30,333,136**

Investment projects in the manufacturing sector will be implemented by UNIDO while UNEP will be responsible for the implementation of all non-investment components including the activities in the servicing sector, as well as policy and awareness activities.

8.8 Estimated phase out of HCFC in ODP ton

Activities	HCFC phase out in ODP ton (2009 base)					
	10% (2015)	35% (2020)	67.5% (2025)	97.5% (2030)	100% (2040)	Total
Manufacturing Sector	71.70	48.76	13.63	25.28	-	159.37
Servicing Sector	7.40	25.00	22.00	19.61	6.05	80.06
Total Phase out	**79.10**	**73.76**	**35.63**	**44.89**	**6.05**	**239.43**

ANNEX-1

LIST OF INVESTMENT AND NON-INVESTMENT PROJECT

Annex-1

List of Investment and Non-Investment MP Projects for Pakistan

Code	IA	Sub-sector	Project Title	Impact	Fund
PAK/FOA/41/INV/58	IBRD	Flexible Molded	Phase out of the use of CFCs in remaining foam enterprises: Pakistan Insulation, Simpson Wire, HEPCO, Indus Plastic, Workman and Thermocraft Engineering	106.90	646,642
PAK/FOA/30/PRP/37	IBRD	Preparation of project proposal	Project preparation in the rigid polyurethane foam		12,000
PAK/FOA/22/PRP/15	IBRD	Preparation of project proposal	Project preparation to phase out CFC consumption that is not accounted for in the country programme		25,000
PAK/FOA/17/INV/06	IBRD	Flexible molded	Phase out of CFC-11 in the manufacture of flexible PUF molded and integral skin at Master Group: (Master Enterprises Ltd., Durafoam Ltd., Khyber Plastic and Polymer Industries Lte., Procon En)	205.00	1,246,300
PAK/FOA/18/INV/07	IBRD	Multiple sub-sectors	Phase out of CFC-11 in the manufacture of molded and rigid PUF at Razi Sons	60.00	493,262
PAK/FOA/23/INV/16	IBRD	Integral Skin	Conversion to CFC free Technology in the manufacture of integral skin polyurethane foam at Synthetic Products Enterprises (Pvt.) Ltd.	13.60	136,829
PAK/FOA/23/INV/20	IBRD	Rigid	Umbrella Project: Conversion to CFC free technology in the manufacture of rigid polyurethane foam (thermoware)	239.60	1,390,525
PAK/FOA/23/INV/22	IBRD	Multiple sub-sectors	Conversion of CFC free technology in the manufacture of polyurethane foam (flexible slabstock, flexible molded, rigid foam) at Diamond Group of Industries	64.10	563,339
PAK/FOA/25/INV/25	IBRD	Rigid	Terminal Umbrella: Conversion to HCFC-141b and water blown technology in the manufacture of rigid polyurethane foam (thermoware)	105.65	557,052
PAK/FOA/26/INV/29	IBRD	Flexible slabstock	Elimination of CFC-11 through conversion to methylene chloride/ LIA technology in the manufacture of flexible polyurethane slabstock foam at United Foam Industries	28.60	178,200
PAK/FOA/26/INV/30	IBRD	Flexible molded	Elimination of CFC-11 through conversion to water based technology in the manufacturer of lexible molded polyurethane foam at Saleem Automotive Industries Ltd.	2.50	31,603
PAK/FOA/29/INV/34	IBRD	Integral Skin	Conversion from CFC-11 to water based technology in the manufacture of rigid polyurethane shoe soles at Jaguar Industries	40.00	273,667

Annex-1

List of Investment and Non-Investment MP Projects for Pakistan

Code	IA	Sub-sector	Project Title	Impact	Fund
PAK/REF/26/INV/31	IBRD	Domestic	Phase out of CFC-11 and CFC-12 by conversion to HCFC-141b and HFC-134a in the manufacture of domestic refrigeration equipment at refrigerators Manufacturing Company Pakistan		
PAK/REF/19/INV/11	IBRD	Domestic	Conversion of refrigerator manufacture from CFC-11 to cyclopentane foam blowing agent and CFC-12 to R-134a refrigerant at Domestic Appliances Ltd/ (DAL)		
PAK/REF/23/INV/18	IBRD	Commercial	Conversion to CFC free Technology in the manufacture of polyurethane foam at Kold Kraft Ltd.	11.50	175,000
PAK/REF/23/INV/19	IBRD	Domestic	Conversion to CFC free technology in the manufacture of polyurethane foam (domestic refrigeration) at Cool Industries Ltd. (Waves)	117.60	841,750
PAK/REF/23/INV/21	IBRD	Domestic	Conversion to CFC free technology in the manufacture of polyurethane foam at Singer Pakistan Ltd.	17.80	205,893
PAK/REF/25/INV/26	IBRD	Commercial	Elimination of CFC-11 and CFC-12 by converting to HCFC-141b and HFC-134a in the manufacture of commercial refrigeration equipment at Dawlance (Pvt.) Ltd.		
PAK/REF/25/INV/27	IBRD	Domestic	Elimination of CFC-11 and CFC-12 by converting to HCFC-141b and HFC-134a in the manufacture of refrigeration equipment at United Refrigeration Industries Ltd.		
PAK/REF/25/INV/28	IBRD	Commercial	Elimination of CFC-11 and CFC-12 by converting to HCFC-141b and HFC-134a in the manufacture of commercial refrigeration equipment at Shadman Electronic Industries P. Ltd.	15.53	236,936
PAK/REF/30/PRP/35	IBRD	Preparation of project proposal	Preparation of projects in the foam flexible sub-sector		9,000
PAK/REF/30/PRP/36	IBRD	Preparation of project proposal	Project proposal in the refrigeration sector (railway)		16,000
PAK/REF/32/INV/39	IBRD	Commercial	Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Pakistan Air-conditioning Engineering Co. P. Ltd., (PAECO)	19.70	176,681

Annex-1

List of Investment and Non-Investment MP Projects for Pakistan

Code	IA	Sub-sector	Project Title	Impact	Fund
PAK/REF/32/INV/40	IBRD	Domestic/ commercial	Conversion from CFC-11 to HCFC-141b and from CFC-12 to HFC-134a technology in the manufacture of commercial refrigeration equipment at Mumtaz Engineers	13.90	182,866
PAK/REF/42/INV/59	IBRD	Domestic/ commercial	Phase out of CFC-11 and CFC-12 in the manufacture of refrigeration equipment at Dawlance, United Refrigeration, Ice Age and at 29 small enterprises	181.30	1,077,691
PAK/REF/42/INV/64	UNIDO		Implementation of the RMP (institutional customs empowerment, training service technicians, recovery and recycling) (3rd Tranche)	80.00	414,300
PAK/REF/12/TAS/03	UNIDO	Technical Assistance	Strategy to phase-out ODS in the refrigeration industry		49,768
PAK/REF/35/INV/43	IBRD	Domestic	Replacement of refrigerant CFC-12 with HFC-134a and foam blowing agent CFC-11 with HCFC-141b in the production of domestic refrigerators at Ideal Appliances, Ltd.	12.89	171,759
PAK/REF/39/PRP/50	UNIDO	Preparation of project proposal	Preparation of phase out plan in the refrigeration sector (CFC manufacturing)		19,832
PAK/REF/41/TAS/56	UNIDO	CFC-12	Implementation of the RMP (institutional customs empowerment, training service technicians, recovery and recycling) (1st Tranche)	36.00	170,781
PAK/REF/23/INV/17	UNIDO	Domestic	Phase out ODS at the freezer factory of Hirra Farooq (Pvt.) Ltd.	31.20	518,470
PAK/REF/44/TAS/61	UNIDO	CFC-12	Implementation of the RMP (institutional customs empowerment, training service technicians, recovery and recycling) (2nd Tranche)	80.00	534,200
PAK/REF/19/INV/10	UNIDO	Domestic	Phasing out ODS at the refrigerator and chest freezer plants of Pak Elektron Ltd. (PEL)	68.00	1,143,080
PAK/REF/19/INV/09	UNIDO	Domesti	Phasing out ODS at the chest freezer factory of Riaz Electric Co. Ltd.	48.20	818,904
PAK/REF/27/PRP/32	UNIDO	Preparation of project proposal	Preparation of refrigerant management plan		27,794
PAK/FUM/45/TAS/63	UNIDO	Awareness Workshop	Training and awareness workshop in the fumigants sector (methyl bromide)		22,851
PAK/FUM/39/TAS/49	UNIDO		Preparation of a Phase-out plan in the fumigants sector		20,677

Annex-1

List of Investment and Non-Investment MP Projects for Pakistan

Code	IA	Sub-sector	Project Title	Impact	Fund
PAK/FUM/24/TAS/24	UNIDO		Preparation of a demonstration project (tobacco, tomatoes, cucurbits)		8,882
PAK/HAL/41/TAS/55	UNIDO		Plan for the phase out of import and net consumption of halons in the fire fighting sector	24.20	208,614
PAK/HAL/40/TAS/53	UNIDO		Project preparation for a halon sector phase out plan		21,220
PAK/PAG/35/TAS/42	UNIDO	Process Conversion	Conversion of carbon tetrachloride as process solvent to 1,2-dichloroethane at Zafa Chemi (Himont Chemicals)	80.00	485,701
PAK/PHA/55/PRP/69	UNEP		Preparation of a HCFC phase-out management plan		
PAK/PHA/55/PRP/70	UNIDO		Preparation of a HCFC phase-out management plan		
PAK/PHA/54/PRP/67	UNIDO		Sector Phase out Plan of CTC (3rd Trancche)	62.50	245,665
PAK/PHA/44/PRP/62	UNIDO		Sector Phase out Plan of CTC (2nd Trancche)	326.50	1,300,000
PAK/PHA/41/INV/57	UNIDO		Sector Phase out Plan of CTC (1st Trancche)	100.00	1,200,000
PAK/ARS/54/PRP/68	UNDP		Project preparation for MDI Investment Project		60,000
PAK/SEV/36/CPG/46	IBRD	Country Program	Assistance for the country programme update		45,000
PAK/SEV/27/PRP/33	IBRD	Project Preparation	Preparation of Projects in the foam and refrigeration sectors		66,000
PAK/SEV/24/PRP/23	IBRD	Project Preparation	Project preparation in the foam and refrigeration sectors		63,000
PAK/SEV/21/PRP/12	IBRD	Project Preparation	Project preparation in the foam and refrigeration sectors		45,000
PAK/SEV/18/PRP/38	IBRD	Project Preparation	Project Preparation		100,000
PAK/SEV/16/PRP/08	IBRD	Project Preparation	Preparation of investment projects (1995)		143,009
PAK/SEV/12/PRP/04	IBRD	Project Preparation	Preparation of investment projects (1994)		94,320
PAK/SEV/11/PRP/02	IBRD	Project Preparation	Preparation of investment projects (1993)		8,956
PAK/SEV/53/INS/66	UNDP		Extension of institutional strengthening project (Phase IV, Second year)		112,234
PAK/SEV/51/INS/65	UNDP		Extension of institutional strengthening project (Phase IV, First year)		45,363

Annex-1

List of Investment and Non-Investment MP Projects for Pakistan

Code	IA	Sub-sector	Project Title	Impact	Fund
PAK/SEV/41/INS/54	UNDP		Extension of institutional strengthening project (Phase 3)	18.60	224,467
PAK/SEV/35/INS/44	UNDP	Ozone Unit Support	Renewal of the institutional strengthening project (Phase-II)		172,564
PAK/SEV/14/INS/05	UNDP	Ozone Unit Support	Institutional strengthening under the Multilateral Fund for the Implementation of the Montreal Protocol		254,958
PAK/SEV/09/CPG/01	UNEP	Country Program	Country Programme preparation		60,000
PAK/SOL/40/INV/52	UNIDO		Conversion of cleaning installations from carbon tetrachloride (CTC), methyl chloroform (MCF) and CFC-113 to tetrachloroethylene (PER) and water in combination with process modification at Breeze Frost Industries Ltd. Lahore	33.20	281,852
PAK/SOL/40/INV/51	UNIDO		Conversion of cleaning installations from carbon tetrachloride (CTC), methyl chloroform (MCF) and CFC-113 to tetrachloroethylene (PER) and water in combination with process modification at Hirra Farooq (Pvt.) Ltd. Lahore	37.50	245,957
PAK/SOL/39/PRP/48	UNIDO		Preparation of investment projects in the solvents sector (CTC/TCA)		24,193
PAK/SOL/37/INV/47	UNIDO		Conversion of cleaning installation from carbon tetrachloride tp tetrachloroethylene at Riaz Electric Ltd. Lahore	10.02	121,413
PAK/SOL/36/PRP/45	UNIDO	Preparation of project proposal	Preparation of two projects in the solvents sector		19,361
PAK/SOL/33/PRP/41	UNIDO	Preparation of project proposal	Project preparation for 4 projects in the solvent (CTC) sector		22,978
PAK/SOL/22/INV/14	UNIDO	CFC-113	Conversion of ODS cleaning and coating processes from CFC-113 to trichloroethylene and IPA at Treet Corporation Ltd., Lahore	40.70	510,162
PAK/SOL/22/INV/13	UNIDO	CFC-113	Conversion of ODS coating processes from CFC-113 to trichloroethylene and IPA at Treet Corporation Ltd., Hyderabad	18.90	317,971
Total				2,352	18,897,492

