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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Fifty-second Meeting
Montreal, 23-27 July 2007

Addendum

HCFC SURVEYS IN ARTICLE 5 COUNTRIES (PRESENTED BY UNDP)

This document is issued to **add**:

- Executive summary for the HCFC survey reports of Malaysia, Sri Lanka and Syria; and
- HCFC country survey:
  Malaysia.

HCFC SURVEYS IN SELECTED COUNTRIES
(Malaysia, Sri Lanka, Syria)

SUMMARY AND PRELIMINARY CONCLUSIONS

APPROACH AND PREPARATION

1. The Executive Committee of the Multilateral Fund at its 45th Meeting, approved activities to be implemented by UNDP, which aimed to conduct limited surveys of HCFC use in selected countries, with a goal of enabling the Executive Committee to establish a national aggregate level of HCFC consumption in the future for these countries, against which projects and activities may be funded. The selected 12 countries were:

Latin America:	Argentina, Brazil, Colombia, Mexico, Venezuela
Middle East:	Lebanon, Syrian Arab Republic
South Asia:	India, Islamic Republic of Iran, Sri Lanka
Southeast Asia:	Indonesia, Malaysia

2. To ensure effective coordination of survey activities in this global project and to better address cross-regional issues, UNDP planned the activities to be carried out, using a three-stage process:

- Data collection and survey at the national level
- Compilation and analysis of survey data
- Presentation and reporting of survey data

3. The national-level data collection and survey work was carried out by local consultant entities (either an individual or a company/institution) in consultation with the national Governments. The compilation and analysis of the survey data was carried out through UNDP-appointed international experts. The presentation and reporting of survey data was carried out in consultation with the country governments, which in turn ensured the country-level consultations with and validations by national stakeholders such as the HCFC supply and consuming industry.

SURVEY METHODOLOGY

4. The data collection at the national level was initiated through interactions with major producers/suppliers/importers of HCFCs and HCFC-related chemical products and equipment. Industry associations were consulted where available. The current consumption of HCFCs in the various HCFC-consuming sectors, along with the number of HCFC users by sub-sector, was estimated and established.

5. Historical trends in HCFC consumption through various sources (e.g. CP progress data reporting, information from importers, etc.) were then established. Wherever feasible the historical consumption was allocated by sub-sectors. Trends in the future consumption of HCFCs were then projected by applying growth rate calculations based on existing GDP projections as well as individual considerations per sector and substance.

6. The national expert entity incorporated these data along with related forecasts, conclusions and recommendations into a draft report following an agreed template. This report was then reviewed by the international expert responsible for the region and subsequently forwarded through MPU to the Government for comments, policy considerations, final validation and endorsement before being submitted to the MLF Secretariat.

7. For the purpose of uniformity and to ensure completeness, following reporting template was developed:

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CURRENT STATUS

8. Nine out of the twelve countries completed the survey process and the HCFC Survey Reports for these nine countries (Argentina, Brazil, Colombia, Mexico, Venezuela, Islamic Republic of Iran, Lebanon, India and Indonesia) were submitted to and reviewed by the Executive Committee at its 51st Meeting held in March 2007. The remaining three countries (Malaysia, Sri Lanka and Syrian Arab Republic) have now completed the survey process, and their Survey Reports are submitted to the 52nd Executive Committee Meeting for review and consideration.

OBSERVATIONS

Institutional Frameworks

9. The descriptions of the existing institutional frameworks shows the progress participants have made in managing CFCs. It is considered feasible to apply these frameworks with certain adjustments to managing HCFCs. With respect to regulations, the existing regulations governing CFCs can be adapted to cover HCFCs. With respect to enforcement of regulations, the existing pool of enforcement officials trained during the course of implementation of CFC phase-out programmes, can be deployed for enforcement of regulations pertaining to HCFCs if and when such regulations evolve, with minimal additional inputs.

10. The participating countries appear prepared to take up these tasks from regulatory and managerial perspectives.

HCFC Supply Scenario

11. The HCFC consumption is calculated using the formula:

Consumption = Production + Imports – Exports.

12. The countries do not have indigenous production of HCFCs, nor do they report exports. HCFC import and consumption data has been provided for the period 1996-2005 (Malaysia) and 1999-2005 (Sri Lanka and Syria). The import and consumption figures are generally consistent with the Article-7 and Country Programme Progress data reporting.

13. HCFC imports occur through importers who are registered, authorized or otherwise known. HCFCs are distributed to consumers through secondary distributors or retailers and occasionally directly by importers.

14. There is currently no reporting or registration requirement specifically for HCFCs for importers, distributors, retailers and consumers in the three countries.

HCFC Consumption

15. HCFC consumption patterns by substance show the following distribution (2005) in the three countries:

Country	HCFC-22 (%)	HCFC-141b (%)	Other HCFCs (%)	Total (metric tonnes)
Malaysia	80	18	2	5,635
Sri Lanka	99	0.9	0.1	225
Syria	72	27	1	757
Overall	**80**	**19**	**1**	**6,617**

16. The Refrigeration and Air Conditioning Sector was the predominant consumer of HCFCs in the three countries. In 2005, in Malaysia it contributed to over 80% of the overall consumption (the Foams Sector contributed to about 18%), while in Sri Lanka and Syria it contributed to almost 100% of the consumption.

17. In Malaysia, almost 90% of the overall HCFC consumption is reported to originate in manufacturing activities and the balance in servicing. For Sri Lanka, manufacturing activities contributed about 15%, while in Syria, manufacturing activities contributed about 54% to the overall HCFC consumption (all figures for 2005).

ANALYSIS

Unconstrained Demand Projections

18. Unconstrained demand forecasts have been calculated using growth rates either based on past growth rates or expected growth rates based on national/sectoral growth rates using economic indicators. The table below summarizes the unconstrained growth scenario for these three countries:

Country	2005 Consumption (metric tonnes)	Growth Rate (%)	Unconstrained 2015 Consumption (metric tonnes)	Growth Factor (2015/2005)
Malaysia	5,635	3.90	8,261	1.466
Sri Lanka	225	10.00	530	2.356
Syria	757	10.00	1,965	2.596
Total/Avg	**6,617**	**4.81**	**10,756**	**1.626**

19. The unconstrained growth scenario indicates a substantial increase in HCFC consumption by 2015, by factors ranging from about 47% to 160% over the 2005 consumption levels.

