

Government of Ghana

Hydrochlorofluorocarbon Phase-out Management Plan (HPMP)

Lead Implementing Agency: UNDP

Co-operating Implementing Agency: Government of Italy

National Executing Agency: Environmental Protection Agency

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EXECUTIVE SUMMARY

The Hydrochlorofluorocarbon Phase-out Management Plan (HPMP) for Ghana was prepared following an Inception Workshop for stakeholders organized in Accra, Ghana by the National Ozone Unit (NOU) with the support of UNDP from 15 - 16 June 2009. Prior to the Inception Workshop two data collection teams were set up by the NOU to collect data on domestic and light commercial refrigeration units on the one hand and industrial and commercial refrigeration and residential and commercial air conditioning units on the other. The data collected were analysed and the results obtained used as the basis for the preparation of the HPMP.

Concurrently with the preparation of the HPMP two other projects, namely a pilot project on ODS waste destruction for which project preparation funds were approved at the 57th Executive Committee meeting and a project on improvement of energy efficiency in the domestic refrigeration sector to be co-funded by the Global Environment Facility (GEF) were also prepared. There was close collaboration among the teams preparing the three projects in order to maximize the synergies to be gained through implementation of the projects. When implemented as planned the three projects will complement each other, as detailed in appendix A of this document.

The final draft of the HPMP was discussed at a stakeholders' workshop held in Accra on 11th and 12th March 2010 which was attended by local refrigeration and air conditioning technicians and engineers, chemicals importers and dealers, air conditioning equipment suppliers, representatives of key Government agencies, UNDP and the Government of Italy. All the results and conclusions from the analysis of the data were discussed and resource requirements for implementing the HPMP were calculated by teams of refrigeration experts with the assistance of international experts with knowledge of Multilateral Fund guidelines.

To the extent possible the preparation of the HPMP was based on the Guidelines for the Preparation of HPMP prepared by the Fund Secretariat. The HPMP document consists of 6 sections, annexes and appendices as described below:

Section I: Overview of ODS Phase-out provides the country's profile with brief socio-economic background, relevant multilateral environmental agreements to which it is a Party and a review of implementation of approved ODS phase-out projects.

Section II: Legal and institutional Framework provides a summary report of a senior legal consultant engaged to review laws and regulations pertaining to import, distribution and regulation of industrial chemicals, in particular ODS. The complete report is available on request.

Section III: Data Collection and Analysis describes the methodology used to collect the data, including HCFC and other chemical refrigerant import data at Customs and importer/distributor levels, HCFC use at enterprise and end-user levels and the method of validation of HCFC consumption of the country as well as data on imports of refrigeration and air conditioning equipment. Other relevant information, including prices of chemicals is also described in this section. Results of calculations and analyses of the data are described, together with tables and charts as necessary. The results and conclusions drawn were used as basis for developing the national HPMP strategy and for calculating the associated costs.

The survey identified that refrigerant R406a has become the transitional refrigerant of choice for most end-uses in the refrigeration servicing sector and in 2009, the R406a consumption increased about fivefold over the previous year 2008, which raised some concern, especially considering that one importer alone accounted for over half the amount. If that becomes a trend then as 96% of R406a blend is HCFC (HCFC-22 and HCFC-142b) there would be the tendency for the consumption of R406a to phase in as much HCFCs as are being phased out in other applications. The anomalous growth in R406a and the

need to curb such growth played a role in the country's selection of starting point consumption for aggregate reductions of HCFCs as well as policy decision to start HCFC import quota system from January 2011.

Starting Point for Aggregate Reductions of HCFC Consumption Phased Out.

The forecast baseline was chosen as starting point consumption based on the 2009 consumption data and 2010 forecast consumption taken at the level of 2008 without the option of adjusting the baseline for purposes of recalculating the starting point. Secondly having considered the need for continuity and sustained effort to keep the HCFC consumption in check it was agreed to extend the first stage implementation to the 35% reduction in 2020 as Phase 1 of the Ghana HPMP. The table below shows the agreed starting point consumption which formed the basis for determining the eligible HCFC consumption to be phased out and implementation strategy, Table ES.1: Starting HCFC Consumption for Ghana.

Year	Metric Tonnes	ODP Tonnes
2008	513.0	28.2
2009	1,337.6	70.8
2010	513.0	28.2
Baseline/Starting Point*	925.3	49.5

* Average of amounts for 2009 and 2010

Section IV: Strategy and Plan for the Implementation of HCFC Phase-Out describes:

- The overarching strategy which involves linkages between the HPMP, a pilot ODS destruction project and energy efficiency improvement programme in the use of domestic refrigerators and freezers;
- HCFC phase-out overall plan;
- Proposed reductions in HCFC consumption and implementation time frame; and
- Activities for the phase-out of HCFCs.

Under the overall plan, based on HCFC starting point consumption indicated above the overall plan will result in the-phase out of 925.3 metric tonnes of HCFC equivalent to 49.5 ODP tonnes, 17.3 ODP tonnes should be phased out by 1 January 2020, Based on the starting point figure the overall cost and cost associated with HCFC consumption phase out to achieve 2020 reduction target were estimated. Table ES.2 shows the results of this estimate,

Table ES.2: Estimated Cost of HCFC Phase-out in Ghana (2010-2040)				
Activity	Cost (US \$)	HCFC Phase-out Metric Tonnes	HCFC Phase-out ODP Tonnes	Cost- Effectiveness US \$/ ODP kg
Overall Programme	3,880,774	925.3	49.5	4.31
Phase 1 (Extended Stage 1)	1,356,311	323.9	17.3	4.31
Remaining Stages	2,524,463	601.4	32.2	4.31

Section V: First Stage Implementation of the Ghana HPMP describes actions to be undertaken to achieve the reductions in HCFC consumption envisaged to be undertaken as the first phase. The associated costs to be released in 6 tranches from 2010-2019 is shown in Table ES.3 below

Table ES.3. HCFC Reductions and Associated Funding in Stage 1

	Estim. Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Montreal Protocol reduction schedule of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Maximum allowable total consumption of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Lead IA (UNDP) agreed funding (US \$)		200,000		200,000		190,000		195,000		125,000	121,311		1,031,311
Support costs for Lead IA (US \$)		15,000		15,000		14,250		14,625		9,375	9,098		77,348
Cooperating IA (Italy) agreed funding (US \$)		70,000		60,000		70,000		65,000		60,000	-		325,000
Support costs for Cooperating IA (US \$)		9,100		7,800		9,100		8,450		7,800	-		42,250
Total agreed funding (US \$)		270,000		260,000		260,000		260,000		185,000	121,311		1,356,311
Total support costs (US \$)		24,100		22,800		23,350		23,075		17,175	9,098		119,598
Total agreed costs (US \$)		294,100		282,800		283,350		283,075		202,175	130,409		1,475,909
Total phase-out of HCFC-22 and HCFC-142b (used in R-406a) agreed to be achieved under this agreement (ODP tonnes)													17.3
Phase-out of HCFC-22 and HCFC-142b (used in R-406a) to be achieved in previously approved projects (ODP tonnes)													0.0
Remaining eligible consumption for HCFC-22 and HCFC-142b (used in R-406a) (ODP tonnes)													32.2

Section V.4 provides description of all activities to be undertaken to meet the phase-out objectives of Phase 1 of the HPMP. In this regard it is anticipated that most of the activities for enhancing the institutional and regulatory environment to ensure safe use of flammable and natural refrigerants and training will be undertaken through bilateral cooperation with the Government of Italy, while most investment projects (retrofit, recovery and recycling, end-user incentive programme) will be undertaken with UNDP as the lead implementing agency.

Due to the nature and duration of the programme detailed implementation modalities will be discussed between the Government and the implementing and bilateral agencies prior to the start of the implementation of the HPMP as part of the implementation process.

Section VI: Project Coordination and Management describes the management structure and implementation and monitoring procedures. While the NOU will have the sole responsibility for monitoring the implementation of the HPMP, a Technical Management and Monitoring Committee will be established under the existing inter-ministerial/interagency National Committee on ODS (NACODS) to assist the NOU in its implementation and monitoring role. The cost of monitoring has been calculated as part of the activities under Stage 1 of the HPMP (in Section V).

Annexes and Appendices

One annex (Annex I) and three appendices are attached to the HPMP.

Annex I provides the agreement between the Government of Ghana and the Executive Committee for the implementation of the HPMP.

Appendix A: Combining and sequencing GEF and MLF Funding for Climate and Ozone Benefits in Ghana describes in detail an integrated plan for energy efficiency, climate mitigation and ODS destruction management (overarching strategy) and their inter-linkages with the HPMP.

Appendix B,C,D: Summary of Activities under the HPMP - Stage 1 provides detailed breakdown of the activities and their cost and budgetary allocation by year and by agency. It also provides the project implementation milestones as well as a table listing the required equipment and their costs and calculation of the total estimated cost of the recovery, recycling and/or reclamation component of the HPMP.

Appendix E: Background Note for the End-user Incentive Programme describes in detail the procedures for implementing the end-user incentive activities in a cost-effective, transparent and sustainable manner.

I. OVERVIEW OF ODS PHASE-OUT IN GHANA

I.1. Background Information

I.1.1. Geographical location and brief socio-economic background

1. Ghana, a member state of the Economic Community of West African States (ECOWAS) lies in the centre of the West African coast on the Gulf of Guinea. Ghana shares 2,093 km of land borders with the three French-speaking nations of Burkina Faso to the north, Côte d'Ivoire to the west, and Togo to the east. To the south are the Gulf of Guinea and the Atlantic Ocean.

2. The total area of the country is 238,533 square kilometres with a population estimated at 23.8 million. Its southernmost coast is at 4° 30' north of the equator and extends inland for some 670 kilometres to about 11° north. The distance across the widest part is between longitude 1° 12' east and longitude 3° 15' west and measures about 560 kilometres. The Greenwich Meridian passes through the eastern part of Ghana at the port city of Tema about 40 km. from the capital, Accra.

Fig. 1.1: Map of Ghana



3. The GDP for 2008 was reported to be US \$34.04 billion distributed as follows:

- Agriculture: 37.3%
- Industry: 25.3%
- Services: 37.5%

4. Ghana recorded a growth in the GDP of 7.3% in 2008. The per capita GDP was US \$1,500. In 2006 Ghana produced 8.204 billion kWh of electricity and consumed 6.76 billion kWh. It exported 755 million kWh while it imported 629 million kWh of electricity.

I.1.2. Status of Ghana Relation to Multilateral Environmental Agreements

5. Ghana became a Party to the Vienna Convention in October 1988 and was a signatory to the Montreal Protocol. Ghana was also a start-up member of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol representing Article 5 Parties from 1991 to 1994. It is classified as an Article 5 Party to the Montreal Protocol and a low volume CFC-consuming (LVC) country.

6. Ghana has ratified the Vienna Convention, its Montreal Protocol and all its amendments and is a Party to all those agreements. It has been operating a functional licensing system prior to adopting the Montreal Amendment. Ghana has also been reporting its ODS consumption data to the as well as data on the progress of implementation of its Country Programme to the Ozone Secretariat and the Multilateral Fund Secretariat respectively on schedule, sometimes even ahead of schedule. Ghana is also a Party to several multilateral environmental agreements (MEAs), including the United Nations Framework Convention on Climate Change to which she was a signatory. The table below shows the status of Ghana's ratification of the ozone and climate-related multilateral environmental agreements (MEAs).

Table 1.1: Status of Ratification of Ozone and Climate-Related MEAs

Multilateral Environmental Agreement	Date of Ratification	Date of Entry into Force for Ghana
Ozone-related		
Vienna Convention on the Protection of the Ozone Layer	24 July 1989	22 October 1989
Montreal Protocol on Substances that Deplete the Ozone Layer	24 July 1989	22 October 1989
Montreal Amendment	24 July 1992	22 October 1992
Copenhagen Amendment	9 April 2001	8 July 2001
Montreal Amendment	8 August 2005	6 November 2005
Beijing Amendment	8 August 2005	6 November 2001
Climate-related		
United Nations Framework Convention on Climate Change (UNFCCC)	6 September 1995	5 December 1995
Kyoto Protocol	30 May 2003	16 February 2005

I.2. Scope of the Hydrochlorofluorocarbon Management Plan (HPMP)

I.2.1. HCFC Control Measures under the Montreal Protocol

7. The Parties to the Montreal Protocol in their Decision XIX/6 of the Nineteenth Meeting agreed to accelerate the phase-out of production and consumption of hydrochlorofluorocarbons (HCFCs) on the basis of the following for Parties operating under paragraph 1 of Article 5 of the Protocol (Article 5 Parties):

- (a) To choose as the baseline the average of the 2009 and 2010 levels of, respectively, consumption and production;
- (b) To phase out the consumption and production according to the following schedule:

- (c) To freeze, at that baseline level, consumption and production in 2013;
- (d) To have completed on the basis of the following reduction steps the accelerated phase-out of production and consumption in 2030, while allowing for servicing an annual average of 2.5 per cent during the period 2030–2040:

- Step 1: 10 per cent by 2015;
- Step 2: 35 per cent by 2020;
- Step 3: 67.5 per cent by 2025;
- Step 4: 97.5 per cent by 2030;
- Step 5: 100 per cent by 2040

The Ghana HPMP is designed to comply with the above reduction steps in a most environmentally sound manner and if technologically feasible accelerate the process to a complete phase-out.

I.2.2. Controlled Substances and Sector Covered

8. Currently Ghana's consumption of HCFCs is in the servicing of refrigeration and air conditioning equipment. Historically Ghana has consumed significant quantities of HCFC-22 used to repair and service residential, commercial and industrial refrigeration and air conditioning equipment. Following the phase-out of the consumption of CFCs in the domestic and commercial refrigeration equipment significant quantities of HCFC-containing blends have been introduced and their use continues to grow. Consequently the HPMP will cover HCFC and HCFC refrigerant blends, including HCFC-22, HCFC-142b, HCFC-123, R406a and R409a.

I.2.3. Nature and Duration of the HPMP

9. The Executive Committee at its Fifty-fourth Meeting (by Decision 54/39) decided inter alia, as follows, that:

- (a) Countries should adopt a staged approach to the implementation of an HCFC phase-out management plan (HPMP), within the framework of their over arching strategy;
- (b) For countries with consumption in the servicing sector only the elaboration of stage one of the HPMP and subsequent stages should be consistent with existing guidelines for the preparation of RMPs/RMP updates and, if applicable, the preparation of TPMPs; as soon as possible and depending on the availability of resources, herein;
- (c) Countries should employ the guidelines to develop, in detail stage one of the HPMPs, which would address how they would meet the freeze in 2013 and the 10 per cent reduction in 2015, with an estimate of related cost considerations (applying cost guidelines as they were developed).

10. Consistent with Decision XIX/6 of the Parties and Decision 54/39 of the Executive Committee the HPMP of Ghana aims in the long term to phase out the consumption of HCFCs by 2030 or earlier but focuses on measures to ensure the achievements of the goals of Stage 1 of the plan including activities to be undertaken in the period (2010-2012) leading up to the freeze in HCFC consumption in 2013. The Ghana HPMP is developed as an HCFC phase-out programme integrated with two other projects, namely energy efficiency programme to be implemented as interdepartmental activity with funding from the Global Environment Facility (GEF) and a previously approved ODS destruction pilot project which is currently under preparation. These are described in the strategy section of the document. The scope and duration of the HPMP is outlined below:

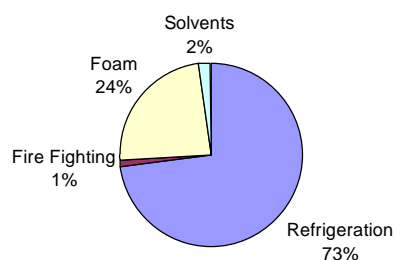
Item	Programme Description	Duration
Overall Plan	Overarching strategy: HPMP activities integrated with a pilot project on ODS waste destruction all of which are to be undertaken in synergy with GEF funded Energy Efficiency improvement programme in the domestic refrigeration subsector. The Plan will be implemented in phases,	2010-2030 or earlier ¹
Phase 1 (Extended First Stage HPMP)	Phase 1 will include the freeze obligations and extend through the first (10%) reduction step to the 35% reduction on 1 January 2020. The early stages of the HPMP will focus on establishment of safe hydrocarbon and natural refrigerant use culture to enable their safe general long term use, Activities to curb growing phase-in of HCFC-based refrigerant blends, recovery and incentive programmes to convert HCFC use to environmentally sound alternatives will be undertaken, drawing on experience gained and lessons learned from the previous programmes to phase out CFCs in the servicing sector. An ODS destruction pilot project that may be implemented alongside the HPMP will provide resources for destroying waste HCFCs that may be generated from the HPMP.	2010-2019
Ohase 2 (Second Stage HPMP)	Phase 2 (Second Stage Implementation programme) involving phase-out of the remaining HCFC consumption based on natural refrigerants to the extent possible.	2020-2030 or earlier

I.3. ODS Phase-out Programme in Ghana

11. Ghana's Country Programme for the Phase-out of Ozone Depleting Substances (ODSs) was approved by the Executive Committee of the Multilateral Fund at its 8th Meeting in October 1992. A countrywide survey data collection conducted at the time confirmed that Ghana did not produce any ODSs but imported all its requirements mainly CFC 11 and 12. The total ODS consumption in 1991 was 101.4 ODP tonnes.

12. As shown in Fig.1 below refrigeration and foam sectors accounted for 73% and 24% respectively of the ODS consumption, almost the country's entire ODS consumption. Consumption in the two large sectors was primarily for the servicing of refrigeration equipment and manufacturing of flexible foams.

Fig. 1.2: Distribution of ODS Consumption by Sector in 1991



¹ Earlier completion of the HPMP implementation programmes will be dependent upon availability of mature phase-out technologies and funds.

13. The Government adopted an accelerated ODS phase-out strategy for phasing out the country's manly CFC consumption well in advance of the Montreal Protocol 2010 schedule. This was deemed possible in part because the Government understood that alternative technologies and practices were already available in the refrigeration and foam sectors. The phase-out strategies sought to:

- (a) Achieve the most significant ODS reduction by targeting the largest consumption sectors first; and
- (b) Minimize the costs to Ghanaian industries and consumers.

14. Appropriate phase-out projects and programmes had to be developed for the two main sectors to achieve the set goals. Thus with the cooperation of implementing agencies of the Multilateral Fund, primarily United Nations Development Programme (UNDP), programmes combining institutional strengthening, regulatory measures, training, monitoring and awareness programmes and other supportive measures have been developed and implemented to enable achievement of the ODS phase-out goals.

15. The implementation of 28 projects and activities funded by the Multilateral Fund at the cost of US \$3.1 million, including US \$315,000 agency support cost resulted in the phase-out of 414 ODP tonnes of ODS and enabled Ghana to completely phase out her CFC consumption by 2008. A summary of the activities is provided in Table 1.2 below.

Table 1.2: Brief Review of Activities Undertaken on CFC Phase-Out

Activity	MLF Approved Funds US\$	Period of Implementation	Imple- menting Agency
Train-the-Trainer Workshop for Refrigeration technicians and Engineers	99,000	1993	UNEP
Umbrella project for continuation of CFC free-technology in the manufacture of flexible polyurethane foam at Ashanti, Latex Foam, Nsawam and Prestige Foam	329,225	1994-2000	UNDP
Training Workshop for Refrigeration Technicians in Code of Good Practices Establishment of National Refrigeration Demonstration Centre Certification of Trained Technicians Distribution of Recovery and Recycling Equipment to Technical Institutions and Refrigeration Associations Hydrocarbon Refrigeration Technology Training	328,000	1993-2005	UNDP
<u>RMP:</u> MAC Technicians Training and Distribution of Recovery and Recycling Equipment End-User Incentive Programme Customs Training Monitoring of the RMP	98,902 198,000 43,000 15,455	2002 2001-2004 2002-2003 2002-2005	UNDP
<u>TPMP:</u> Public Awareness & Information Dissemination to Stakeholders Refrigeration Training, Certification & Code of Good Practices Training Programme for Customs Officers Mobile Air-Conditioning Sector Recovery & Recycling Retrofit of Domestic & Small Commercial Refrigerators to HC Retrofit of Car Air-Conditioning Equipment Financial Incentive Package for Commercial Sector End-Users Monitoring and Management of National ODS Phase-out Plan	344,894		UNDP

I.4. Refrigeration Sector Background

16. Ghana's country programme approved at the 8th Meeting of the Executive Committee in October 1992 showed that whilst ODS consumption in 1991 amounted to 101 ODP tonnes 73 ODP tonnes were used in the refrigeration sector. According to official records, the consumption in this sector dropped to an average of 35.6 ODP tonnes representing the averages 1995 – 1997 annual consumptions (baseline). This success has been possible due to –

- (a) The establishment of the NOU under Ghana's EPA.
- (b) The early introduction of regulations and licensing system to control the importation of chemicals, including ODSs in Ghana.
- (c) The various projects in the refrigeration sector already approved by the Executive Committee.

I.4.1. Refrigerant Management Plan (RMP)

17. In spite of the successes achieved earlier Ghana's annual consumption data reported to the Ozone and the Multilateral Fund Secretariats showed significantly increased levels of CFC consumption for the years 1998 and 1999 of 50.33 ODP tonnes and 43.6 ODP tonnes respectively. This alarming consumption trend called for additional activities to be urgently carried out in order to reduce Ghana's CFC consumption to enable compliance with her obligations under the Montreal Protocol for the 1999 freeze, 2005 50% reduction and the 2007 85% reduction. This prompted the preparation of a Refrigerant Management Plan (RMP) which was approved at the 32nd Meeting of the Executive Committee. The RMP components are described in more detail in the following paragraphs.

18. In order to obtain relevant data in key end-user sectors for the preparation of the RMP a survey of cold stores and fishing vessels was conducted with the assistance of a National Consultant. 67 CFC based cold store end-users were identified from an estimated 900 cold store enterprises. Seventy-six fishing vessel companies were identified out of which twenty-four used ammonia while fifty two used HCFC22.

19. The RMP had four main activities, which are listed below:
- (a) Incentive Programme for the Commercial and Industrial Refrigeration End-user Sector
 - (b) Mobile Air-Conditioning Recovery and Recycling Project
 - (c) Customs Training Project
 - (d) RMP Monitoring Component

Table 1.3 below shows the list of activities under the RMP, their funding allocations, impact (CFC phased out) and duration of implementation.