ANNEX-2

LIST OF SERVICE CENTERS

List & Addresses of Service Centres Airconditioner, Fridge & Freezers

Service Centers of Cool Industries (Waves)	
-	Plot # A-69-70, Sindh Small Industries Golimar Sukkar
-	21 - A, Small Industry Estate, Bahawalpur
-	0pposite - 416/1-H, Awami Street. Samundri Road, FaisalAbad
-	Inside GMS Builders, Near Pindi Bypass Opp Gold Marriage Hall, GujranWala
-	Al Madina Fan Building GT Road, Near NBF(Babi Bux Fan) Company, Gujrat
-	Shop # 15-16, Block B, Al-Amina Complex, Alamgir Road Civil Lines Cantt, Hyderabad
-	209-210, Burhani Chambers, Abdullah Haroon Raod
-	10 - Km HanjarWal Multan Road, Near Sheikhan Wala Petrol Pump, Lahore
-	769 / D, MunirAbad Colony, KhaneWal Road Multan
-	Shop # B9 - B14, Kher Muhammad Plaza, Opp State Bank Saddar Road Cantt, Peshawar
-	14-B-1, Habib Plaza, B Block, Satellite Town, Rawalpindi
-	Waves Customer Service Center, 449-1/VI GT Road, Pakpattan Chowk, Sahiwal
-	37-A, Islamabad Colony, PAF Road
-	Chowk Kotli Bahram, Gohadpur Road, Near Naji Plaza, Sailkot
Service Centers of Haier, Lahore	
-	Liberty Market, Lahore 042-5755869
-	College Road, Lahore Ph:042-5217774-5
-	Saddar, Karachi Ph: 021-2751868
-	Jinnah Road, Quetta Ph: 081-2835121
Service Centers of Orient, Lahore	
-	Lahore Office: 55-D, Chamberlain Road, Tel: (042) 7232623 Mob: 0300-9489105
-	C.D 415, 1.D, Flat-2, Ground Floor Galaxy Tower, Opp. Wapda Revenue Off., Sukkhur
-	Minara Road., Tel: (071) 5626805-6 Fax: (071) 5625696 E-mail: skr@ogc.com.pk
-	Hyderabad Office: 101/C, Block-D, Unit No. 7, Latifabad. Tel: (022) 3818602-3
-	Sahiwal Office: H #. 202, Block 7, Civil Lines, Liaqat Road
-	Sargodha Office: 40/41, Pir-Muhammad Colony. Tel: (48) 3765309-10
-	Peshawar Office: 3A/1, Main Shami Road, Near Chit Chat Corner. Tel: (091)5284677-8
-	Jhelum Office: B/1/239, Old G.T Road, Opp. Pakistan Cadet school, Jada Road.
-	Sialkot Office: Plot No. 75, Muslim colony, Sharif Park, Street No. 1, Haji Pura Road
-	Gujranwala Office: 7-C, satellite Town. Tel: (055) 3847161-2
-	Multan Office: 180-Shamasabad Colony, Eid Gah Road, Tel: (061) 4582895, 4583649
-	Faisalabad Office: 6/24, New Civil Lines. Tel: (041) 2601403-4
-	Rawalpindi Office: 94/C, Block-E, Satellite Town, Near Holy Family Hospital.
-	Karachi Office: 7-Queen's court Building, 1st Floor, Abdullah Haroon Road

List & Addresses of Service Centres Airconditioner, Fridge & Freezers

Service Centers of PEL, Lahore	
-	99 Shah Jamal, Opp. Takoni Park, Lahore Tel: 111-102-103, 042-7552643,7552349
-	BLOCK II 189-E, P.E.C.H.S. Near Govt Girls College, Karachi Tel: 111-102-103
-	Zumarred Plaza 223- Block B Near Chandni Chowk, Sattelite Town, Rawalpindi
-	11-A / 1 Gulgusht Colony, Opp Pizza Hut, Multan Tel: 111-102-103
-	8-Z-1, Near Bank More, Madina Town, Faisalabad. Tel: 111-102-103
-	2 C1 Street # 1, Session Court Road, Civil Lines, Gujranwala
Kentax, Lahore	
-	251-A, Block 6 PECHS, Shara-e-Faisal, Karachi. Ph: 021-4529042-4
-	Bungalow No 108, Block E, Unit No. 6, Latifabad, Hyderabad. Ph: 022-3817271
-	Faisalabad: Ph:0345-4012280
-	Rawalpindi: Ph:051-5529589
-	Multan: Ph:0345-7200206
MECO	
-	500/14 Kiyani Road Saddar Karachi (021) 567-1999
Other Large Service Centers	
-	Iqbal Airconditioning
-	Pakistan Railway
-	Waheed Engineering
-	Cool Concern
-	PAECO, Lahore
-	Mia Corporation
-	Faisal Air Conditioning
-	Mohatta Engg.
-	Pharmaceutical, Hotel, Food & Textile
-	PN, AF and Army

ANNEX-3

NON INVESTMENT COMPONENTS
ACTIVITIES FOR PERIOD 2011-2015 OF
STAGE 5 (SERVICING SECTOR)

Non Investment Components Activities for period 2011-2015 of Stage 5 (Servicing Sector)

The strategic objective of the non-investment component of stage 5 (to be implemented during 2011-15) is to ensure, that the Pakistan's obligation is met in terms of the Montreal Protocol's control measure by reducing HCFC consumption by 10% in 2015. This will initially be more towards legislative arrangements, public awareness and working arrangements to start the activities of training to technicians and customs officers.

Description of Components

1) Policy and Enforcement Capacity-building

Project objective: To strengthen institutional capacities for enforcement of regulations related to HCFC phase out

Target audience: Ozone Cell/ Federal Ministry of Environment, Pakistan Customs, Ministry of Commerce, Ministry of Finance & Revenue/ Federal Board of Revenue, Provincial governments.

Proposed activities:

Component 1: Strengthening enforcement of the import control systems

- Setting up national sets of HS based codes for HCFCs, HCFC-based blends and HCFC-based equipment using WCO's HS codes 2012 as base.
- Management of the license system with quotas (e.g. establishment of electronically-operated system for issuing and control of quotas and permits for HCFC related trade; harmonization of the license/quota management system and the Customs import/export registry).
- Participation in informal Prior Informed Consent (iPIC) and Cross-border dialogues.
- Coordination among Ozone Cell, the Customs and non-traditional enforcement partners.

Component 2: Policy and enforcement training

- Establishment of a sustained and mandatory training course on HCFC trade control policies and best practices as part of the Customs core induction curriculum. In collaboration with Customs Training Centers in Karachi, Lahore and Islamabad.
- Capacity building of customs officers to control the illegal re-entry of HCFCs into Pakistan that are imported for Afghanistan through Afghan Transit Trade.
- Preparation and distribution of training manuals for Customs officers in local languages. Production of informative material for local authorities.
- Procurement and distribution of new models of ODS identifier to customs training centres. (with maintenance options).
- Training of representatives of local governments on ODS/HCFC regulatory frameworks.

The training will be imparted to 60 customs officers (inspectors, controllers and appraisers) in the first phase. 15 officers in a batch will be trained with two training sessions in Karachi, one in Lahore and one in Islamabad.

Time Frame	2011	2012	2013	2014	2015
Component 1: Strengthening enforcement of the import and export control systems					
Component 2: Policy and enforcement training					

2) Servicing Sector Training

Project objective: To create a critical mass of qualified RAC Servicing technicians to reduce and eliminate eventually of virgin HCFC use by the sector.

Target audience: Over 600 technicians during the period 2011-2015.

Proposed activities:

Component 1: Training of trainers

- Identification of Technical Institutes as long-term capacity-building partners.
- Establishment of three (3) Training Centers.
- Procurement of equipment for the centers.
- Award of contracts to those selected institutes.
- Training of master trainers.
- Production of training material in local languages.

Component 2: Training workshops on good practices for the selected technicians

- Identification of technicians in 2-3 big cities who conduct HCFC based servicing regularly;
- Organize the training on good practices to the selected technicians

(Under this component it might also need one or two ad-hoc workshop to train the current technicians that have already been working in the workshops.)

Component 3: Networking for Standard setting and promotion of Code of Good Practices

- Strengthening of RAC associations. Survey on existing servicing techniques and standards. Development of a Code of Good Practices for RAC servicing
- Production of training material in local languages to promote Good Practices in servicing with HCFC and non-HCFC refrigerants.

Component 4: Preparation for R&R and other interventions

- Consultation with stakeholders on Recycling and Recovery project.
- Development of an implementation plan of the R & R project.

Component 5: Certification of refrigeration technicians

- Standard examination and certification procedure
- Establishing Testing Center
- Certification program
- Database of certified technician

Time Frame	2011	2012	2013	2014	2015
Component 1: Training of trainers					
Component 2: Training of technicians on good practices					
Component 3: Networking for Standard setting and promotion of Code of Good Practices					
Component 4: Preparation for R&R and other interventions					
Component 5: Certification of refrigeration technicians					

Good practices training program will start as soon as possible in 2011. It is estimated that with the training provided to the technicians in the first phase, as well as promotion of the good practices through the refrigeration association, around 14.00 ODP tones will be phased out by the end of 2015.

3) Awareness promotion

Target Audiences: The primary target audience will be government officials and offices outside the NOU unit, as well as importers, dealers, large-scale users of HCFC, including service technicians. It is estimated that engaging these groups on a priority basis will consume **70% to 80%** of this plan's activities and resources, and will help Pakistan to meet the immediate compliance target. The secondary target audience will include those who can help multiply the HCFC phase-out message such as journalists, scientists, NGOs and consumer groups. It is estimated that engaging these groups will consume **20% to 30%** of this plan's activities and resources.

Primary Target Audience	Key stakeholders (subject to change)
Relevant Government officials	• Parliamentarians and policy-makers • Customs officers • Environmental officers at Provincial and District levels • Officials handling foreign investment promotion (Board of Investment) • Officials of Foreign Employment Bureau
Relevant industry networks	• Refrigeration Associations • American Society of Heating Refrigeration and Air-conditioning Engineers (ASHRAE)
HCFC importers, dealers and service technicians	• Importers & dealers of unitary air conditioners • Importers & dealers of refrigerators and chillers • Importers & dealers of HCFC in foam industry • Service technicians who repair and service equipment
Industrial/commercial scale users of HCFC-containing equipment	• Supermarkets (in cold storage, display units) • Medium-sized stores (in display units) • Food processing industries (fish, milk, poultry farms, meat processing, ice cream) • Manufacturing industries • Hotels and resorts • Mobile users of refrigeration & air conditioning

Secondary Target Audience	Key stakeholders (subject to change)
Message 'Multipliers': those who can help spread the message to others	• Journalists and editors (print, broadcast and web-based) • Advertising and social marketing professionals • Educators (primary, secondary, tertiary levels) • Vocational trainers (especially those training service technicians in refrigeration and air conditioning sectors) • Environmental advocacy and activist groups • Consumer associations • Trade chambers
Scientific and professional associations/networks; Climate change community, Student group	• Scientific Associations • Institute of Architects • Institution of Engineers • Energy Managers' Association • Construction industry networks • Clean Air Quality Management Control • Campus Carbon Neutral groups
General public; team up with local NGOs, advocacy and consumer groups, etc.	• Consumers Groups • Consumers • School children

Proposed activities:

Primary Target Group Core Activities - 70% to 80%

Activity and timing	Brief description
Updating key stakeholder contact data Early 2011	Update NOU contact database; add contacts for all relevant government offices, and relevant HCFC sectors, ie, importers, large-scale commercial users, etc., Database for second-tired audience should also be updated in this effort, see core activity for secondary target group below.
Benchmark KAPB survey of all primary target groups. Including industry and government agencies, etc During 2011	To understand information habits and sources of primary target groups, commission a study on their knowledge, attitude and practices and behaviour (KAPB). Findings will help customize info materials to better suit their needs, and also assist in later evaluation of impacts of IEC activities.
Awareness workshops for industry associations 2011-2012	To organize workshop to train at least 100 industry trainers who can spread the HCFC phase-out process and its ozone/climate benefits to all primary target groups. 2 or 3 Training workshops during 2011-2012.
Awareness Workshop for government offices about the role that they could play to help phase out HCFCs 2011-2012	There is a need for appropriate policy and regulatory interventions to make the energy efficient units with the alternative refrigerants more affordable. Raising awareness among government officials who are decision makers in this regard is critical to help putting appropriate policy and regulations in place. In addition, public sector is a major procurer

Activity and timing	Brief description
	of goods and services. It is necessary to introduce energy efficiency and low HCFC procurement in governments to not only promote the market for such goods and services but also to provide leadership to other entities to do so.
Awareness information material (print) During 2011-2012 On-going distribution	Produce simple, easily accessible information pack that explains HCFC phase-out, its dual benefits and technical steps needed to sustain phase out. Translate UNEP's materials relating to HCFC phase out into local language. Mix of leaflets, booklets and posters in local language to be used at least until 2015.
Awareness materials (video) During 2011-2012 On-going distribution	Sector-specific short (5 – 10 min) films shown in IEC events. At least 3 films covering RAC, Refrigerator and Foam sectors, in local language. Budget should cover production, plus DVD/VCD based mass duplication & distribution. Including dubbing of existing training films, ie, detecting illegal ODS cross border trade plus others into local language.
Awareness materials (web) During 2011-2012 On-going updating	Develop a section of NOU website dedicated to HCFC phase-out, and content manage it as authoritative online place for industry and public. Add all print and video materials (proposed above) also to this website.
Localise international training material for Customs officers During 2011-2012. On-going training use.	UNEP and EIA have produced training materials for Customs officers on understanding and detecting illegal ODS trade across borders. Adapt the relevant segments into local languages and use them in Customs training workshops.
NOU participation in trade and industry events 2012-2015	Support NOU participation (speaking, exhibitions) at relevant trade/industry events during 2012-2015, in engineering, construction, architecture, chemicals and shipping, etc.

Secondary Target Group Core Activities - 20% to 30%

Activity	Brief description
Update key "multiplier" stakeholder database: Early 2011	Update NOU contact database: press, radio, television, scientific bodies, NGOs, student and consumer groups, etc… all groups that help multiply the HCFC phase-out message. To be done in concert with database updating for government and industry stakeholders in "primary target."
Engaging the print and broadcast media: 2011-2015	Media training workshops that are stand alone and combined with workshops prepared for primary target group: • Media training workshops on ozone-climate issues: cover at least 50 journalists & TV producers per year for 3 yrs • Media award on best ozone-climate reporting, presented as part of annual awards of Pakistan's key journalist association • Media gatekeeper roundtable on ozone-climate issues, early 2012
Engage Scientific Associations, NGOs,	The object is to leverage the energy and memberships of these groups into getting the message out. Where appropriate they

Activity	Brief description
Student groups, etc. 2011-2015	should be involved and invited to attend media and stakeholder workshops, public events, roundtables and participate in ozone writing and reporting contests.
Engaging formal education system: 2011-2015	Partner with National Institute of Education (NIE) to: • Update curriculum elements on ozone, to include HCFC phase out efforts (2011-2012) • Conduct workshop for curriculum developers and/or master teachers (2011-2012) • Organise essay, debating or quiz competitions on ozone protection and climate benefits • Felicitate winners on International Ozone Day public event organised by NOU
Engaging consumers: 2012 onwards	Work with consumer groups and eco-labelling bodies to: • Develop labelling for HCFC-free equipment • Raise consumer awareness on responsible buying of refrigerators & air conditioners • Raise awareness on proper servicing during equipment use (by certified technicians only)
Public engagement events: annually from 2012 - 2015	Organise public events on International Ozone Day, World Environment Day or important holidays in Pakistan etc with particular focus on HCFC phase-out process. Use these events to disseminate public information materials produced by NOU and UNEP and to recognise innovation, dynamism and commitment by key stakeholders in HCFC phase out activities.