Availability and Prices of HCFCs

20. None of the three countries report concerns on availability of HCFCs for the foreseeable future. The prices of HCFCs range from US$ 2.00 to US$ 4.00, depending on the type of HCFC and have remained steady in the past few years. The HCFC prices are expected to rise either due to inflation or due to increased demand with respect to supply or both. The projections for prices of HCFCs indicate that the HCFC prices would increase by 20-40% by 2015.

Technology

21. While the feasibility of substitute technologies has not been fully evaluated or established at each country level or for each application, the technology overview provided indicates that for most applications, prospective alternatives are identified based on trends in developed countries. For some of those applications (e.g. Foams), alternative technologies seem to be relatively more accessible.

22. Some of the identified alternatives to HCFCs are already available in the markets; however sustainable availability and favorable prices are not yet established. The prices of available substitutes are typically 4-5 times more than those of HCFCs at present.

Environmental Impact

23. The impacts of current and unconstrained consumption of HCFC until 2015, on ozone depletion as well as global warming have been presented. The incremental impacts on ozone depletion and global warming for the three countries, due to unconstrained demand between 2005 and 2015 are tabulated below:

Country	Increase in Ozone Depletion (ODP tonnes)	Increase in Global Warming (Tonnes/Tonne CO_2)
Malaysia	170.42	4,072,630
Sri Lanka	17.04	542,297
Syria	65.39	1,972,410
Total	**252.85**	**6,587,337**

Compliance Challenges and Opportunities

24. The major challenges in the three countries, which are foreseen as constraints for early conversion from HCFCs to alternatives, are as below:

- Relatively adequate supply of HCFCs at reasonable prices until 2015
- High cost and inadequate availability of alternatives
- Inadequate technical and financial capacity to manage the transition
- Lack of awareness on the impending HCFC controls and available alternatives, as well as their impact on processes, practices and the environment.

25. The opportunities to meet the compliance requirements are mentioned as below:

- Experience gained and lessons learnt in phasing out CFCs
- Infrastructures established for managing CFC phase-out can be partially applied towards achieving HCFC reductions
- Technical and financial assistance for managing the transition from HCFCs to substitutes

Potential Compliance Measures

26. The potential compliance actions mentioned for meeting the 2016 freeze in HCFC consumption include the following:

- Preparation of a comprehensive strategy and action plan for compliance with the freeze in HCFC consumption from 2016
- Prioritize identification of sectors and applications where HCFC demand can be cost-effectively reduced at an early date by implementing technology conversions, best practices, conservation, etc.
- Existing infrastructures created for reducing CFC demand could be appropriately leveraged for reducing HCFC demand, through additional equipment inputs and investments, technical assistance, training, capacity-building, etc.
- Promoting use of drop-in substitutes could be promoted to reduce HCFC demand at end-users installations.
- Intensive awareness programmes incorporating compliance obligations, information dissemination on alternative technologies, networking and information exchange and technical assistance, to sensitize stakeholders on the importance of taking early actions for compliance
- Adequate technical assistance and training is provided to stakeholders in the government and industry, to make informed decisions and choices about HCFC reductions and HCFC management.

27. The three countries stress the need for adequate technical and financial assistance to mitigate the incremental costs of these actions.

CONCLUSIONS

28. The broad conclusions of the surveys in these three countries were as below:

- The Refrigeration and Air Conditioning Sector is the predominant consumer of HCFCs, followed by the Foams Sector. HCFC-22 is the dominant substances followed by HCFC-141b.

- Unconstrained demand for HCFCs from 2006 to 2015 would lead to increases over the current consumption ranging from about 47% to 160%. This will have significant impacts on ozone depletion as well as global warming.

- The availability and costs of HCFCs are expected to remain favorable for the foreseeable future. In conjunction with the high prices and uncertain availability of HCFC substitutes, this presents a major constraint in complying with the 2016 freeze. Experience gained in CFC phase-out and the institutional and technical infrastructures created in the process, are seen as major opportunities for meeting with the 2016 freeze on HCFC consumption.

- Potential compliance measures include development of comprehensive country-specific strategies and action plans for HCFC management and phase-out, prioritizing

sectors and applications where HCFC use reductions can be achieved by technology conversions and drop-in substitutes, promoting awareness, technical assistance and training programmes for stakeholders, etc.

SURVEY OF HCFCs IN MALAYSIA

FINAL REPORT

PREPARED BY

Ozone Protection Section, Department of Environment, Malaysia
and
United Nations Development Programme (UNDP)

July 2007

EXECUTIVE SUMMARY

Malaysia acceded to the Vienna Convention in 29 August 1989 and ratified the Montreal Protocol on Substances that deplete the Ozone Layer in 29 August 1989.

The annual calculated consumption in Malaysia of controlled substances listed in Annex-A of the Montreal Protocol was less than 0.3 Kg per capita. Malaysia was therefore classified as a party operating under Paragraph-1, Article-5 of the Montreal Protocol and thus qualified for technical and financial assistance, including transfer of technology, through the financial mechanism of the Montreal Protocol.

Malaysia's Country Programme incorporating the national strategy and action plan for controlling the use of Ozone Depleting substances was approved at the 6th Meeting of the Executive Committee of the Multilateral Fund for Implementation of the Montreal Protocol in June 1990. Until date, Malaysia is in compliance with the Montreal Protocol control schedule for Annex-A, B and E substances, through a combination of projects and programs featuring technology transfer investments, technical assistance, training & capacity building, information dissemination and awareness-raising and institution of a proactive regulatory framework. In compliance with Article-4B of the Montreal Protocol incorporated through the Montreal Amendment, Malaysia has established a licensing system for import and export of Annex-A, B, C and E controlled substances, which includes recovery, recycling and reclamation. All importers and exporters of these substances are required to register and obtain licenses which are issued based on annual quotas and are subject to reporting requirements.