Table 1.3: Summary of the Implementation of the Refrigerant Management Plan (RMP)

Activity	Phased Out (ODP tonnes)	Date of Approval	Date of Completion	Funds Approved (US \$)	Agency Support Cost (US \$)	Total Project Cost (US \$)
Mobile air conditioning recovery and recycling of CFC-12	7.7	Dec-00	Dec-03	\$98,857	\$12,851	\$111,708
Incentive programme for commercial/industrial refrigeration end-user sector	15.3	Dec-00	Dec-06	\$198,000	\$25,740	\$223,740
Implementation of monitoring activities included in the RMP	1.2	Dec-00	Dec-07	\$15,455	\$2,009	\$17,464
Implementation of customs training programme	0	Dec-00	Jan-03	\$62,806	\$8,165	\$70,971

a) Incentive Programme for the Commercial and Industrial Refrigeration End-User Sector

20. Due to the large number of enterprises involved and the limited funds available from the Multilateral Fund for projects to eliminate ODS consumption in the commercial and industrial refrigeration end-user sector between 2001 - 2006, projects for individual enterprises involving equipment replacement, retrofit, or “drop-in” refrigerant solutions were neither feasible nor cost-effective. Consequently an “end-user incentive programme” was recommended for addressing the phase-out of CFCs in the commercial and industrial refrigeration end-user sector, mainly cold stores. The objective of this programme was to encourage refrigeration end-users to replace or permanently retrofit their existing ODS based equipment to use zero ODP, or low ODP refrigerants.

21. 34 of the 67 identified enterprises received a total amount of US \$133,640 in subsidies under the incentive programme to support the conversion of their facilities from the use of R12 and R502 to non-ODS or low ODS refrigerants. This contribution from the Multilateral Fund provided incentive to the beneficiary enterprises to upgrade their facilities with modern technologies and operational safety and environmental health conditions. The total cost of the upgrades to the 34 enterprises was estimated to be US \$780,000. Thus the incentive subsidies amounted to less than 20% (17.1%) of the actual project cost.

22. The programme which was implemented in three batches resulted in the phase-out of 3.1 ODP tonnes of CFC-12, about 80% of the targeted CFC phase-out. The predominant replacement refrigerants for the CFC-12 and R502 used by the enterprises were HFC134a and R404a (also HFC blend - R143a/R125/R134a).

b) Mobile Air-Conditioning (MAC) - Recovery and Recycling of CFC-12

23. The objective of this project was to implement a comprehensive National programme for Recovery and Recycling of refrigerants, particularly R12 in the MAC sector.

24. Two training seminars for technicians who undertake repairs, maintenance and installation of MAC equipment were carried out to familiarise them with the recovery and recycling of refrigerants and also to explain the different methods and techniques of recovery and recycling of refrigerants in the sub-sector. The seminars also included practical demonstration of the use of the Recovery and Recycling equipment and emphasized the need for good refrigeration practices and safety in refrigerant handling during installation, servicing and dismantling of MAC systems.

25. In all 16 MAC recovery and recycling equipment with accessories were distributed to deserving large workshops where large amounts of CFC12 are used. As of 2006 a total of 8.8 ODP tonnes of CFC-12 had been recovered and recycled by all 16 MAC workshops.

26. The machines were capable of recovering both R12 and R134 refrigerants and some beneficiary shop owners used the equipment for both CFC and R134a system evacuations. Poor record keeping by shop owners and low level of stock of some consumable parts such as sight-glass were some of the problems encountered in the implementation of the project.

c) Customs Training Programme

27. As part of the RMP a two-phase training programme was organised for officers of Customs Excise and Preventive Service (CEPS) to facilitate the implementation of the ODS regulations and to control the import of ODS. The two phases included:

- (a) The train-the-trainer phase which involved the training of 30 selected Customs trainers and senior Customs officers; and

- (b) Training of selected Customs officers drawn from the most active border posts by officers trained during Phase I.

28. A total of 180 Customs officers were trained in “Control and Monitoring of ODSs and their Containing Equipment”. This sensitisation and awareness creation workshop made CEPS officials very knowledgeable in ODS issues and resulted in heightened vigilance at the ports and other entry points resulting in frequent interceptions and seizures of refrigerants which otherwise would have entered the country illegally.

29. In both training programmes, the use of the refrigerant identifier was demonstrated and each participant had a hands-on practical experience with the equipment. Eleven refrigerant identifiers procured under the programme were distributed to the most active Customs border posts after the training programme. The use of the refrigerant identifiers distributed to the border posts have been very useful in isolating mislabelled refrigerants. Through this collaborative effort a total of 30.3 tonnes of CFC12 has been seized and numerous quantities of mislabelled refrigerants detained.

d) Monitoring of the RMP

30. For an effective monitoring of the afore-mentioned activities, a National Consultant experienced in refrigeration was contracted to monitor the activities and collect relevant information which would be used to evaluate the performance of the various activities under the RMP.

31. Principally, monitoring activities carried out under the RMP project helped the NOU to ensure that:

- (a) The Recovery and Recycling equipment distributed to the beneficiary MAC workshops were properly used, kept and maintained;
- (b) Proper records of the amount of CFCs recovered, recycled and re-used are maintained
- (c) Cold storage facilities under the End-user project were properly converted, components of R12/502 disposed of and also to ensure a non-reversal to ODS based technology

32. Periodic monitoring visits to various MAC workshops and cold storage facilities kept beneficiaries alert to do the right thing at all times. The NOU also undertakes follow-up sensitisation visits to the various border posts in the country to ensure that every Custom officer at post is aware of the need to monitor and control ODSs imports.

I.4.2. Refrigeration Sector Terminal Phase-Out Management Plan (TPMP)

33. The Terminal Phase-Out Management Plan (TPMP) for Ghana was prepared to address the remaining 15% of the baseline consumption of 35.6 ODP tonnes, i.e. 17.8 ODP tonnes consumed exclusively in the refrigeration servicing sector. It was approved at the 50th Meeting of the Executive Committee at the level of funding of US \$344,894. The TPMP was implemented in two tranches to completely phase out the remaining 17.8 tonnes of CFCs by 2010. The CFC phase-out was however achieved earlier than scheduled in 2008. The TPMP was essentially planned to complete, augment or reinforce the activities undertaken under the RMP. The components of the plan are described below:

(a) Public Awareness & Information Dissemination to Stakeholders

34. A survey was conducted in four cities and some urban towns to find out the level of awareness among Ghanaians on issues related to the ozone layer depletion. The findings of this survey formed the basis for developing improved strategies for education and awareness creation in the country. Multifaceted programme in public awareness through the media, including interactive programmes and lectures were organized as a result.

(b) Refrigeration Training, Certification & Code of Good Practices

35. The emergence of new technologies e.g. hydrocarbons as refrigerant in the refrigeration industry demanded that technicians and mechanics be abreast with new developments in the trade. Hydrocarbon blends were being used as a drop-in and a local manufacturer began producing some hydrocarbon refrigerants while some individuals were importing some brand name HC R2000 formulated by Sabanta Incorporated, USA. There were also growing number of used refrigerators from Europe and elsewhere with R600a-based system. As R600a must be used on R600a appliance training was necessary. Thus scheduled training programmes were organised for practitioners.

36. Training focused on conversion of CFC-based domestic refrigerators to HC refrigerants. A total of 1,350 refrigeration practitioners drawn from all ten regions of the country received practical training in conversion from CFC-based domestic refrigeration system to Hydrocarbon. All the technicians who took part in the training programme during the have been certified. The incidence of over-dependence on CFCs has considerably reduced as more private enterprises are importing hydrocarbon refrigerant to sustain its availability. The fear of technicians using pure butane as refrigerant and its attendant potential risks as flammable refrigerant is gradually being abated due to availability of R600a, Care 30 and R290/R600.

(c) Training Programme for Customs Officers

37. Under the RMP, 11 refrigerant identifiers were procured and distributed to some active Customs border posts. In view of the limited number of officers who were privileged to benefit from the training and the relatively few identifiers procured earlier vis-à-vis the numerous active points of entry and yearly recruitment of new officers, the office found the need to train and upgrade the skills of those officers who had not benefited from previous training programmes. A total of 800 Customs officials were trained in two phases to identify controlled CFCs and mislabelled refrigerants with the use of newly procured refrigerant identifiers. 1,000 posters of Customs reference checklist and 2,000 leaflets developed and printed by the NOU were distributed to Customs officers at various border posts.

38. The training has paid off. In the previous year Customs seized about 300 cylinders of mislabelled refrigerants including CFC12. Illegal importation of CFC12 has reduced considerably due to Customs' vigilance at the ports of entry. Illegal importation of ODS, mislabelled refrigerants, however, has taken a different form as importation of these refrigerants come in 300g to 700g cans. Continuous training and sensitisation of Customs officials will keep them abreast with events as and when they occur.

(d) Mobile Air-Conditioning Sector Recovery & Recycling

39. The objective of this programme was to implement a comprehensive National Code of Good Refrigeration Practices in the MAC service workshops and to reduce the dependence on CFCs in the MAC sector by converting as many as possible CFC based MAC vehicles to run on HFC 134a. Refrigeration practitioners including so-called wayside mechanics received training.

40. As a result of the training practitioners including the wayside mechanics have joined the National Refrigeration Association and they benefit from regular education and training programmes to enable them conform to good practices as well as the use of alternative ozone-friendly refrigerant technology in order to move away from their dependency on obsolete CFC technology. Another positive aspect of the training is that the wayside mechanics have started regularising their activities by way of establishing shelter workshops. Some practitioners in the MAC sector have purchased their own Recovery/Recycling machines and two of them have gone further to purchase refrigerant identifiers. Most MAC practitioners now take their refrigerant R134a to their colleagues who have the refrigerant identifiers at their various

workshops for testing before they use them, while those who cannot afford to purchase the Recovery/Recycling machine have in their own way, constructed a simple recovery device to enhance their work.

(e) Retrofit of Domestic & Small Commercial Refrigerators to HC

41. The objective of this activity was to reduce the usage of CFCs in domestic and small commercial refrigerators by training technicians to retrofit to hydrocarbon blends. A total of 53 workshops were selected countrywide to carry out the retrofit exercise as a result of a survey conducted to select relatively well-equipped workshops with sound environmental conditions to carry out retrofit of existing CFC based domestic refrigerators and deep freezers to Hydrocarbon blends. Memorandum of Understanding (MOUs) and Terms of Reference (TOR) were signed between the EPA and the beneficiary workshops.

42. A reporting format was developed for completion by servicing workshops for each retrofit carried out. Stickers for notification and warning that the system has been charged with hydrocarbon refrigerant were also deployed after units were retrofitted.

43. The application of hydrocarbon retrofit technology has not been extended to larger refrigeration systems. Only technicians trained and certified are allowed to work with hydrocarbon refrigerants. A total of 850 refrigerators and 200 deep freezers have been retrofitted.

(f) Retrofit of Car Air-Conditioning Equipment

44. As a way of demonstrating the MAC retrofits MOUs were signed between EPA/UNDP and the three MAC workshops with experience in MAC retrofit already and able to source the necessary parts and components. These workshops were given incentives upon proof (using a specified reporting format) of retrofitting from CFC12 to HFC134a based MAC system.

45. 532 kg of CFC-12 was recovered from a number of vehicles in 2007. Good refrigeration practices are being applied and customers are informed about the need to change over from CFC-based to non-CFC alternative. Follow-up calls from the NOU have confirmed how satisfied the beneficiaries are with regard to their retrofitted vehicles. A better cooling effect is observed after conversion to R134a-based technology. Customers who send their vehicles to these three selected workshops are assured of quality refrigerant that is used to charge their MAC systems. Some motor companies e.g. Toyota and Nissan are in agreement with two of these selected workshops to carry out the retrofitting exercise on their vehicles.

(g) Financial Incentive Package for Commercial Sector End-Users

46. The objective of the activity was to continue the RMP activity to mop up the residual of CFC12 in that sector by providing financial incentives to end-users with Commercial Cold Storage facilities to convert from CFC to non-CFC based alternative. The activity was implemented in two phases with ten companies receiving approval by the Technical Review Committee and NACODS. Verification visits to applicants' cold storage facilities to validate their eligibility was carried out by the NOU team.

47. Upon submission of acceptance letter following approval of the application and a bank guarantee or an insurance cover, 60% of the total financial incentive was advanced to the applicant. Upon submission of Statement of Completion report and satisfactory conversion, the remaining 40% of the package was finally paid to the beneficiary company after verification was made. As a result of the activity the high cost of plant maintenance incurred by beneficiaries due to leakages, obsolete equipment and inefficient energy consumption has reduced considerably. Awareness of ODS impact on the environment is also disseminated to other colleagues who are in the business though they did not practically benefit from the project.

(h) Monitoring and Management of National ODS Phase-out Plan

The objective of the monitoring and management of the TPMP was to ensure that activities under the TPMP were satisfactorily implemented, managed and monitored.

A monitoring and technical management committee was constituted to serve as an advisory panel to the TPMP projects. Three refrigerant identifiers and one multi-purpose identifier were used to monitor refrigerant from the ports of entry and the open markets. The impact of the monitoring and management activities includes the following:

- The sensitivity and effectiveness of the identifiers assisted the NOU and the Customs officers to isolate a lot of mislabelled refrigerants.
- The technicians in the domestic retrofitting programme now keep proper records.
- Technicians are encouraged to practice more recovery and recycling which is economical and cost-effective.
- The less advantaged wayside mechanics have been encouraged to work under the umbrella of NARWOA or form an association under the MAC sector.
- Sporadic and periodic monitoring visits to the various project sites kept beneficiaries alert to do the right thing at all times.

I.5. Lessons Learned

48. The following are some of the lessons learned from the implementation of the ODS phase-out activities.

- (a) The co-operation between the Environmental Protection Agency (EPA) and the Customs, Excise and Preventive Service (CEPS) resulted in the establishment of a dependable database which highly facilitated an efficient chemical monitoring system.
- (b) As a result of increased awareness among the general public and vigilance of Customs officers at the various entry points after the Customs training programme and subsequent training activities increasing numbers of importers come to the Environmental Protection Agency for permits to clear consignments of refrigerants.
- (c) Notwithstanding the increased Customs vigilance, a number of mislabelled refrigerants particularly the HFC range of refrigerants have been found on the market thanks to the use of refrigerant identifiers acquired as part of the RMP.
- (d) The pressure on the supply of CFCs as chemicals facing “extinction” considerably drove up their prices.
- (e) After a slow start there were increasing numbers of applications from enterprises in the commercial end-user sector seeking to be considered for incentive package to convert their CFC-based facilities to alternatives following the targeted awareness programme and discernible results of the earlier beneficiary enterprises. However funds under the programme were not adequate to enable extension of the activity to all potential beneficiary enterprises.
- (f) Patronage of MAC servicing/repairs workshops equipped with recovery and recycling machines has increased considerably resulting in increasing patronage of the equipment. This is a clear reflection of acquired improved servicing techniques from the project and public confidence in the quality of the outputs of the workshops.
- (g) There has been significant increase in the importation of other alternative refrigerants

especially the R400 and R500 series of HCFCs as well as R22 without any directions from any authority signifying the propensity for the market to adapt to prevailing circumstances for better or for worse.

- (h) There has also been sharp increase in the importation of used CFC/HFC/HC based domestic refrigerators.
- (i) Poor record keeping by shop owners and low level of stock of some consumable parts such as sight-glass were some of the problems that impacted more effective implementation of the project.

49. While the RMP has contributed to the CFC phase-out through a mix of activities, the Terminal Phase-Out Management Plan stressed on the need for strengthening the capabilities of the service companies to meet the demands of the various new technologies being introduced. In addition to the RMP activities executed, it was essential for Ghana to pursue a retrofit and other activities to ensure the reduction in the need for CFC usage.

I.6. Consumption of HCFCs relative to CFCs in Ghana

50. Historically the consumption of HCFCs in Ghana, typically HCFC-22 has been considerably higher than the consumption of CFCs even at the time of peak demand of CFCs in the country. Both CFCs and HCFCs were used predominantly in the refrigeration servicing sector, but while CFCs, in particular CFC-12 were used in the servicing of domestic refrigerators, freezers, water coolers and dispensers etc. with much smaller refrigerant charge HCFC, mainly HCFC-22 was used in refrigeration equipment with larger refrigerant charge, such as commercial and industrial refrigeration equipment, residential and commercial air conditioners and chillers. In the domestic refrigeration servicing sub-sector, the increasing use of HCFC-based refrigerant blends as interim replacement for CFC-12 and R502 refrigerants has resulted in the phase-in of increasing amounts of HCFCs (HCFC-22, HCFC-142b and possibly HCFC-124). Another dimension to ODS consumption in the refrigeration servicing sector is the import annually of large consignments of used refrigerators and freezers mainly from Europe and North America which places considerable pressure on refrigerant demand, especially of near drop-in HCFC blends.

II. LEGAL AND INSTITUTIONAL FRAMEWORK

II.1 Methodology

51. A Senior Legal Consultant was engaged to review all the institutional arrangements and relevant laws that could influence activities to phase out HCFCs in the country with the view to identifying areas that could be addressed in the short term to facilitate successful implementation of the HPMP. No need for immediate action to address any implementation issues was felt.

II.2 Early Beginnings

52. Ghana laid the groundwork for sound environmental management following the United Nations Conference on the Human Environment held in Stockholm in June 1972. The Environmental Protection Council (EPC) was established in 1973 and located within the Ministry of Finance and Economic Planning. Among the various environmental management activities that the EPC undertook was in the sector of industrial and toxic chemicals management. A permit system which became the precursor to the current licensing system was established by the EPC. Under this system all importers of industrial chemicals were required to obtain a permit from the EPC prior to importation of the chemicals. Industrial chemicals imported into the country would not be cleared by Customs without a valid permit from the EPC.

II.3 Strengthening the Chemical Management Role

53. In 1993 the Ministry of Environment, Science and Technology was created to provide dedicated cabinet position in environmental matters in the Government. The Environmental Protection Agency (EPA) was established in 1994 by Act of Parliament to replace the EPC which operated in a mostly advisory capacity. The Environmental Protection Agency Act, 1994 (Act 490) gave enforcement powers to the EPA, including powers of persecution.

54. The EPA has seven divisions including the Centre for Chemicals Management (CCM) and Legal Division. Both of these Divisions play important roles in the regulation of the import distribution and use of chemicals, including ODS. The Centre for Chemicals Management has three main units, namely

- Pesticides
- Industrial and Consumer Chemicals
- National Ozone Unit

55. EPA Act empowers it to issue environmental permits and pollution abatement notices for controlling the volumes, types, constituents and effects of waste discharged, emissions, deposits or other source of pollutants and substances which are hazardous or potentially dangerous to the quality of the environment or any segment of it. The EPA Act also empowers the Minister responsible for EPA to make regulations through legislative instruments to control the importation of hazardous substances as well as prohibit or restrict the importation of such substances.

56. It also created the Board of Management of EPA and conferred on it the powers to create such departments or divisions in the agency as the Board may consider necessary for the efficient discharge of the function of the Agency. Thus the National Ozone Unit has been established according to law.

II.4 Institutional Framework - Participatory Approach to Management of ODS

57. Under the EPA a National Committee on ODS has been formed. This Committee serves as an advisory body to EPA on all ODS related matters and is responsible for giving advice on, inter alia, policy requirements, legislation, programmes of action, research, institutional strengthening and awareness campaigns in this regard. The Committee is headed by the Executive Director of EPA and includes representatives from the under listed organizations. The Coordinator of the NOU acts the Secretary to the Committee.

- Ministry of Environment Science and Technology
- Ministry of Agriculture
- Ministry of Trade and Industries
- Meteorological Services Department
- Department of Geography and Resource Development
- Department of Factories Inspectorate
- Friends of the Earth – Ghana (NGO)
- Council for Scientific and Industrial Research
- United Nations Development Programme – Ghana
- Faculty of Science, University of Science & Technology
- Ghana Association of Industries
- Customs, Excise and Preventive Service
- National Air-conditioning and Refrigeration Workshop Owners Association
- Legal Officer, EPA (Co-opted)
- Ministry of Finance (Co-opted)
- Accra Technical Training Centre (Co-opted)
- National Committee on Improved Refrigeration Practices (Co-opted)
- Centre for Chemicals Management (Co-opted)
- Government of Italy through the Ministry of Environment and the Sea

58. Involvement of these key Ministries, department of Government and private sector organizations ensures cooperation and enables the agencies to contribute to the formulation of policies and strategies for the control of ODS use.

II.5 Legal Framework

59. Although Ghana operates liberalized import regime there are laws that enable relevant agencies to control or regulate certain aspects of import-export trade to ensure that the public is not exposed to harmful substances or products and also ensure that the country meets its obligations under international treaties of which it is a party. These laws include:

- CEPS (Management) Law, 1993 (PNDC L330)
- Export and Import Act, 1995 (Act 503)
- Environmental Protection Agency Act, 1994 (Act 490)
- Management of Ozone Depleting Substances and Products Regulations, 2005 (LI 1812)
- Pesticides Control and Management Act, 1996 (Act 528)
- Food and Drugs Law 1992 (PNDC L305B)
- Standards Decree, 1973 (NRCD 173)
- Ghana Standard Board (Food, Drugs and Other Goods) General Labelling Rules 1992, (LI 1541)
- Pharmacy Act, 1994 (Act 489)

60. The laws that are most relevant or directly linked to the management of ODS consumption in Ghana among the above pieces of legislation are three laws, namely,

- Export and Import Act, 1995 (Act 503)
- CEPS (Management) Law, 1993 (PNDC L330)
- Management of Ozone Depleting Substances and Products Regulations, 2005 (LI 1812)

These three laws are briefly described below.

II.6 Export and Import Act, 1995 (Act 503)

61. The Ministry of Trade and Industries is responsible for regulating international trade, namely, import and export of goods. The Export and Import Act governs trade in Ghana operates a liberalized trade regime without import licenses but within certain regulatory boundaries. The Minister of Trade and Industry is empowered to prohibit or restrict the exportation or importation of any goods, by legislative instrument. The thrust of the import-export trade regime may be summarised as follows:

- No licence is required to import goods;
- Imports for commercial purposes should be covered by an Import Declaration Form (IDF);
- All commercial goods are subject to local inspection to ensure quality, quantity and price and other specifications;
- All commercial goods are to be covered by Final Classification and Validation Report. The Minister may by Regulations exempt goods from Inspection and Final Classification and Valuation Report.
- Importer shall comply with other enactments e.g. Permit, licence or certificate.