ANNEX-4

ENERGY EFFICIENCY INITIATIVES AND COST FOR CLIMATE CO-BENEFITS

Energy Efficiency Initiatives and Cost for Climate Co-benefits

1. Strengthening of Standards and Labeling Programme (SSLP)

Pakistan has initiated the standards and labeling programme recently and has included CFLs into it as of now. The programme needs to be deepened as well as broadened to synergize the twin objectives of ODS reduction as well as enhanced energy efficiency. The SLP is a powerful public policy tool to overcome the barriers associated with energy efficient products which are:

- High first cost as they provide an economic option in the long run - looking at the life cycle costs
- Information about the energy performance on the label

The SLP with an associated outreach and awareness programme could stimulate market transformation in favour of these equipments. This strategy could also integrate the ODS phase out objectives as they too have the effect of increasing the price of the equipments.

The SLP could have an impact on these policy goals given, as per the survey results; usage of ACs in Pakistan is witnessing an aggressive growth. The annual production of air conditioners in Pakistan is around 350,000 units, 90% of which is the residential and commercial sector. The growth rate of the industry is projected at around 15% per annum. Similarly for SLP for domestic refrigeration sector could also be structured to ensure synergies of enhanced energy efficiency with HCFC phase out objectives. This would not only supplement GOP efforts under the AHPR by encouraging a market based instrument, it would also enable the industry to overcome market barriers, particularly in relation of higher cost and information asymmetry. Synergies between energy efficiency standards and HCFC phase out plan with proper design could well serve the twin purposes while making its administration transparent and simpler. Given that Pakistan has already embarked on this programme for CFLs, broadening the same to cover refrigeration, air-conditioning and vending applications must be taken up. The programme could integrate the following:

- Energy efficiency standards including Minimum Energy Performance Standards (MEPS);
- HCFC phase out linked to up gradation of standards in a predefined period;
- Demand pull by providing a comparative label (from 1 STAR to 5 STAR) that duly integrates (a) and (b) above;
- Graded taxation regime in favour of higher standards to accelerate market transformation with the twin objective of enhancing energy efficiency and reducing HCFC.
- A well researched and targeted awareness campaign to enhance demand for higher STAR labeled equipments. This would not only include a comprehensive mass media campaign but also a programme to enhance capacity of retailers, servicing professionals.

SLP could be a good instrument to ensure that all new products manufactured or imported in Pakistan conform to energy efficiency and HCFC standards. The comparative labels, with proper outreach and information dissemination could leverage the consumer demand to ensure the transformation of the market.

2. Framework for Efficient and Low HCFC Economic Development (FELHED)

FELHED will include promotion of market based accelerated replacement of ACs and other energy and HCFC using equipments. This is necessary to take care of replacements of equipments which are already in operation. For instance, the population of ACs in Pakistan is

estimated to almost 18 million. The FELHED could be implemented by using the three instruments indicated below:

- ESCO Delivery Instrument (EDI): The ESCO mode of delivery through performance contracts could not only increase demand but also could overcome the twin barriers of higher costs and information asymmetry that any new technology has to usually overcome. This delivery instrument would work the best in the commercial sector given that it is easier to bundle projects to a critical mass needed for attracting ESCOs and also the monitoring and verification is simpler (as compared to the household sector).

  In addition, a mandatory programme for public procurement of higher STAR labeled equipments is recommended to not only demonstrate the Government resolve but also to encourage manufacturers/ importers towards higher quality and efficiency products.

- Utility Driven Replacements (UDR): Utilities usually do not have incentives to undertake Demand Side Management (DSM) programmes as it is in conflict with its basic objective of maximizing electricity sales. However, properly structured DSM programmes could help achieve energy efficiency and allied policy objectives in a much faster manner. For instance, the industries in Pakistan are subjected to differential tariffs for peak and off-peak hours - the difference being almost 2 times. Also, the country, with an installed capacity of 19,982 MW, faces a peak shortage of over 4,000 MW (2010). About 46% of the total generation of 97.42 GWh is used in the domestic and commercial sector. The study carried out by ENERCON through the funding of GTZ; identify approximately 25-30% efficiency gains in the refrigeration and air conditioner sector. The potential savings of energy if theoretically all the existing stock of old ACs and refrigerators are replaced (which are presumed to contribute to 55% of residential and commercial electricity) is around 4.5 GWh. The opportunity cost to the utility for sale to industry being Rs. 4 per KWh (the difference between the two rates), the gain to the utility of saving energy during peak hours and selling to industry is around Rs. 20.0 billion. This savings could be leveraged to fund DSM programmes that could help replacement of old ACs and Refrigerators which are not only energy efficient but also comply with the HCFC phase out plan. The savings could be used to provide incentives to manufacturers/ consumers to go in for replacements. These incentives could be in the form of incremental cost of the efficient equipments, etc. This concept is the same as the Climate REDI initiative of USA, which is now being promoted by the Major Economies Forum on Energy and Climate Change as well as the International Partnership on Energy Efficiency Cooperation (IPEEC).

- Energy Efficient Public Procurement and Replacement (EEPPR):

  GOP is a large procurer of energy using goods, particularly in areas like officers, defense establishments, railways, etc. There is a need for GOP to mandate that:

  - All new equipments that use HCFCs must conform to the new energy efficient standards- preferably the government must mandate that only high energy efficient and HCFC phase out compliant equipments will be procured. For instance, in case of a comparative labeling programme with integrated HCFC phase out targets, government must mandate procurement of 3 STAR and above equipments only. The necessary tools for evaluating the lifecycle costs of energy efficient equipments will be prepared as a part of the programme to enable its use by public procurement officers of GoP.

  - All establishments of the government must undergo energy efficiency retrofits by ESCO delivery mechanism. Appropriate mandate for use of low or no HCFC equipments could be provided as well.

- Enhanced Awareness and Outreach and Capacity building:

  There has to be a comprehensive media strategy that needs to be evolved based on the need to create awareness about energy conservation and efficiency along with the objectives of HCFC phase out. The strategy must focus on motivating stakeholder to not only save energy by its rational use but also on the irreversible damage that ODS could cause to the environment. Piggy back on such umbrella messages could be the campaign on making the STAR label as a lifestyle brand. The essential ingredients of the media strategy must include:

  - Identification of the target group and segregation in terms of their respective socio-economic parameters;

  - Messages for communication must be tailored in a manner that is most effective for different strata of society - for instance for the middle class, cost saving is an effective communication strategy while for the upper classes, lifestyle branding or saving environment are usually better than cost saving communications.

  - Media must be chosen appropriately to target different consumer and stakeholders. While television is a good medium for lower and middle classes, internet, mobile SMS have better acceptability in the higher classes.

  - Simple messages usually are accepted better and the strategy must focus on this.

  - A combination of television, print and internet must be taken, in terms of their relative reach followed by radio, which usually has a good recall value.

  - A consumer survey must form the basis of preparation of the media strategy, media plan and communication strategy.

  - A capacity building programme aimed at retailers and distributors must also be initiated along with. This should include a broad framework of the SLP, its advantages to consumers & society, comparative performance of higher STAR labeled equipments, etc. A standard module may form the basis of this outreach with expert trainers. Easy to understand tip sheets and flyers must be prepared which could help the retailers to inform the consumers. This could compliment the awareness programme.

3. Capacity Building and Training

In order that the above initiatives achieve the goal set forth for them, the need to enhance capacities for the entire gamut of stakeholders is essential. The key stakeholders and their identified capacity building requirements are a under:

S. No	Stakeholder (s)	Capacity Building Requirements	Capacity building/ training tool
1	Policy Makers/ Ozone Officers/ Energy Efficiency Institutions	- Energy Efficiency/ Climate Change - SLP - Synergising ODS and EE targets - Life cycle cost analysis - Barrier analysis and policy options based on best practices	EE Toolkit for policy makers to initiate and sustain these programmes

S. No	Stakeholder (s)	Capacity Building Requirements	Capacity building/ training tool
2	Manufacturers/ Importers/ Traders	- Best practices in EE and ODS - Deployment of new technologies to enable manufacture of EE and low ODS equipments - Policy objectives of the emerging regulatory framework - Training of distributors and retailers	-EE Toolkit with best practices of technology deployment and emerging international policy framework. - Training modules for retailers and distributors.
3	Consumers	- Awareness about ODS and need to reduce their use - Awareness about climate change and impact on economic growth and social development (adaptation) - Mitigation of climate change by using energy efficiency - Saving money by using EE equipments which are beneficial to consumers	-A scientifically designed outreach programme for consumers through the mass media covering the messages - FAQs on SLP and ODS

4. Budget (co-financing)

1. Promotion of Ozone Climate co-benefits (SLP)

Sr.#	Description	Time Frame	Budget
1.1	SLP- Policy preparation and institutional framework	2011-2013	50,000
1.2	Situation Analysis, Survey, dynamic standard setting with ODS timelines, setting up of Technical Committees	2011-2015	70,000
1.3	Capacity building workshops of policy makers	2011-2020	100,000
1.4	Capacity building of retailers, distributors, promotional material for sales staff	2011-2020	120,000
1.5	Impact Analysis	2011-2015	20,000
	Sub-total	**2011-2020**	**360,000**

2. Promotion of Ozone Climate co-benefits (FELHED)

Sr.#	Description	Time Frame	Budget
2.1	Policy preparation and institutional framework	2011-2013	30,000
2.2	ESCO market design and development, including performance contracts	2011-2020	100,000
2.3	Guidelines for Energy Efficient Public Procurement	2011-2012	15,000
2.4	Capacity building workshops of policy makers	2011-2020	70,000
2.5	Capacity building of financial institutions, facility owners	2011-2020	90,000
2.6	Stakeholder Consultation and Environmental Impact Assessment	2012-2013	60,000
2.7	Capacity building of the managing entity	2011-2015	50,000
	Sub-total	**2011-2020**	**415,000**

3. Promotion of Ozone Climate co-benefits (SLP)

Sr. #	Description	Time Frame	Budget
3.1	Strategy Design	2011	10,000
3.2	Research and Analyses	2011	15,000
3.3	Stakeholder Engagement/Workshops	2011-2020	60,000
3.4	Media Campaign	2011-2020	150,000
3.5	Print material (leaflets, pamphlets booklets etc)	2011-2020	60,000
	Sub-total	**2011-2020**	**295,000**
	Grand Total (1+2+3)		**1,070,000**

ANNEX-5

HCFC USERS PROFILES IN MANUFACTURING SECTORS

Company Baseline Profiles

1. Refrigeration Sector

1.1 Domestic Refrigeration PU Foam

1. United Refrigerators

United Refrigerators Industries Limited (URIL) was incorporated in Pakistan on March 1, 1980. The Company has 100% local shares. The Company is in the manufacturing of Refrigerators of various sizes and models. The manufacturing plant is located in Hyderabad, Pakistan. During the last three years, the annual average increase in production is around 4.6% despite of the slow down of economy at international and national level. The annual production of refrigerators during 2009 is around 370,000. The foaming facilities are at two different locations approximately 500 meter away from each other. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models at both the locations. The company annual consumption of HCFC 141b in 2009 as per physical survey is 294.9 Metric ton (32.4 ODP ton).

The enterprise has 2405 employees in both the production areas including 142 technical, 285 administrative and 1978 operating staff. The factory operates in three shifts during peak seasons and in two shifts during off peak seasons. The main market is Pakistan; however URIL has also exported approximately 1% of its goods to Afghanistan. The compact density of the rigid PU foams produced depends on the exact product and ranges 37-38 kg/m³. The plant is located at D-14, SITE, Hali Road, Hyderabad.

M/s. United Refrigerators has converted to HCFC-141b from CFC through the funding of Montreal Protocol.

The baseline equipment of foaming line at both the location is as under:

Old Foaming Line

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	Elastogran polyurethane	2	500L*	Elastogran, Germany	1993
2	Isocyanate Storage Tank	Elastogran polyurethane	1	2500L*	Local Made	2006
3	HCFC 141-b Drum	-	1	250Kg	Packing Drum	
Assembly Line 1 - Old Foaming Line						
1	Polyol Day Tank	Elastogran polyurethane	1	300L*	Elastogran Germany	1993
2	Isocyanate Day Tank	Elastogran polyurethane	1	300L*	Elastogran, Germany	1996
3	PU Foaming Machine with 2 mixing heads	PU 80/80	1	80kg/min	Elastogran Germany	1986
4	Jigs & Fixtures	Based on Models	Cabinet: 6 Door: 6	8/Hr	Filli Rossi	2001
				8/Hr	Perros	1984
				20/Hr	Filli rossi Ref. Jig	2004

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
Assembly Line 2 - Old Foaming Line						
1	Polyol Day Tank	–	1	300L*	Elastogran Germany	1993
2	Isocyanate Day Tank	–	1	300L*	Elastogran Germany	1993
3	PU Foaming Machine with 2 mixing heads	PU 80/80	1	80kg/min	Elastogran Germany	1993
4	Jigs & Fixtures	Based on Models	Door: 16	30/Hr	Filli rossi Ref. Jig	2006
				50/Hr	Filli rossi Ref. Jig	1990

New Foaming Line

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	H.1	1	500L*	Krauss maffei, Germany	2006
2	Isocyanate Storage Tank	H.1	1	2500L*	Krauss maffei, Germany	2006
3	HCFC 141-b Tank	H.1	1	500L*	Factory Made	2006
4	Polyol Buffer Tank	H.1	1	500L*	Krauss maffei, Germany	2006
5	Isocyanate Buffer Tank	H.1	1	500L*	Krauss maffei, Germany	2006
6	Polyol Day Tanks	H.1	1	500L*	Krauss maffei, Germany	2006
7	Isocyanate Day Tanks	H.1	1	500L*	Factory Made	2006
8	PU Foaming Machine with 2 mixing heads	PU Puromat 80/80	1	80kg/min	Krauss maffei, Germany	2006**
9	Jigs & Fixtures	Based on Models	9	09/Hr per jig	Filli Rossi	2006

* Effective Capacity
** Equipment purchased in 1998, retrofitted in 2005 and commissioned in 2006

2. Dawlance (Pvt.) Limited

Dawlance Private Limited (DPL) was incorporated in Pakistan on January 16, 1991. The Company has 100% local shares. The Company is in the manufacturing of Refrigerators and Freezers of various sizes and models. The manufacturing plant is located in Karachi, Pakistan at two different locations. During the last three years, the annual average increase in production is around 17.0% despite of the slow down of economy at international and national level. The annual production of refrigerators and Freezers during 2009 is around 239,000. The foaming facilities are at both the plants located approximately 2 km away from each other. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in both the plants. The company annual consumption of HCFC 141b in 2009 as per physical survey is 203.7 Metric ton (22.4 ODP ton).