Hydrofluorocarbons (HCFCs) are classified as controlled substances under Annex-C Group-I of the Montreal Protocol and therefore their use has to be controlled and eventually phased out. In accordance with the control schedule of the Montreal Protocol for Article-5 countries, production and consumption of HCFCs will be subject to a freeze at 2015 levels from 01 January 2016 and are required to be completely eliminated by 2040. HCFCs are used in Malaysia in the Foams and Refrigeration & Air Conditioning sectors. The predominant HCFCs used are HCFC-22 and HCFC-141b.

Due to the sustained growth in the middle-class population and consequent growth in demand for consumer and commercial products, the consumption of HCFCs in Malaysia increased from about 4,321 metric tonnes in 1998 to 5,635 metric tonnes in 2005, signifying an average annual growth rate of about 3.9%. Since 1999, the consumption of HCFCs has remained stable around 5,500 metric tonnes. At a conservative annual growth rate in demand forecasted for HCFCs of 3.9% from 2006 until 2015, it is estimated that the consumption of HCFCs in Malaysia is likely to reach about 8,261 metric tonnes by 2015. HCFCs additionally have a global warming impact due to their high global warming potential (GWP).

Actions to control and reduce consumption of HCFCs to ensure compliance with the 2016 freeze would need to be formulated and initiated at an early date. Challenges and constraints for such actions include sustained and cost-effective availability of environment-friendly substitutes for HCFCs and access to technology and funding to facilitate transition without undue burden on the economic health of the country and on the consumers and industry. Malaysia expects that the international community will recognize these challenges and provide the requisite technical and financial support for realizing this transition.

SURVEY OF HCFCs IN MALAYSIA

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AP	Application Import Permit
CFC	Chloro Fluoro Carbons
CP	Country Programme
CTC	Carbon Tetra Chloride
DOE	Department of Environment
ExCom	Executive Committee of the Multilateral Fund
GTZ	Gesellschaft für Technische Zusammenarbeit, Germany
GWP	Global Warming Potential
HCFCs	Hydrochlorofluorocarbons
IA	Implementing Agency
MAC	Mobile Air Conditioning
MITI	Ministry of International Trade and Industry
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MP	Montreal Protocol
MT	Metric Tonnes
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
R&R	Recovery and Recycling
SMEs	Small and Medium-sized Enterprises
TR	Tons of Refrigeration
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNOPS	United Nations Office for Project Services
WB	World Bank

1. INTRODUCTION

1.1 BACKGROUND

Malaysia is a tropical peninsular country in southeastern Asia, bordering Brunei, Thailand, Malaysia, Singapore and the South China Sea, with a coast line of about 4,700 km. The total land area is about 329,000 sq. km and with a population of about 24 million (2006). The population density is about 211 persons per sq. km and urban population is about 65% of the total population. The per capita GDP (PPP) was about US$ 12,700 in 2006, with agriculture accounting for 8.3%, industry about 48.1% and services contributing to 43.6% of the GDP.

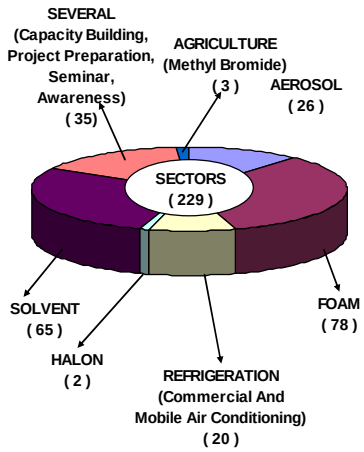
Malaysia ratified the Vienna Convention and Montreal Protocol on Substances that Deplete the Ozone Layer in August 1989. The table below shows the dates of ratification by Malaysia of the Montreal Protocol and its amendments:

Table-1: Malaysia – Dates of Ratification of Montreal Protocol and Amendments

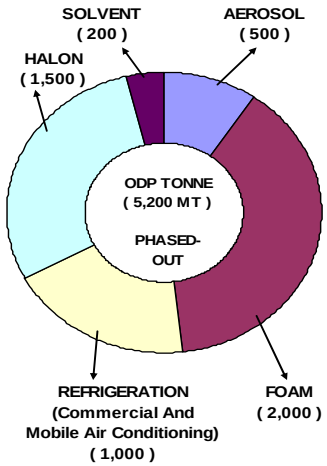
Agreement/Amendment	Date of Ratification
Vienna Convention	29 August 1989
Montreal Protocol	29 August 1989
London Amendment	16 June 1993
Copenhagen Amendment	05 August 1993
Montreal Amendment	26 October 2001
Beijing Amendment	26 October 2001

Malaysia's Country Programme reflecting the national strategy and action plan for controlling the use of ozone depleting substances, was approved at the 6th Meeting of the Executive Committee of the Multilateral Fund for Implementation of the Montreal Protocol in 1992. The Country Programme prioritized ODS phase-out activities in the main ODS consuming sectors, through technology transfer investments, technical assistance, capacity building, and training. The figure below shows the overview of activities and ODS phased out since the approval of the Country Programme:

Figure-1: ODS Phase-out Activities in Malaysia (1992-2001)



Number of Activities



ODS Phase-out

Malaysia's Country Programme Update was prepared in 1995. The Country Programme Update reassessed the ODS consuming sectors in Malaysia, reviewed the progress made in ODS phase-out and identified further activities needed for the future, thus renewing Malaysia's commitment for complying with the Montreal Protocol control targets and obligations.

Malaysia prepared a National CFC Phase-out Plan for addressing the phase-out of all remaining consumption of Annex-A Group-I substances (CFCs) and also CTC/TCA by 2010. This was approved at the 35th Meeting of the Executive Committee in December 2001. The National CFC Phase-out Plan is a performance-based multi-year agreement between Malaysia and the Executive Committee, which will enable Malaysia to comply with the 2005, 2007 and 2010 control milestones of the Montreal Protocol.