62. Thus, issues pertaining to the need to identify the imported goods through a declaration, inspection to ensure compliance with and the need to meet permit requirements of other jurisdictions facilitates cooperation in ODS import management. Another aspect of the Export and Import Act that works for the facilitates the regulation of ODS imports is the requirement that import Declaration Form (IDF) must be completed and submitted to the appropriate agencies, which include:

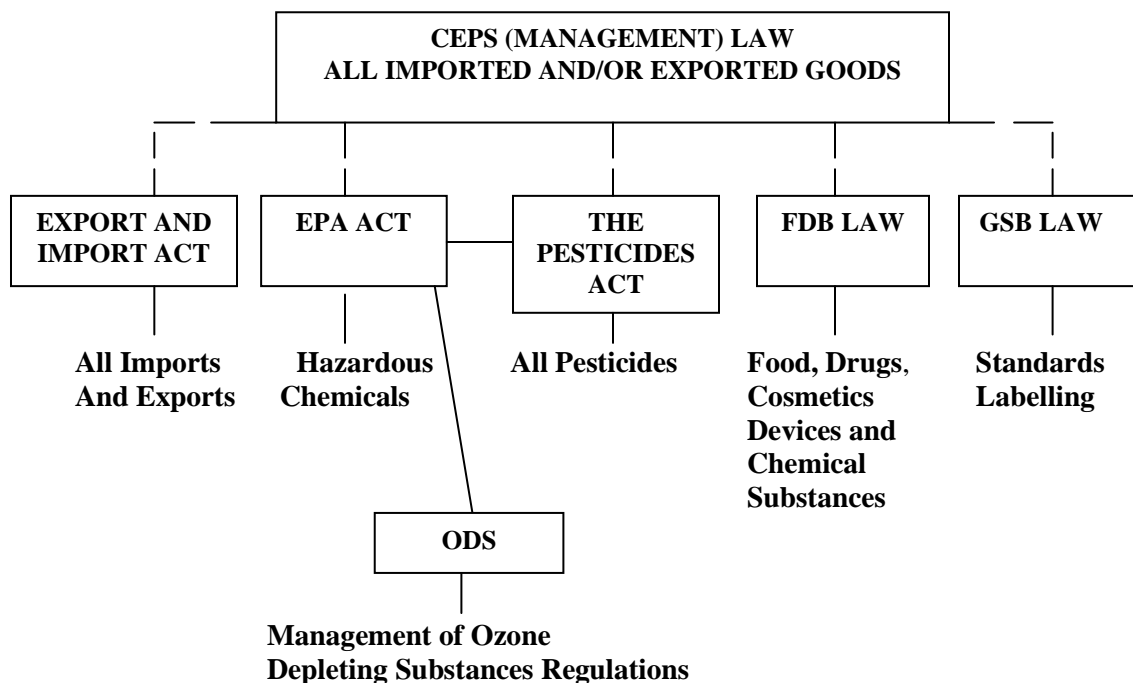
- a) The Commissioner of Customs
- b) The Inspector to be appointed by the Minister
- c) Any other agency specified on the form

II.7 Customs, Excise and Preventive Service (Management) Law, 1993 (PNDC L330)

63. As can be seen in figure II.1 below, the CEPS Management Law acts as an omnibus law on import and export trade and could be used to address regulatory requirements any of the agencies where such agency lacks adequate legal backing to do so. There are provisions in the CEPS (Management) Law, 1993 (PNDC Law 330) that deal with infringements which may not be specifically covered in the EPA laws or laws of similar regulatory agencies. For instance, Regulations may be made to prohibit the importation of any goods or classes of goods for temporary use.

Fig. 2.1

Legislation Relevant to Control of Imports of ODS



KEY

- — — Act enforced by Customs at ports and entry points
 ————— Area of responsibility prescribed by law

II.8 Management of Ozone Depleting Substances and Products Regulations, 2005 (LI 1812)

64. In order for the country to meet its obligations under the Montreal Protocol, that of progressive phase-out of the consumption of ODS it was necessary to control their import. As there was no express provision prohibiting or controlling the importation/exportation of ODS or authorising the issue of permits as allowed under the Import and Export Trade Act, the Minister acting on the authority granted him under the EPA Act, 1994 issued Management of Ozone Depleting Substances and Products Regulations LI 1812 to address the situation. Specific provision has now been made in the Regulations.

65. Until the promulgation of the Regulation there were no penalties for infringing the import/export of the controlled substances and products, as required under Section 28 (3). The Management of Ozone Depleting Substances and Products Regulations, 2005 (LI 1812) also addresses these deficiencies in the principal enactment.

66. The Regulations specify the scope of restrictions on imports/exports, Permits to be applied for and issued for the import/export of the controlled substances and products and “offences and penalties”: Penalties under the Regulation include failing or neglecting to report data to the Executive Director and providing false or misleading information as well as neglecting to keep records.

67. Controlled products are defined in Schedule I to the Regulations while controlled substances are described in Schedule II. Controlled products include inter alia:

- a) Automobile and truck containing units (whether incorporated in vehicles or not);

- b) Domestic and commercial refrigeration and air conditioning equipment when containing controlled substances as a refrigerant or in insulating material of the product. These include:

- Refrigerators;
- Freezers
- Dehumidifiers;
- Water coolers;
- Ice machines;
- Air conditioning and heat pump units

- c) Insulation boards, panels and pipe covers.

68. Controlled substances include all the substances now controlled under the Montreal Protocol, including hydrochlorofluorocarbons (HCFCs).

69. Other provisions under the regulations include “Register of Permits” whereby the Executive Director is enjoined to keep a register of all holders of permits and “Reporting Procedures” which make it an obligation for all importers to submit reports on the type and quantities of controlled substances imported during the year. The regulations also provide for End-user Declaration to be made according to a prescribed format and make it a duty for importers to maintain records which should be submitted to the EPA every six months. The controlled substance or product imported or exported may be subject to Customs verification.

70. All these procedures and regulations in place should make it possible for the NOU to compile accurate records of imports of ODS including HCFCs when under control.

The Penalties prescribed under this regulation are:

- 250 penalty units or to a term of imprisonment not exceeding one year or both
- Revocation of the permit
- Confiscation of the controlled substances or products;
- Order for re-exportation at the cost to the importer

II.9 Regional Arrangements

71. Draft Harmonised Regulations for the Economic Commission of West African States (ECOWAS) Member States is reported to have been developed by the ECOWAS Commission in cooperation with UNEP OzonAction Programme, UNEP Regional Office for Africa and is currently under review by UNEP. As soon as the review is completed processes for the adoption of the draft by the Council of Ministers will be initiated by the ECOWAS Commission. At the moment the date of adoption cannot be foretold as the document is still under review. When adopted by the Council of Ministers and ratified by the Heads of State they will be binding on the member states,

II.10 OBSERVATIONS AND RECOMMENDATIONS

72. The following observations and recommendations were made by the legal consultant. While some of the recommendations are or can be addressed under current institutional arrangements those that are not would be addressed during the implementation of the HPMP.

II.10.1 Institutional Framework

73. The National Ozone Unit (NOU) apart from ensuring compliance with the terms and conditions of the Montreal Protocol also serves as the liaison between the Environmental Protection Agency, the Multilateral Fund and the implementing agencies of the Fund. The training of both EPA officials and other stakeholders is also the responsibility of the NOU.

74. With the adoption of the ECOWAS Harmonised Regulations the NOU will have added responsibility, for example, of preparing annual reports for submission to the ECOWAS Commission and monitoring of transit transactions in the sub-region.

75. As phase-out schedules become imminent, education of the general public will have to be intensified. For example, importers will have to be more educated on the importation of ODS, specifically HCFC dependent equipment. The draft action plan when adopted by the Council of Ministers of ECOWAS would require more action on the part of the NOU to ensure the achievement of its objectives. The NOU should also draw up its own plan of action based on local needs and what the ECOWAS Plan of Action would also bring on board.

76. Some stakeholders have received some training organized by the EPA. One Agency that needs more training is the CEPS. The EPA should start planning now to ensure, for example, that officers of the CEPS are made familiar with issues like transit and trans-shipment of HCFCs and HCFC-containing products.

77. Again the EPA will have to look into replacing or augmenting the testing machines that were given to CEPS in 2002. The NOU should make periodic checks to ensure that these machines are being utilized properly.

78. The CEPS should also make sure that amendments to the Annexes (Controlled substances and ODS dependent equipment) are expeditiously incorporated into its laws.

79. It was observed that a major constraint during the implementation of the RMP and the TPMP was lack of mobility for carrying out the day-to-day activities including monitoring of the various investment projects under the Plans. For instance, it was reported that in several instances the NOU did not have any facility to transport seized refrigerants and other products and had to rely on the transport pool of EPA which sometimes either delayed required action or made it sometimes even ineffective. Therefore during the implementation of the HPMP arrangements should be made or a flexibility given to the EPA to acquire a vehicle within the approved funds for travel costs.

II.10.2 Legislative Framework

80. The first and major problem that was noticed is the fact that more than one Public institution is dealing with the issue of chemicals which include the controlled substances.

These institutions basically are:

The Environmental Protection Agency;

The Food and Drugs Board; and to some extent

The Ghana Standards Board.

Each of these institutions operates on its own law even though the subject matter is the same – chemicals.

81. It is recommended that the various laws dealing with the importation of chemicals should be looked into and the EPA charged with managing the controlled substances exclusively. One way this may be done is to insert an exclusion clause in the laws of the FDB and GSB in the provisions dealing with chemicals. For example, the Definition of chemical substances to include “pesticides” can be amended to exclude “pesticides” from the definition.

82. In view of the fact that multiple institutions are handling the same matter – chemicals, and this in different laws, the issue of imposition of penalties on offences also should be looked into. It is suggested that since the CEPS is the first line of defence and in almost all cases detect any infringement against the laws on the controlled substances and ODS dependent equipment the penalties contained in the CEPS law should be made to apply. This will ensure that the same penalties are imposed on offenders who break the

same law, for example, on smuggling, concealment or import/export of prohibited or restricted goods. The laws could be amended to accommodate this recommendation.

83. The regulations concerning controlled substances are being implemented in full and facilitating the data reporting obligations of the country. However, the same cannot be said about the regulations concerning controlled products (Schedule I). There is the need to further examine the complexities of the enforcement of this aspect of the regulations with the view to ensuring its full enforcement.

III. DATA COLLECTION AND SURVEYS

III.1. Introduction

84. The data collection and surveys were undertaken against the background of the historical ODS consumption in the country and the factors affecting demand for ODS refrigerants and their alternatives, including reliance on imported used refrigerators.

85. Data were collected to determine:

- (a) The annual import of HCFCs and thereby determine Ghana's consumption of HCFCs and its trends since Ghana neither manufactures nor exports ODS;
- (b) The installed capacity of HCFC-based residential, commercial and industrial air conditioning and refrigeration equipment, refrigerant stock in the existing equipment as well as annual HCFC refrigerant demand;
- (c) The population of domestic refrigerators, freezers and other refrigeration appliances and HCFC-based refrigerant demand;
- (d) The annual import of new and used domestic refrigerators and freezers and other refrigeration equipment, residential and commercial air conditioners.

III.2. Methodology

III.2.1. Annual HCFC Consumption Data

86. Ghana neither produces nor exports HCFCs or its blends. Therefore its consumption of HCFCs is equal to its import. Although import of HCFCs and their blends is not yet governed by any quotas the chemicals management procedures of EPA's Chemicals Control and Management Centre (CCMC), including the licensing system provide a mechanism for tracking the imports. Such mechanism involves close collaboration between the Customs, Excise and Preventive Service (CEPS) and the NOU, which operates as part of the CCMC. Thus collection of data on import of chemicals as well as of import of refrigeration and air conditioning equipment is undertaken on a continuous basis through the information provided from the CEPS data base of daily records of imported chemicals and refrigeration equipment cleared at the ports of entry. The import data from CEPS are compiled by the NOU and compared with the data obtained through the Permit system operated by the EPA.

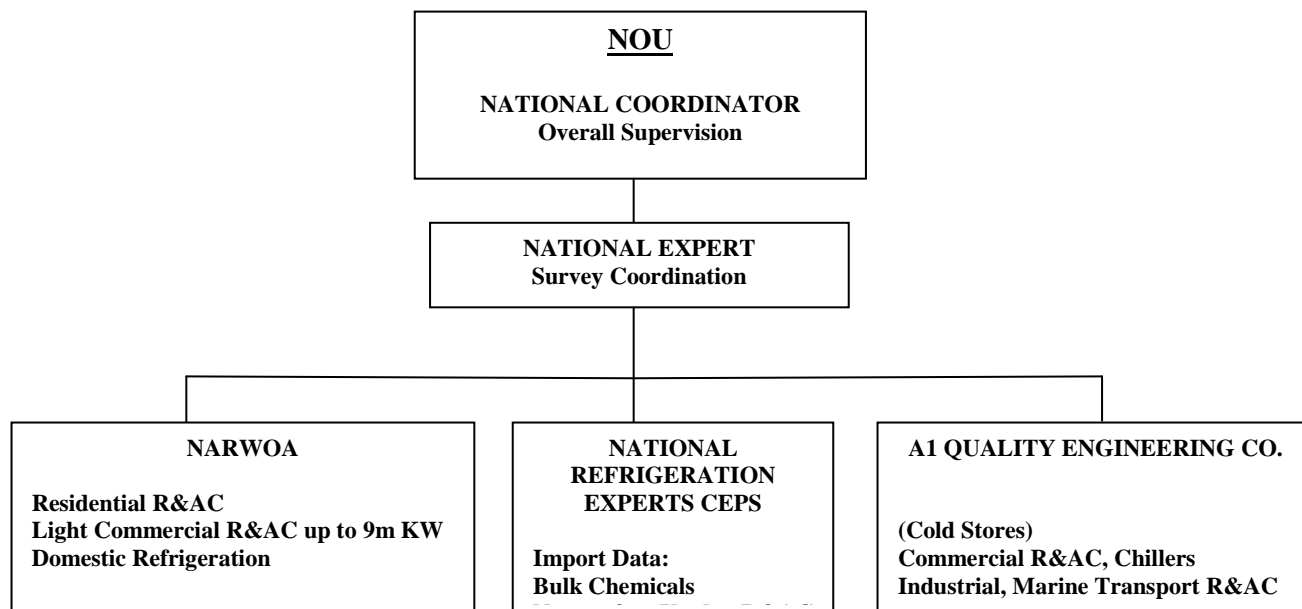
87. Since 2006 a more accurate monitoring of import, distribution and use of HCFCs in the country has been undertaken by the NOU. In the absence of a quota system for regulating HCFC import a survey of chemical importers registered under the licensing system is undertaken annually to determine the import and distribution of refrigerants and cross check with customs data. The refrigerants targeted in the survey of importers include HCFC-22 (R22), HFC-134a (R134a), R406a, R409a, R410a, and R600a.

III.2.2. HCFC Consumption at Enterprise and End-user Levels and Installed Capacity of Refrigeration and Air Conditioning Equipment

88. The EPA contracted the National Air Conditioning and Refrigeration Workshop Owners Association (NARWOA) and A1 Quality Engineering Co. Ltd to carry out surveys and collect data on the equipment in use as well as the use of HCFCs at the enterprise and residential user levels for their repair and servicing. NARWOA is an organization with nationwide membership and is active in all regions and districts of the country. It is an organization with expertise in the management of refrigeration sector phase-out projects, having been involved in the phase-out of CFC-12 in the servicing refrigeration

servicing sector. A1 Quality Engineering Co. Ltd is a leader in the refrigeration engineering services in the country providing refrigeration engineering, servicing and consulting services to enterprises and end-users in the refrigeration sector. Figure--- below shows the scheme for the collection of data for the HPMP in Ghana.

Fig. 3.1: Organizational Chart for the Collection of Data for the Preparation of the Ghana HPMP



III.2.3. Survey of Domestic Refrigerators and Low Capacity Air Conditioners

89. In order to achieve the widest possible coverage of the survey NARWOA distributed the survey questionnaire to all its members country-wide with instructions to go from house to house, office to office and all small businesses to take inventory of all refrigerators, freezers and ice machines and windows and mini split air conditioners up to 10 kw cooling capacity that use HCFC-22 or HCFC-22 blend as refrigerant. The information requested included:

- Location of the equipment
- Brand name
- Year installed
- Cooling capacity
- Quantity of R22 in the equipment
- Frequency of service per year
- Number of repairs per year
- Quantity of R22 used for repairs
- Number of hours of operation per day
- Number of days of operation per week
- Condition of the unit

III.2.4. 3.2.4 Survey of Commercial and Industrial Refrigeration Equipment, Medium Capacity Air Conditioners and Chillers

90. The staff of A1 Quality Engineering Company visited the following enterprises and end users:

- Cold stores of over 10kw cooling capacity
- Enterprises using commercial air conditioning plants of between 10kw and 15kw cooling Capacity
- Industries and facilities using industrial refrigeration, air conditioning equipment mostly of reciprocating compressors above 16Kw cooling capacity
- Companies using chillers of 16kw and above cooling capacity. These chillers use either Scroll, Screw or centrifugal compressors
- Fishing vessels with refrigeration and air conditioning systems for the inboard freezers for storing their catch and air conditioning the vessels

91. The survey teams visited and collected the required data from Banks, sports stadia, food and beverage processing plants, State Banquet Halls, Radio and TV broadcasting stations, the Kotoka International Air port, several cold stores, freezers and ice plants, Regional Hospitals, National Theatres, fishing harbours, major Hotels, cocoa processing plants, pharmaceuticals manufacturing plants, high rise office buildings, research institutions, mobile phone communication companies, Universities, fishing trawlers, etc. The survey covered all the major cities and towns in all ten regions of the country.

92. In addition to the information listed in paragraph 43 above information on the type of compressors used on the equipment and the number of breakdowns of the equipment per year was also collected.

III.2.5. Import of New and Used Refrigeration and Air Conditioning Equipment

93. Comprehensive data on import of air conditioners including spare parts and accessories for the period 2007 to 2008 and of refrigerators and freezers (domestic and commercial), water coolers, etc. and spare parts and accessories for the period 2005 to 2008 compiled by the customs (CEPS) on a daily basis were made available from the Customs data base (GCNet). Information generated includes the names and addresses of the importers and exporters, country of export, description of the items, HS Codes, quantities imported and their FOB and CIF prices. The information is provided to the NOU which reviews and processes it for the ODS management programme.

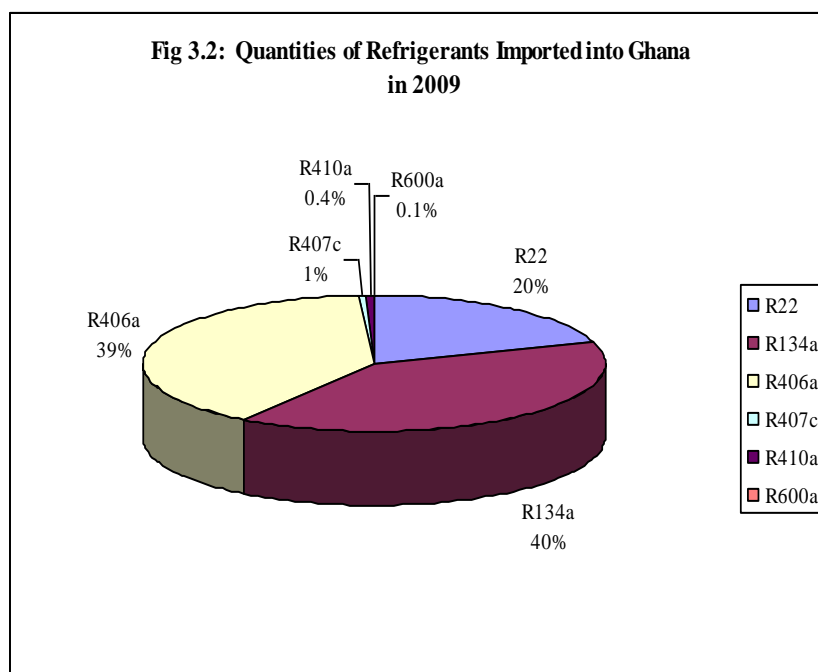
III.3. Results and Analysis

III.3.1. HCFC Consumption

94. During the period 1995-2005 Ghana consumed average of 85 metric tonnes of HCFC annually. During the same period its CFC consumption was average 36 tonnes. However, while CFCs were controlled substances subject to quotas and strict reporting the HCFCs were not and the consumption data were based mainly on voluntary reporting by those companies that complied with the requirements of the licensing system. Therefore the HCFC consumption figures for this period may be considered as conservative. More accurate monitoring of HCFC imports since 2006 have provided more accurate HCFC consumption in the country and its growth. Table 3.1 below provides the HCFC consumption data for the period 2006 to 2009. HCFC-142b is derived from R406a blend as a component of the blend while the amount of HCFC-22 also includes the amount derived from the R406a blend as the other HCFC component.

Table 3.1: HCFC Consumption in Ghana (2006-2009) Based on Customs Data Reports						
Year	HCFC Consumption (ODP tonnes)			HCFC Consumption (Tonnes)		
	All HCFCs	HCFC-22	HCFC-142b²	All HCFCs	HCFC-22	HCFC-142b
2005	7.7	7.7	0	140.0	140.0	0
2006	21.1	21.1	0	197.3	197.3	0
2007	19.4	18.0	1.6	350.9	326.4	24.5
2008	21.6	18.4	3.2	384.6	335.4	49.2
2009	77.3	52.9	24.4	1337.6	961.9	375.7

III.3.2. Import of Refrigerants



95. Figure 3.2 illustrates the comparative amounts of refrigerants imported for use in the refrigeration and air conditioning servicing sector in Ghana in 2009. A total amount of 2,352 tonnes of refrigerants was imported in 2009 for use in the refrigeration and air conditioning servicing sector in Ghana. In addition to HCFC-22 the main alternative refrigerants imported for use in Ghana from 2007 when consumption of CFC-12 was almost completely phased out were HFC-134a, R406a. Since then R406a in particular has seen an explosive growth in imports as “the new R-12” for the practitioners who are increasingly using it as a drop-in refrigerant for

a wide range of applications, including recharge of R134a equipment with R406a during servicing, due to its relatively cheaper price compared with other alternatives as shown in Table 3.3 below. Specifically with the increasing scarcity of CFC-12 and increasing demand for CFC-12-based refrigerant servicing as a result of the large stock of CFC-12 based refrigerators and freezers end users have resorted to using R406a as a direct drop in refrigerant.

96. In 2006 and previous years there was no import of the refrigerant R406a as indicated in Table 3.2, however in 2007 about 60 tonnes was imported increasing in the following year (2008) by 100 per cent to 120 tonnes and further increasing by over 700 per cent in 2009, making R406a the refrigerant of choice. In 2008 HFC-134a accounted for 79% of all the HCFC-22 alternative refrigerants imported into the country while R406a accounted for 20%. However in 2009 each of these refrigerant types accounted for almost 50% of the imported alternative refrigerants. R600a import made up much less than 1% in each year.

². HCFC-142b as a 41% by weight component of refrigerant R406a. The other components, HCFC-22 and R600a are 55% and 4% by weight respectively..

97. In general demand for HCFC-based refrigerants has risen due to increasing use of comfort air conditioning as a result of increasingly affordable market prices of both new and used air conditioning units. The demand however has been exacerbated by power outages which have become more frequent in recent times due to instability in the power supply in many areas of the country.

III.3.3. Prices of Refrigerants

98. The average prices of refrigerants in Ghana CIF at the port of Tema ranged from US\$3.50 to US\$14.00 for R410a in 2009. Of all the HCFC-22 and CFC-12 alternatives currently on the market R406a, a transitional refrigerant, is the cheapest, being 33% and 39% of the prices of HFC-134a and R-600a respectively. Table 3.3 below provides the average CIF prices of refrigerants in the country in 2009. This poses a challenge to the Government as R406a is itself a blend of HCFCs.