The enterprise has 1596 employees in both the production areas including 116 technical, 283 administrative and 1197 operating staff. The factory operates in three shifts during peak seasons and in two shifts during off peak seasons. The main market is Pakistan; however DPL has also exported approximately 1% of its goods to Afghanistan. The compact density of the rigid PU foams produced depends on the exact product and ranges 37-38 kg/m³. The plants are located at S-476, National Highway, Landhi, Karachi and D-89, Deh Khanto, Bin Qasim Town National Highway, Landhi, Karachi.

M/s. Dawlance has converted to HCFC-141b from CFC through the funding of Montreal Protocol.

The baseline equipment of foaming line at both the location is as under:

Foaming Line DPL-1

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	113845	1	500L*	Krauss maffei, Germany	2006
2	Isocyanate Storage Tank	–	1	500L*	Krauss maffei, Germany	2006
3	HCFC 141-b Drum	-	1	250Kg	Packing Drum	
Assembly Line 1						
1	Polyol Day Tank	25052	1	250L	Elastogran, Germany	2006
2	Isocyanate Day Tank	25057	1	250L	Elastogran, Germany	2006
3	PU Foaming Machine with 1 mixing head	Pu 40/40	1	40kg/min	Krauss maffei, Germany	2006
4	Jigs & Fixtures	Based on Models	Cabinet:7	–	Canon Crios	2002
Assembly Line 2						
1	Polyol Day Tank	25052	1	500L	Krauss maffei, Germany	2006
2	Isocyanate Day Tank	25057	1	500L	Krauss maffei, Germany	2006
3	PU Foaming Machine with 1 mixing head	Pu 80/80	1	80kg/min	Elastogran, Germany	1996
4	Jigs & Fixtures	Based on Models	Door: 7	–	Canon Crios	2002

Foaming Line DPL-2

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	Locally Made	1	500L*	Locally Made	2005
2	Isocyanate Storage Tank	Locally Made	1	500L*	Locally Made	2005

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
3	Polyol Day Tank	80997	1	470L*	Krauss maffei, Germany	2005
4	Isocyanate Day Tank	80997	1	470L*	Krauss maffei, Germany	2005
5	PU Foaming Machine	B 2001 80/80	1	HP= 102 Kg/min LP= 48 Kg/ min	Krauss maffei, Germany	2005**
6	Jigs & Fixtures	DF200, 300,400, 500,400T, 500T,300G, 400G	Cabinet: 8 Door: 5		–	Dates not Available

* Effective Capacity
** Equipment purchased in 1997, retrofitted and commissioned in 2005

3. Haier, Lahore

HRN Manufacturing Company was incorporated in Pakistan on November 12, 2001. The Company has 70% local shares by Ruba Group of Pakistan and 30% shares by Haier Group of China. The Company is in the manufacturing of Refrigerator and Domestic Freezers. For the manufacturing of these products they used HCFC-141b in their sub-sector of rigid polyurethane foam. The manufacturing plant is in Lahore, Pakistan. During the last three years, the annual average increase in production is around 19.7% despite of the slow down of economy at international and national level. The annual production of refrigerators and Freezers during 2009 is around 75,000. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 69.9 Metric ton (7.7 ODP ton)

The enterprise has 574 employees in both the production lines. Out of these 318 is in the Refrigerator factory including 11 technical, 18 administrative and 289 operating staff. 256 employees are working in air conditioning factory. The factory operates in two shifts during peak season and in one shift during off peak season.

The main market is Pakistan, but HNR also exports approximately 2.5% of its goods to Afghanistan, Uzbikistan and Moritania. The compact density of the rigid PU foams produced depends on the exact product and ranges 37-38 kg/m^3. The plant is located at 19.5 KM Raiwind Road, Lahore.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	PM 1000	1	900L	Wuhan Light Industries, China	2004
2	Isocyanate Storage Tank	PM 1000	1	900L	Wuhan Light Industries, China	2004

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
3	HCFC 141-b Tank	GP150-98	1	500L	Wuhan Light Industries, China	2004
Assembly Line 1 (Cabinet)						
1	Polyol Day Tank	PM 1000	1	250L	Wuhan Light Industries, China	2004
2	Isocyanate Day Tank	PM 1000	1	250L	Wuhan Light Industries, China	2004
3	PU Foaming Machine with 1 mixing head	A SYS 2005+DN 280169	1	90kg/min	Cannon, Italy	2004
4	Jigs & Fixtures	Based on Models	Cabinet:8	600units/2 Shifts	Haier, China	2004
Assembly Line 1 (Door)						
1	Polyol Day Tank	PM 1000	1	500L	Wuhan Light Industries, China	2004
2	Isocyanate Day Tank	PM 1000	1	500L	Wuhan Light Industries, China	2004
3	PU Foaming Machine with 1 mixing head	PU80/EAS gron	1	33.6 Kg/min	Wuhan Light Industries, China	2004
4	Jigs & Fixtures	Based on Models	Door:20	600units/2 Shifts	Haier, China	2004

4. Cool Industries

Cool Industries (Pvt.) Ltd. marketing under the brand name of Waves was incorporated in Pakistan on 1973. The Company has 100% local shares. The Company is in the manufacturing of Refrigerators and freezers of various sizes and models. The manufacturing plant is located in Lahore, Pakistan. Two separate foaming facilities exist in the plant. One is through cyclo-pentane and the other is through 141-b as blowing agent. The cyclo pentane based foaming facilities is for refrigerators whereas the 141b based facilities is for freezer. The conversion of CFC foaming facilities in the manufacturing of Polyurethane foam in domestic refrigerator to cyclo-pentane technology was implemented in December 2006 through the funding of Montreal Protocol. The company is still using HCFC-141b in the manufacturing of freezers and their annual consumption of HCFC 141b in 2009 as per physical survey is 106.0 Metric ton (11.7 ODP ton).

The factory operates in three shifts during peak seasons and in two shifts during off peak seasons. The main market is Pakistan. The compact density of the rigid PU foams produced depends on the exact product and ranges 37-38 kg/m^3. The plant is located at Hanjarwal, Multan Road, Lahore.

1.2 Commercial Refrigeration PU Foam

1. Varioline, Lahore

Varioline Private Limited Company was incorporated in Pakistan on 14 September 1995. The Company has 60% local shares by Varioline Pakistan Limited and 40% shares by Songserm Intercool (Pvt.) Limited. The Company is in the manufacturing of visi/ chest cooler and chest freezers. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Lahore, Pakistan. During the last three years, the annual average increase in production is around 49.6% despite of the slow down of economy at international and national level. The annual production of visi/ chest cooler and chest freezers during 2009 is around 79,000. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 47.7 Metric ton (5.2 ODP ton).

The enterprise has 600 employees including 45 technical, 28 administrative and 527 operating staff for manufacturing, research and development, design, assembly, training, technical support, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The main market is Pakistan, but Varioline also exports approx. 10% of its goods to Afghanistan. The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at 3-KM Kahna Kacha Road, Kahna, Lahore.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
Assembly line 1						
1	Polyol Day Tank	–	1	750L	Krauss maffei, Germany	1998
2	Isocyanate Day Tank	–	1	750L	Krauss maffei, Germany	1998
3	PU Foaming Machine with 1 mixing head	RIM-Star E40/40	1	60kg/min	Krauss maffei, Germany	1998
4	Jigs & Fixtures	Based on Model	36	2 holding jigs/ unit	Local make	1996
Assembly line 2						
1	Polyol Day Tank	–	1	250L	Krauss maffei, Germany	2005
2	Isocyanate Day Tank	–	1	250L	Krauss maffei, Germany	2005
3	PU Foaming Machine	Puromat 80/30 IQ	1	60kg/min	Krauss maffei, Germany	2005
4	Jigs & Fixtures	Based on Model	14	2 holding jigs/ unit	Local make	2005

2. Shadman Electronics

Shadman Electronics Industries (Pvt.) Ltd was incorporated in Pakistan on June 04, 1984. The Company has 100% local shares. The Company is in the manufacturing of

Ice Cream Cabinet of various sizes and models. The manufacturing plant is located in Karachi, Pakistan. During the last three years, the annual average increase in production is around 15.7% despite of the slow down of economy at international and national level. The annual production of Ice Cream Cabinet during 2009 is around 31,000. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 35.6 Metric ton (3.9 ODP ton).

The enterprise has 95 employees including 60 technical, 10 administrative and 25 operating staff. The factory operates in one shift only. The main market is Pakistan only. The compact density of the rigid PU foams produced depends on the exact product and ranges 37-38 kg/m³. The plant is located at Plot-201, Sector-23, Korangi Industrial Area, Karachi.

M/s. Shadman has converted to HCFC-141b from CFC through the funding of Montreal Protocol.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	MGD 2501	1	250L*	Elastogran Germany	2000
2	Isocyanate Storage Tank	MGD 2501	1	250L*	Elastogran Germany	2000
3	PU Foaming Machine with 1 mixing head	80 PQS Puromat	1	80kg/min	Elastogran Germany	2000
4	Jigs & Fixtures	Based on Model	Body: 14 Door: 2	–	Semi Auto	2000

* Effective Capacity

3. Mumtaz Engineers

M/s. Mumtaz Engineering (Pvt.) Ltd. was incorporated in Pakistan on December 17, 1986. The Company has 100% local shares. The Company is in the manufacturing of visi/ chest cooler. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Lahore, Pakistan. During the last three years, the annual average increase in production is around 30% in 1st year, 40% in 2nd year & 50% in 3rd year. The annual production of visi/ chest cooler during 2009 is around 10,000 Units. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 8.0 Metric ton (0.9 ODP ton).

The enterprise has 130 employees including 100 technical, 10 administrative and 10 operating staff for manufacturing, research and development, design, assembly, training, technical support, sales, marketing and 10 for after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The main market is Pakistan, but Mumtaz also exports approx. 1% of its goods to neighboring countries. The compact density of the rigid PU foams produced depends

on the exact product and ranges 33±0.5 kg/m³. The plant is located at 141-Industrial Area, Kot Lakhpat, Lahore.

M/s. Mumtaz Engineers has converted to HCFC-141b from CFC through the funding of Montreal Protocol in November 2005. However the project was approved by MLF in December 2000.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	NF 041178	1	250 Kg	Sirone (Lecco) Italy GBM	2005
2	Isocyanate Storage Tank	NF 041184	1	250 Kg	Sirone (Lecco) Italy GBM	2005
3	PU Foaming Machine with 1 mixing head	Sr. No: 003134	1	120 Kg/min at 150 PSI & Temp: 22 C°	OMS Group, Italy, (Cerom Veramo B.za (MI) Italy)	2005
4	Jigs & Fixtures	30,50,170, 260,400,500, 800,1000 (Model for Liters)	Body: 08	–	Semi Auto	2005

2. Foam Sector

2.1 Rigid Foam

1. Asif Zubair & Co.

M/s. Asif Zubair & Co. was incorporated in Pakistan on 1983. The Company has 100% local shares. The Company is in the manufacturing of thermoware and plastic goods. Products manufactured include water coolers and hot pots, which are marketed locally and export 10% of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 40.0 Metric ton (4.4 ODP ton). Chemical suppliers include ICI, BASF and Simpson. The premixing of 141b & Polyol is done at the factory.

The enterprise has 61 employees including 5 technical, 55 administrative and 1 operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at F-385 SITE, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2002. However the project was approved by MLF in November 1997.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Day Tank	65 R	1	250L*	Hennecke Germany	2002
2	Isocyanate Day Tank	65 R	1	250L*	Hennecke Germany	2002
3	PU Foaming Machine with 1 mixing head	65 R	1	24 kg/min	Hennecke Germany	2002
4	Jigs & Fixtures	Based on Model		–	Semi Auto	2002

2. Tropical Plastic

M/s. Tropical Plastic was incorporated in Pakistan on 1988. The Company has 100% local shares. The Company is in the manufacturing of thermoware, mainly water coolers and thermoses insulated with polyurethane which are marketed locally and export 1% of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 15.0 Metric ton (1.7 ODP ton). Chemical suppliers include ICI. The premixing of 141b & Polyol is done at the factory.

The enterprise has 32 employees including 4 technical, 3 administrative and 25 operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at C-11/D, S.I.T.E, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

3. Zulquarnain Corp.

M/s. Zulquarnain Corp. was incorporated in Pakistan on _2004 (Previously 3Z Ind_since 1996). The Company has 100% local shares. The Company is in the manufacturing of _Thermic House Hold Products, which are marketed locally and export indirectly of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 12.5 Metric ton (1.4 ODP ton). Chemical suppliers include ICI & Other Traders. The premixing of 141b & Polyol is done at the factory.

The enterprise has 28 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Karachi.

4. Delight Plastic

The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 12.0 Metric ton (1.3 ODP ton). The premixing of 141b & Polyol is done at the factory.

5. Mehran Plastic Industries

M/s. Mehran Plastic Industries was incorporated in Pakistan on 1985. The Company has 100% local shares. The Company is in the manufacturing of thermoware insulated with polyurethane, and marketed under the brand names Mehran and Mehran. Products manufactured are marketed locally with no exports of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 6.0 Metric ton (0.7 ODP ton). Chemical suppliers include ICI, BASF and Aupzone. The premixing of 141b & Polyol is done at the factory.