HCFCs, which have Ozone Depleting Potential (ODP) up to 15% of that of CFCs, are also classified as controlled substances under Annex-C, Group-I of the Montreal Protocol. HCFCs therefore, have use restrictions and would eventually have to be phased-out. For developing countries, the scheduled phase-out date for HCFCs is 01 January 2040 with an interim control measure of freezing HCFC production and consumption at 2015 levels, from 01 January 2016. HCFCs being controlled substances, projects or activities leading to reductions of HCFCs may be eligible for funding by the Multilateral Fund at a future date.

HCFCs have been approved as substitutes for CFCs in many of the projects and activities supported by the Multilateral Fund. However, recently, restrictions on HCFC use have been increasingly adopted by developed countries. This may potentially affect availability of HCFCs in developing countries, especially those which do not produce HCFCs. Considering the increasing demand for HCFCs, and considering the imminent restrictions on HCFCs, including the 2016 freeze in consumption for Article-5 countries, the user industry needs to be equipped to address the technology and environmental issues arising from HCFC use reductions. Moreover, actions to reduce HCFC consumption may need to be initiated sooner rather than later. Recognizing these challenges, the ExCom approved at its 45th Meeting, funding for UNDP to carry out HCFC surveys in 12 countries. Malaysia is one of the countries which requested to be a part of this activity.

1.2 APPROACH AND PREPARATION

The Executive Committee of the Multilateral Fund at its 45th Meeting approved a project to be implemented by UNDP, which aims to conduct a limited survey of HCFC use in selected countries, with a goal of enabling the Executive Committee to establish a national aggregate level of HCFC consumption against which future projects and activities may be funded. The selected countries are:

Latin America:	Argentina, Brazil, Colombia, Mexico, Venezuela
Middle East:	Iran, Lebanon, Syria
South Asia:	India, Sri Lanka
Southeast Asia:	Indonesia, Malaysia

To ensure effective coordination of survey activities in this global project involving 12 countries and to better address cross-regional issues, UNDP planned the activities to be carried out, using a three-stage process:

- Data collection and survey at the national level
- Compilation and analysis of survey data
- Presentation and reporting of survey data

The national-level data collection and survey work was to be carried out through recruitment of a local consultant entity (either an individual or a firm/institution) recommended by the respective governments. The compilation and analysis of the survey data was carried out through UNDP's international experts to impart credibility and quality. The presentation and reporting of survey data was carried out in consultation with the country governments, which in turn ensured the required country-level consultations within the respective industry and expert institutions.

UNDP, in consultation with the Department of Environment and the National Ozone Unit selected a local firm, Centre for Environmental Technologies (CETEC) to undertake the implementation of the tasks for the survey.

1.3 SURVEY METHODOLOGY

Data Collection

Data collection was carried out from both the supply and demand side. From the supply side, data on importers and suppliers were obtained from:

a) Department of Environment.
b) The Internet

These importers and suppliers provided data of quantities and types of HCFCs brought into and used in Malaysia.

(i) From the demand side, names of dealers/users where possible were obtained from:

(ii)

a) HCFC suppliers
b) HCFC service sector
c) HCFC end-users

In addition to the data from suppliers and users, cross-checking was carried out on the information from different sources, including the local UNDP office and also on the current various applications for usage of these HCFCs in the market in order to understand in which sectors they are being used.

A questionnaire in the prescribed format was used to solicit information from the various sectors during the data collection period in order to ascertain:

- Estimated types and amounts of HCFCs in the market,
- Current application of these HCFCs in the various sectors,

Consultations with the National Ozone Unit located at the Department of Environment and the local UNDP office were carried out throughout the survey period.

Data Processing and other activities

1. Finalization of questionnaire to be used to collect the required information from the users and suppliers of HCFCs.

2. Develop list of sources of information. In addition to DOE, Customs Department and Ministry of International Trade and Industry (MITI), past relevant seminars/workshops and projects were referenced to obtain additional contacts.

3. Develop initial list of suppliers and users. The information available was compiled into a list of names for contacting for the survey.

4. Contact was made by telephone, fax, and through meetings. The questionnaire was used as necessary

5. A HCFC workshop was organised in Kuala Lumpur to inform key stakeholders on the status of HCFC uses and alternatives available, as well as to brief them on the results of the survey and obtain their feedback.

6. A survey summary paper on HCFC supply and application was prepared and presented at the HCFC workshop held in September 2006.

7. Feedback obtained from various stakeholders was incorporated into the draft final report.

2. OBSERVATIONS

2.1 INSTITUTIONAL FRAMEWORK

2.1.1 Institutional Arrangements

The Ozone Protection Section under the Air Division within the Department of Environment, Ministry of Natural Resources and Environment, acts as the national focal point for Montreal Protocol. The Ozone Protection Section appoints local experts or consultants for various activities as defined in its phase-out programmes, to support its work.

A National Steering Committee comprising of relevant Ministries, Departments and Industry representatives meet at least once a year to provide direction to the NOU and endorse the country programme and activities. Sub-groups on MDI, Aerosol, Refrigeration, MAC, Solvent, Foam, Halons and Methyl Bromide had been formed to address the concerns of the main sectors affected by the phase-out programme and these sub-groups are also represented on the National Steering Committee.

2.1.2 Policies and Regulations

Government of Malaysia has developed proactive policies and regulations, for controlling the use of ODS. Under the umbrella legislation, namely the Environment Quality Act 1974, the Department of Environment has promulgated a set of regulations administered by the DOE for controlling the use of specified ODS:

- The Environmental Quality (Prohibition on the Use of Chlorofluorocarbons and other Gases as Propellants and Blowing Agents) Order 1993: This controls the manufacture of aerosols and plastic foams using specified ODS

- The Environmental Quality (Refrigerant Management) Regulations, 1999: This prohibits the use of CFCs in new installations of building chillers, refrigeration systems and mobile air conditioning systems and controls the venting of CFCs. The regulation also extends this control to the firefighting sector, prohibiting use of Halons in new installations of fire protection systems

One of the primary systems of controls on ODS is the Application Import Permit System (AP System), which is administered by the Ministry of International Trade and Industry (MITI).