Table 3.3: Prices of Refrigerants in Ghana (as of December 2009)	
Refrigerant	Average Price (CIF) (US \$/kg)
R22	3.5
R134a	12.8
R404a	13.5
R406a	4.27
R407c	12
R410a	14
R507	12.6
R600a	10.95
R717	0.89

99. In 2008 17 importers accounted for the bulk of the HCFC-22 and other refrigerants imported into the country. However in 2009 the number of importers had risen to 31 with one importer accounting for 75% of the total amount of R406a imported that year. Table 3.4 below shows the list of importers of HCFCs and HCFC blends which exclusively were R406a.

Table 3.4: Importers of HCFC Refrigerants in 2009							
No.	Names of Importers	HCFC Chemicals Imported (Metric tonnes)					
		HCFC-22	R406a	R406a HCFC component			Total HCFCs
				HCFC-22	HCFC-142b	Total	
1	God's Will Ent		2.7	1.5	1.1	2.6	2.6
2	Capital Refrigeration	11.2	19.1	10.5	7.8	18.3	29.5
3	Frank Mensah Bonsu Ent	32.6	35.9	19.7	14.7	34.5	67.1
4	Platinum Impex Ltd	106.8		0.0	0.0	0.0	106.8
5	Tomorrow's People Ent	0.3	1.1	0.6	0.5	1.1	1.4
6	Elizabeth Ampeah Ent	22.0	19.0	10.5	7.8	18.2	40.2
7	Nak-Na Electricals Trading	35.6	15.6	8.6	6.4	15.0	50.6
8	Ransford Osei Ntim	7.0					7.0

9	Mary Larweh	0.7	0.5	0.3	0.2	0.5	1.2
10	Patrick Tetteh	13.6	690.4	379.7	283.1	662.8	676.4
11	Glopol Global Ltd	56.9	31.3	17.2	12.8	30.0	86.9
12	Chi-Boy Com. Ltd		1.2	0.7	0.5	1.2	1.2
13	Balanced View Ltd		15.5	8.5	6.4	14.9	14.9
14	Alfredesco Ltd	26.9	8.4	4.6	3.4	8.1	35.0
15	Madson Japan Elec. Ltd	8.7	6.8	3.7	2.8	6.5	15.2
16	Josuni Ent. Ltd	2.7	9.4	5.2	3.9	9.0	11.7
17	Nofa Ltd	15.5	0.7	0.4	0.3	0.7	16.2
18	Bestman Global Merch.	39.9	0.7	0.4	0.3	0.7	40.6
19	Melcom Ltd	15.5		0.0	0.0	0.0	15.5
20	Uniwell Trading Co.	12.8	2.7	1.5	1.1	2.6	15.4
21	When Logistics						
22	Dizengoff Gh. Ltd	1.0					1.0
23	Alex Ent	5.7	8.8	4.8	3.6	8.4	14.1
24	Doris Amoako Agyeman						
25	Eastern Points Gh. Ltd		15.6	8.6	6.4	15.0	15.0
26	Afari Dodi Bernard	1.7	0.7	0.4	0.3	0.7	2.4
27	Becksam Ent		15.5	8.5	6.4	14.9	14.9
28	Charles Onwesonye		1.6	0.9	0.7	1.5	1.5
29	Epheco Rens Gh. Ltd		13.6	7.5	5.6	13.1	13.1
30	Golden Stork Gh. Ltd	19.4					19.4
31	Airnet Building Services	12.5					12.5
	Total	448.9	916.4	504.0	375.7	879.7	1328.6
Number of importers of HCFC-22: 22							
Number of importers of R406a: 24							

III.3.4. HCFC Consumption Validation

100. The HCFC import data compiled annually from the Customs data received from the GCNet as shown in Table 3.1 above was compared with the data reported by the chemicals importers through the EPA Permit system shown in Table 3.4 above. The import data reported for R406a in each reporting procedure was the same (879.7 tonnes). However comparison of the Customs data (457.9 tonnes) with the data from the importers that reported through the Permit system showed a difference of 9 tonnes. Thus the total HCFC consumption obtained from the Customs data and the Permit system was 1,337.6 tonnes and 1,328.6 tonnes respectively, i.e. less than 1% difference. This difference was not considered statistically significant. Hence the Customs data was used as the basis of determining the HCFC consumption consistent with past practice.

III.3.5. HCFC Consumption at Enterprise and End-User Levels

101. Results of the surveys showed that the installed capacity of refrigeration and air conditioning units in the country, excluding domestic refrigeration units, was a total of 1,859,382 units in 2008. These include residential air conditioners, light commercial refrigeration and air conditioning units, cold stores, industrial refrigeration and air conditioning, chillers, road transport refrigeration and marine refrigeration and air conditioning units. Light commercial refrigeration and air conditioning units (1,210,400 units) accounted for 65% of the installed capacity while the residential air conditioning units accounted for

almost 35%. All the other remaining units accounted for only 0.3% of the installed capacity. On the basis of parameters including cooling capacity of the units and estimated unit charge per equipment the stock of HCFC-22 refrigerant in the refrigeration and air conditioning systems was calculated. Table 3.5 provides a summary of installed capacity and HCFC-22 demand.

Table 3.5: Population of Air Conditioning, Commercial and Industrial Refrigeration Units and Chillers and HCFC-22 Use in Ghana in 2008								
Type of Refrigeration/Air Conditioning System	Number of Enterprises, Residential Households and Other Facilities	Number of Refrigeration/Air Conditioning Units	Per Cent of Installed Capacity	Cooling Capacity (Kw)	Total HCFC-22 in Refrigeration/AC Units (tonnes).	Total HCFC-22 Servicing Demand (tonnes)	Refrigerant Use Ratio Per Cent	Per Cent of Total Refrigerant Demand
Residential Air Conditioning	335,200	645,256	35	836,140	901.1	88.9	9.9	25.8
Light Commercial Refrigeration / Air Conditioning	402,345	1,210,400	65	1,825,227	1,171.1	239.2	20.4	69.5
Cold Stores (10-15 KW)	66	564	0.03	22,095	8.2	2.4	29.3	0.7
Commercial Air Conditioning (10-15 KW)	63	1,064	0.06	42,383	9.2	3.5	38.0	1.0
Industrial Refrigeration / Air Conditioning (16 KW and higher)	57	522	0.03	35,894	9.9	4.6	46.5	1.3
Chillers	43	630	0.03	42,394	5.7	2.5	43.9	0.7
Road Transport Refrigeration / Air Conditioning	45	622	0.03	543,050	2.6	2.2	84.6	0.6
Marine Refrigeration/Air Conditioning	8	324	0.02	38,918	6.6	1.1	16.7	0.3
TOTAL	737,827	1,859,382	100	3,386,101	2,114.4	344.4	16.3	100
NOTES:								
1. Domestic/Residential Air Conditioners: These are air conditioners mainly used by households in their homes especially for comfort cooling. They consist of window and mini split systems air conditioners of less than 9 Kw cooling capacity.								
2. Light Commercial Refrigeration & Air Conditioning Systems:: These are refrigeration and air conditioning systems mainly used in small to medium sized of up to 9kw cooling capacity per unit businesses such as mini marts, babering shops & saloons, guest houses, offices etc.								
3. Commercial Air Conditioning: These are for cooling large commercial buildings such as high-rise offices, Banks, Hospitals, Air ports, Hotels, large conference & state banquet halls etc. These are mainly central air conditioning systems, of between 10 to 15kw cooling capacity.								
4. Road Transport Refrigeration / Air Conditioning: These are installations in Buses, Coaches for air conditioning purposes and Thermoking freezers and chillers for transporting chilled and frozen foods.								

III.3.6. Date of Installation and Other Relevant Characteristics

102. The oldest existing air conditioning equipment was installed in 1960. The survey showed that 12% of the installed refrigeration and air conditioning units were 20-40 years old, 27% were 10-19 years old, and 32% were 5-9 years old while 29% were less than five years old. The oldest units (older than 10 years) account for 31% of the HCFC-22 refrigerant in existing air conditioning units. The survey also showed a high HCFC-22 recharge rate of 23%-49% of the average recharge rate of 34%. It also showed frequency of equipment servicing of 4 to 12 times a year with average servicing rate of nearly 10 times a year. Table 3.6 provides a summary of the installation dates and related information.

Table 3.6: Date of Installation and HCFC-22 Demand

Period	Age (Years)	Per cent of Installed capacity	Per Cent of Total Cooling Capacity	Per Cent of Total HCFC-22	Recharge % of HCFC-22	Average Servicing Frequency Per Year
1960-1989	20-40	12	17	12	28.7	11
1990-1999	10-19 yrs	27	19	19	39.6	10
2000-2004	5-9 yrs	32	34	32	35.8	10
2005	4 yrs	5	4	5	48.7	9
2006	3yrs	13	12	13	38.0	8
2007-2008	1-2 yrs	11	14	19	23.0	9*
* Frequency 5 times per year for equipment installed in 2008						

III.4. HCFC Consumption

103. The following is a brief summary of the main HCFC use in the sub-sector.

(a) Residential air conditioning

104. 15. The sub-sector consists of air conditioners mainly used by households in homes especially for comfort cooling. They consist of windows and mini split systems of less than 9KW cooling capacity. 335,200 households were identified as having a total of 836,140 of such units with HCFC-22 stock of 901 tonnes, about 43% of the total HCFC-22 stock in the sub-sector.

(b) Light commercial refrigeration and air conditioning systems.

105. These are small to medium size refrigeration and air conditioning units of up to 9KW cooling capacity per unit. They are used in businesses such as mini marts, barber shops and saloons, guest houses and offices. These are the most predominant units according to the survey. Over 1.2 million are in use by over 400,000 enterprises and facilities accounting for 65% of the installed capacity and 55% of the of HCFC-22 refrigerant stock.

(c) Commercial air conditioning

106. These units are used for cooling large commercial buildings such as high rise offices, banks, conference rooms and banquet halls. They are mainly central air conditioning systems of 10-15KW cooling capacity. The survey identified 1,064 units installed in 63 facilities. Although these systems currently account for the use of 9.2 tonnes of HCFC-22 which is only 0.4% of the total HCFC-22 stock their use has a high potential for growth because of developments in the country.

(d) Cold Stores

107. 564 HCFC-22 consuming cold stores were identified by the survey. These are enterprises using refrigeration units of 10-15 KW cooling capacity. Several cold stores which were using CFC-12 as refrigerants have already been converted mostly to the use of HFC-134a through an incentive programme undertaken under the completed TPMP.

(e) Other HCFC-22 End-User Sub-sectors

108. All the other remaining end-user sub-sectors, including chillers, industrial refrigeration, road transport refrigeration and marine refrigeration and air conditioning accounted for a total of 3,726 units holding 857 tonnes of the HCFC-22 stock. Compared to residential units these numbers appear insignificant. However in terms of HCFC phase-out they play an important role as they have potential to cause the growth in HCFC-22 consumption.

III.5. Import of Air Conditioners

109. Data made available by CEPS for the years 2007 and 2008 were filtered to exclude items that were not air conditioning or refrigeration equipment, such as spare parts and accessories like condenser driers, copper pipes, control boards, capacitors, drain hoses and miscellaneous spare parts. The remaining data were analysed to determine the types and quantities of air conditioners imported. Analysis showed that about 80% of the air conditioners imported were split and window type air conditioners predominantly of 1-2 ½ HP capacities. A total of 250,422 air conditioners were imported in the two years. Unlike domestic refrigeration units only a small fraction of the quantity of the imported air conditioners was “used air conditioners”.

110. The main countries of export of the imported air conditioners were China, United Kingdom, Italy and United States with imports from China accounting for about 50% of the total quantity imported. Based on the results of the analysis and the installed capacity of the sub-sector of commercial/industrial refrigeration and residential and commercial air conditioning the average rate of growth of the sub-sector due to imports of air conditioners was determined to be about 7% per annum while the average rate of growth in split and window type air conditioners was determined to be 15%. Table 3.7 provides a summary of the data on import of air conditioners in Ghana in 2007 and 2008.

Table 3.7: Estimated Quantities of Imported Air Conditioners (2007-2008)			
Year	Total Quantity of Imported ACs	Quantity of Split and Window ACs	Quantity of Other ACs
2007	140,263	113,612	26,650
2008	110,160	79,315	30,845
Total	250,422	163,615	54,305
Total population (installed capacity) of commercial and industrial refrigeration units and air conditioners (residential and commercial):			1,859,382
Average annual increase through imports			125,211
% increase as a ratio of installed capacity of commercial and industrial refrigeration and air conditioners			6.7
Total population of split and window air conditioners			645,256
Average increase through imports			96,464
% increase as a ratio of installed capacity of split and window ACs			14.9

III.6. Domestic Refrigeration Sub-Sector

111. The servicing of domestic refrigerators and freezers is significant to HCFC consumption in Ghana for two main reasons.

- (a) Increasing use of R406a, a refrigerant blend composed of 55% HCFC-22 41% HCFC-142b (and 4% r-600a) as refrigerant of choice for servicing and repair of domestic refrigerators, freezers, water coolers, and dispensers as well as some commercial refrigeration units.
- (b) Importation of large volume of used refrigerators and freezers, some of whom even without-motors that have the potential to increase demand for R406a.

112. The growth in the use of R406a and potentially R409a, a blend consisting of 60% HCFC-22, 15% HCFC-142b and 25% HCFC-124, would phase in HCFCs, more significantly HCFC-22 and HCFC-142b in the domestic refrigerator servicing and repair sub-sector.

III.6.1. Population of domestic refrigerators

113. A survey carried out for a proposal for energy efficiency project funded by GEF estimated the population of domestic refrigerators and freezers in 2008 at 7,700,000 units. Based on this estimate and the average refrigerant charge of 80g per refrigerator the total stock of refrigerant in existing domestic refrigerators and freezers was estimated to be 616 tonnes. Note must however be taken of the fact that import data show that import of domestic refrigerators consists of large quantities of double door and other larger refrigerators and freezers and the estimated average refrigerant charge and level of use could be quite conservative.

III.6.2. Importation of New and Used Domestic Refrigerators and Freezers

114. The import data compiled by the CEPS GCNet for the years 2005-2008 were reviewed and analyzed. Beside information such as entry numbers, entry dates and description of the items the spreadsheets provided the sources of import, names and addresses of the importers and exporters, the quantities of items imported, HS codes and the cost, freight and insurance (CIF cost) of the items delivered at the ports of entry.

115. The review of the data showed that, due to similarities in the HS Codes large consignments of spare parts and accessories, including compressors, motors, condensers, capacitors, driers and fridge fans were not segregated as such but included under the records of import of domestic refrigerators and freezers. There were other items unrelated to refrigerators and freezers such as computers and computer accessories and automobile cup holders as well as items which have cooling functions, such as ice chests and cool boxes but do not consume any refrigerants which were entered in the data base and counted as domestic refrigerator and freezer imports.

116. For the above reasons, in order to establish accurate quantities of actual refrigerators and freezers imported, during the review of the data all the e above-mentioned items were filtered out of the data before analysis. For example, as shown in the table below, in 2005 56, 000 items were entered in the spreadsheet as imports of new refrigerators and freezers. However the items included only 4,317 refrigerators, deep freezers and visicoolers (about 8% of the total import). The remaining 51,675 items were refrigerator accessories, spare parts and other miscellaneous items, including about 47, 000 pieces of fridge filter dryers and 2000 condensers. The summary table below of the review of the import data illustrates the method used.

Table 3.8: Breakdown of Imported Items Registered Under HS Codes for New Domestic Refrigerators and Freezers (2005)

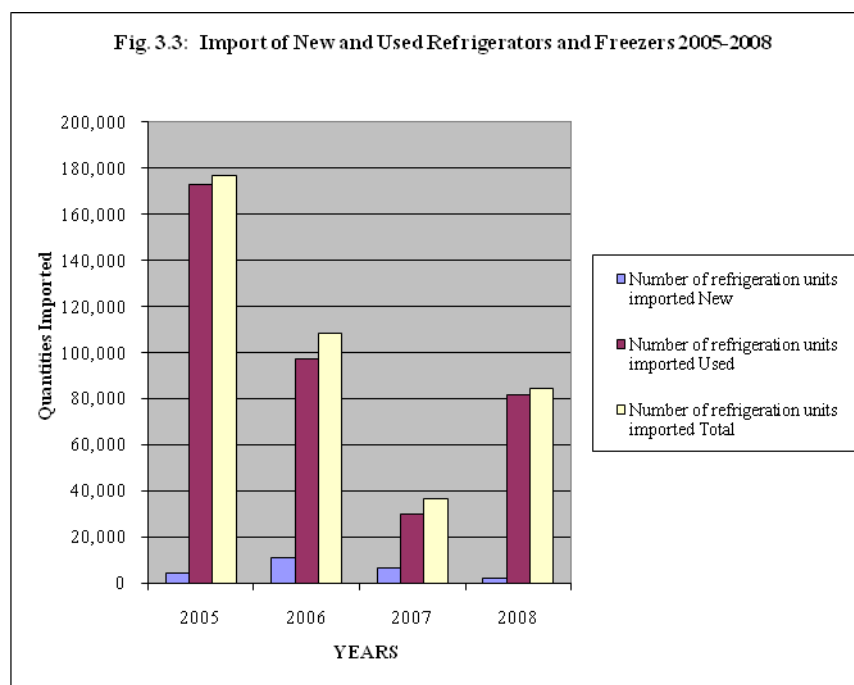
Total Number of imports registered by Customs	Per cent actual new fridges and freezers in registered imports	Per cent accessories and spare parts for fridges and freezers	Per cent non-fridge related items
56002	7.7*	91.9	0.4

* Only 4300 of the 56,000 recorded as imported new domestic refrigerators and freezers were actual refrigerators and freezers. The rest were compressors (about 50% of the recorded items), motors, condensers, dryers, refrigerator fans and other spare parts and accessories.

117. The results of the analysis of the data contained in the spreadsheets for the years 2005 to 2008 are summarised below.

- Nearly 389,200 used refrigerators and freezers were imported into Ghana from Jan 2005 to Dec 2008, while at the same time less than 25,000 new refrigerators were imported.
- On the average only about 5% of domestic refrigerators and freezers imported to Ghana from 2005 to 2008 were new, the rest were used.
- The average price (CIF) of used domestic refrigerators cleared at the ports was only about 15% that of new domestic refrigerators at GH ₵29.49 (Ghana Cedis)³ equivalent to US \$20.33 and GH ₵185.20 or US \$127.83 respectively (at current rate of exchange).
- The largest volume of used refrigerators (over 172,000) was imported in 2005.
- The main source of imported used refrigerators is the countries of the European Union.

118. Fig.3.3 below shows a comparison of the volumes of imports of domestic refrigeration units in the period 2005-2008.



³ (GH ₵) Ghana (New) Cedi at the rate of exchange of GH ₵1.00:US \$0.6902 (Interbank rate as at 28 December 2008)

119. Table 3.9 below also provides the summary of quantities of domestic refrigerators and freezers imported by year as well as the corresponding costs in Ghana Cedis. The CIF cost of imported goods which is a determinant of market prices of the goods shows a very wide gap between the costs of imported new and used refrigerators and freezers. The very low costs of used refrigerators would make them much more affordable than the new refrigerators and consequently appear more attractive as a household appliance for such an essential item of equipment in the home.

Table 3.9: Summary of Importation of New and Used Refrigerators into Ghana for the Four-Year Period 2005-2008

YEAR	Number of refrigeration units imported				Cost CIF (GH ₵) of imported units			(Average) Unit Cost CIF (GH ₵)		
	New	Used	Total	% New	New	Used	Total	New	Used	% New
2005	4,317	172,541	176,858	2	696,897	4,726,497	5,423,394	161.43	27.45	17
2006	10,944	97,240	108,184	10	2,256,527	2,751,055	5,007,582	206.19	28.29	14
2007	6,607	30,277	36,884	18	983,102	887,898	1,871,000	148.80	29.33	20
2008	2,401	81,854	84,255	3	557,992	2,886,685	3,444,677	232.40	35.27	15
Total	24,269	381,912	406,181	6	4,494,518	11,252,135	15,746,653	185.20	29.46	
Average	6,067	95,478	101,545	6	1,123,630	2,813,034	3,936,663	183.56	29.46	16

III.6.3. Sources of Importation of Domestic Refrigerators and Freezers

a) Used Refrigerators and Freezers

120. Used refrigerators were imported from all regions of the world including Europe, North America and Asia by Ghanaian commercial importers, shop owners, traders, and individuals. Large consignments in commercial quantities originated mainly from Europe while imports from North America tended to be predominantly in small consignments and single units. Europe, in particular some countries of the European Union accounted for the bulk of the import of used refrigerators. Out of the total of 381, 550 used refrigerators imported in the period 2005 to 2008 346,400 (about 91%) were imported from five European countries, namely Belgium (59,200), Germany (32,000), Italy (48,000), Netherlands (46,600) and United Kingdom (160,500). Fig 3.4 below shows the main sources of import of used refrigerators into Ghana.

b) New Refrigerators and Freezers

121. New refrigerators were imported from about 27 countries in all the regions. Unlike the old used refrigerators the main source of import was Article 5 countries. Four Article 5 countries China, India, Thailand and Turkey accounted for 62% of the new refrigerators imported during the period January 2005 to June 2009. China was the predominant source of the imports accounting for nearly 50% of the number of new refrigerators imported. Italy was the main source of import in Europe accounting for about 10% of the total import.