The company currently runs at about 60% capacity. The enterprise has 12 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located atB-43, SITE, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in July 1998.

6. Arm Brothers

M/s. ARM Brothers Plastic Industries (Pvt.) Ltd. was incorporated in Pakistan on 1983. The Company has 100% local shares. The Company is in the manufacturing of Thermoware, mainly hot pots and water coolers insulated with polyurethane which are marketed locally and export 5% of their products in UAE and West African countries. For the manufacturing of these products, they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models of hotpots and water coolers in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 6.8 Metric ton (0.7 ODP ton). Chemical suppliers include ICI and BASF. The premixing of 141b & Polyol is done at the factory. Since, the company has been manufacturing premium quality products, the machinery being used is very important to the plant.

The enterprise has approximately 28 employees including 2 technical, 21 operating/labour staff for manufacturing, and 5 administrative staff for sales and marketing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at WH-11, Sector 16-B, Block-22, F.B. Industrial Area, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	65R	2	250L*	Hennecke, Germany	2003
2	Isocyanate Storage Tank	65R	2	250L*	Hennecke, Germany	2007

7. Decent Plastic

M/s. Decent Plastic was incorporated in Pakistan on 1994. The Company has 100% local shares. The Company is in the manufacturing of thermoware, mainly hot pots, Jugs, school bottles and water coolers insulated with polyurethane which are marketed locally and export 10% of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 1.0 Metric ton (0.1 ODP ton). Chemical suppliers include ICI. The premixing of 141b & Polyol is done at the factory.

The enterprise has 27 employees including 20 technical and 7 administrative staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Plot No. 8/2 Sector 12-D North Karachi Industrial Area, Karachi.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	MGD 2501	1	250L*	Elastogran Germany	2006
2	Isocyanate Storage Tank	MGD 2501	1	250L*	Elastogran Germany	2006
3	PU Foaming Machine with 1 mixing head	40/20 kg/min	1	40/20 kg/min	Elastogran Germany	2006
4	Jigs & Fixtures	Based on Model		–	Semi Auto	2006

8. Pifcom (Pvt.) Ltd

M/s. Pifcom (Pvt.) Ltd was incorporated in Pakistan on 1975. The Company has 100% local shares. The Company is in the manufacturing of thermoware and other plastic products. Products manufactured include insulated thermal water coolers and hotpots which are marketed locally. For the manufacturing of these products they

used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 3.0 Metric ton (0.3 ODP ton). Chemical suppliers include ICI, BASF and Simpson. The premixing of 141b & Polyol is done at the factory.

Installed capacity is approximately 500,000 pieces/year, with the plant currently producing at 25-70% capacity. The enterprise has 6 employees including 2 technical, 2 administrative and 2 operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Plot # LY 70-3/4 Faqir Muhammad, Durra Khan Road, Lane # 14, Usmanabad, Karachi.

9. Plasticrafter

M/s. Plasticrafter was incorporated in Pakistan on 1948. The Company has 100% local shares. The Company is in the manufacturing of thermoware and other plastic products. Products manufactured include insulated thermal water coolers and hotpots, as well as plastic buckets, tubs and plastic parts for industrial customers which are marketed locally. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 10.0 Metric ton (1.1 ODP ton). Chemical suppliers include ICI, BASF and Simpson. The premixing of 141b & Polyol is done at the factory.

Installed capacity is approximately 500,000 pieces/year, with the plant currently producing at 25-70% capacity. The enterprise has 200 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at L/A-6, Block-22, F. B. Industrial Area, Karachi.

10. Shoaibee Industries

M/s Shoaibee Industries was incorporated in Pakistan on 1982. Shioaibee Industries is the first thermoware company who voluntarily shifted to 141b from F-11. The Company has 100% local shares. The Company is in the manufacturing of thermoware under the brand name Eagle Star. Products manufactured include coolers, Ice Boxes (Small Medium & Large), casseroles and hot pots insulated with polyurethane which are marketed locally. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulating material for the manufacturing of various models in the plant. The company annual consumption of HCFC-141b in 2009-2010 as per physical survey is 200.0 Metric Ton (21.50 ODP Ton). Chemical suppliers include ICI, BASF, Nippon, Yantai and Simpson. The premixing of 141b & Polyol is done at the factory.

Installed capacity is Two Million Pieces/year and the plant is currently running at 90% capacity. The enterprise has 350 employees including 8 technical, 330 administrative and 12 operating staff for manufacturing, sales, marketing and after sales services. The factory generally operates in one shift. However, during peak season it also operates in Round the clock.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Plot No. 55 & 56, Sector 24, Korangi Industrial Area, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol. The project was approved by MLF in November 1997.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer	Year
1	PU Foaming Machine (with 1 mixing head)	Baseline 65 R/MX8	4 Sets	Min ~Max 20 ~ 120 gr/Sec	Hennecke (Germany)	2002
2	Pre Mixer Polyol with 141b	Prominent	4 Sets		Hennecke (Germany)	2002
3	Chillers for Cooling of storage tanks 250L 2 Nos		4 Sets	3 Tons	GWK (Germany)	2002
4	Air-conditions (for PU Plants)		4 Sets	1.5 ~ 2 Tons	Mitsubishi	2002
5	Jigs & Fixtures		120 Ps	As per product design requirement		

11. Pakistan Plastic Industries

M/s. Pakistan Plastic Industries was incorporated in Pakistan on 1991. The Company has 100% local shares. The Company is in the manufacturing of thermoware under the brand names of Bright and Igloo. Products manufactured are mainly water coolers and thermoses insulated with polyurethane which are marketed locally. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 12.5 Metric ton (1.375 ODP ton). Chemical suppliers include ICI. The premixing of 141b & Polyol is done at the factory.

Installed capacity is 400,000 - 600,000 pieces/year, and the plant is running at about 50% capacity. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Plot No. 167, Sector 4-D, Orangi Town, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

12. Unique Plastics

M/s. Unique Plastics is in the manufacturing of thermoware. Products manufactured include coolers and hot pots insulated with polyurethane which are marketed locally and no export of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 5.0 Metric ton (0.55 ODP ton). Chemical suppliers include ICI, BASF and Simpson. The premixing of 141b & Polyol is done at the factory.

The enterprise has 35 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Plot No. 17, Sector 27, Korangi Industrial Area, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

13. Thermocraft Engineering Corporation

M/s. Thermocraft Engineering Corporation was incorporated in Pakistan on 1988. The Company has 100% local shares. The Company is manufacturing a wide range of rigid injected CFC FREE Polyurethane insulated panels, for prefabricated building, refrigerated warehouse, refrigerated trucks & trailers bodies, walk in cooler/ freezer, commodity storage complex, produce ripening rooms, blast freezer, meat storage or other refrigeration requirement which are marketed locally. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 4.0 Metric ton (0.44 ODP ton). Chemical suppliers include ICI and BASF. The premixing of 141b & Polyol is done at the factory.

The enterprise has 6 employees including 4 administrative and 2 operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at 305, 3rd floor, Uni Plaza, I.I. Chundrigar Road, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

14. ANZ Insutech Enterprises

M/s. ANZ Insutech Enterprises was incorporated in Pakistan on 1996. The Company has 100% local shares. The Company is in the manufacturing of chassis mounted insulated containers, and serving the frozen food industry which are marketed locally

and no export of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 2.5 Metric ton (0.3 ODP ton). Chemical suppliers include ICI. The premixing of 141b & Polyol is done at the factory.

The enterprise has 12 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at C-18, S.I.T.E., Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

15. Kold Kraft Ltd

M/s. Kold Kraft Ltd was incorporated in Pakistan on 21 May 1986. The Company has 100% local shares. The Company is in the manufacturing of Cold Store Plant, Equipments & Refrigerated Containers which are marketed locally and export Different Countries of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Lahore, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 11.0 Metric ton (1.2 ODP ton). Chemical suppliers include ICI Pakistan Limited. The premixing of 141b & Polyol is done at the factory.

The enterprise has 75 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at 247-S, Industrial Estate, Kot Lakhpat, Lahore.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in December 2002. However the project was approved by MLF in November 1997.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	A. System 100 STD	1	250L*	Afros S.p.A Canon	2000
2	Isocyanate Storage Tank	A. System 100 STD	1	250L*	Afros S.p.A Canon	2000

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
3	PU Foaming Machine with 1 mixing head	90 kg/min	1	90 kg/min	Afros S.p.A Canon	2000
4	Jigs & Fixtures	Based on Model		–	Semi Auto	2000

16. Pakistan Insulation

The company annual consumption of HCFC 141b in 2009 as per physical survey is 45.0 Metric ton (5.0 ODP ton).

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

17. Pakistan Air-conditioning Engineering Co. (PAECO)

M/s. PAECO was incorporated in Pakistan on 1971. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Lahore, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 15.0 Metric ton (1.7 ODP ton).

18. Islamuddin & Sons

M/s. Islamuddin & Sons was incorporated in Pakistan on 1980. The Company has 100% local shares. The Company is in the manufacturing of PUR pipe insulation and PUR floaters for fishing nets and other miscellaneous industrial applications which are marketed locally and no export of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Karachi, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 2.0 Metric ton (0.2 ODP ton). The premixing of 141b & Polyol is done at the factory.

The enterprise has 25 employees including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at Krishna Nivas, Thathai Compound M.A.Jinnah Road, Karachi.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2006. However the project was approved by MLF in November 1997.

19. Pak Motors (Pvt.) Ltd

M/s. Pak Motors (Pvt.) Ltd was incorporated in Pakistan on 1953. The Company has 100% local shares. The Company is in the manufacturing of Ice boxes and plastic products which are marketed locally and no export of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their

production operations. The manufacturing plant is in Lahore, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulating material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 8.0 Metric ton. Chemical suppliers include ICI and Kaghan. The premixing of 141b & Polyol is done at the factory.

The enterprise has 21 employees including 6 technical, 5 administrative and 10 operating staff for manufacturing, sales, marketing and after-sales services. The factory generally operates in 2 shifts. However, during peak season it also operates in three shifts.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at 14 km Multan Road, Lahore.

The baseline equipment of foaming line is as under:

Sr. #	Type of Equipment	Model	No.	Design Capacity	Manufacturer Type	Commission Year
1	Polyol Storage Tank	470R	1	1000 L	Henecke Germany	2004
2	Isocyanate Storage Tank	470R	1	1000 L	Henecke Germany	2004
3	PU Foaming Machine with 1 mixing head	470R	1	1.5 kg/sec	Henecke Germany	2004
4	Jigs & Fixtures	Molds		–	Local	2004

20. SMEs unidentified

A number of small enterprises are currently involved in the manufacturing of motorcycle seats. A provision of 24 ton of HCFC-141b is kept in a plan to cover these small enterprises.

2.2 Spray Foam

1. Master Chemicals

M/s. Master Chemicals are in the spray foam business. The company annual consumption of HCFC 141b in 2009 as per physical survey is 80.0 Metric ton (8.8 ODP ton).

2. Ittehad Insulation

M/s. Ittehad Insulation is in the spray foam business. The company annual consumption of HCFC 141b in 2009 as per physical survey is 11.5 Metric ton (1.265 ODP ton).

2.3 Flexible Molded Foam

1. Razi Sons

M/s. Razi Sons are in the Flexible foam business. The company annual consumption of HCFC 141b in 2009 as per physical survey is 15.0 Metric ton (1.7 ODP ton).

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in November 2002. However the project was approved by MLF in November 1995.

2. Simpson Wires

M/s. Simpson Wires are in the flexible foam business. The company annual consumption of HCFC 141b in 2009 as per physical survey is 7.9 Metric ton (0.9 ODP ton).

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in December 2006. However the project was approved by MLF in December 2003.

3. Tariq Engineering

M/s. Tariq Engineering is in the flexible foam business. The company annual consumption of HCFC 141b in 2009 as per physical survey is 6.0 Metric ton (0.7 ODP ton).

3.1 Integral Skin Foam

1. Workman

M/s. Workman was incorporated in Pakistan on 1980. The Company has 100% local shares. The Company is in the manufacturing of Furniture parts including Arm, Arm Rests and Table Legs insulated with polyurethane which are marketed locally and no export of their products in other Article V countries. For the manufacturing of these products they used HCFC-141b in their production operations. The manufacturing plant is in Lahore, Pakistan. HCFC-141b is used as blowing agent for rigid polyurethane foam as insulting material for the manufacturing of various models in the plant. The company annual consumption of HCFC 141b in 2009 as per physical survey is 3.5 Metric ton (0.385 ODP ton). Chemical suppliers include ICI and open market. The premixing of 141b & Polyol is done at the factory.

The compact density of the rigid PU foams produced depends on the exact product and ranges 33±0.5 kg/m³. The plant is located at 42-43 Sunflower Building, Liberty Market, Gulberg, Lahore.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in December 2006. However the project was approved by MLF in December 2003.

3. Air-conditioning Sector

3.1 Domestic Air-conditioner

1. Dawlance, Karachi

M/s. Dawlance (Pvt) Ltd was incorporated in Pakistan on January 16,1991. The Company has 100% local shares. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2006. The products are marketed locally and in small quantity are exported to Afghanistan and Central Republic States. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per survey is 35.4 Metric ton (1.9 ODP ton).

The enterprise has 284 employees including technical, administrative and operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at Plot No 89, Deh Khanto Bin Qasim Town, National Highway, Landhi, Karachi Pakistan. The annual production reported during 2008 was

approximately 55,600 units. The annual production capacity of the plant is 261,000 units. It has one assembly line, three (3) charging machines and seven (7) leakage detectors. Beside they have two (2) refrigerant recovery machines and eighteen (18) vacuum pumps each capacity of 16.0m^3 per hour.

2. Haier, Lahore

M/s. Haier was incorporated in Pakistan on 2001. The Company has 70% local shares and 30% shares from China. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2001. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per survey is 92.5 Metric ton (5.1 ODP ton).

The enterprise has 256 employees including technical, administrative and operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at 19.5KM, Raiwind Road, Lahore. The annual production reported during 2008 was approximately 84,300 units. The annual production capacity of the plant is 300,000 units. It has three (3) lines, one for indoor, the second is for outdoor & the third is for window air-conditioners, one (1) charging machines and seven (7) leakage detectors. Beside they have refrigerant tank of 218.5m^3 capacity and twenty one (21) vacuum pumps each capacity of 30.0m^3 per hour.