Since its introduction in 1994 under the Prohibition of Import (Amendment No. 4) Order, 1994 of the Customs Act, 1967, all importers of the listed ODS, namely CFC-11, CFC-12, CFC-13, CFC-113, CFC-114, CFC-115, carbon tetrachloride (CTC) and 1,1,1-trichloroethane (TCA) must obtain an import permit issued by MITI. The total quantity of any of these substances that can be imported in any year is set by MITI in consultation with DOE. The amount is reduced each year in line with the Montreal Protocol obligations.

Presently the AP system does not control mixtures such as R-502 and other controlled substances such as HCFCs.

2.2 HCFC SUPPLY SCENARIO

2.2.1 Production

Malaysia does not produce any HCFCs.

2.2.2 Exports

Malaysia does not export HCFCs.

2.2.3 Imports

HCFCs are imported into Malaysia through about fourteen authorized importers. The imports typically are sourced mainly from China, EU, India, Japan, Singapore, Taiwan and USA. The historical imports of various HCFCs from 1996 to 2005 are depicted in the table below:

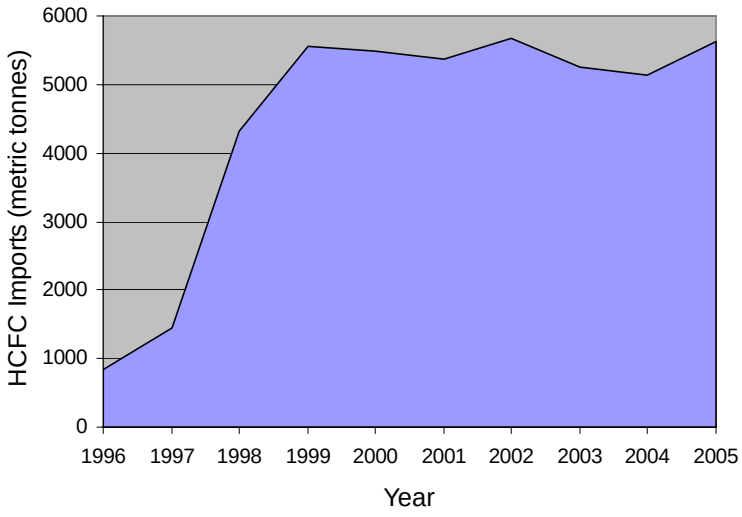
Table-2: HCFC Imports in Malaysia (1996-2005)

Year	HCFC Imports (metric tonnes)						
	HCFC-21	HCFC-22	HCFC-123	HCFC-141b HCFC-142b	HCFC-225	Other HCFCs	Total
1996	1	782	8	46	4	0	**841**
1997	48	1,050	25	227	81	25	**1,456**
1998	2	3,580	37	641	19	42	**4,321**
1999	17	4,530	22	887	19	80	**5,555**
2000	0	4,867	43	571	17	0	**5,498**
2001	0	4,679	66	574	24	28	**5,371**
2002	0	5,001	37	572	53	11	**5,674**
2003	0	4,488	18	738	4	3	**5,251**
2004	0	4,173	0	925	35	0	**5,133**
2005	30	4,553	60	1,007	13	2	**5,635**

Note: *All figures are rounded off to the nearest one metric tonne*

The figure below graphically depicts the HCFC imports in Malaysia from 1996 to 2005:

Figure-2: HCFC Imports in Malaysia (1996-2005)



2.2.4 Distribution and supply chain

The HCFCs brought in by the importers are normally passed to their dealers who distribute the chemicals to their customers. The consumption of HCFCs in Malaysia being substantial, HCFCs are also supplied through service establishments and contractors.

2.3 HCFC CONSUMPTION

2.3.1 Aerosols Sector

There is no identified use or reported consumption of HCFCs in the Aerosols Sector from 2003 to 2005.

2.3.2 Foams Sector

The use of HCFCs in the Foams Sector is mainly as a blowing agent for rigid polyurethane foam and integral skin foam applications. HCFC-141b is the most commonly used technology for polyurethane foam in Malaysia, followed by HCFC-142b (in combination with HCFC-22). HCFC-141b is often pre-blended in the polyols used in the manufacture of foams. As a result, the quantity of direct imports of HCFC-141b may not indicate the actual amount of HCFC-141b consumed in the production of foams.

In 2005, the Foams Sector accounted for about 18% of the overall HCFC consumption in Malaysia and is the second largest consumer of HCFCs after the Refrigeration and Air Conditioning Sector.

From historical import data it is clear that the consumption of HCFCs in the Foams Sector has increased substantially over the past decade, estimated at about 10-15% growth annually. In the past three years, the HCFC consumption in the Foams Sector increased from 736 metric tonnes in 2003 to 1,012 metric tonnes in 2005, signifying an average annual growth rate of about 11%. The table below shows this trend:

Table-3: HCFC Consumption in the Foams Sector (2003-2005)

Year	2003	2004	2005
HCFC Consumption (metric tonnes)	736	925	1,012

The increased use of HCFCs in the Foams Sector is attributed partly to conversions from the earlier CFC-based technology under the Montreal Protocol programme. In addition, several manufacturers established HCFC-based manufacturing capacity directly.

It is estimated that there are around 150-200 manufacturers in the Foams Sector in Malaysia. Over 100 of these converted their CFC-based production to HCFC-based technology with assistance from MLF.

2.3.3 Firefighting Sector

There is no identified use or reported consumption of HCFCs in the Firefighting Sector from 2003 to 2005.