Table 3.10: Main Sources of Import of New Refrigerators in Ghana (Jan. 2005-June 2009)

Country	Number of New Refrigerators Imported	% of Total Import
China	11,992	47.7
Italy	2,410	9.6
India	1,328	5.3
Turkey	1,271	5.1
USA	1,184	6.2
Thailand	997	4.0
Sub-total	19,182	76.3
Total Import for Period	25,156	

III.7. Forecast Consumption of HCFCs

122. Consumption of HCFCs in Ghana is influenced by two main factors, namely the age and frequency of servicing and repairs in the residential and commercial air conditioning sub-sector and the consumption of HCFCs in refrigerant blend as a result of the increasing use of these blends, particularly R406a as a replacement for CFC-12 in domestic refrigeration servicing and repairs and as a transitional substitute for HFC-134a and other expensive HFC blends and hydrocarbon refrigerants which are also currently much more expensive than R406a. In the residential and commercial air conditioning sub-sector the survey identified that nearly 30% of the existing equipment are 15 to 40 years old requiring frequent servicing while refrigerant use ranged from 10% to nearly 50%. On the other hand consumption of R406a is exacerbated by the high volume of annual import of used domestic refrigerators and freezers mainly from Europe. No system exists for determining the nature of refrigerants contained in the imported used refrigerators or for ascertaining the amounts of refrigerant in them. However, given the useful life of domestic refrigerators which exceeds 10 years it could be concluded that the imported used domestic refrigerators would be the old generation of refrigerators manufactured with CFC-11 or HCFC-141b and charged with either HFC-134a or even CFC-12 as refrigerants instead of the new generation of pentane-based refrigerators charged with hydrocarbon refrigerants. While those refrigerators running on HFC-134a may require a top-up or recharge with the same refrigerant and those running on CFC-12 would likely be recharged with R406a as drop-in and a cheaper alternative than HFC-134a. Information from practitioners shows that a growing number of workshops and practitioners are reverting to R406a as substitute for every refrigerant where this can be used as a drop-in. These and other factors including conversions of industrial refrigeration and air conditioning units by multinational companies, such as the numerous mining companies are contributing to higher levels of refrigerant use in the country, with import of refrigerants exceeding 1,000 tonnes in 2008 and 2325 tonnes in 2009 as shown in Table 3.11 below

Table 3.11: Refrigerants Imported into Ghana in 2008 and 2009 (Metric tonnes)

Year	Chemicals Imported (Metric tonnes)						Total	Number of Importers
	R22	R134a	R406a	R407c	R410a	R600a		
2008	269.3	612.0	120.2	3.4	0.3	1.4	1006.5	17
2009	457.9	924.3	916.4	14.0	9.7	3.2	2325.5	31

123. In forecasting future demand for HCFC-based refrigerants, namely in the years preceding the compliance period consideration was given to the following factors: the potential impact of public

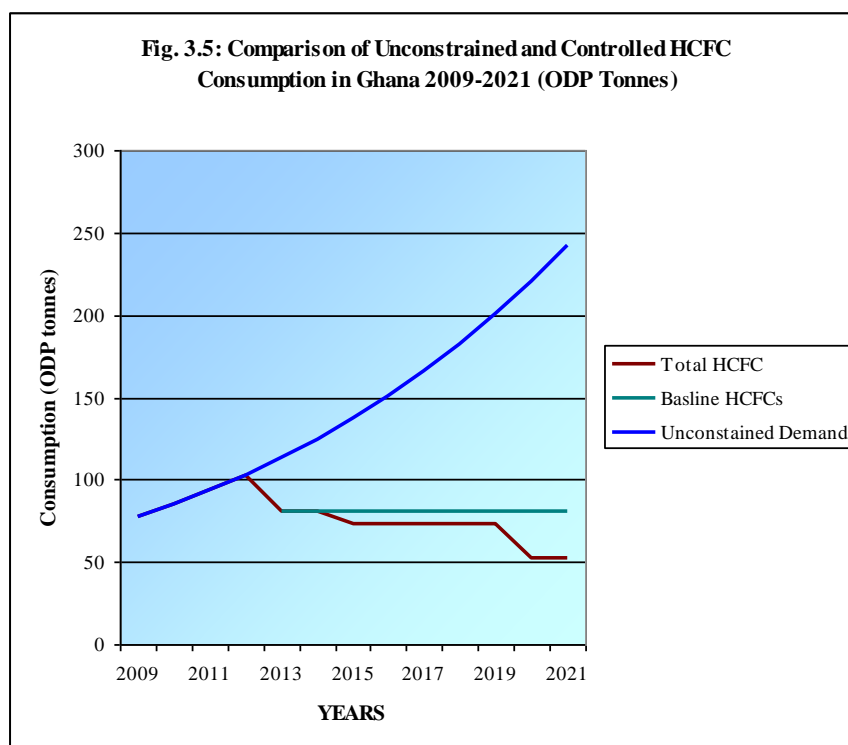
awareness programmes proposed in the HPMP to be carried out at the initial stage (2010-2011) of Stage 1 of the HPMP; as well as a parallel GEF project on improvement of energy efficiency in the domestic refrigeration sub-sector being undertaken as an interdepartmental programme with the Ghana Energy Commission as the lead agency. Thus using the powers conferred on it under the Management of Ozone Depleting Substances and Products Regulations (2005) the EPA intends to restrict the rate of growth to 10% per year until 2012. Quotas based on this rate of growth will start from 2011. Importers' applications will, however, be considered on a case by case basis, with some importers receiving reduced quotas depending on import and distribution history.

124. Table 3.11 below provides the forecast HCFC consumption in metric tons and ODP tonnes indicating peak demand and allowable consumption under the Montreal Protocol reduction schedule from 2013 to 2040.

Table 3.12: Forecast HCFC Consumption of Ghana 2009-2040										
Substance	Units	Base Year Consumption (2009)	Forecast Peak Consumption (2012)	Forecast Baseline Consumption ⁴	2013-14 Forecast Annual Allowable Consumption	2015-19 Forecast Annual Allowable Consumption	2020-24 Forecast Annual Allowable Consumption	2025-29 Forecast Annual Allowable Consumption	2030-39 Forecast Annual Allowable Consumption	2040 Forecast Allowable Consumption
HCFC-22 (Pure)	Tonnes	457.9	609.5	480.8	480.8	432.7	396.2	156.3	12.0	0.0
	ODP tonnes	25.2	33.5	26.4	26.4	23.8	21.8	8.6	0.7	0.0
HCFC-22 from R406a blend	Tonnes	504	670.8	529.2	529.2	476.3	436	172.0	13.2	0.0
	ODP tonnes	27.7	36.9	29.1	29.1	26.2	24.0	9.5	0.7	0.0
Total HCFC-22	Tonnes	961.9	1,280.3	1,010.0	1,010.0	909	832.2	328.2	25.3	0.0
	ODP tonnes	52.9	70.4	55.5	55.5	50.0	45.8	18.1	1.4	0.0
HCFC-142b from R406a blend	Tonnes	375.7	500.1	394.5	394.5	355	325.1	128.2	9.9	0.0
	ODP tonnes	24.4	32.5	25.6	25.6	23.1	21.1	8.3	0.6	0.0
Total HCFCs from R406a blend	Tonnes	879.7	1170.9	923.7	923.7	831.3	761.1	300.2	23.1	0.0
	ODP tonnes	52.1	69.4	54.7	54.7	49.3	45.1	17.8	1.4	0.0
Total HCFC Consumption	Tonnes	1,337.6	1,789.3	1,404.5	1,404.5	1,264.0	1,157.3	456.5	35.1	0.0
	ODP tonnes	77.3	102.9	81.2	81.2	73.1	66.9	26.4	2.0	0.0

125. The unconstrained demand and the allowable consumption under the Montreal Protocol phase-out schedule with 2009 as the base year is also illustrated in figure 3.5 below.

⁴ Average consumption for the years 2009 and 2010



III.8. Availability of Alternatives to HCFCs and Prices

126. For the longer term, there are only five important different groups of refrigerants, which are options for the vapour compression cycle in all refrigeration and A/C sectors⁵. These include ammonia (R-717), carbon dioxide (R-744), hydrocarbons and blends, hydrofluorocarbons (HFCs), including 400 and 500 number designation HFC blends and water. Some of the refrigerants currently available for various applications are listed in the table below. Other new refrigerants, such as R-421A a blend of HFC-125 and HFC-134a with wide, almost universal application (across all sub-sectors) are being developed and introduced commercially onto the market, especially in the non-Article 5 countries. R-421A, for instance, is claimed to be suitable for use in chillers (centrifugal, screw, reciprocating), industrial process refrigeration; industrial process air conditioning, retail food refrigeration, cold storage warehouses, refrigerated transport, commercial ice machines, household refrigerators and freezers, vending machines, water coolers, household and light commercial air conditioning and heat pumps, residential dehumidifiers; and ice skating rinks. Refrigerants which have been used in Ghana and their prices are listed in Table 3.3 above.

Sub-Sector	HCFC Alternatives
Domestic Refrigeration	R600a, R134a (HFC-134a)
Commercial Refrigeration	R134a, R404a, R507, R290 (Propane), R744 (CO ₂), R1270 (Propylene)
Industrial Refrigeration	R717 (Ammonia), R404a
Transport Refrigeration	R404A, R134a
Air conditioning	R407C, R410A, R134a, R290

⁵ UNEP TEAP/Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee: 2006 Assessment Report

IV. STRATEGY AND PLAN FOR THE IMPLEMENTATION OF HCFC PHASE OUT

IV.1 Overarching Strategy

127. Ghana does not manufacture refrigeration and air conditioning equipment but relies on imports of these types of equipment to meet the needs of consumers. Ghana's immediate concerns therefore relate to decreasing its needs in the refrigeration servicing sector.

128. Historically, the average consumer, for reasons of affordability, has usually opted for the purchase of used rather than new refrigerators or freezers. As shown by the data in Table 3.9, used domestic refrigerators and freezers constitute about 95% of the import of these types of equipment. Reliance on used largely energy inefficient domestic refrigerators results in higher energy consumption and higher refrigerant leakage rate. In addition, imported used appliances often are based on the UK's 240 Volts network while Ghana has 220 Volts. This exacerbates the problem as the lower voltage results in higher amperage which in turn leads to increased servicing and refrigerant needs. The use of R406a as an alternative for CFC-12 in domestic refrigerators and freezers and its growth has added to the consumption of HCFC-22 and HCFC-142-b by traditional HCFC consuming sectors.

129. In the air conditioning sub-sector data showed a high proportion of old equipment with high leakage rates and high servicing frequency resulting in higher consumption and emission of HCFC-22.

130. Considering the current state of the refrigeration servicing sector against the background of Decision XIX/6 of the Parties to the Montreal Protocol the concerned government agencies agreed following the HPMP inception workshop to adopt an integrated strategy to address the refrigeration sector as a whole. The HPMP is one component of this overarching strategy. Other components include a project for the promotion of energy efficiency through an early retirement scheme of refrigerators and freezers with funding from the Global Environment Facility (GEF) and an ODS destruction pilot project funded by the Multilateral Fund. The three components are interlinked and there is no duplication of efforts. More details on this overarching strategy can be found in appendix A.

131. As indicated in Table 3.5 about 40% of the existing 1.9 million refrigeration and air conditioning units using HCFC-22 are 10-40 years old. A refrigerant recovery/hydrocarbon programme and an end-users incentive scheme to retrofit or replace equipment will form part of the HPMP. However, it is expected that a large percentage of the stock of HCFC-22 in the serviced and replaced units would not be recyclable and would have to be destroyed, which would be done using the facilities provided under the MLF-funded ODS destruction pilot project. The latter would be submitted as a separate project.

IV.2 HCFC Phase-out Overall Plan

132. As indicated in Table 3.12 Ghana's consumption of HCFCs in 2009 was 1,337.6 tonnes (77.3 ODP tonnes) made up of 961.9 tonnes (52.9 ODP tonnes) of HCFC-22, 375.7 tonnes (24.4 ODP tonnes) of HCFC-142b consumed in the air conditioning and residential/commercial refrigeration sub-sectors, some of which is consumed as R406a refrigerant blend. A detailed breakdown is provided in Table 4.1 below.

Table 4.1: Summary of HCFC Consumption 2009		
Consumption	2009	
	Metric Tonnes	ODP tonnes
HCFC-22 Pure	457.9	25.2
HCFC-22 from R406a blend	504.0	27.7
Total HCFC-22	961.9	52.9
HCFC-142b from R406a blend	375.7	24.4
Total HCFCs from 406a blend	879.7	52.1
Total HCFC Consumption	1337.6	77.3

133. However, as indicated in the Table 4.2 and as mentioned in section III, the survey at the air conditioning and industrial/commercial refrigeration end user level showed a consumption of 344.4 tonnes of pure HCFC-22 in 2008 as against the reported consumption of 269 tonnes based on Customs import data, nearly 30% difference. Consequently for the 2009 data all the importers were contacted for complete records of their invoices for the year which were verified against the permit system and the Customs entries in the GCNet. The import figure 457.9 tonnes was found to be consistent with the importers' records. The rapid growth in the use of HCFC-22 has been attributed to increasing use of split and window systems to replace chillers in large offices and facilities like airports and the growing number of commercial banks, etc. This has been exacerbated by frequent power outages resulting in blowouts and sometimes even catastrophic fires in public facilities. Based on the field survey the 2009 HCFC-22 consumption of 457.9 tonnes was allocated by sub-sector as indicated in Table 4.2 below.

Table 4.2: Population of Air Conditioning, Commercial and Industrial Refrigeration Units and Chillers and HCFC-22 Use in Ghana in 2008 and 2009						
Type of Refrigeration/Air Conditioning System	Number of Enterprises, Residential Households and Other Facilities	Number of Refrigeration/Air Conditioning Units	Charge in kg	Installed Capacity of HCFC-22 (tonnes)	HCFC-22 Consumption by Sub-sector (tonnes)	
					2008 as per Survey	2009 Extrapolated Figures
Residential Air Conditioning	335,200	645,256	1.40	903.4	88.9	118.2
Light Commercial Refrigeration / Air Conditioning	402,345	1,210,400	0.97	1,174.1	239.2	318.1
Cold Stores (10-15 KW)	66	564	14.59	8.2	2.4	3.2
Commercial Air Conditioning (10-15 KW)	63	1,064	8.64	9.2	3.5	4.7
Industrial Refrigeration / Air Conditioning (16 KW and higher)	57	522	18.93	9.9	4.6	6.1
Chillers	43	630	8.97	5.7	2.5	3.3
Road Transport Refrigeration / Air Conditioning	45	622	20.23	12.6	2.2	3.0
Marine Refrigeration/Air Conditioning	8	324	20.23	6.6	.1	1.4
TOTAL	737,827	1,859,382		2,129.5	344.4	457.9

Note: In addition there is a consumption of 879.7 metric tonnes of R-406a containing 504 tonnes of HCFC-22 and 375.7 tonnes of HCFC 142b.

The total 2009 HCFC consumption would thus amount to 1337.6 metric tonnes.

134. In addition, the survey identified that refrigerant R406a has become the transitional refrigerant of choice for most end-uses in the refrigeration servicing sector. Thus in 2009, the R406a consumption has increased about fivefold as compared to 2008. Most of this consumption is believed to be used in the domestic and commercial refrigeration equipment which formerly depended on CFC-12 systems as well as more expensive HFC-134a. In spite of this, the very high R406a imports in 2009 amounting to 879.7 metric tonnes (over 500% increase over the previous year's figure), containing 504 tonnes of HCFC-22 and 375.7 tonnes of HCFC-142b raised some concern, especially considering that one importer imported over half the amount. This is a contributory factor to the Government's decision to establish and enforce HCFC import quotas as early as possible to prevent possible future speculative imports as a section of the market positions itself to react to perceived government measures to reduce imports HCFCs and HCFC blends.

135. The peak consumption of HCFCs based on 2009 consumption data is expected to be 1,789.3 tonnes (102.9 ODP tonnes) in 2012 of which nearly 40% is expected to be in the domestic refrigeration servicing sector where the use of HCFC refrigerant blend R406a continues to grow. This would normally represent the total consumption of HCFCs to be phased out for Ghana to meet its obligations under the Montreal Protocol. Under such scenario at the estimated growth rate of 10% a considerable amount of HCFCs will be phased in until end-2012. Therefore, although the 10% growth rate will be maintained as this may be necessary for some end users, particularly those of pure HCFC-22, through selective application of the quota system and other vigorous institutional measures, public awareness programmes, training projects and the investment activities proposed in this HPMP, any runaway growth in consumption of HCFCs will be held in check in a manner that does not impose economic hardships on consumers. In addition the Government will establish its starting point consumption for aggregate reduction of the country's HCFC consumption at a lower consumption level based on assumption of 2010 import data equivalent to that of 2008. In effect as a policy the baseline will be capped at 2008 and 2009 levels irrespective of what is imported into the market in 2010.

136. It is reported that a small number of used refrigerators working on hydrocarbon refrigerant R600a are being imported into the country. The trend is expected to continue with hydrocarbons replacing HCFC containing refrigerant blends as standard refrigerants in the traditional exporting countries of used as well as new refrigerators. Therefore, an important goal of the HPMP should be putting in place through the HPMP programmes an enabling environment necessary for safe use of hydrocarbon refrigerants in Ghana

137. While other refrigerants such as HFC-134a and blends will continue to be used, emphasis in the HCFC phase-out will be given to the uses of low GWP natural refrigerants subject to availability of mature and affordable alternatives. Effort will be made to stimulate local production where feasible to ensure sustainable supply of the refrigerants.

138. Consistent with Decision of the Executive Committee, Ghana will adopt a staged approach to the phase-out of HCFCs in its servicing sector as described below:

Phase 1: Stage 1 of the HPMP will be implemented as Phase 1 HPMP combining the freeze, 10% reduction and the 35% reduction and commence in 2010 and end by the end of 2019,. This is to ensure efficiency in the application of available funds and effective implementation of the regulations in a continuous manner in order to achieve maximum impact. A review will be undertaken in 2018 to assess the needs and extent of the subsequent stage or stages;

Phase 2: Project preparation for Phase 2 to address the remaining 65% consumption should start in early 2020 and submitted for approval by the end of 2019 to enable its implementation to start by 2020 in order to ensure seamless transition to the 2025 compliance with 67.5% consumption reduction step by the end of end of 2024 and possibly subsequent reductions. At this time the Government will review future needs

and determine the extent and scope of Stage 2. Subject to availability of resources and mature technologies and barring any constraining decisions by the Parties to the Montreal Protocol or the Executive Committee, the Government's overall plan foreshadows more aggressive action against the phase-in of HCFCs in the servicing sector resulting from the use of interim HCFC-based refrigerant blends, in particular R406a. This would ensure an earlier phase-out than described in Table 3.12 above.

IV.3 Proposed Reductions in HCFC Consumption and Implementation Time Table

139. Initial reductions in HCFC consumption will be substance based rather than ODS based. Since HCFC blends are used as whole substances their phase out should also be treated as a whole rather than as part of a group of similar chemicals.

140. Currently R406a refrigerant a blend of HCFC-22, HCFC – 142b and isobutane (R600a) is the only HCFC- based refrigerant blend used in Ghana. In view of the potentially constraining effect on phase out of HCFCs in the refrigeration servicing sector the Government plans to institute a quota system for importation of refrigerants with effect from the year 2011. Under the quota system the growth rate of pure HCFC-22 will be capped at 10% per year in 2011 and 2012. With regard to the consumption of R406a, due to the unusually high levels of import of the refrigerant in 2009 importation of the refrigerant by individual importers will be reviewed. In order to curb the excessive growth in the consumption of HCFC-based refrigerants the growth rate will be capped at 10% per year in 2011 and 2012 to apply to relevant refrigerants and end users. In particular it is intended to restrict the import of R406a in 2011 and possibly in 2012 by the importer responsible for more than 50% of the consumption of that refrigerant in 2009. No permit for importation for additional R406a in 2010 will be issued to this particular importer and possibly in 2011 too without a clear justification. These measures should ensure consistency of the phase-out strategy with the Montreal Protocol schedules as mandated by the Executive Committee.

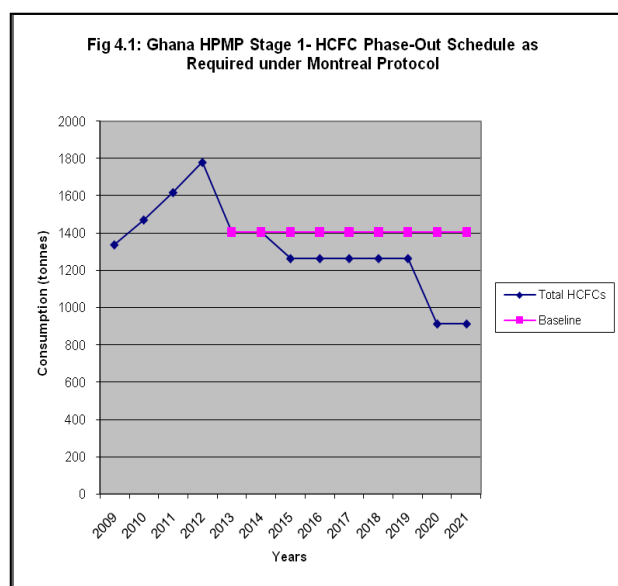
141. In view of the fact that the R406a is the drop-in substitute for CFC-12 and that its import-level has risen significantly in 2009, more efforts will be needed to rein in its unconstrained growth during the first few years of the HPMP implementation. Nevertheless, sectors consuming HCFC-22 will also receive due attention from the onset.

142. Table 4.3 below shows the consumption growth and subsequent reductions in HCFC-22 and the HCFC components of the refrigerant R406a.

Table 4.3: Ghana HPMP Stage 1- HCFC Phase-Out Schedule by Type as Required under Montreal Protocol

Consumption (metric tonnes)	YEARS												
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
HCFC-22 (Pure)	457.9	503.7	554.1	609.5	480.8	480.8	432.7	432.7	432.7	432.7	432.7	312.5	312.5
HCFCs from R406a	879.7	967.7	1064.4	1170.9	923.7	923.7	831.3	831.3	831.3	831.3	831.3	600.4	600.4
Total HCFCs	1337.6	1471.4	1618.5	1780.4	1404.5	1404.5	1264.0	1264.0	1264.0	1264.0	1264.0	912.9	912.9
Baseline					1,404.5	1,404.5	1,404.5	1,404.5	1,404.5	1,404.5	1,404.5	1,404.5	1,404.5

IV.3.1 Unconstrained Demand Scenario



143. As indicated earlier, the unconstrained HCFC demand is expected to grow by 10% per year to a peak of 1,789.4 metric tonnes in the year 2012. The freeze in 2013 would necessitate a drop in consumption to the baseline level, estimated to be 1404.5 tonnes. This would represent a phase out of 375.8 metric tonnes. After that, another 10% reduction in the year 2015 would bring the consumption level down to 1264.0 metric tonnes which would represent a further drop of 140.5 tonnes. As such phase 1 of the HPMP would result in a total phase out of 516.3 tonnes which would constitute a considerable effort. Further steps that the country will have to take would include the 35% reduction level by 2020, 65% reduction level in 2025 and a quasi-total phase-out by the year 2030. In reality in Ghana's circumstances it is considered more expedient to address the phase-out

up to the 35% phase-out step in one phase in 2010-2020. The second phase of the HPMP will stipulate how the 2025 and further steps will be achieved, but it is anticipated that similar measures as being proposed in the current phase 1 would have to be continued in future years.

IV.3.2 Starting Point Consumption Scenario

144. Under this phase-out scenario by which Ghana will implement the phase-out of HCFCs the forecast HCFC consumption baseline is chosen as the starting point by the country for aggregate reductions in HCFC consumption. As discussed in paragraphs 133, 134 and 139 above the forecast consumption will be based on the average of 2009 HCFC consumption and 2010 consumption, the latter being determined at the level of 2008. As shown in the Table below the Starting Point HCFC consumption on this basis will be 925 metric tonnes or 49.5 ODP tonnes.