3. Cool Industries, Lahore

The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2006. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 95.0 Metric ton (5.2 ODP ton). The plant is located at Hanjarwal, Multan Road, Lahore.

4. Orient, Lahore

M/s. Orient was incorporated in Pakistan on August 2005. The Company has 100% local shares. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2006. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 95.0 Metric ton (5.2 ODP ton). The plant is located at Multan Road, Lahore.

5. PEL, Lahore

M/s. PEL was incorporated in Pakistan on 1956. The Company has 100% local shares. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2006. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 60.0 Metric ton (3.3 ODP ton).

The enterprise has 260 employees in this section including technical, administrative and operating staff for manufacturing, sales, marketing and after-sales services. The

factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at 14-KM Ferozepur Road, Lahore. The annual production reported during 2008 was approximately 58,000 units. The annual production capacity of the plant is 230,000 units. It has two (2) lines, two (2) charging machines and four (4) leakage detectors. Beside they have refrigeration tank of 900kg capacity and 29 vacuum pumps each capacity of 14.4m^3 per hour.

6. Digital World Pakistan

M/s. Digital World was incorporated in Pakistan on 06 April, 2000. The Company has 100% local shares. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2005. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 20.0 Metric ton (1.1 ODP ton).

The enterprise has 150 employees including technical, administrative and operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it may also operate in two shifts.

The plant is located at 35KM, Multan Road, Lahore. The annual production reported during 2008 was approximately 37,300 units. The annual production capacity of the plant is 156,000 units. It has one line, two (2) charging machines and five (5) leakage detectors. Beside they have refrigeration tank of 60kg capacity and 24 vacuum pumps each capacity of 0.55 m^3 per hour.

7. Kentax, Lahore

The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 15.1 Metric ton (0.8 ODP ton). The plant is located at Katar Band Road, Thokar Niaz Baig Lahore.

8. New Allied Electronics

The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 15.0 Metric ton (0.8 ODP ton).

9. Shahab Industries

The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 4.5 Metric ton (0.2 ODP ton). The plant is located at E-30, SITE, Karachi.

10. SABRO Technologies (Pvt.) Ltd, Islamabad

M/s. SABRO Technologies was incorporated in Pakistan on 2003. The Company has 100% local shares. The Company is in the manufacturing of domestic air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Islamabad, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 40.0 Metric ton (2.2 ODP ton). The plant is located at Plot # 270, Industrial Triangle, Kahuta Road, Islamabad.

3.2 Commercial Air-conditioner

1. SABRO, Rawalpindi

The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Rawalpindi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 10.3 Metric ton (0.6 ODP ton). The plant is located at Rawalpindi.

2. Petal Engineering (Pvt.) Ltd, Lahore

M/s. Petal Engineering was incorporated in Pakistan on 1990. The Company has 100% local shares. The Company is in the manufacturing of commercial air-conditioners Air Cooled Split Air Conditioners, Air Cooled Package Air Conditioners, Air Cooled Water Chillers, Water Cooled Water Chillers type of various sizes including 1 ton upto 80 tons since 1990. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 7.8 Metric ton (0.4 ODP ton).

The enterprise has 82 employees including 10 technical, 12 administrative and 60 operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at 10-Umer Khan Road Manawan, Batapur, Lahore. The annual production reported during 2008 was approximately 2000 units. The annual production capacity of the plant is 3500 units. It has 2 lines, one (1) charging machine and one (1) leakage detector. Beside they have refrigeration cylinder of 13.6kg capacity and 02 vacuum pumps each capacity of 440 dm^3 per min.

3. PARC

M/s. PARC was incorporated in Pakistan on 1982. The Company has no local shares. The Company is in the manufacturing of commercial air-conditioners (Package and split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 1982. The products are marketed locally and in small quantity are exported to Afghanistan. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 9.0 Metric ton (0.5 ODP ton).

The enterprise has 85 employees including 70 technical, 10administrative and 5 operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at S-34 Maripur Road, Karachi. The annual production reported during 2008 was approximately 11364 units. The annual production capacity of the

plant is 15000 units. It has 3 lines, 2 charging machine and 4 leakage detector. Beside they have refrigeration cylinders of 60 kg capacity and 6 vacuum pumps each capacity of 18 m^3 per hour.

4. Waheed Engineering

The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 3.0 Metric ton (0.2 ODP ton). The plant is located at 21-C, Street-26, Phase-V, D.H.A Badar Commercial St. # 1, Karachi.

5. MECO

The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 1.1 Metric ton (0.1 ODP ton). The plant is located at S/3-G. Allana Road, Sindh Industrial Trading Estate, Karachi.

6. Cool Point, Lahore

The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 3.9 Metric ton (0.2 ODP ton). The plant is located at Adda Plot Shahraiz Avenue, Off Raiwind Road, Near Sharifi Medical Complex, Lahore.

7. Age Co (Pvt.) Ltd.

M/s. AGECO was incorporated in Pakistan on 1988 as Private Limited company. The Company has 100% local shares. The Company is in the manufacturing of commercial air-conditioners (split type) of various sizes including 1 ton, 1.5 ton and 2 ton since 2000. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in 262, Kahuta Triangle Industrial Area, Humak, Islamabad, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 3.9 Metric ton (0.2 ODP ton).

The enterprise has around 100 employees including technical, administrative and operating staff for manufacturing. The factory generally operates in one shift. However, during peak season it also operates in two shifts.

The plant is located at in 262, Kahuta Triangle Industrial Area, Humak, Islamabad, Pakistan. The annual production reported during 2008 was approximately 1000 units. The annual production capacity of the plant is 3000 units. It has 4 charging machines and 2 leakage detectors. They have 4 vacuum pumps each capacity of 440 dm^3 per min.

8. PAECO

M/s. Pakistan Air-Conditioning Engineering Company (Pvt.) Ltd was incorporated in Pakistan on 1971. The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Lahore, Pakistan. The company annual consumption of HCFC 22 in 2009

as per physical survey is 2.2 Metric ton (0.1 ODP ton). The plant is located at Gardee Trust Building Napier Road, Lahore.

The company has converted to HCFC-141b from CFC through the funding of Montreal Protocol in October 2005. However the project was approved by MLF in November 2000.

9. ANZ Insutech Enterprises

The Company is in the manufacturing of commercial air-conditioners of various sizes. The products are marketed locally. For the cooling system, they are using HCFC-22 in their production operations. The manufacturing plant is in Karachi, Pakistan. The company annual consumption of HCFC 22 in 2009 as per physical survey is 2.0 Metric ton (0.1 ODP ton). The plant is located at 18-C, SITE, Karachi.

ANNEX-6A

DETAIL OF INCREMENTAL CAPITAL COST
OF THE COMPANIES COVERED UNDER STAGE-I

Annex-6A

INCREMENTAL CAPITAL COST (ICC)

United Refrigeration Industries, Hyderabad

All cost in US$

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Replacement of 1986 and 1993 foam dispenser	2	175,000	350,000		350,000
2	Retrofit of the 2006 high pressure foam dispensers with two mixing heads	1	100,000	100,000		100,000
3	Replacement of pre-mixing unit	2	60,000	120,000		120,000
4	Modification of Jigs/ fixtures	37	3,000	111,000		111,000
5	Hydrocarbon tank and accessories (piping and pumps, ventilation)	2	60,000	120,000		120,000
6	Nitrogen supply system	2	30,000	60,000		60,000
Sub-total				**861,000**	0	**861,000**
Plant Safety						
7	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	2	40,000	80,000		80,000
8	Heating, ventilation and enclosure for **cabinet** plant (domestic refrigeration)	2	45,000	90,000		90,000
9	Heating, ventilation and enclosure for **door** plant (domestic refrigeration)	1	45,000	45,000		45,000
10	Gas sensors, alarm. Monitoring system for entire plant	2	30,000	60,000		60,000
11	Fire protection/ control system for the plant	2	10,000	20,000		20,000
12	Lightning protection and grounding	2	20,000	40,000		40,000
13	Antistatic floor	2	5,000	10,000		10,000
14	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
15	Stand-by electric generator	2	15,000	30,000		30,000
Sub-total				**400,000**	**0**	**400,000**
General Works						
16	Truck receiving area	2	10,000	20,000	20,000	0
17	Firefighting water reserviour	2	15,000	30,000	30,000	0
Sub-total				**50,000**	**50,000**	0
Technology Trasfer						
18	Technology trasfer/ training	2	20,000	40,000		40,000
19	Trial, prototyping and Commission	2	15,000	30,000		30,000
Sub-total				**70,000**	**0**	**70,000**
	Total of above cost			**1,381,000**	**50,000**	**1,331,000**
	Contigencies @ 10 %					133,100
	Total ICC					**1,464,100**

Dawlance, Karachi

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Replacement of the 1996 high pressure foam dispenser	1	175,000	175,000		175,000
2	Retrofit of the 2006 and 2005 foam dispensers with two mixing heads	2	75,000	150,000		150,000
3	Replacement of pre-mixing unit	2	60,000	120,000		120,000
4	Modification of Jigs/ fixtures	27	3,000	81,000		81,000
5	Hydrocarbon tank and accessories (piping and pumps, ventilation)	2	50,000	100,000		100,000
6	Nitrogen supply system	2	35,000	70,000		70,000
Sub-total				**696,000**	**0**	**696,000**
Plant Safety						
7	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	2	40,000	80,000		80,000
8	Heating, ventilation and enclosure for **cabinet** plant (domestic refrigeration)	2	45,000	90,000		90,000
9	Heating, ventilation and enclosure for **door** plant (domestic refrigeration)	1	45,000	45,000		45,000
10	Gas sensors, alarm. Monitoring system for entire plant	2	30,000	60,000		60,000
11	Fire protection/ control system for the plant	2	10,000	20,000		20,000
12	Lightning protection and grounding	2	20,000	40,000		40,000
13	Antistatic floor	2	5,000	10,000		10,000
14	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
15	Stand-by electric generator	2	15,000	30,000		30,000
Sub-total				**400,000**	**0**	**400,000**
General Works						
16	Truck receiving area	2	10,000	20,000	20,000	0
17	Firefighting water reserviour	2	15,000	30,000	30,000	0
Sub-total				**50,000**	**50,000**	**0**
Technology Transfer						
18	Technology trasfer/ training	2	20,000	40,000		40,000
19	Trial, prototyping and Commission	2	15,000	30,000		30,000
Sub-total				**70,000**		**70,000**
	Total of above cost			**1,216,000**	**50,000**	**1,166,000**
	Contigencies @ 10 %					116,600
	Total ICC					**1,282,600**

HNR Company (Haier), Lahore

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of the 2004 (33.6 kg/min) high pressure foam dispensers	1	60,000	60,000		60,000
2	Retrofit of the 2004 (90 kg/min) high pressure foam dispensers	1	75,000	75,000		75,000
3	Replacement of pre-mixing unit	2	60,000	120,000		120,000
4	Modification of Jigs/ fixtures	28	3,000	84,000		84,000
5	Hydrocarbon tank and accessories (piping and pumps, ventilation)	1	50,000	50,000		50,000
6	Nitrogen supply system	1	35,000	35,000		35,000
Sub-total				**424,000**	**0**	**424,000**
Plant Safety						
7	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	30,000	30,000		30,000
8	Heating, ventilation and enclosure for **cabinet** plant (domestic refrigeration)	1	45,000	45,000		45,000
9	Heating, ventilation and enclosure for **door** plant (domestic refrigeration)	1	45,000	45,000		45,000
10	Gas sensors, alarm. Monitoring system for entire plant	1	30,000	30,000		30,000
11	Fire protection/ control system for the plant	1	10,000	10,000		10,000
12	Lightning protection and grounding	1	20,000	20,000		20,000
13	Antistatic floor	1	5,000	5,000		5,000
14	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
15	Stand-by electric generator	1	15,000	15,000		15,000
Sub-total				**225,000**	**0**	**225,000**
General Works						
16	Truck receiving area	1	10,000	10,000	10,000	0
17	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	**0**
Technology Transfer						
18	Technology trasfer/ training	1	20,000	20,000		20,000
19	Trial, prototyping and Commission	1	20,000	20,000		20,000
Sub-total				**40,000**	**0**	**40,000**
	Total of above cost			**714,000**	**25,000**	**689,000**
	Contigencies @ 10 %					68,900
	Total ICC					**757,900**

Varioline Intercool Pakistan, Lahore

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of the 1996 (60 kg/min) high pressure foam dispensers	1	120,000	120,000		120,000
2	Retrofit of the 2005 (60 kg/min) high pressure foam dispensers with two mixing heads	1	75,000	75,000		75,000
3	Replacement of pre-mixing unit	1	50,000	50,000		50,000
4	Modification of Jigs/ fixtures	50	3,000	150,000		150,000
5	Hydrocarbon tank and accessories (piping and pumps, ventilation)	1	50,000	50,000		50,000
6	Nitrogen supply system	1	35,000	35,000		35,000
Sub-total				**480,000**	**0**	**480,000**
Plant Safety						
7	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	35,000	35,000		35,000
8	Heating, ventilation and enclosure for **cabinet** plant (commercial and domestic refrigeration)	1	45,000	45,000		45,000
9	Heating, ventilation and enclosure for **door** plant (commercial and domestic refrigeration)	1	45,000	45,000		45,000
10	Gas sensors, alarm. Monitoring system for entire plant	1	30,000	30,000		30,000
11	Fire protection/ control system for the plant	1	10,000	10,000		10,000
12	Lightning protection and grounding	1	20,000	20,000		20,000
13	Antistatic floor	1	5,000	5,000		5,000
14	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
15	Stand-by electric generator	1	15,000	15,000		15,000
Sub-total				**230,000**	**0**	**230,000**
General Works						
16	Truck receiving area	1	15,000	15,000	15,000	0
17	Firefighting water reserviour	1	10,000	10,000	10,000	0
Sub-total				**25,000**	**25,000**	**0**
Technology Transfer						
16	Technology trasfer/ training	1	20,000	20,000		20,000
17	Trial, prototyping and Commission	1	20,000	20,000		20,000
Sub-total				**40,000**	**0**	**40,000**
	Total of above cost			**750,000**	**0**	**750,000**
	Contigencies @ 10 %					75,000
	Total ICC					**825,000**