2.3.4 Refrigeration & Air Conditioning Sector

The Refrigeration and Air Conditioning Sector in Malaysia is by far the largest consumer of HCFCs, accounting for an estimated 80% of the overall HCFC consumption in Malaysia during 2005. The HCFC consumption in this Sector in Malaysia has grown rapidly at an average rate of about 19% over the past decade. This significant growth in has been due to the consistent growth in the per capita incomes, the predominance of the service industry and the relatively low market penetration of refrigeration and air conditioning appliances and equipment in the past.

HCFCs (HCFC-22, HCFC-123) are used as refrigerants and blowing agents (HCFC-141b) in the manufacture of refrigeration and air conditioning equipment. For appliances such as comfort air conditioning equipment, HCFC-22 has been the traditional refrigerant. For central air conditioning chillers, HCFC-123 was a popular refrigerant in centrifugal equipment. For commercial and industrial refrigeration equipment, HCFC-22 has been used both as a traditional refrigerant as well as a replacement refrigerant for CFC-12.

Manufacturing

The manufacturing activities in the Refrigeration and Air Conditioning Sector comprise of comfort air conditioning equipment (such as window and split air conditioners and central air conditioning chillers) and commercial/industrial refrigeration equipment (such as household refrigerators, display cabinets, chest freezers, beverage chillers, walk-in coolers and cold rooms).

Servicing

There is a significant existing population of domestic, commercial, industrial and transport refrigeration appliances, equipment and systems requiring servicing. Also, due to economic growth, there are several office buildings and complexes served by HCFC-based chillers for central air conditioning, which require servicing. There are a number of cold room installations serving hotels, hospitals, restaurants, food industry for preserving, fruits and vegetables, and other perishables. Many of these installations are HCFC-based. As a result, there is a fast growing servicing sector comprising of a large number of servicing establishments.

The table below shows the breakdown of HCFC consumption in the Refrigeration and Air Conditioning Sector in Malaysia for 2005:

Table-4: Estimated Breakdown of HCFC Consumption in the Refrigeration and Air Conditioning Sector (2005)

Application	HCFC Consumption (metric tonnes)
Manufacturing	
Comfort Air Conditioning	1,000
Chillers	500
Domestic Refrigeration	140
Commercial Refrigeration	1,587
Industrial Refrigeration	1,000
Servicing	
Servicing (all applications)	429
Total	**4,656**

2.3.5 Solvents Sector

Although there is no reported consumption of HCFCs in the Solvents Sector in Malaysia during 2003 to 2005, ODS import data for 2005 indicates import of 12.63 metric tonnes of HCFC-225, which is predominantly used as a cleaning agent. This consumption has been recorded under the Refrigeration and Air Conditioning Sector indicating its likely use as a cleaning agent in that sector.

2.3.6 Summary and Conclusions

HCFC imports into Malaysia have rapidly increased over the past decade, from 841 metric tonnes in 1996 to about 5,635 metric tonnes in 2005. The imports remained relatively stable since 1999, around 5,500 metric tonnes.

The HCFC consumption in Malaysia is mainly concentrated in the Foams and Refrigeration and Air Conditioning sectors. The predominant HCFCs used are HCFC-141b and HCFC-22. HCFC-141b is used as a blowing agent in rigid polyurethane foam and HCFC-22 as a refrigerant.

The Foams and Refrigeration/Air conditioning sectors currently account for the bulk of HCFCs used in Malaysia. The Foams Sector accounted for about 18% and the Refrigeration and Air Conditioning Sector accounted for over 80% of the total HCFC consumption in Malaysia during 2005.

Both the Foams and Refrigeration and Air Conditioning Sectors have experienced significant growth in the past decade. In the Foams Sector, the HCFC consumption increased at an average annual rate of 10-15%, while the HCFC consumption in the Refrigeration and Air Conditioning Sector increased at an average annual rate of 19%.

Due to the significant existing as well as growing population of HCFC-based refrigeration and air conditioning equipment, there is a fast growing servicing sector, which is expected to account for increased demand for HCFCs to service this equipment.

3. ANALYSIS

3.1 DEMAND FORECASTS

The overall HCFC demand in Malaysia as indicated by imports increased from about 841 metric tonnes in 1995 to 5,635 metric tonnes in 2006. However, in the past few years, the demand has been steady at around 5,500 metric tonnes. Thus, to establish a more realistic average historical growth rate, it would be useful to consider the growth from 1998 (4,321 metric tonnes) until 2005 (5,635 metric tonnes). This translates to an average annual growth of about 3.9%.

The demand for HCFCs in Malaysia is expected to continue to grow steadily due to the expected economic growth and consequent rise in demand for consumer and industrial goods. HCFC-22 and HCFC-141b are, and will remain the most significant HCFCs in use in Malaysia. Future HCFC-22 and HCFC-141b consumption in Malaysia is linked to the growth of the Foams and Refrigeration and Air Conditioning sectors. In addition, conversion of some of the residual CFC consumption to HCFCs, as well as expansion of capacity of manufacturing HCFC-based equipment will contribute to growth. Also increasing population of HCFC-based products will increase servicing demand. Based on this, it is possible to make projections of unconstrained future demand for HCFCs until 2015.

Applying an average annual growth rate in demand of 3.9% from 2006 to 2015, which is the expected average growth rate in demand in both the Foams and Refrigeration & Air Conditioning Sectors, the unconstrained HCFC consumption in Malaysia is expected to reach 8,261 metric tonnes by 2015. The following table shows the unconstrained demand for HCFCs:

Table-5: Projected unconstrained demand for HCFCs in Malaysia by 2015

Substance	**Demand in 2005** (metric tonnes)	**Unconstrained demand in 2015** (metric tonnes)
HCFCs	5,635	8,261

3.2 AVAILABILITY AND PRICES

3.2.1 Availability Scenario

Due to increasing restrictions on HCFC use in developed countries, many of which would be in place by 2010, it is expected that the future source of HCFCs would mainly be developing country producers, such as India and China. Based on market information, there is adequate manufacturing capacity in these countries to cater to the increased demand. It is also possible that some of the manufacturing capacity in developed countries could shift to developing countries. In view of these factors, it does not appear that there would be constraints on the availability of HCFCs in Malaysia by 2015.