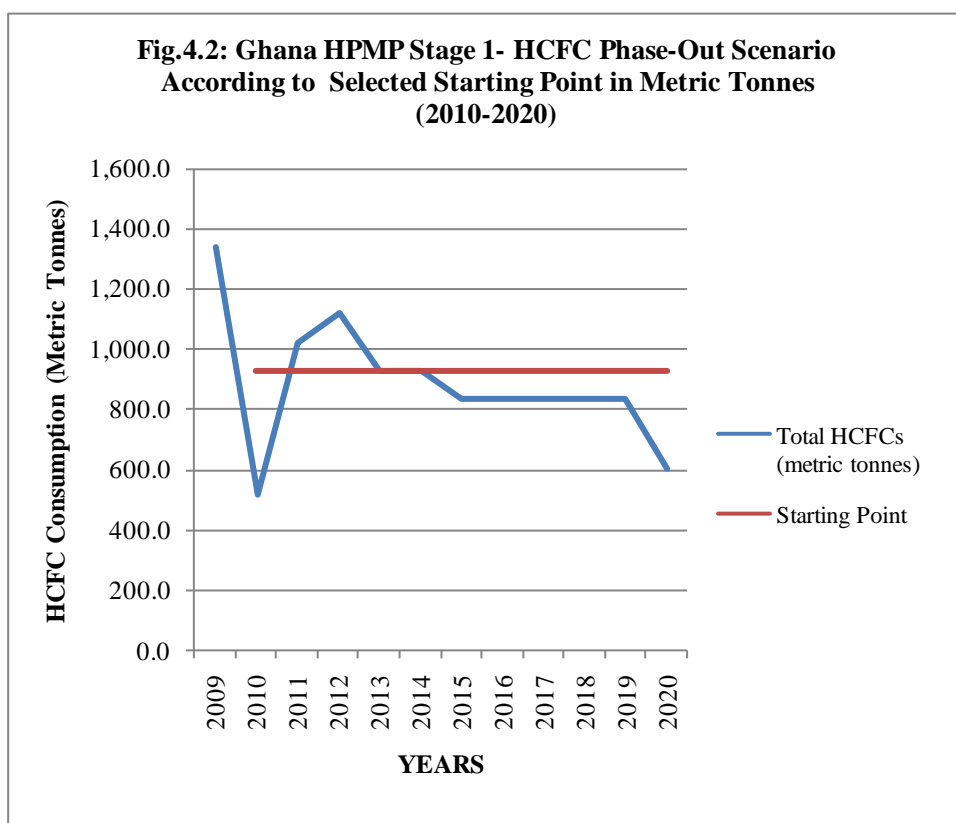
Table 4.3 bis: Starting HCFC Consumption for Ghana

Year	Metric Tonnes	ODP Tonnes
2008	513.0	28.2
2009	1,337.6	70.8
2010	513.0	28.2
Baseline/Starting Point*	925.3	49.5

* Average of amounts for 2009 and 2010

The country undertakes not to adjust this starting point consumption when the actual 2010 consumption and correspondingly the baseline HCFC consumption become known,

145. On the basis of above baseline values the maximum amounts of HCFCs expected to be imported in 2011 and 2012 and the eligible consumption values for the period 2013-2014 and 2015-2020 have been determined. The data have been used for calculating the costs associated with the HPMP and the various activities developed under it to meet the 2013-2020 reduction obligations of the country. The phase-out schedule based on this modified scenario is illustrated in figure 4.2 below. Comparison of the two figures 4.1 and 4.2 shows that while the phase-out in the latter scenario is at a lower level it poses bigger challenges to the country than in the former case.



IV,4 Comparative Climate Impact of the Use of HCFCs and their Alternatives

146. Dec XIX/6 encourages the project proponent to take into account the climate benefit in the accelerated phase out of HCFCs. The following consideration is based on a rough estimate based on the GWP values of the chemicals involved. The baseline carbon emission for 1,780.4 metric tonnes of HCFC in 2012 is estimated at 3,414 MtCO₂e and if the consumption is frozen at 1,404.5 metric tonnes in 2013 will emit 2,693MtCO₂e with a reduction of 720.8 MtCO₂e (from 375.5 metric tonnes of HCFC). If all the HCFC were to be converted to HFC134a then the climate benefits will be a corresponding reduction in carbon emission from 903.8 MtCO₂e in 2012 to 713 MtCO₂e in 2013. If the transition is into hydrocarbon (Iso-butane) then the climate benefit is much greater from 3,387.5 MtCO₂e in 2012 to 2,672.2 MtCO₂e in 2013. With a further 10% reduction in 2015 the baseline carbon emission from 1,264 metric tonnes of HCFC is set at 2,423.9 MtCO₂e. Therefore under Phase 1, the overall climate benefit in converting 516.3 metric tonnes of HCFC into iso-butane is 982.6 MtCO₂e and 262.2 MtCO₂e for HFC134a where hydrocarbon will give 3.7 times lower carbon emission than that of HFC134a. Having said so, there is at present no way to determine the split between the amount of HFC-based alternatives or hydrocarbon alternatives, nor were other possible alternatives taken into account. The potential to monetize these environmental services into carbon asset has not yet been envisaged at present.

IV.5 Activities for the phase-out of HCFCs

147. Assessment of activities for the phase-out of HCFCs will be guided by the lessons learned from the RMP / TPMP and it will build on the resources made available and experience gained through these previous programmes. The activities and their proposed period of implementation are listed below. The activities are further described in detail under the 1st Stage implementation of the HPMP.

No.	Activity	Planned period of Implementation
1	Enhancement of institutional and regulatory measures	Stage 1
2	Public awareness	Overall plan
3	Norms and procedures for safe use of HC refrigerants including code of Good Practice	Stage 1
4	Training programmes for:	
(a)	Customs officers	Overall plan
(b)	Refrigeration technicians and certification.	Overall plan
(c)	Factories Inspectorate & Fire Service Training (HC safety)	Stage 1
(d)	Upgrade of Refrigeration and Air Conditioning Training Centres	Stage 1
5	Refrigerant Recovery and Retrofit Programme (RRRP)	Overall plan
(a)	Workshops on safe and environmentally sound use of HFCs and HC containing R and AC equipment	Overall plan
(b)	Establishment of Recovery and HC-conversion facilities	Stage 1 of plan
(c)	Recovery and HC-Conversion programme	Overall plan
6	End-Users Incentive Programme (EUIP) to retrofit residential/ commercial / industrial refrigeration and air conditioning equipment	Overall plan
7	Incentives for sustainable supply of hydrocarbon refrigerants (Support to local production of refrigerant grade hydrocarbons and hydrocarbon blends)	Overall Plan (following Stage 1)
8	Monitoring and management of the HPMP	Overall plan

IV.6 Cost of Implementation of the Plan The implementation of the Stage 1 of the HPMP is crucial to the success and cost-effective implementation of the phase-out of the entire HCFC consumption in the country. Stage 1 of the HPMP will provide the enabling environment, the legal and institutional framework, the resources and know-how for the implementation of the phase-out activities for eliminating 35% of the HCFC consumption in the country. The cost of the Plan was determined on the basis of starting point HCFC consumption and related concepts described earlier. A draft multiyear agreement between the Executive Committee and the Government of Ghana with 6 tranches of funding releases was prepared and appended to the document. The Stage 1 implementation programme is described in detail in Section V below.

Table 4.4: Estimated Cost of HCFC Phase-out in Ghana (2010-2040)

Activity	Cost (US \$)	HCFC Phase-out Metric Tonnes	HCFC Phase-out ODP Tonnes	Cost-Effectiveness US \$/ ODP kg
Overall Programme	3,880,774	925.3	49.5	4.31
Phase 1 (Extended Stage 1)	1,356,311	323.9	17.3	4.31
Remaining Stages	2,524,463	601.4	32.2	4.31

V. FIRST STAGE IMPLEMENTATION OF THE GHANA HPMP

V.1 Introduction

148. Stage 1 of the HPMP as described earlier covers the pre-compliance years 2010-2012, through the freeze period of 2013-2014 to the 35% reduction step on 1 January 2020. Implementation of the activities proposed is to be spread over the period of 9.5 years with 6 funding releases. This poses a challenge to articulation of the various segments of the programme in order to ensure achievement of the programme objective. Successful implementation of the activities planned for the first two tranches is considered key to the success of Stage 1 of the HPMP as well as for the overall phase-out plan.

V.2 Reductions in HCFCs and Impact of Phase 1 Implementation of the HPMP

149. Currently there are several non-ODS refrigerant blends on the global market. The unregulated or uninformed use of these blends as alternatives, especially in situations where they are cheaper or are considered drop-in alternatives, would make it difficult to manage and control the phase-out of HCFC and HCFC-based refrigerant blends especially in the direction foreshadowed under the HPMP. . Not only would they hamper the progress in the HCFC phase-out towards more environmentally friendly and energy efficient alternatives but they would pose potential risk to efficient servicing practices. Therefore the initiatives to be undertaken during the first two tranches of the HPMP will include regulatory measures, focused public awareness programmes and technical assistance and investment activities as necessary that will direct stakeholders, refrigeration equipment suppliers and service technicians to the use of more environmentally friendly alternatives. These actions would positively impact reductions in HCFC consumption even in the early phase of the plan. As can be seen from Fig 4.2 above and the table below the country is committed to control of the phase in HCFC-based refrigerants in order to facilitate a stable process of phase-out of all HCFCs, Thus as the table below shows in the initial phase much more HCFCs would be phased out than apparent in the Plan's data.

HCFC Reductions under the Ghana HPMP **(Phase I: 2010-2020)**

<u>Event</u>	<u>HCFC Reductions</u> <u>(Tonnes)</u>
Reductions prior to 2013	194
Reductions at 2015	92.5
Reductions at 2020	231.4
Total	517.9
Avoided through attrition	218
Grand total	735.9

150. Table 5.1 below provides the scheduled HCFC reductions and associated funding allocations. Although Phase 1 of the HPMP extends from the freeze to the second reduction step targets to be achieved are identified in relation steps in a manner that facilitates accountability and monitoring consistent with the reduction steps. Targets to be achieved are as follows:

- (a) Baseline HCFC consumption of 49,5 ODP tonnes by January 2013 and maintain through to 31 December 2014;
- (b) 10% reduction in the baseline HCFC consumption (4.95 tonnes) by 1 January 2015 and maintain such level through 2015 to 31 December 2019;
- (c) 35% reduction in the baseline HCFC consumption (17.3 tonnes) by 1 January 2015.

151. The activities and associated costs are described in Section V.4. The total cost of the activities in the Phase 1 of the HPMP is estimated to be US \$1.356 million and about US \$119, 600 agency support cost for a total cost to the Multilateral Fund of US \$1,681 million. UNDP is the lead implementing agency with the Government of Italy as supporting bilateral agency, providing assistance mainly for the institutional measures drawing from experience from Italy in particular and the European Union in general, particularly in the use of natural refrigerants. A total of 17.3 ODP tonnes of HCFCs is expected to be phased out to reach the 35% reduction step by 1 January 2020.

Table 5.1. HCFC Reductions and Associated Funding in Stage 1.

	Estim. Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Montreal Protocol reduction schedule of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Maximum allowable total consumption of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Lead IA (UNDP) agreed funding (US \$)		200,000		200,000		190,000		195,000		125,000	121,311		1,031,311
Support costs for Lead IA (US \$)		15,000		15,000		14,250		14,625		9,375	9,098		77,348
Cooperating IA (Italy) agreed funding (US \$)		70,000		60,000		70,000		65,000		60,000	-		325,000
Support costs for Cooperating IA (US \$)		9,100		7,800		9,100		8,450		7,800	-		42,250
Total agreed funding (US \$)		270,000		260,000		260,000		260,000		185,000	121,311		1,356,311
Total support costs (US \$)		24,100		22,800		23,350		23,075		17,175	9,098		119,598
Total agreed costs (US \$)		294,100		282,800		283,350		283,075		202,175	130,409		1,475,909
Total phase-out of HCFC- 22 and HCFC-142b (used in R-406a) agreed to be achieved under this agreement (ODP tonnes)													17.3
Phase-out of HCFC- 22 and HCFC-142b (used in R-406a) to be achieved in previously approved projects (ODP tonnes)													0.0
Remaining eligible consumption for HCFC- 22 and HCFC-142b (used in R-406a) (ODP tonnes)													32.2

V.3. Management of HCFC, Supply and Demand

152. Until now, although the regulations by which CFCs were managed covered also HCFCs the quota system implemented through the licensing system of the Chemicals Control and Management Centre have not applied to HCFCs. This is because HCFCs were not subject to a controlled phase out. As part of the Stage 1 implementation the following actions will be taken for the purpose of managing HCFC consumption as per Montreal Protocol phase-out schedules.

- (a) The regulations will be applied in full to place all HCFCs and HCFC blends under the quota system as of 2011.
- (b) Sections 9 and 10 of L.I. 1812 regarding register of permits and reporting procedures will be strictly enforced and all importers of HCFCs or their blends will be required to register with EPA and comply with the import reporting procedures beyond 2010.
- (c) From the year 2011 only registered importers of HCFCs will be permitted to import HCFCs based on set quotas related in part to historical data.
- (d) Quotas for import of HCFCs including blends will not exceed estimated levels in the HPMP.

- (e) Market incentives and disincentives will be applied to try to limit the growth of HCFC blends and boost the importation and use of environmentally friendly alternatives.

153. The NOU with the support of the National Committee on ODS (NACODS) will hold periodic reviews of the use of HCFCs in the country in order to validate the consumption of HCFCs on a continuous basis.

154. Through a memorandum of understanding between the EPA and the Ghana Ports Authority, and Ghana Customs, Excise and Preventive the NOU or the Environmental Inspectors will be granted access to the Ports to carry out periodic testing of imported refrigerants as a way to reduce unauthorized imports of HCFCs.

V.4. DESCRIPTION OF ACTIVITIES AND COSTS

155. Activities necessary for the implementation and their costs are described below. These activities and figures are also summarized in Appendix B. The total amount being requested for the first phase of this HPMP which includes the first and second HCFC consumption reduction steps is US \$ 1,356,311 plus agency support cost of US \$, US \$119,598 broken down as follows:

- (a) Government of Italy: US \$ 325,000 and agency support cost of US \$42,250;
(b) UNDP: US \$1,031,311 and agency support cost of US \$77,348.

156. In view of the nature and the length of the programme the distribution of specific funds and duration to each activity should be seen as estimates that will be reviewed on a regular basis. Furthermore, the figures / timing below as well as the contents of appendix B, C, D needed quick revision after the project-review process and approval of the HPMP in June/July 2010, and are therefore to be seen as tentative. They will thus have to be re-discussed and revised at the inception of the implementation phase.

V.4.1. Safe Use of Hydrocarbon Refrigerants and Upgrade of the Regulatory Environment

157. Objectives: (a) to institute an enabling environment for the safe use of hydrocarbon and other natural refrigerants and (b) to enhance the legal backing for the phase-out of HCFCs in Ghana.

Activity V.4.1. (a): Safe use of hydrocarbon and other natural refrigerants

158. Although the level of use of hydrocarbons currently is not as high as other refrigerants, it is envisaged that hydrocarbons will become a widely used refrigerant in Ghana, especially in view of the fact that appliances coming from Ghana's traditional exporters of domestic and other refrigerators and air conditioning equipment, already converted to these alternatives. At the moment besides initial training provided under the TPMP, no other action has been taken to ensure safe use of these refrigerants. Under this activity a core group of Ghanaian refrigeration engineers and technicians will be provided on-site training in a country where the use of hydrocarbons is well established to study all aspects of the use of hydrocarbon and other natural refrigerants such as CO₂ and ammonia in order to assist in establishing and enforcing the norms, regulations, and code of practice etc necessary for safe use of the substances.

Implementing Agency:	Italy
Period of implementation:	3Q10-4Q13
Cost:	US\$ 30,057

Activity V.4.1. (b): Legal framework for the management of HCFCs in Ghana

159. The study of the legal and institutional framework for the management of ODS in the country which was undertaken by a senior legal consultant in connection with the preparation of the HPMP, identified a number of issues that could hamper the successful phase out of these chemicals. With the assistance of a national and a foreign legal expert from a non Article 5 country with experience in the phase-out of HCFCs, recommendations will be made to Government on the harmonization of laws governing the management of these chemicals.

Implementing Agency:	Italy
Period of implementation:	3Q10-4Q11
Cost:	US\$ 15,028

Activity V.4.2.: Focused Sensitization of Target Groups

160. A survey conducted under the TPMP established the need for continuous public awareness programmes in view of the low level of awareness among certain sections of the public. While the institutional strengthening project has had a component related to public awareness, it was geared to the public at large, schools, mass media, etc. The kind of public awareness proposed in the HPMP however would be focused to the Importers, Distributors, Refrigeration Associations, Ghana-missions abroad (with regards to export of appliances by Ghanaians who are living abroad) and other focus groups. As such, the sensitization activities would be of a different nature than the activities of the Institutional Strengthening project. In view of the wider use of HCFCs and the complexity of its phase-out, the awareness activities will be continued taking account of the lessons learned in previous programmes.

Implementing Agency:	Italy
Period of implementation:	3Q10-4Q13
Cost:	US\$ 18,785

Activity V.4.3.: Training and Certification for HCFC Servicing

161. Under the RMP and TPMP training was provided to Customs officers and refrigeration technicians. As part of the training of technicians, the technicians were taken through a quick reference manual developed by Accra Technical Training Centre. Customs, Excise and Preventative Service officers were provided with refrigerant identifiers for distribution to ports of entry. Additional training however is needed and would focus on hydrocarbon related and other low-GWP technologies. As such this activity would be complementary to previous courses focusing on CFCs only. The training would also be complimentary to the efforts that would be provided by the GEF-funded Energy Efficiency programme. The latter would only deal with early retirement of energy less-efficient domestic refrigerators and their dismantling. Due to the nature of HCFC conversion, retraining of technicians will be undertaken under the HPMP. The HPMP-related training would include institutes that have been established before and they will be upgraded with newly supplied equipment. Activities will include the following:

- a) Upgrade the National Refrigeration Demonstration Centre (NRDC) located at the Accra Technical Training Centre (ATTC) so that they would be able to provide training regarding servicing and retrofitting larger RAC systems. The NRDC would also have a facility for rental of equipment to refrigeration technicians. NRDC should thus be able to provide training on these matters to application engineers, designers, installers and master craftsmen. These in turn would collaborate with architects, surveyors, civil engineers and builders in the application of RAC systems using Valuable Air Volume (VAV) and Variable Refrigerant Volume (VRV) systems, hydronic systems, energy recovery systems, chillers, multi-ducted systems

in the application of air-conditioning in high rise office and commercial buildings. As such it is proposed to upgrade the NRDC to become a “Centre of Excellence” for the training aspects of the refrigeration sector in Ghana.

- b) Support for the establishment of two smaller additional training centres (one for the southern sector in Kumasi and one for the northern sector of the country).
- c) Extension of the training activities to include officers of Factories Inspectorate, Distributors, Importers, Sales Personnel and Fire Service (with regards to HC-related safety concerns).
- d) Update of the Quick Reference Manual with information on hydrocarbon technology and covering larger RAC equipment.
- e) Provision of identifiers to the Customs Excise and Preventive Service (CEPS) and other stakeholders which may be identified later.
- f) Training and retraining of Customs Officers (to control, monitor, identify imports of HCFCs and their blends).
- g) Training and retraining and certification of refrigeration technicians in collaboration with the Council for Technical and Vocational Education and Training (COTVET).

Implementing Agency:	From a through d → UNDP From e through g → Italy
Period of implementation:	3Q10-4Q17
Cost:	From a through d → US\$ 184,098 From e through g → US\$ 195,380

Activity V.4.4: Refrigerant Recovery & Retrofit Programme (RRRP)

162. Refrigerant conservation is the effort to extend the useful life span of refrigerant by establishing efforts to recover and reuse refrigerants. While such efforts were initiated during the CFC-phaseout, most equipment purchased was not able to deal with HCFCs and sectors such as Air Conditioning were never covered before with the exception of the Mobile Air Conditioning. In addition, most equipment purchased has already broken down and has outlived its useful lifespan. The benefits of the RRRP include

- a) Ability to recover refrigerant and decreased dependency on virgin refrigerant.
- b) Increased use of hydrocarbon-based equipment thanks to increased numbers of retrofits to hydrocarbon technology.
- c) Proper design and installation of new refrigeration and air conditioning equipment so as to minimize actual or potential refrigerant leakages.
- d) Periodic leak testing of existing refrigeration and AC systems so as to reduce emissions;
- e) Enforce the code of good refrigeration practices and improve service practices, including use of refrigerant recovery equipment;
- f) Safe handling, storage, transportation and disposal techniques that provide for refrigerant recovery systems at the point of final disposal.

163. The RRRP will assist 16 Servicing Centres (SCs) throughout Ghana as per following table. Selection criteria may be determined by NACODS or a specialized committee established under NACODS to assist in the selection of these centres, but could include following selection criteria:

- The company must be registered under the Ghana’s company registration Act.
- Total number of technical staff.
- Tax obligation.
- Knowledge about the ozone layer depletion.
- Volume of refrigerant usage for repairs, installation and maintenance per month.

- Existing maintenance agreement with end-user companies, hospitals, hotels and other institutions.
- Frequency of training of technical staff.
- The workshop environment and in-house keeping.

164. The SCs will receive a standard set of equipment that will allow them to recover refrigerant and retrofit appliances to hydrocarbons. Each centre will also have a performance-based contract which would provide them with an incentive towards their operational costs. After receiving a one-time advance, further payments would depend on the amount of recovered refrigerant and/or the number of retrofits to hydrocarbons. The size of the equipment-lot and subcontract amount may vary depending on the size of the operations that may be anticipated in each one of them. Precise details on the TOR for the subcontracts will be established at the outset of the programme.

City	Nr of Centres
Accra	3
Tema	2
Kumasi	3
Takoradi/Mines	2
Koforidua	1
Tamale	1
Sunyani	1
Ho	1
Upper East	1
Upper West	1

16

165. The RRRP was conceived so that it fits into the overarching strategy of the overall refrigeration sector as contained in appendix A. Recovered refrigerant that can no longer be reused would be sent through the Servicing Centres (SCs) where they would be accumulated in cylinders. From there, the pilot ODS-waste project has a budget that would allow transport by road to the ODS Destruction Centre that would be established in Accra. This is also where ODS-Waste from the Used Appliances Collection and Disposal Facilities (UACDFs) forming part of the GEF-funded Early-Retirement Scheme would also be destroyed.

166. The low price of HCFC-22 compared to the alternatives poses a challenge to the success of RRRP programmes. Such challenges should be addressed through the institutional and regulatory actions under the HPMP. As recommended by the RAC Technical Options Committee Ghana will take the opportunity afforded by the implementation of the HPMP to leverage the knowledge gained from developed countries, especially its bilateral partner, Italy, during the implementation of the conservation programme.

167. All consultants that would be involved in this programme have been listed under section V.6 below. Other activities will include (see more details in appendix B):

- Set of equipment for recovery/retrofit for up to 16 Servicing Centres
- Performance-based 2 years subcontracts with up to 16 Servicing Centres)
- Training workshops for up to 16 Servicing Centres

Implementing Agency: UNDP
Period of implementation: 3Q10-4Q19
Cost: US\$ 430,841

Activity V.4.5.: End-User Incentive Programme (EUIP) for the Retrofit of Residential and Commercial RAC and the Industrial Refrigeration Sectors

168. While the previous programme is geared towards the servicing technicians and repair-men, the EUIP will be benefiting end-users of existing refrigeration systems. Residential and Commercial RAC and the Industrial Refrigeration units that have not reached their end of useful life will be selected to be replaced or retrofitted with the view to convert them to no-ODP and – preferably - low-GWP technology to replace HCFC-22.