Annex-6A

Shadman Electronics, Karachi

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of the 2000 (80 kg/min) high pressure foam dispensers	1	75,000	75,000		75,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	16	3,000	48,000		48,000
4	Hydrocarbon tank and accessories (piping and pumps, ventilation)	1	40,000	40,000		40,000
5	Nitrogen supply system	1	30,000	30,000		30,000
Sub-total				**243,000**	**0**	**243,000**
Plant Safety						
6	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	35,000	35,000		35,000
7	Heating, ventilation and enclosure for **cabinet and door** plant (commercial refrigeration)	1	45,000	45,000		45,000
8	Gas sensors, alarm. Monitoring system for entire plant	1	30,000	30,000		30,000
9	Fire protection/ control system for the plant	1	10,000	10,000		10,000
10	Lightning protection and grounding	1	20,000	20,000		20,000
11	Antistatic floor	1	5,000	5,000		5,000
12	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
13	Stand-by electric generator	1	15,000	15,000		15,000
Sub-total				**185,000**	**0**	**185,000**
General Works						
16	Truck receiving area	1	15,000	15,000	15,000	0
17	Firefighting water reserviour	1	10,000	10,000	10,000	0
Sub-total				**25,000**	**25,000**	**0**
Technology Transfer						
14	Technology trasfer/ training	1	20,000	20,000		20,000
15	Trial, prototyping and Commission	1	20,000	20,000		20,000
Sub-total				**40,000**	**0**	**40,000**
	Total of above cost			**468,000**	**0**	**468,000**
	Contigencies @ 10 %					46,800
	Total ICC					**514,800**

ANNEX-6B

DETAIL OF INCREMENTAL OPERATING COST
OF THE COMPANIES COVERED UNDER STAGE-I

Annex-6B

INCREMENTAL OPERATING COST (IOC)

Chemicals	R-141b system			Cyclo-pentane system		
	Amount Kg	**Price US$/kg**	**Cost US$**	**Amount Kg**	**Price US$/kg**	**Cost US$**
Polyol	0.404	2.24	0.905	0.420	2.240	0.941
Isocyanate	0.506	2.55	1.290	0.526	2.550	1.341
Blowing agent	0.090	2.03	0.183	0.054	1.770	0.096
Total	**1.000**		**2.378**			**2.378**
				Difference per kg		**-0.00028**

United Refrigeration Industries, Hyderabad

	Before conversion	**Year I**	**Year II**
Foam production [kg]	3,277,081	3,277,081	3,277,081
Total annual cost of chemicals used	7,792,768	7,791,842	7,791,842
Cost difference per annum		-926	-926
Discount factor		0.9091	0.8264
NPV		-842	-765
Total IOC, US$			**-1,607**

Dawlance, Karachi

	Before conversion	**Year I**	**Year II**
Foam production [kg]	2,262,997	2,262,997	2,262,997
Total annual cost of chemicals used	5,381,316	5,380,676	5,380,676
Cost difference per annum		-640	-640
Discount factor		0.9091	0.8264
NPV		-582	-529
Total IOC, US$			**-1,110**

HNR Company (Haier), Lahore

	Before conversion	**Year I**	**Year II**
Foam production [kg]	776,335	776,335	776,335
Total annual cost of chemicals used	1,846,094	1,845,874	1,845,874
Cost difference per annum		-219	-219
Discount factor		0.9091	0.8264
NPV		-200	-181
Total IOC, US$			**-381**

Varioline Intercool Pakistan, Lahore

	Before conversion	**Year I**	**Year II**
Foam production [kg]	530,003	530,003	530,003
Total annual cost of chemicals used	1,260,326	1,260,176	1,260,176
Cost difference per annum		-150	-150
Discount factor		0.9091	0.8264
NPV		-136	-124
Total IOC, US$			**-260**

Shadman Electronics, Karachi

	Before conversion	**Year I**	**Year II**
Foam production [kg]	395,708	395,708	395,708
Total annual cost of chemicals used	940,978	940,866	940,866
Cost difference per annum		-112	-112
Discount factor		0.9091	0.8264
NPV		-102	-92
Total IOC, US$			**-194**

ANNEX-7A

DETAIL OF INCREMENTAL CAPITAL COST
OF THE COMPANIES COVERED UNDER STAGE-II

Annex-7A

INCREMENTAL CAPITAL COST (ICC)
Cool Industries- Domestic Refrigeration

All cost in US$

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Replacement of foam dispenser	1	175,000	175,000		175,000
2	Replacement of pre-mixing unit	1	60,000	60,000		60,000
3	Modification of Jigs/ fixtures	10	3,000	30,000		30,000
4	Hydrocarbon tank and accessories (piping and pumps, ventilation)	1	60,000	60,000		60,000
5	Nitrogen supply system	1	30,000	30,000		30,000
Sub-total				**355,000**	0	**355,000**
Plant Safety						
6	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	40,000	40,000		40,000
7	Heating, ventilation and enclosure for **cabinet** plant (domestic refrigeration)	1	45,000	45,000		45,000
8	Heating, ventilation and enclosure for **door** plant (domestic refrigeration)	1	45,000	45,000		45,000
9	Gas sensors, alarm. Monitoring system for entire plant	1	30,000	30,000		30,000
10	Fire protection/ control system for the plant	1	10,000	10,000		10,000
11	Lightning protection and grounding	1	20,000	20,000		20,000
12	Antistatic floor	1	5,000	5,000		5,000
13	Safety audit/ safety inspection & certification	1	25,000	25,000		25,000
14	Stand-by electric generator	1	15,000	15,000		15,000
Sub-total				**235,000**	**0**	**235,000**
General Works						
15	Truck receiving area	1	10,000	10,000	10,000	0
16	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
17	Technology trasfer/ training	1	20,000	20,000		20,000
18	Trial, prototyping and Commission	1	15,000	15,000		15,000
Sub-total				**35,000**	**0**	**35,000**
	Total of above cost			**650,000**	**25,000**	**625,000**
	Contigencies @ 10 %					62,500
	Total ICC					**687,500**

The ICC for conversion of 141-b to cyclo pentane is as per UNEP/OzL.Pro/ExCom/55/47 Annex III Appendix I

Annex-7A

Mumtaz Engineers- Commercial Refrigeration

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	5	3,000	15,000		15,000
4	Hydrocarbon tank and accessories (piping and pumps, ventilation)	0	0	0		0
5	Nitrogen supply system	1	20,000	20,000		20,000
Sub-total				**145,000**	0	**145,000**
Plant Safety						
6	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	15,000	15,000		15,000
7	Heating, ventilation and enclosure for **cabinet** plant (commercial refrigeration)	1	20,000	20,000		20,000
8	Gas sensors, alarm. Monitoring system for entire plant	1	20,000	20,000		20,000
9	Fire protection/ control system for the plant	1	5,000	5,000		5,000
10	Lightning protection and grounding	1	5,000	5,000		5,000
11	Antistatic floor	1	5,000	5,000		5,000
12	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
13	Stand-by electric generator	1	10,000	10,000		10,000
Sub-total				**95,000**	**0**	**95,000**
General Works						
14	Truck receiving area	1	10,000	10,000	10,000	0
15	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
16	Technology trasfer/ training	1	20,000	20,000		20,000
17	Trial, prototyping and Commission	1	15,000	15,000		15,000
Sub-total				**35,000**	**0**	**35,000**
	Total of above cost			**300,000**	**25,000**	**275,000**
	Contigencies @ 10 %					27,500
	Total ICC					**302,500**

Asif Zubair & Co.- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	1	15,000	15,000		15,000
Sub-total				**125,000**	0	**125,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	15,000	15,000		15,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	20,000	20,000		20,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	10,000	10,000		10,000
Sub-total				**75,000**	**0**	**75,000**
General Works						
11	Truck receiving area	1	10,000	10,000	10,000	0
12	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	20,000	20,000		20,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**255,000**	**25,000**	**230,000**
	Contigencies @ 10 %					23,000
	Total ICC					**253,000**

Tropical Plastic - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	1	15,000	15,000		15,000
Sub-total				**125,000**	0	**125,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	15,000	15,000		15,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	20,000	20,000		20,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	10,000	10,000		10,000
Sub-total				**75,000**	**0**	**75,000**
General Works						
11	Truck receiving area	1	10,000	10,000	10,000	0
12	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	20,000	20,000		20,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**255,000**	**25,000**	**230,000**
	Contigencies @ 10 %					23,000
	Total ICC					**253,000**

Zulquarnain Corp.- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Delight Plastic - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Mehran Plastic Ind.- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Arm Bros - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Decent Plastic - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Pifcom - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Plasticrafter - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Shoaibee Ind. - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	1	15,000	15,000		15,000
Sub-total				**125,000**	0	**125,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	15,000	15,000		15,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	20,000	20,000		20,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	10,000	10,000		10,000
Sub-total				**75,000**	**0**	**75,000**
General Works						
11	Truck receiving area	1	10,000	10,000	10,000	0
12	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	20,000	20,000		20,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**255,000**	**25,000**	**230,000**
	Contigencies @ 10 %					23,000
	Total ICC					**253,000**

Pakistan Plastic Ind. - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Unique Plastic - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Thermocraft Engg. - Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

ANZ Insutech Enterprises- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Kold Kraft- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Pakistan Insulation- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	50,000	50,000		50,000
3	Modification of Jigs/ fixtures	1	15,000	15,000		15,000
Sub-total				**125,000**	0	**125,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	15,000	15,000		15,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	20,000	20,000		20,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	10,000	10,000		10,000
Sub-total				**75,000**	**0**	**75,000**
General Works						
11	Truck receiving area	1	10,000	10,000	10,000	0
12	Firefighting water reserviour	1	15,000	15,000	15,000	0
Sub-total				**25,000**	**25,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	20,000	20,000		20,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**255,000**	**25,000**	**230,000**
	Contigencies @ 10 %					23,000
	Total ICC					**253,000**

PAECO- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	15,000	15,000		15,000
Sub-total				**105,000**	0	**105,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**200,000**	**10,000**	**190,000**
	Contigencies @ 10 %					19,000
	Total ICC					**209,000**

Islamuddin & Sons- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Pak Motors- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of foam dispenser	1	60,000	60,000		60,000
2	Replacement of pre-mixing unit	1	30,000	30,000		30,000
3	Modification of Jigs/ fixtures	1	5,000	5,000		5,000
Sub-total				**95,000**	0	**95,000**
Plant Safety						
4	Ventilation and exhausting system (fans, piping, ductwroks, grounding, electrical boards/ connections)	1	10,000	10,000		10,000
5	Gas sensors, alarm. Monitoring system for entire plant	1	15,000	15,000		15,000
6	Fire protection/ control system for the plant	1	5,000	5,000		5,000
7	Lightning protection and grounding	1	5,000	5,000		5,000
8	Antistatic floor	1	5,000	5,000		5,000
9	Safety audit/ safety inspection & certification	1	15,000	15,000		15,000
10	Stand-by electric generator	1	5,000	5,000		5,000
Sub-total				**60,000**	**0**	**60,000**
General Works						
11	Truck receiving area	1	5,000	5,000	5,000	0
12	Firefighting water reserviour	1	5,000	5,000	5,000	0
Sub-total				**10,000**	**10,000**	0
Technology Trasfer						
13	Technology trasfer/ training	1	15,000	15,000		15,000
14	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**25,000**	**0**	**25,000**
	Total of above cost			**190,000**	**10,000**	**180,000**
	Contigencies @ 10 %					18,000
	Total ICC					**198,000**

Annex-7A

SMEs unidentified- Rigid Polyurethane

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Technology Trasfer						
1	Technology trasfer/ training	15	15,000	225,000		225,000
2	Trial, prototyping and Commission	15	10,000	150,000		150,000
	Total of above cost			**375,000**	**0**	**375,000**
	Contigencies @ 10 %					37,500
	Total ICC					**412,500**

ANNEX-7B

DETAIL OF INCREMENTAL OPERATING COST
OF THE COMPANIES COVERED UNDER STAGE-II

INCREMENTAL OPERATING COST (IOC)

Chemicals	R-141b system			Cyclo-pentane system		
	Amount Kg	Price US$/kg	Cost US$	Amount Kg	Price US$/kg	Cost US$
Polyol	0.404	2.24	0.905	0.420	2.24	0.941
Isocyanate	0.506	2.55	1.290	0.526	2.55	1.341
Blowing agent	0.090	2.03	0.183	0.054	1.77	0.096
Total	**1.000**		**2.378**	**1.000**		**2.378**
				Difference per kg		**-0.00028**

Cool Industries- Domestic Refrigeration

	Before conversion	Year I	Year II
Foam production [kg]	1,177,660	1,177,660	1,177,660
Total annual cost of chemicals used	2,800,428	2,800,099	2,800,099
Incremental maintenance and insurance cost		32,141	32,141
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		2,837,239	2,837,239
Cost difference per annum		36,811	36,811
Discount factor		0.9091	0.8264
NPV		33,464	30,423
Total IOC, US$			**63,888**

Mumtaz Engineers- Commercial Refrigeration

	Before conversion	Year I	Year II
Foam production [kg]	88,880	88,880	88,880
Total annual cost of chemicals used	211,353	211,328	211,328
Incremental maintenance and insurance cost		14,142	14,142
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		230,470	230,470
Cost difference per annum		19,117	19,117
Discount factor		0.9091	0.8264
NPV		17,379	15,800
Total IOC, US$			**33,179**

Asif Zubair & Co.- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	444,400	444,400	444,400
Total annual cost of chemicals used	1,056,765	1,056,641	1,056,641
Incremental maintenance and insurance cost		11,828	11,828
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		1,073,469	1,073,469
Cost difference per annum		16,703	16,703
Discount factor		0.9091	0.8264
NPV		15,185	13,805
Total IOC, US$			**28,990**

Tropical Plastic - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	166,650	166,650	166,650
Total annual cost of chemicals used	396,287	396,240	396,240
Incremental maintenance and insurance cost		11,828	11,828
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		413,068	413,068
Cost difference per annum		16,781	16,781
Discount factor		0.9091	0.8264
NPV		15,256	13,870
Total IOC, US$			**29,125**