3.2.2 Price Trends

In 2005, the average cost of HCFC-22 was RM 7.44 (US$ 2.20) per kg and for HCFC-141b it was RM 6.13 (US$ 1.80) per kg. The retail prices would be about 10-15% higher. These prices are expected to remain stable, except for inflation, for the next few years.

The projections are based on the assumption that the production and supply situation for HCFCs will not dramatically change for the foreseeable future. This is indeed likely to be the case as there is adequate manufacturing capacity for HCFCs in developing countries such as China and India. If production in developed countries is reduced, it is unlikely to affect the supply situation, as corresponding consumption controls are also in place in developed countries. Currently there are no consumption controls on HCFCs in developing countries (until the first control in 2016).

Thus it is seen that the prices of HCFCs in Malaysia in 2015 would not be significantly higher, reflecting the relatively comfortable supply situation.

Substitutes for HCFCs are available, though not commonly used. The prices of substitutes vary between US$ 8.00 to US$ 15.00 per kg.

3.3 TECHNOLOGY

The selection of the alternative technologies would be governed by the following considerations:

a) Proven and reasonably mature technology
b) Cost effective conversion
c) Easy availability of substitutes, at acceptable pricing
d) Critical properties to be maintained in the end product
e) Meeting established local and international standards on environment and safety

In addition to zero ODP, it is preferable that the alternatives either have low GWP and/or sufficiently higher energy efficiency to compensate for the higher GWP.

3.3.1 Replacements for HCFC-141b

HCFC-141b is used predominantly as a blowing agent for polyurethane foam, in which rigid foam insulation is the main application. It is also used as a propellant in aerosols.

In **rigid polyurethane foams**, comparison of properties of major currently available alternative blowing agents to HCFC-141b is shown below:

Table-6: Comparison of Zero-ODP alternatives to HCFC-141b in rigid polyurethane foam

Parameter	HCFC-141b	Cyclopentane	HFC-134a	HFC-245fa	HFC-365mfc
Boiling Point (°C)	32	49	-26.5	15.3	40.2
ODP	0.11	0	0	0	0
GWP	630	11	1,300	820	840
VOC	No	Yes	No	No	No
Conductivity (W/m-K)	9.70	12.00	13.6	12.2	10.6
Flash point (°C)	None	-37	None	None	-25
Flammability (% vol)	7.4 - 15.5	1.5 – 8.7	None	None	3.5 – 13.0

HFC-245fa and HFC-365mfc have been commercially introduced in the last few years in the US and other developed countries and their performance has been largely established, however their prices are still high and availability is not wide. Their application may involve some changes to existing processing equipment. Since HFC-365mfc is flammable, safety issues need to be addressed.

Pentane isomers including Cyclopentane are in commercial use, however, due to their flammability, their use is limited to high-volume applications in organized sectors, where additional challenges and costs for safety can be more effectively managed.

HFC-134a is not popularly applied in rigid polyurethane foams, where thermal conductivity is a critical property, due to its relatively lower insulation performance and also its poor miscibility with polyols.

Recent commercial introduction of additional organic chemicals (Methylal, Methyl Formate) as blowing agents for in rigid polyurethane foam systems has generated interest. While field validation of these technologies continues, safety issues resulting from their flammability need to be addressed.

In **integral skin polyurethane foams**, alternatives to HCFC-141b include water/CO_2 blown systems, as well as HFC-134a, both of which have been commercially applied for the last few years.

3.3.2 Replacements for HCFC-22

HCFC-22 is primarily used as a refrigerant in refrigeration and air conditioning systems.

In general, pure fluid alternatives are preferred, as they tend to provide stable and predictable performance, more efficient heat transfer, avoid temperature glides in the evaporator and have relatively less issues from leakage. On the other hand, blends can be better optimized for performance, but are accompanied by less efficient heat transfer, evaporator temperature glide and leakage issues.

New Equipment

Table-7 below shows available alternative technologies to HCFC-22 for new equipment.

Table-7: Select Zero-ODP Alternatives to HCFC-22 in New Equipment

Substance	GWP	Application	Remark
Hydrocarbons	0	Small-capacity domestic and commercial refrigeration equipment	Flammability issues
Ammonia	0	Industrial refrigeration and process chillers	Flammability and toxicity issues
CO_2	0	Supermarket refrigeration in a secondary loop and in stationary and mobile air conditioning systems	Major redesign of system components needed.
HFC-134a	1,300	Domestic and commercial refrigeration, medium temperature applications	Not efficient in low-temperature systems. Needs synthetic lubricants
R-407C	1,520	Most applications	Properties closely match HCFC-22 Temperature glide, synthetic lubricants needed, slightly less efficient than R22
R-410A	1,710	Most applications	Higher pressures, better cooling capacity, low temperature glide, high GWP, synthetic lubricants needed
R-404A	3,260	Low temperature applications	High GWP, less efficient at medium temperatures, synthetic lubricants needed

Existing Equipment

For replacement of HCFC-22 in existing systems, the main considerations are compatibility with the lubricant, performance and ease of retrofitting. Table-8 below shows the available technologies for replacing HCFC-22 in existing systems as drop-in replacements:

Table-8: Select Zero-ODP Alternatives to HCFC-22 in Existing Equipment

Substance	GWP	Application	Remark
Hydrocarbons	0	Small-capacity commercial refrigeration equipment	Flammability issues
R-417A	1,950	Residential and commercial air conditioning and commercial refrigeration	Slightly less efficient than R22, High temperature glide, high GWP, compatible with mineral oil
R-422D	2,290	Low and medium temperature commercial refrigeration, water chillers	About 5% less cooling capacity, lower discharge temperature and comparable efficiency with R22, high GWP, compatible with mineral oil
R-424A (RS-44)	NA	Most applications	Comparable performance to R22, compatible with mineral oil, lower discharge temperatures than R22

Most of the blends described have been recently introduced in the past 1-4 years. While being commercially available, their prices are still quite high and supplies are not predictable at present. It is expected that the prices and availability would improve as the demand for HCFC-22 replacements gathers more momentum.