169. Details on selection criteria will be similar to the previous end-user incentive programme for CFCs which has been very successful in Ghana. A revised background note was drafted and is attached as Appendix E, but it should be finalized at the beginning of the implementation of the EUIP. While HFCs and their blends would continue to be used priority will be given to conversions to hydrocarbon and other natural refrigerants where mature technologies to enable their use are available and where assurances are provided that adequate safety precautions will be taken.. Selection criteria will be revised by NACODS in cooperation with the NOU or through a specialized committee established under NACODS to assist in the management of the Plan. The committee, if one is established will in collaboration with the NOU monitor compliance and sustainability of HCFC use (preventing reversion to HCFC-22 or other HCFC-based blends). The EUIP however would only envisage permanent retrofits of existing systems, unlike the CFC End-Users project which also contemplated replacement by new equipment.

170. The EUIP would not duplicate the efforts of the GEF-funded Early Retirement Scheme either, as the latter would mostly focus on domestic refrigerators.

171. All consultants that would be involved in this programme have also been listed under section V.6 below. Other activities will include:

- a) Workshop for Outreach to End-User
- b) Subcontracts End-Users

Implementing Agency:	UNDP
Period of implementation:	1Q14-4Q19
Cost:	US\$ 179,202

Activity V.4.6.: Monitoring and Technical Support to above Components.

172. Rather than splitting out the international and national consultants over the various components mentioned above, all of them were grouped into this HPMP-component. This makes sense as one consultant will often be covering the various components of the project. The consultants would provide the needed technical support to the HPMP and carry out the needed functions of monitoring the activities as well. Italy has also announced it would introduce a paperless system for establishing and keeping a database and monitoring system.

173. The inputs related to this component are the following:

- (a) Monitoring system - paperless system
- (b) International Consultant for Italy's activities over 6 years
- (c) International Consultant for UNDP's activities over 6 years
- (d) National Consultants over 6 years
- (e) Local Travel budget over 6 years

Implementing Agency:	From c through e → UNDP From a through b → Italy
Period of implementation:	3Q10-4Q15
Cost:	From c through e → US\$ 237,170 From a through b → US\$ 65,749

174. As mentioned before, all these activities are detailed in appendix B.

VI. PROJECT COORDINATION AND MANAGEMENT

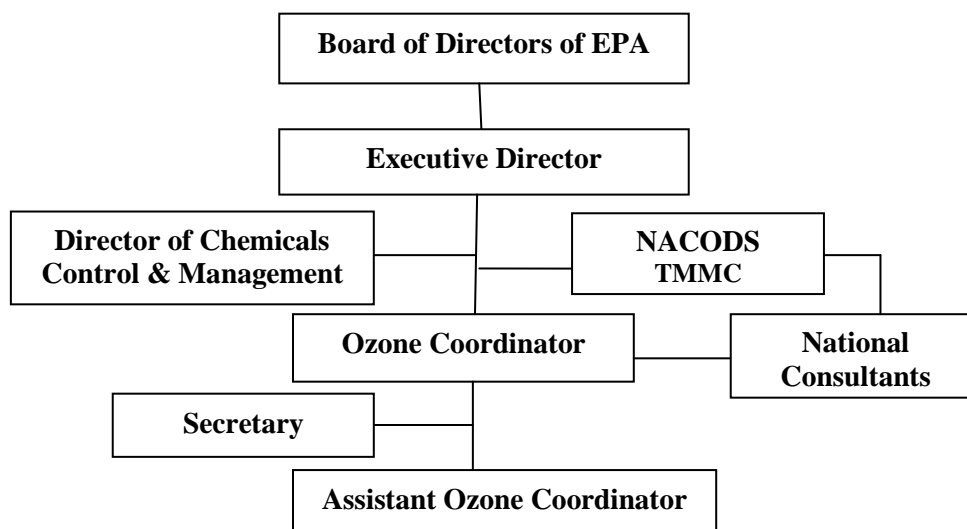
VI.1 Management Structure

175. The National Ozone Unit was created within the Environmental Protection Agency (EPA) under the Ministry of Environment, Science and Technology (MEST). A National Committee on Ozone Depleting Substances (NACODS), under the chairmanship of the Executive Director of the EPA was also created to enlist the collaboration of relevant government departments as well as the private sector. NACODS is used as an advisory body on policy requirements, legislation, programmes of action, research, institutional strengthening and awareness campaigns. The Committee includes representation from:

- Ministry of Environment, Science & Technology
- Ministry of Trade & Industries
- Ghana Meteorological Agency
- Department of Factories Inspectorate
- Friends of the Earth – Ghana (NGO)
- Council for Scientific & Industrial Research
- UNDP – Ghana country office
- Faculty of Engineering, Kwame Nkrumah University of Science & Technology
- Customs Excise & Preventive Service
- National Air-Conditioning & Refrigeration Workshop Owners Association (NARWOA)
- Legal Officer, EPA (Co-opted)
- Ministry of Finance & Economic Planning (Co-opted)
- Accra Technical Training Centre (Co-opted)
- National Committee on Improved Refrigeration Practices (Co-opted)
- Chemicals Control & Management and Centre of EPA (Co-opted)

176. It is also envisaged that the membership may increase with the proposed inclusion of Energy Commission in view of their collaboration in the upcoming overarching strategy project and a representative of refrigeration servicing practitioners or engineers not members of NARWOA.

177. The NOU acts as Secretariat for NACODS and deals with all activities related to ODS including monitoring of National ODS consumption, co-ordination as well as international activities and will thus perform the monitoring role under the HPMP. The organizational chart of the NOU is as described below.



VI.2 Implementation and Monitoring Procedures

178. During the implementation of the TPMP a monitoring and technical management committee was constituted to serve as an advisory panel to the TPMP projects. A similar arrangement will be considered under the HPMP. A Technical Management and Monitoring Committee (TMMC) will be established with specific terms of reference under NACODS to inter alia examine all applications and requests for funding for activities under the HPMP and make recommendations to NACODS. The TMMC would be assisted by the Assistant Ozone Coordinator and the relevant national consultant, where applicable in their technical review and other work. The TMMC will also assist the National Ozone Unit in the monitoring of the implementation of activities under the Plan. Membership of the TMMC may include at least one member of the core group of experts that may have training abroad and at least one representative of CEPS.

179. The cost of monitoring of the Plan is elaborated under the Activity V.4.6.: Monitoring and Technical Support in Section V above.

VI.3 Political Commitment

180. Government is fully supportive of the NOU. The parent ministry for the EPA, MEST has ensured the passage and operationalization of the Ozone Protection Regulations LI 1812 – Management of Ozone Depleting Substances and Products Regulations, 2005 with which the NOU regulates imports of ODSs and ODS-containing equipment. As far as possible Ghana participates at the highest level in international works related to the Montreal Protocol.

**ANNEX I: AGREEMENT BETWEEN THE GOVERNMENT OF GHANA AND THE
EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND**

STAGE 1 HPMP IMPLEMENTATION PROGRAMME (2010-2015)

PROJECT COVER SHEET – MULTI-YEAR PROJECTS

COUNTRY: Ghana

PROJECT TITLE

Hydrochlorofluorocarbon Phase-Out Management Plan
(HPMP) – Stage 1: Implementation

IMPLEMENTING AGENCIES

Lead Implementing Agency: UNDP

Co-operating Implementing Agency:
GOVERNMENT OF ITALY (GOI)

SUB-PROJECT TITLES

a) Establishment of the Regulatory Environment <ul style="list-style-type: none">i. Enabling Environment for Safe Use of HCii. Legal Framework for the Management of HCFCs	GOI
b) Focused Sensitisation of Target Groups <ul style="list-style-type: none">i. Information for importers, distributors, Refrigeration Associations Training and Certification for HCFC Servicingii. Brochures/handouts to Ghana missionsiii. Information to focus groups	GOI
c) Training and Certification for HCFC Servicing <ul style="list-style-type: none">i. Upgrade of existing Refrigeration Training Centre (NRDC) to Centre of Excellenceii. Establishment of 2 Training Centres (one in South, one in North)iii. Training of Factories Inspectorate, Distributors, Importers, Sales Personnel and Fire Service (re HC-safety)iv. Upgrade quick reference guidev. Provision of Identifiers (45 pieces)vi. Training/retraining of Customs Officers (train the trainers)vii. Training/retraining of refrigeration technicians in collaboration with COTVET	UNDP/GOI UNDP UNDP UNDP GOI GOI GOI UNDP
d) Refrigerant Recovery/Retrofit Project (RRRP) <ul style="list-style-type: none">i. Equipment (see list)ii. Contingenciesiii. 3 recovery/retrofit workshopsiv. Subcontracts with 12 full and 4 half centres (subcontracts for 2 years)	UNDP
e) End-User Incentive Programme (EUIP) for the Retrofit of Residential and Commercial RAC and the Industrial Refrigeration Sectors <ul style="list-style-type: none">i. Workshop geared to End-Usersii. Incentives to End-Users	UNDP/GOI
f) Monitoring and Technical Support (Monitoring and Management of the HPMP) <ul style="list-style-type: none">i. Monitoring system (paperless system)ii. International Consultant (Italy)iii. International Consultantiv. National Consultantsv. Local Travel for National Consultant	GOI GOI UNDP UNDP UNDP

NATIONAL COORDINATING AGENCY: NOU, ENVIRONMENTAL PROTECTION AGENCY

**AGREEMENT BETWEEN GHANA AND THE EXECUTIVE COMMITTEE OF THE
MULTILATERAL FUND FOR THE REDUCTION IN CONSUMPTION
OF HYDROCHLOROFLUOROCARBONS**

This Agreement represents the understanding of the Government of Ghana (the “Country”) and the Executive Committee with respect to the reduction of controlled use of the ozone-depleting substances (ODS) set out in Appendix 1-A (the “Substances”) to a sustained level as set out in Appendix 2-A (the “Targets and Funding”). This would correspond to 32.2 ODP tonnes prior to 1 January 2020 in compliance with Montreal Protocol schedules, with the understanding that this figure is to be revised one single time in 2011, when the true baseline consumption will be known.

The Country agrees to meet the annual consumption limits of the Substances as set out in row 1.2 of Appendix 2-A (the “Targets and Funding”) in this Agreement as well as in the Montreal Protocol reduction schedule. The Country accepts that, by its acceptance of this Agreement and performance by the Executive Committee of its funding obligations described in paragraph 3, it is precluded from applying for or receiving further funding from the Multilateral Fund in respect to any consumption of the Substances which exceeds the level defined in row 1.2 of Appendix 2-A as corresponding to the reduction step under this agreement for all ODS specified in Appendix 1-A, and in respect to any consumption of the substances which exceeds the level defined in row 3.1.

Subject to compliance by the Country with its obligations set out in this Agreement, the Executive Committee agrees in principle to provide the funding set out in row 2.5 of Appendix 2-A (the “Targets and Funding”) to the Country. The Executive Committee will, in principle, provide this funding at the Executive Committee meetings specified in Appendix 3-A (the “Funding Approval Schedule”).

The Country will meet the consumption limits for each of the Substances as indicated in Appendix 2-A -- row 2.2 with the understanding that these figures are to be revised one single time in 2011, when the true baseline consumption will be known. It will also accept independent verification to be commissioned by the relevant implementing agency (IA) of achievement of these consumption limits as described in sub-paragraph 5(b) of this Agreement.

The Executive Committee will not provide the Funding in accordance with the Funding Approval Schedule unless the Country satisfies the following conditions at least 60 days prior to the applicable Executive Committee meeting set out in the Funding Approval Schedule:

- That the Country has met the Targets for all relevant years. Relevant years are all years since the year in which the hydrochlorofluorocarbons phase-out management plan (HPMP) was approved when an obligation for reporting of country programme data exists at the date of the Executive Committee Meeting at which the funding request is being presented;
- That the meeting of these Targets has been independently verified, except if the Executive Committee decided that such verification would not be required;
- That the Country has substantially completed all actions set out in the previous tranche implementation plan and submitted a tranche implementation report in the form of Appendix 4-A (the “Format of Tranche Implementation Report and Plan”) for each previous calendar year; and
- That the Country has submitted and received endorsement from the Executive Committee for a tranche implementation plan in the form of Appendix 4-A (the “Format of Tranche Implementation Report and Plan”) for each calendar year until and including the year for which the funding schedule foresees the submission of the next tranche or, in case of the final tranche, until completion of all activities foreseen.

The Country will ensure that it conducts accurate monitoring of its activities under this Agreement. The institutions set out in Appendix 5-A (the “Monitoring Institutions and Roles”) will monitor and report on that monitoring in accordance with the roles and responsibilities set out in Appendix 5-A. This monitoring will also be subject to independent verification as described in sub-paragraph 5(b).

While the Funding was determined on the basis of estimates of the needs of the Country to carry out its obligations under this Agreement, the Executive Committee agrees that the Country may have the flexibility to reallocate the approved funds, or part of the funds, according to the evolving circumstances to achieve the goals prescribed under this Agreement. Reallocations categorized as major changes must be documented in advance in the next tranche implementation plan and endorsed by the Executive Committee as described in sub-paragraph 5(d). Reallocations not categorized as major changes may be incorporated in the approved tranche implementation plan, under implementation at the time, and reported to the Executive Committee in the tranche implementation report. Any remaining funds will be returned to the Multilateral Fund upon closure of the last tranche of the plan.

Specific attention will be paid to the execution of the activities in the refrigeration servicing sub-sector, in particular that the:

- Country would use the flexibility available under this Agreement to address specific needs that might arise during project implementation; and
- Country and the implementing agencies will take full account of the requirements of decisions 41/100 and 49/6 during the implementation of the plan.

The Country agrees to assume overall responsibility for the management and implementation of this Agreement and of all activities undertaken by it or on its behalf to fulfil the obligations under this Agreement. UNDP has agreed to be the lead implementing agency (the “Lead IA”) and Italy has agreed to be cooperating implementing agency (the “Cooperating IA”) under the lead of the Lead IA in respect of the Country’s activities under this Agreement. The Country agrees to evaluations, which might be carried out under the monitoring and evaluation work programmes of the Multilateral Fund or under the evaluation programme of any of the IA taking part in this Agreement.

The Lead IA will be responsible for carrying out the activities of the plan as detailed in the first submission of the HPMP with the changes approved as part of the subsequent tranche submissions, including but not limited to independent verification as per sub-paragraph 5(b). This responsibility includes the necessity to co-ordinate with the Cooperating IA to ensure appropriate timing and sequence of activities in the implementation. The Cooperating IA will support the Lead IA by being responsible for carrying out the activities listed in Appendix 6-B under the overall co-ordination of the Lead IA. The Lead IA and Cooperating IA will enter into a formal agreement regarding planning, reporting and responsibilities under this Agreement to facilitate a co-ordinated implementation of the Plan, including regular co-ordination meetings. The Executive Committee agrees, in principle, to provide the Lead IA and the Cooperating IA with the fees set out in rows 2.2 and 2.4 of Appendix 2-A.

Should the Country, for any reason, not meet the Targets for the elimination of the Substances set out in row 1.2 of Appendix 2-A or otherwise does not comply with this Agreement, then the Country agrees that it will not be entitled to the Funding in accordance with the Funding Approval Schedule. At the discretion of the Executive Committee, funding will be reinstated according to a revised funding approval schedule determined by the Executive Committee after the Country has demonstrated that it has satisfied all of its obligations that were due to be met prior to receipt of the next tranche of funding under the Funding Approval Schedule. The Country acknowledges that the Executive Committee may reduce the amount of the Funding by the amounts set out in Appendix 7-A in respect of each ODP tonne of reductions in consumption not achieved in any one year. The Executive Committee will discuss each specific case in which the country did not comply with this agreement, and take related decisions. Once

these decisions are taken, this specific case will not be an impediment for future tranches as per paragraph 5.

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

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

The completion of the HPMP and the associated Agreement will take place at the end of the year following the last year for which a maximum allowable total consumption has been specified in Appendix 2-A. Should at that time activities be still outstanding which were foreseen in the plan and its subsequent revisions as per sub-paragraph 5(d), the completion will be delayed until the end of the year following the implementation of the remaining activities. The reporting requirements as per Appendix 4-A (a), (b), (d) and (e) continue until the time of the completion if not specified by the Executive Committee otherwise.

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

APPENDICES

APPENDIX 1-A: THE SUBSTANCES

Substance	Annex	Group	Starting point for aggregate reductions in consumption (ODP tonnes)
HCFC-22	C	I	35.7
HCFC-142b	C	I	13.8
TOTAL HCFCs	C	I	49.5

Footnote: In 2011, a one-time revision of the ODP tonnes will be calculated to replace the “estimated baseline” and “starting point” with the true baseline as soon as this figure is available.

APPENDIX 2-A: THE TARGETS, AND FUNDING

	Estim. Baseline	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Montreal Protocol reduction schedule of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Maximum allowable total consumption of Annex C, Group I substances (ODP tonnes)	49.5	21.7	NA	NA	49.5	49.5	44.5	44.5	44.5	44.5	44.5	32.2	NA
Lead IA (UNDP) agreed funding (US \$)		200,000		200,000		190,000		195,000		125,000	121,311		1,031,311
Support costs for Lead IA (US \$)		15,000		15,000		14,250		14,625		9,375	9,098		77,348
Cooperating IA (Italy) agreed funding (US \$)		70,000		60,000		70,000		65,000		60,000	-		325,000
Support costs for Cooperating IA (US \$)		9,100		7,800		9,100		8,450		7,800	-		42,250
Total agreed funding (US \$)		270,000		260,000		260,000		260,000		185,000	121,311		1,356,311
Total support costs (US \$)		24,100		22,800		23,350		23,075		17,175	9,098		119,598
Total agreed costs (US \$)		294,100		282,800		283,350		283,075		202,175	130,409		1,475,909
Total phase-out of HCFC-22 and HCFC-142b (used in R-406a) agreed to be achieved under this agreement (ODP tonnes)													17.3
Phase-out of HCFC-22 and HCFC-142b (used in R-406a) to be achieved in previously approved projects (ODP tonnes)													0.0
Remaining eligible consumption for HCFC-22 and HCFC-142b (used in R-406a) (ODP tonnes)													32.2

Footnote: it was agreed that the US\$ amounts would be considered for approval as per the above table, irrespective of a possible change in the ODP baseline. However in 2011, a revision of the ODP tonnes will be calculated to replace the “estimated baseline” with the true baseline as soon as this figure is available. Other ODP amounts in the table will then be adjusted accordingly as well.

APPENDIX 3-A: FUNDING APPROVAL SCHEDULE

1. Funding for the future tranches will be considered for approval not earlier than the second meeting of the year specified in Appendix 2-A – row 2.5.

APPENDIX 4-A: FORMAT OF TRANCHE IMPLEMENTATION REPORT AND PLAN

- The submission of the Tranche Implementation Report and Plan will consist of five parts:
 - A narrative report regarding the progress in the previous tranche, reflecting on the situation of the Country in regard to phase out of the substances, how the different activities contribute to it and how they relate to each other. The report should further highlight successes, experiences and challenges related to the different activities included in the plan, reflecting on changes in the circumstances in the country, and providing other relevant information. The report should also include information about and justification for any changes vis-à-vis the previously submitted tranche plan, such as delays, uses of

the flexibility for reallocation of funds during implementation of a tranche, as provided for in paragraph 7 of this Agreement, or other changes. The narrative report will cover all relevant years specified in sub-paragraph 5(a) of the Agreement and can in addition also include information about activities in the current year;

- A verification report of the HPMP results and the consumption of the substances mentioned in Appendix 1-A, as per sub-paragraph 5(b) of the Agreement. If not decided otherwise by the Executive Committee, such a verification has to be provided together with each tranche request and will have to provide verification of the consumption for all relevant years as specified in sub-paragraph 5(a) of the Agreement for which a verification report has not yet been acknowledged by the Committee;
- A written description of the activities to be undertaken in the next tranche, highlighting their interdependence and taking into account experiences made and progress achieved in the implementation of earlier tranches. The description should also include a reference to the overall plan and progress achieved, as well as any possible changes to the overall plan foreseen. The description should cover the year specified in sub-paragraph 5(d) of the Agreement. The description should also specify and explain any revisions to the overall plan which were found to be necessary;
- A set of quantitative information for the report and plan, submitted online into a database, as per the relevant decisions of the Executive Committee in respect to the format required. This quantitative information, to be submitted by calendar year, will be amending the narratives and description for the report (see sub-paragraph 1(a) above) and the plan (see sub-paragraph 1(c) above), and will cover the same time periods and activities; it will also capture the quantitative information regarding any necessary revisions of the overall plan as per sub-paragraph 1(c) above. While the quantitative information is required only for previous and future years, the format will include the option to submit in addition information regarding the current year if desired by the country and agency; and
- An Executive Summary of about five paragraphs, summarizing the information of above sub-paragraphs 1(a) to 1(d).

APPENDIX 5-A: MONITORING INSTITUTIONS AND ROLES

1. All the monitoring activities will be coordinated and managed through the National Ozone Unit, which is included within this HPMP.

2. The Lead IA will have a particularly prominent role in the monitoring arrangements because of its mandate to monitor ODS imports, whose records will be used as a crosschecking reference in all the monitoring programmes for the different projects within the HPMP. This organization, along with the cooperating IA will also undertake the challenging task of monitoring illegal ODS imports and exports with advisements made to the appropriate national agencies through the National Ozone Office.

APPENDIX 6-A: ROLE OF THE LEAD IMPLEMENTING AGENCY

The Lead IA will be responsible for a range of activities to be specified in the project document as follows:

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

- (b) Assisting the Country in preparation of the tranche Implementation Plan and subsequent report as per Appendix 4-A;
- (c) Providing verification to the Executive Committee that the Targets have been met and associated annual activities have been completed as indicated in the tranche Implementation Plan consistent with Appendix 4-A.
- (d) Ensuring that the experiences and progress is reflected in updates of the overall plan and in future tranche implementation plans consistent with sub-paragraphs 1(c) and 1(d) of Appendix 4-A;
- (e) Fulfilling the reporting requirements for the tranches and the overall plan as specified in Appendix 4-A as well as project completion reports for submission to the Executive Committee; this responsibility includes the reporting about activities undertaken by the Cooperating IA.
- (f) Ensuring that appropriate independent technical experts carry out the technical reviews undertaken by the Lead IA;
- (g) Carrying out required supervision missions;
- (h) Ensuring the presence of an operating mechanism to allow effective, transparent implementation of the Tranche Implementation Plan and accurate data reporting;
- (i) Co-ordinating the activities of the Cooperating IA, and ensuring appropriate sequence of activities;
- (j) Ensuring that disbursements made to the Country are based on the use of the indicators; and
- (k) Providing assistance with policy, management and technical support when required.