Zulquarnain Corp.- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	138,875	138,875	138,875
Total annual cost of chemicals used	330,239	330,200	330,200
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		344,457	344,457
Cost difference per annum		14,218	14,218
Discount factor		0.9091	0.8264
NPV		12,925	11,751
Total IOC, US$			**24,676**

Delight Plastic - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	133,320	133,320	133,320
Total annual cost of chemicals used	317,030	316,992	316,992
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		331,249	331,249
Cost difference per annum		14,219	14,219
Discount factor		0.9091	0.8264
NPV		12,927	11,752
Total IOC, US$			**24,679**

Mehran Plastic Ind.- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	66,660	66,660	66,660
Total annual cost of chemicals used	158,515	158,496	158,496
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		172,753	172,753
Cost difference per annum		14,238	14,238
Discount factor		0.9091	0.8264
NPV		12,943	11,768
Total IOC, US$			**24,711**

Arm Bros - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	75,548	75,548	75,548
Total annual cost of chemicals used	179,650	179,629	179,629
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		193,885	193,885
Cost difference per annum		14,235	14,235
Discount factor		0.9091	0.8264
NPV		12,941	11,766
Total IOC, US$			**24,707**

Decent Plastic - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	11,110	11,110	11,110
Total annual cost of chemicals used	26,419	26,416	26,416
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		40,673	40,673
Cost difference per annum		14,253	14,253
Discount factor		0.9091	0.8264
NPV		12,958	11,781
Total IOC, US$			**24,738**

Pifcom - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	33,330	33,330	33,330
Total annual cost of chemicals used	79,257	79,248	79,248
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		93,505	93,505
Cost difference per annum		14,247	14,247
Discount factor		0.9091	0.8264
NPV		12,952	11,776
Total IOC, US$			**24,727**

Plasticrafter - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	111,100	111,100	111,100
Total annual cost of chemicals used	264,191	264,160	264,160
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		278,417	278,417
Cost difference per annum		14,225	14,225
Discount factor		0.9091	0.8264
NPV		12,932	11,758
Total IOC, US$			**24,690**

Shoaibee Ind. - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	1,066,560	1,066,560	1,066,560
Total annual cost of chemicals used	2,536,237	2,535,938	2,535,938
Incremental maintenance and insurance cost		11,828	11,828
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		2,552,766	2,552,766
Cost difference per annum		16,529	16,529
Discount factor		0.9091	0.8264
NPV		15,026	13,661
Total IOC, US$			**28,688**

Pakistan Plastic Ind. - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	138,875	138,875	138,875
Total annual cost of chemicals used	330,239	330,200	330,200
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		344,457	344,457
Cost difference per annum		14,218	14,218
Discount factor		0.9091	0.8264
NPV		12,925	11,751
Total IOC, US$			**24,676**

Unique Plastic - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	55,550	55,550	55,550
Total annual cost of chemicals used	132,096	132,080	132,080
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		146,337	146,337
Cost difference per annum		14,241	14,241
Discount factor		0.9091	0.8264
NPV		12,946	11,770
Total IOC, US$			**24,717**

Thermocraft Engg. - Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	44,440	44,440	44,440
Total annual cost of chemicals used	105,677	105,664	105,664
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		119,921	119,921
Cost difference per annum		14,244	14,244
Discount factor		0.9091	0.8264
NPV		12,949	11,773
Total IOC, US$			**24,722**

ANZ Insutech Enterprises- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	27,775	27,775	27,775
Total annual cost of chemicals used	66,048	66,040	66,040
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		80,297	80,297
Cost difference per annum		14,249	14,249
Discount factor		0.9091	0.8264
NPV		12,953	11,777
Total IOC, US$			**24,730**

Kold Kraft- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	122,210	122,210	122,210
Total annual cost of chemicals used	290,610	290,576	290,576
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		304,833	304,833
Cost difference per annum		14,222	14,222
Discount factor		0.9091	0.8264
NPV		12,929	11,755
Total IOC, US$			**24,684**

Pakistan Insulation- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	499,950	499,950	499,950
Total annual cost of chemicals used	1,188,861	1,188,721	1,188,721
Incremental maintenance and insurance cost		11,828	11,828
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		1,205,549	1,205,549
Cost difference per annum		16,688	16,688
Discount factor		0.9091	0.8264
NPV		15,171	13,793
Total IOC, US$			**28,963**

PAECO- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	166,650	166,650	166,650
Total annual cost of chemicals used	396,287	396,240	396,240
Incremental maintenance and insurance cost		9,771	9,771
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		411,011	411,011
Cost difference per annum		14,724	14,724
Discount factor		0.9091	0.8264
NPV		13,386	12,170
Total IOC, US$			**25,555**

Islamuddin & Sons- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	22,220	22,220	22,220
Total annual cost of chemicals used	52,838	52,832	52,832
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		67,089	67,089
Cost difference per annum		14,250	14,250
Discount factor		0.9091	0.8264
NPV		12,955	11,778
Total IOC, US$			**24,733**

Pak Motors- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	66,660	66,660	66,660
Total annual cost of chemicals used	158,515	158,496	158,496
Incremental maintenance and insurance cost		9,257	9,257
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		172,753	172,753
Cost difference per annum		14,238	14,238
Discount factor		0.9091	0.8264
NPV		12,943	11,768
Total IOC, US$			**24,711**

SMEs unidentified- Rigid Polyurethane

	Before conversion	Year I	Year II
Foam production [kg]	266,640	266,640	266,640
Total annual cost of chemicals used	634,059	633,985	633,985
Incremental maintenance and insurance cost		19,284	19,284
Incremental Energy Cost		5,000	5,000
Total Incremental Cost		658,269	658,269
Cost difference per annum		24,210	24,210
Discount factor		0.9091	0.8264
NPV		22,009	20,009
Total IOC, US$			**42,018**

ANNEX-8A

DETAIL OF INCREMENTAL CAPITAL COST
OF THE COMPANIES COVERED UNDER STAGE-III

Annex-8A

INCREMENTAL CAPITAL COST (ICC)

Master Chemicals- Spray Foam

All cost in US$

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Replacement of low pressure with high pressure spray foam dispenser 7 kg per minute with standard accessories	1	20,000	20,000		20,000
2	Replacement of pre-mixing unit	1	40,000	40,000		40,000
Sub-total				**60,000**	0	**60,000**
Technology Trasfer						
3	Technology trasfer/ training	1	10,000	10,000		10,000
4	Trial, prototyping and Commission	1	20,000	20,000		20,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**90,000**	**0**	**90,000**
	Contigencies @ 10 %					9,000
	Total ICC					**99,000**

The ICC for conversion of 141-b to water/CO_2 is as per UNEP/OzL.Pro/ExCom/55/47 Annex III Appendix I

Ittehad Insulation- Spray Foam

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Replacement of low pressure with high pressure spray foam dispenser 7 kg per minute with standard accessories	1	15,000	15,000		15,000
2	Replacement of pre-mixing unit	1	20,000	20,000		20,000
Sub-total				**35,000**	0	**35,000**
Technology Trasfer						
3	Technology trasfer/ training	1	5,000	5,000		5,000
4	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**15,000**	**0**	**15,000**
	Total of above cost			**50,000**	**0**	**50,000**
	Contigencies @ 10 %					5,000
	Total ICC					**55,000**

Razi Sons - Flexible Foam

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of high pressure foam dispenser	1	15,000	15,000		15,000
2	Retrofit of pre-mixing unit	1	10,000	10,000		10,000
Sub-total				**25,000**	0	**25,000**
Technology Trasfer						
3	Technology trasfer/ training	1	10,000	10,000		10,000
4	Trial, prototyping and Commission	1	20,000	20,000		20,000
Sub-total				**30,000**	**0**	**30,000**
	Total of above cost			**55,000**	**0**	**55,000**
	Contigencies @ 10 %					5,500
	Total ICC					**60,500**

Simpson Wires - Flexible Foam

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of high pressure foam dispenser	1	10,000	10,000		10,000
2	Retrofit of pre-mixing unit	1	0	0		0
Sub-total				**10,000**	0	**10,000**
Technology Trasfer						
3	Technology trasfer/ training	1	5,000	5,000		5,000
4	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**15,000**	**0**	**15,000**
	Total of above cost			**25,000**	**0**	**25,000**
	Contigencies @ 10 %					2,500
	Total ICC					**27,500**

Tariq Engineering - Flexible Foam

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of high pressure foam dispenser	1	10,000	10,000		10,000
2	Retrofit of pre-mixing unit	1	0	0		0
Sub-total				**10,000**	0	**10,000**
Technology Trasfer						
3	Technology trasfer/ training	1	5,000	5,000		5,000
4	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**15,000**	**0**	**15,000**
	Total of above cost			**25,000**	**0**	**25,000**
	Contigencies @ 10 %					2,500
	Total ICC					**27,500**

Workman - Integeral Skin

Item	Description	Qty	Unit Cost	Total	Sharing by Beneficiary	Cost to MLF
Production						
1	Retrofit of dispenser for refrigerated thermal control	1	10,000	10,000		10,000
2	Retrofit of dispenser for variable ration control	1	10,000	10,000		10,000
3	In mold coating high volume low pressure spray system	1	10,000	10,000		10,000
4	Mold preheating oven	1	5,000	5,000		5,000
5	Infrared coating drying system	1	10,000	10,000		10,000
6	In mold coarting exhaust booth	1	10,000	10,000		10,000
Sub-total				**55,000**	0	**55,000**
Technology Trasfer						
7	Technology trasfer/ training (foam)	1	5,000	5,000		5,000
8	Technology trasfer/ training (coating)	1	5,000	5,000		5,000
9	Trial, prototyping and Commission	1	10,000	10,000		10,000
Sub-total				**20,000**	**0**	**20,000**
	Total of above cost			**75,000**	**0**	**75,000**
	Contigencies @ 10 %					7,500
	Total ICC					**82,500**

ANNEX-8B

DETAIL OF INCREMENTAL OPERATING COST OF THE COMPANIES COVERED UNDER STAGE-III

Annex-8B

INCREMENTAL OPERATING COST (IOC)

Chemicals	R-141b system			Water based (water/ CO_2)		
	Amount Kg	Price US$/kg	Cost US$	Amount Kg	Price US$/kg	Cost US$
Polyol	0.404	2.24	0.905	0.384	2.24	0.860
Isocyanate	0.506	2.55	1.290	0.481	2.55	1.226
Blowing agent	0.090	2.03	0.183	0.135	3.50	0.473
Total	**1.000**		**2.378**	**1.000**		**2.559**
				Difference per kg		**0.18124**

Master Chemicals- Spray Foam

	Before conversion	Year I	Year II
Foam production [kg]	888,800	888,800	888,800
Total annual cost of chemicals used	2,113,531	2,274,620	2,274,620
Cost difference per annum		161,089	161,089
Discount factor		0.9091	0.8264
NPV		146,444	133,132
Total IOC, US$			**279,577**

Ittehad Insulation- Spray Foam

	Before conversion	Year I	Year II
Foam production [kg]	127,765	127,765	127,765
Total annual cost of chemicals used	303,820	326,977	326,977
Cost difference per annum		23,157	23,157
Discount factor		0.9091	0.8264
NPV		21,051	19,139
Total IOC, US$			**40,190**

Razi Sons - Flexible Foam

	Before conversion	Year I	Year II
Foam production [kg]	166,650	166,650	166,650
Total annual cost of chemicals used	396,287	426,491	426,491
Cost difference per annum		30,204	30,204
Discount factor		0.9091	0.8264
NPV		27,458	24,963
Total IOC, US$			**52,421**

Simpson Wires - Flexible Foam

	Before conversion	Year I	Year II
Foam production [kg]	87,769	87,769	87,769
Total annual cost of chemicals used	208,711	224,619	224,619
Cost difference per annum		15,908	15,908
Discount factor		0.9091	0.8264
NPV		14,461	13,148
Total IOC, US$			**27,609**

Tariq Engineering - Flexible Foam

	Before conversion	Year I	Year II
Foam production [kg]	66,660	66,660	66,660
Total annual cost of chemicals used	158,515	170,596	170,596
Cost difference per annum		12,082	12,082
Discount factor		0.9091	0.8264
NPV		10,983	9,986
Total IOC, US$			**20,969**

Workman - Integeral Skin

	Before conversion	Year I	Year II
Foam production [kg]	38,885	38,885	38,885
Total annual cost of chemicals used	92,467	99,515	99,515
Cost of In mold coating		52,500	52,500
Total Cost		152,015	152,015
Cost difference per annum		59,548	59,548
Discount factor		0.9091	0.8264
NPV		54,134	49,214
Total IOC, US$			**103,348**

ANNEX-9

ANNUAL CASH FLOW FOR ALL THE STAGES

Annex-9

Proposed Cash Flow for the Implementation of HPMP Pakistan

Annual Cash Flow Summary

All cost '000'

Activities	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Manufacturing Sector																
5 Projects covered under Stage-1	242	2,178	2,420													
21 Projects covered under Stage-2								301	2,710	3,011						
6 Projects covered under Stage-3													44	394	438	
19 Projects covered under Stage-4																
Annual total Manufacturing Sector	242	2,178	2,420	-	-	-	-	301	2,710	3,011	-	-	44	394	438	-
Servicing Sector																
Non-investment component	200			200	40						500	500				550
Training Equipment	68			80	20		1,696		1,527							
Annual total Servicing Sector	268	0	0	280	60	0	1696	0	1527	0	500	500	0	0	0	550
Total of the Program	**510**	**2,178**	**2,420**	**280**	**60**	**-**	**1,696**	**301**	**4,237**	**3,011**	**500**	**500**	**44**	**394**	**438**	**550**

Activities	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Total
Manufacturing Sector																
5 Projects covered under Stage-1																**4,841**
21 Projects covered under Stage-2																**6,022**
6 Projects covered under Stage-3																**876**
19 Projects covered under Stage-4	602	5,419	6,021													**12,043**
Annual total Manufacturing Sector	602	5,419	6,021	-	-	-	-	-	-	-	-	-	-	-	-	**23,781**
Servicing Sector																
Non-investment component	400				400	371										**3,161**
Training Equipment																**3,391**
Annual total Servicing Sector	400	0	0	0	400	371	0	0	0	0	0	0	0	0	0	**6,552**
Total of the Program	**1,002**	**5,419**	**6,021**	**-**	**400**	**371**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**30,333**