3.4 ENVIRONMENTAL IMPACT

Table-9 below shows the impact of HCFC-141b and HCFC-22 consumption in Malaysia between 2005 and 2015, in terms of ODP and GWP. It can be seen that unconstrained demand would increase ozone depletion by 102.42 ODP tonnes and increase global warming by 2,447,160 tonnes/tonne CO2 by 2015.

Table-9: Environmental Impact of HCFC Consumption by 2015

HCFC	ODP	GWP	Impact 2005			Impact 2015		
			Demand	ODP	GWP (MT/MT CO2)	Demand	ODP	GWP (MT/MT CO2)
HCFC-141b	0.11	630	1,007	110.77	634,410	1,476	162.36	929,880
HCFC-22	0.056	1,780	4,553	254.97	8,104,340	6,675	373.80	11,881,500
Total			**5,560**	**365.74**	**8,738,750**	**8,151**	**536.16**	**12,811,380**

The above figures do not account for the GWP of substitutes to HCFCs. The atmospheric lifetimes for HCFCs and their substitutes are also not considered.

From the above it is clear that unconstrained demand of HCFCs until 2015 would increase ozone depletion and global warming by about 28% by 2015, thus resulting in significant environmental impacts.

3.5 COMPLIANCE CHALLENGES AND OPPORTUNITIES

The major challenges, which are foreseen as constraints for early conversion from HCFCs to alternatives, are as below:

- Relatively adequate supply of HCFCs at reasonable prices until 2015
- High cost and inadequate availability of alternatives
- Inadequate technical and financial capacity to manage the transition
- Lack of awareness on the impending HCFC controls and available alternatives, as well as their impact on processes, practices and the environment.

The opportunities to meet the compliance requirements are as below:

- Experience gained and lessons learnt in phasing out CFCs
- Infrastructures established for managing CFC phase-out can be partially applied towards achieving HCFC reductions
- Technical and financial assistance for managing the transition from HCFCs to substitutes

3.6 POTENTIAL COMPLIANCE MEASURES

The potential interventions that would assist in meeting with the next control milestone for HCFCs under the Montreal Protocol, i.e., the freeze in consumption at 2015 levels by 2016, are as below:

- Preparation of a comprehensive strategy and action plan for compliance with the freeze in HCFC consumption from 2016 and progressive reductions thereafter. Such a strategy and action plan could include and prioritize identification of sectors and applications where HCFC demand can be cost-effectively reduced at an early date by implementing technology conversions, best practices, conservation, etc. Existing infrastructures created for reducing CFC demand could be appropriately supplemented for reducing HCFC demand, through additional equipment inputs and investments, technical assistance, training, capacity-building, etc. In addition, use of drop-in substitutes could be promoted to reduce HCFC demand at end-users installations.

- Intensive awareness programmes incorporating compliance obligations, information dissemination on alternative technologies, networking and information exchange and technical assistance, would be needed to sensitize stakeholders on the importance of taking early actions that would ensure compliance

- It would be crucial to ensure that adequate technical assistance and training is provided to stakeholders in the government and industry, to make informed decisions and choices about HCFC reductions and HCFC management.

The incremental costs involved in implementing these compliance measures would need to be adequately funded under the existing Montreal Protocol mechanisms, so that these costs are not a burden on the consumers and industry.

3.7 SUMMARY AND CONCLUSIONS

In Malaysia, HCFC-22 and HCFC-141b are the predominant HCFCs used, in the Foams and Refrigeration & Air Conditioning sectors. HCFC-141b is used as a blowing agent for rigid polyurethane foams and HCFC-22 is used as a refrigerant for refrigeration and air conditioning systems.

Malaysia's consumption of HCFCs increased from 4,321 metric tonnes in 1998 to 5,635 metric tonnes in 2005, signifying an average annual growth rate of about 3.9%. Assuming that this annual growth rate of 3.9% continues from 2006 to 2015, the unconstrained HCFC consumption in Malaysia is expected to reach 8,261 metric tonnes by 2015, leading to additional environmental impacts through ozone depletion and global warming.

It appears that the availability and costs of HCFCs would remain favourable for the next few years. This is seen as one of the potential barriers for compliance with the 2016 freeze in consumption. Potential replacements for HCFCs include hydrocarbons and HFCs/HFC blends. Their availability and techno economic feasibility are not yet favourably established for wider use. Lack of information and awareness about alternatives is another barrier for their application. Lessons learnt and experience gained during implementation of the CFC phase-out, as well as application of the structures established therein towards effecting reductions in HCFC use, are considered opportunities for addressing compliance requirements.

Potential compliance measures include preparation of a national strategy and action plan for meeting the 2016 freeze in consumption and also for future management of HCFCs, reducing dependence on HCFCs in the interim where alternatives can be more easily applied, creating awareness and disseminating information on the 2016 freeze obligations and alternative technologies and providing technical assistance and training to stakeholders for making informed decisions on the transition.

Malaysia expects the incremental costs of compliance to be met under the mechanisms of the Montreal Protocol.

ANNEX-I

INFORMATION ON HCFC CONSUMING ENTERPRISES

Sector	Sub-sector	Estimated number of enterprises
MANUFACTURING		
Foams	Rigid Polyurethane Foam	200
Refrigeration and Air Conditioning	Window/Split Air Conditioners	150
	Air Conditioning Chillers	50
	Domestic Refrigeration	15
	Commercial Refrigeration	300
	Industrial Refrigeration	100
SERVICING		
Refrigeration and Air Conditioning	All	Over 3,000

Note: The numbers and data provided in the table are a result of a limited survey of various sectors related to HCFCs the primary aim of which was to generate information that would enable the ExCom to establish a permanent aggregate level of consumption against which future activities could be funded. The numbers and data in this table are therefore ***indicative only and not binding***. The numbers/data may be revised in future as a result of more detailed sector-level information becoming available. The numbers/data may not be used without the prior consent of the Government.