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

APPENDIX 6-B: ROLE OF COOPERATING IMPLEMENTING AGENCY

1. The Cooperating IA will:

Provide policy development assistance when required;

- Assist the Country in the implementation and assessment of the activities funded for by the Cooperating IA, and refer to the Lead IA to ensure a co-ordinated sequence in the activities; and
- Provide reports to the Lead IA on these activities, for inclusion in the consolidated reports as per Appendix 4-A.

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

1. In accordance with paragraph 11 of the Agreement, the amount of funding provided may be reduced by twice the cost-effectiveness of the programme, or US\$ 9 per ODP tonne of reductions in consumption not achieved in the year.

APPENDIX A

COMBINING AND SEQUENCING GEF AND MLF FUNDING FOR CLIMATE AND OZONE BENEFITS IN GHANA

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) has been set up to support developing countries in their efforts to phase out the use of Ozone Depleting Substances well before the protocol deadline of 2010 and in this way to maximize the related environmental benefits for the global community. The Fund has for over fifteen years supported ODS phase out projects. By and large this support has been restricted to the so-called Annex-A substances from which CFCs constitute the main group. A Terminal Phase out Management Plan (TPMP) is ongoing in Ghana to address the CFC phase-out. The conversion of HCFCs, which have Ozone Depleting Potentials (ODPs) of only 5-10% of those of CFCs, is now recently being supported as well and the formulation of an HCFC Phase out Management Plan (HPMP) are being developed.

UNDP Ghana in collaboration with EPA, Energy Commission and the Institute of Industrial Research of the CSIR has developed on an overarching strategy to provide climate and ozone benefits through the Integrated Plan for Energy Efficiency, Climate Mitigation and ODS Reductions for the Refrigeration Sector as shown in Figure 1.

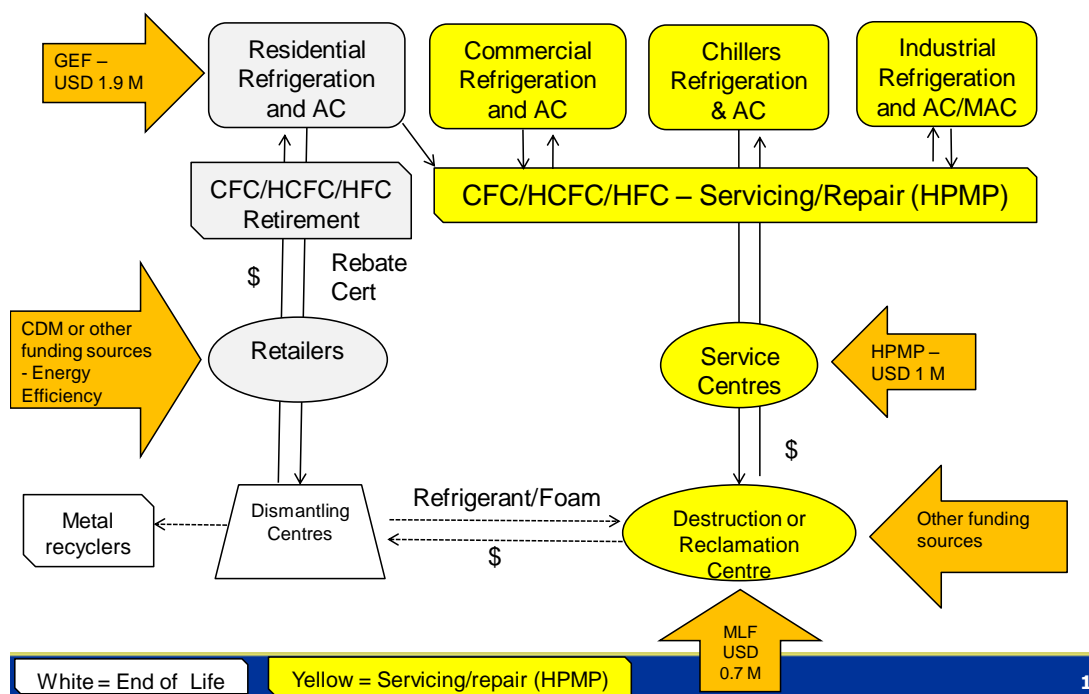


Figure A1: Integrated Plan for Energy Efficiency, Climate Mitigation and ODS Destruction Management

This integrated plan brings about the convergence of 3 synergistic interventions: (i) the phasing out of HCFC based appliances (MLF); (ii) the promotion of energy efficient refrigerators through Market Transformation (GEF) and (iii) the complimentary pilot project for the recovery and destruction of ODS (MLF). Opportunities to convert the environmental services into carbon credits and assets offered by these programs will be explored. The ultimate objective of this plan is to bring economic, social and environmental benefits to the people in Ghana through the scaling up of energy efficient appliances with low global warming potential (GWP).

While it would be cost-effective to address only one refrigeration subsector (e.g. residential fridges) in larger countries, due to the large volume of equipment units, this would not be the case for a smaller country like Ghana, which is an example of a Low-Volume Consuming Country (LVC) as it only uses HCFCs in the refrigeration servicing sector. The proposed Integrated Plan would therefore address all subsectors (residential, commercial, industrial refrigeration, AC, MAC, chillers) and all types of refrigerants (CFCs, HCFCs and HFCs).

The HCFC phase out project only targeted the service sector where broken refrigerators are sent for repair. Whilst the HPMP program is targeted at the accelerated phase out of HCFC in the servicing sector, the ODS destruction project seeks to reduce potential ODS and carbon emissions from the ODS bank. This ODS destruction pilot project with a MLF funding of USD 700k seeks to address both early refrigerator retirement program through rebate and turn in as well as End-of-Life program when old refrigerator reach the end of their life and are beyond repair. It is evident that some of the actions undertaken would address the objectives of both the Montreal Protocol and the Kyoto Protocol.

Figure 1 provides an overview of how the proposed Integrated Plan would work. Boxes in white represent the GEF-funded End-of-Life “Market Transformation for Energy Efficiency” programme, while the yellow boxes represent ODS management projects for the servicing sector financed by the MLF. Through the End-of-Life Scheme, equipment would be collected and dismantled by retailers. The recovered refrigerants would be sent to a central ODS Collection and Disposal Centre. Alternatively, a facility could recycle some of the refrigerants, while unusable ODS would be exported for destruction abroad. The HPMP activities would involve servicing operations on existing equipment, which would be supported by the MLF.

The brown arrows relate to the expected influx of funding from the GEF/MLF and other potential sources. Downward arrows in the diagram represent the process by which refrigeration equipment/refrigerant is delivered to the Collection and Disposal Centre. Upward arrows represent resources required to make the programmes operational and MLF and GEF funding (or funding from other grants) is needed to help developing countries and enterprises (especially Small-Medium Sized Enterprises) cover the necessary upfront investments. Without these funds they would not be able to cover these costs. As such GEF and MLF funding would play a critical role in kick-starting the above-mentioned scheme in Ghana during the first couple of years.

GEF-funds would initiate the Early Retirement as well as End-of-Life scheme for the domestic refrigeration sector. The MLF’s HPMP funds would help establish a refrigerant recovery scheme and collection centre, while the MLF’s ODS waste pilot project would help fund ODS destruction operations, or transshipment ODS waste for destruction abroad. The legislative framework required to help sustain the operations will be established.

Once the model has been tested and proven, it is hoped that other sources of finance, including carbon finance, would generate the necessary funding that would allow the cycle to continue and to become self-sustainable. The Collection and Disposal Centre would contribute to the provision of reliable information regarding the reclaimed/disposed ODS amounts, which in turn would facilitate obtaining approval for these alternative funding sources.

APPENDIX B -- SUMMARY OF ACTIVITIES UNDER THE HPMP- STAGE 1

Activity	Components of Activity	Agency	Duration	Project Cost US\$	Subtotals	2010	2012	2014	2016	2018-19
1) Establishment of the Regulatory Environment	a) Enabling Environment for Safe Use of HC	Italy	3Q10-4Q13	30,057	45,085	15,028	15,028			
	b) Legal Framework for the Management of HCFCs	Italy	3Q10-4Q11	15,028		15,028				
2) Focused Sensitisation of Target Groups	a) Information for importers, distributors, Refrigeration Associations	Italy	3Q10-4Q13	18,785	18,785	14,770	4,015			
	b) Brochures/handouts to Ghana missions									
	c) Information to focus groups									
3) Training and Certification for HCFC Servicing	a) Upgrade of existing Refrigeration Training Centre NRDC to Centre of Excellence	UNDP	3Q10-4Q13	75,142		37,571	37,571			
	b) Establishment of 2 Training Centres (one in South, one in North)	UNDP	3Q12-4Q17	75,142			18,785	37,571	18,785	
	c) Training of of Factories Inspectorate, Distributors, Importers, Sales Personnel and Fire Service (re HC-safety)	UNDP	3Q12-4Q17	30,057			7,514	15,028	7,514	
	d) Upgrade quick reference guide	UNDP	3Q10-4Q11	3,757	184,098	3,757				
	e) Provision of Identifiers (45 pieces)	Italy	3Q12-4Q15	43,958			21,979	21,979		
	f) Training/retraining of Customs Officers (train the trainers)	Italy	3Q12-4Q19	63,312			8,833	7,820	15,028	31,629
	g) Training/retraining of refrigeration technicians (COTVET)	Italy	3Q14-4Q19	88,111	195,380			30,057	39,828	18,226
4) Refrigerant Recovery/Retrofit Project (RRRP)	a) Equipment see list	UNDP	3Q10-4Q13	147,804		111,238	36,566			
	b) Contingencies	UNDP	3Q12-4Q13	14,780			14,780			
	c) 3 recovery/retrofit wkshps	UNDP	3Q12-4Q15	15,780			5,789	9,990		
	d) Subcontracts with 12 full and 4 half centres (subcontracts for 2 years)	UNDP	3Q12-4Q19	252,477	430,841		31,560	63,119	63,119	94,679
5) End-User Incentive Programme (EUIP) for Residential/Commercial RAC & the Industrial Ref Sectors	a) Workshop geared to End-Users	UNDP	3Q14-4Q15	7,514				7,514		
	b) Incentives to End-Users	UNDP	3Q14-4Q19	171,688	179,202			9,343	58,148	104,198
6) Monitoring and Technical Support to above Components	a) Monitoring system (paperless system)	Italy	3Q10-4Q11	15,028		15,028				
	b) International Consultant (Italy)	Italy	3Q10-4Q19	50,721	65,749	10,144	10,144	10,144	10,144	10,144
	c) International Consultant	UNDP	3Q10-4Q19	50,721		10,144	10,144	10,144	10,144	10,144
	d) National Consultants	UNDP	3Q10-4Q19	169,069		33,814	33,814	33,814	33,814	33,814
	e) Local Travel for National Consultant	UNDP	3Q10-4Q19	17,380	237,170	3,476	3,476	3,476	3,476	3,476
				1,356,311	1,356,311	270,000	260,000	260,000	260,000	306,311
	Without Support Costs	UNDP		1,031,311		200,000	200,000	190,000	195,000	246,311
		Italy		325,000		70,000	60,000	70,000	65,000	60,000
		TOTAL		1,356,311		270,000	260,000	260,000	260,000	306,311
	Support Cost	UNDP	7.50%	77,348		15,000	15,000	14,250	14,625	18,473
		Italy	13%	42,250		9,100	7,800	9,100	8,450	7,800
		TOTAL		119,598		24,100	22,800	23,350	23,075	26,273
	Grand Total	UNDP		1,108,660		215,000	215,000	204,250	209,625	264,784
		Italy		367,250		79,100	67,800	79,100	73,450	67,800
		TOTAL		1,475,910		294,100	282,800	283,350	283,075	332,584

APPENDIX C -- STAGE 1 IMPLEMENTATION TIME TABLE (MILESTONES)

Activity	2010-11	2012-13	2014-15	2016-17	2018-19
1) Establishment of the Regulatory Environment					
2) Focused Sensitisation of Target Groups					
3) Training and Certification for HCFC Servicing					
4) Refrigerant Recovery/Retrofit Project (RRRP)					
5) End-User Incentive Programme (EUIP)					
6) Monitoring and Technical Support to above Components					

APPENDIX D: ESTIMATE OF EQUIPMENT COST

An initial estimate as to the equipment cost for the RRP programme was obtained as listed in the table below. It may be revised at the outset of project implementation according to needs.

List of Equipment and Estimated Costs			
Description		US\$/Item	US\$
Portable Refrigerant identifier	2	1,300	2,600
Two Stage Vacuum pump	2	200	400
3 portable recovery units (or 1 reclaim and 1 recovery unit)	3	800	2,400
Portable hydrocarbon charging station	2	800	1,600
Portable Oxy-Acetylene soldering and brazing station	2	400	800
Soldering and brazing hand held portable torch	2	40	80
Shrouded Valves (pack of 50)	2	80	160
Piercing Valves (pack of 30)	2	120	240
Digital Weighing Scale	2	120	240
Electronic portable leak detector	2	100	200
Multifunction clamp-on multimeter	2	60	120
Precision digital thermometer	2	160	320
Compressors - For Hydrocarbon gaz	2	80	160
Standard 3 way gauge manifold set	2	50	100
30 lbs. Recovery cylinders	4	120	480
100 lbs Recovery cylinders	2	250	500
Manual oil pump	2	70	140
Hydrocarbon Refrigerant R-290 (5kg cylinder)	10	70	700
			11,240
Spares (15%)			1,686
Transport / Customs Clearance			1,124
GRAND TOTAL			14,050
12 Full and 4 Half Kits			196,700
Plus Contingencies (10%)			216,370

NOTE: These figures would probably have to be revised downwards at the beginning of project implementation as the available budget was less than anticipated at the approval of the HPMP.

APPENDIX E --- BACKGROUND NOTE FOR THE END-USER INCENTIVE PROGRAMME (EUIP)

The following background note was developed based on an End-User Incentive Programme for CFCs. It was adjusted so that it may become relevant for HCFCs. As activity V-5 mentions above, the final details on the selection criteria will be reviewed at the beginning of the implementation of the HPMP by NACODS in cooperation with the NOU or through a specialized committee established under NACODS. The committee, if one is established will in collaboration with the NOU monitor compliance and sustainability of HCFC use (preventing reversion to HCFC-22 or HCFC-blends).

The reason why it was thought that the new end-user project should be based on the old one is because of the success of the previous project and because it would take the lessons learned from the old programme fully into account.

END-USER INCENTIVE PROGRAMME (EUIP) FOR THE RESIDENTIAL, COMMERCIAL, INDUSTRIAL REFRIGERATION AND AIR CONDITIONING SECTORS

a. Objective & Eligibility -

The objective of the End-User Incentive Programme (EUIP) is to eliminate as much as possible of the consumption of HCFCs (HCFC-22 and R406A) in the residential, commercial and industrial refrigeration and air conditioning end-user sectors through the payment of a financial incentive to enterprises in these sectors that have existing refrigeration equipment that uses these refrigerants.

Such enterprises will be eligible to apply for an Incentive Payment if they replace or permanently retrofit the existing refrigeration equipment to use a refrigerant that is not an Ozone Depleting Substance (e.g. R134a or R404A, R507, R290, R600, R600a, Ammonia, etc.). However, the programme would not apply for the use of a commercial “drop-in” refrigerant blend for which no significant costs are involved anyway.

No HCFC-based blends other than R406a would be considered by this programme unless it is proved with the relevant documentation, including Customs records, that the refrigerant was being used prior to the approval of the programme.

Enterprises can select their preferred replacement or retrofit refrigeration technology but only limited to alternative refrigerants that are not Ozone Depleting Substances such as R134a, R404A, R507, R290, R600, R600a, Ammonia, etc.,

To discourage HCFC-alternatives that have a high GWP (such as HFC and HFC-blends) the incentive amount for those would be half of the level that would be paid to low-GWP alternatives such as hydrocarbons and other natural refrigerants and also in terms of selection of project beneficiaries, the priority rating of conversions to high GWP refrigerants will be lower than those to hydrocarbons and other natural refrigerants.

Enterprises will only be eligible for an incentive payment if they were in existence before the HCFC cut-off date which will soon be decided upon by the Executive Committee of the Multilateral Fund. Their existing equipment that will be replaced or permanently retrofitted must also have been installed before the same cut-off date. Proof of this must be attached to the application.

In the Incentive Payment Project, the residential, commercial and industrial refrigeration end-user sectors are considered as including refrigeration and air conditioning systems used in food-storage (cold stores and silos), fisheries, meat-processing plants, breweries, hospitals, hotels, restaurants, supermarkets, refrigerated transport (trucks, rail, boats) etc.

The United Nations Development Programme (UNDP) through its country office and the National Ozone Unit will implement the Incentive Payment Project. UNDP International and National Consultants will oversee the project and will evaluate the applications for incentive payments and make final recommendations on eligibility and the scale of the incentive payment.

b. Application for an Incentive Payment

Applications must be made using the official EUIP Application Form that can be obtained from the National Ozone Unit, (Ghana-EPA).

Completed applications for an incentive payment, together with all the necessary supporting documentation must be submitted to the National Ozone Unit in Ghana-EPA.

An end-user enterprise wishing to apply for an incentive payment must include the following information in its application for an incentive payment:

- Details of HCFC-22 and/or R406a purchases during one calendar years preceding the year of application used for the service and repair of the existing equipment that is to be addressed, (including copies of suppliers invoices).
- Details of the existing equipment that is to be addressed. These should include the function of the existing equipment, make, model, serial number, year of manufacture, capacity, HCFC/R406A charge, the year that the existing equipment was installed, as well as the price at purchase, etc. Copies of the purchase order and invoice for the existing equipment should be attached to the application (if available).
- Technical details and costs of the proposed replacement or retrofit technology, which must be based on proven and mature technology.
- Information on the current cost of the HCFC-22 and/or R406a refrigerant, and the current cost of the proposed replacement refrigerant.
- Information on any changes in refrigerating capacity that will occur as a result of the replacement or the permanent retrofit.
- Confirmation that the enterprise can meet established local safety, health, and environmental standards related to the new refrigerant (especially when they are flammable/explosive).
- Confirmation that the system will be leak-free.
- Details of the ownership of the enterprise, including the Nationality of shareholders.

The EUIP will operate from 2012 to 2014, or until the approved funds have been exhausted. Applications will be evaluated on a first-come first-served basis and an enterprise can only apply

once during the period, even if it has several refrigeration systems or, systems in different locations. However, an enterprise can include the replacement, or retrofit, of more than one of its refrigeration systems in its request for an incentive payment.

c. Scale of Incentive Payments

The scale of the incentive payments will be based on the following elements:

- The installed capacity of the equipment that needs to be replaced/retrofitted
- The consumption of HCFC-22/R406a during the last calendar year preceding the year of application calculated in Kilograms used for servicing and repair of the existing equipment that is to be replaced or permanently retrofitted. The calculation will be in metric (rather than ODP) tonnes.

The average annual consumption “C” for the purposes of this project will be calculated as follows:

$$“C” = \frac{\text{Installed Capacity} + \text{Average Annual Consumption}}{2}$$

The eligible scale of the incentive payment is determined from the consumption “C” as calculated above, and the following table:

Average between ‘installed capacity’ and ‘consumption’	Scale of Eligible Maximum Incentive Payment In US\$
1 - 3	Ineligible
3 – 20	up to 2,000
20 – 50	up to 5,000
50 – 100	up to 8,000
100 – 200	up to 11,000
200 – 300	up to 14,000
300 – 400	up to 17,000
>400	up to 20,000

The scale of the payable amount will be half in case the replacement refrigerant is a high-GWP one. While this clause may encourage retrofits to hydrocarbons, this latter option will however only be admissible where mature technologies to enable their use are available and where assurances are provided that adequate safety precautions will be taken..

Following completion of the replacement or permanent retrofit, the end-user enterprise must submit invoices to the NOU in Ghana-EPA to confirm the total costs incurred by the enterprise in existing equipment replacement, or retrofit. These invoices will relate to the purchase of capital cost items, to local works carried out by the enterprise, the cost of the initial charge of the replacement compressor lube oil, and to the cost of the initial new charge of the replacement refrigerant.

It should be noted that the scale of eligible incentive payments in the table above is based on 100 % National ownership (or other Article-5 Country) ownership of the enterprise. Eligible incentive payments for enterprises with part National or Article-5 Country ownership will be adjusted to reflect the percentage of National or Article-5 Country ownership of the enterprise.

To receive the eligible incentive payment in full, an end-user enterprise must be able to demonstrate that the total actual costs for the existing equipment replacement, or retrofit, are at least double the calculated eligible incentive payment based on “C” consumption as described above, or higher. In the case that the total costs for the conversion are less than the calculated maximum eligible incentive payment, then the incentive payment to the enterprise will be limited to the verified eligible costs incurred in the existing equipment replacement, or retrofit, divided by two (50%).

d. Existing HCFC-22 or R406a Refrigerant Charges

The existing HCFC or R406a refrigerant charges in existing equipment that is replaced or retrofitted, under the EUIP must be recovered under the Refrigerant Recovery & Retrofit Project (RRRP) being implemented under the auspices of the National Ozone Unit (NOU). To the extent possible, the refrigerant will be recovered or sent for destruction.

e. Destruction of Replaced Equipment

In case of equipment replacement, the replaced equipment must be destroyed/dismantled/rendered unusable with CFCs according to MLF policy decisions and guidelines. This must be certified in a Certificate signed by the Ozone Office in Ghana, the National Consultant, and the enterprise together with appropriate photographic evidence. The replaced equipment cannot be sold to another enterprise within Ghana, or abroad. However, the enterprise is permitted to retain any scrap value of the destroyed equipment.

f. Payment of the Eligible Incentive Payment

The submitted invoices will initially be reviewed by the National Consultant to ensure that all of the required information has been provided. The cost data, together with any comments from the National Consultant, will be reviewed by a local committee consisting of the NOU at Ghana-EPA, UNDP CO, as well as the National Consultant and any other as deemed appropriate, will be sent to the International Consultant for review and to make a formal recommendation on the eligible level of the incentive payment to the Ozone Office in Ghana and the local UNDP-office in Accra.

Up to 65% of the eligible incentive payment can be paid up front to the enterprise if the application and supporting documentation is found to be satisfactory and if the application itself is found to be acceptable and, upon provision of a guarantor.

The eligible balance will only be paid after the existing equipment has been replaced or permanently retrofitted, the total cost data has been reviewed and the International Consultant has made a formal recommendation on the actual level of the incentive payment, and formal certification that the existing equipment has been replaced or permanently retrofitted.

Upon payment of the incentive, the enterprise will sign a statement confirming that it will no longer be using HCFCs/R406a, in the equipment covered by the project.

g. Post-project monitoring

The National Ozone Unit (NOU) may sporadically conduct post-project implementation monitoring visits to enterprises that have received an incentive payment, to ensure that the enterprises do not return to the use of HCFCs or HCFC-based blends.