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

Eighth Meeting
Montreal, 19-21 October 1992

TURKEY COUNTRY PROGRAMME

This document consists of:

a) Evaluation Sheet (prepared by the Fund Secretariat);

b) Country Programme Cover Sheet (prepared by the Fund Secretariat);

c) Transmittal Letter from the Government of Turkey;

d) The Country Programme.

TURKEY COUNTRY PROGRAMME EVALUATION SHEET

The Turkey Country Programme is submitted to the Eighth Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/8/ . The document was revised in accordance with "Guidelines of Country Programme Preparation" (UNEP/OzL.Pro/ExCom/5/5/Rev.2).

It consists of:

- Letter of transmittal from the Government of Turkey;
- Country Programme Cover Sheet;
- Executive Summary;
- Introduction;
- ODS use and alternatives (including forecast demand for ODS by sector);
- Institutional framework;
- Policy framework;
- Response to the Montreal Protocol;
- Phase-out planning (including recovery, recycling and reclamation; alternative strategies; and incremental costs to Turkey);
- Proposed strategy statement by the Government;
- Action plan for the implementation of the phase-out (including recommended Government actions; proposed projects and estimated budget; and fund handling mechanisms).

The Country Programme also contains preliminary project proposals (Annex A), ODS phase-out alternatives (Annex B), and detailed phase-out scenarios by user sector (Annex F).

Turkey has no CFC or halon production facilities. All ozone depleting substances (ODSs) in the country are imported. The consumption of CFCs in Turkey has increased from 3,283 tonnes in 1989 to 3,682 tonnes in 1990, in spite of a reduction in the use of CFCs as propellants in the aerosol sector. Of the total CFCs consumed in Turkey, about 3,100 tonnes were CFC-11 and 12, with the remainder being CFC-113.

The following two scenarios for ODS phase-out were developed in order to identify the "optimum" strategy for the country:

1. Allowable, in which the transition to ODS substitutes is not undertaken until the year 2000 but is completed by the year 2010 as required by the Montreal Protocol; and

2. Accelerated, in which the transition to ODS substitutes is accomplished at a rate consistent with the availability of technology and is fully accomplished between 1992 and 1998.

While the "optimum" strategy for Turkey is one in which ODSs phase-out occurs as early as possible and consistent with technology availability ("accelerated scenario"), no specific strategy has been adopted by the Government.

The net incremental economic cost to Turkey for the phase-out of ODSs range from $127 million to $232 million. The incremental costs depend on the scenario adopted by the Government, as follows:

Description of Costs	Incremental Cost ($) in Scenario	
	Allowable	Accelerated
Capital	2,000,000	1,000,000
Operating, administrative	69,000,000	31,000,000
Forced early replacements	56,000,000	200,000,000
Total	127,000,000	232,000,000

The following conclusions arose while developing the proposed scenarios for phasing-out ODSs in Turkey:

- The most significant net incremental costs to Turkey are those associated with the early replacement of domestic refrigerators when virgin CFC-12 is no longer available for recharge;

- A significant proportion of the incremental operating and administrative costs relates to the incremental production costs for domestic refrigerators based on HFC-134a;

- The incorporation of a recycling/recovery programme reduces consumption of ODSs.

The Action Plan proposed for Turkey is based on the "optimum" phase-out scenario. The principal agents are the Government of Turkey, which is responsible for establishing a National Ozone Policy; the World Bank, which will be the implementing agency for investment projects; and UNDP, which will be responsible for implementing broad-based technical assistance. The Ministry of Environment will be responsible for the enforcement of the Action Plan.

The following investment projects were identified as priority projects in the Country Programme:

- Test, development and production facilities for HFC-134a compressors and ODS-free refrigerators for one of the major refrigerator manufacturers in Turkey, Arcelik, with an incremental cost of $2,411,000;

- Recovery, recycle and reclaim of CFC-12 in service shops in the metropolitan area of Istanbul, with an incremental cost of $583,000;

- Recovery and reclaim of R-12 from defective refrigerators at a refrigerator production facility, with an incremental cost of about $80,000.

RECOMMENDATION

The Fund Secretariat is satisfied with the content and format of this document, and recommends it for approval by the Executive Committee at this meeting, taken the following into consideration:

1. Approval of the Country Programme does not imply approval of funding of all activities and projects listed therein.

2. The priority investment projects identified in the Country Programme were submitted for consideration of the Executive Committee at its Seventh Meeting (UNEP/OzL.Pro/ExCom/7/18 and Add.1). The Committee approved the recovery, recycle and reclaim of CFC-12 in service shops in Istanbul, and allocated $565,000 to the World Bank for its full implementation.

COUNTRY PROGRAMME COVER SHEET

Country: Turkey
Lead National Agency: Government of Turkey (Ministry of Environment)
Participating Implementing Agencies: UNDP, World Bank

Phase-out schedule

Substance	Current consumption (tons x ODP) in 1990	Planned cumulative consumption till phase-out (ton x ODP)		Planned year of phase-out	
		Article 5 schedule (*)	Accelerated schedule	Article 5 schedule	Accelerated schedule (**)
CFC-11	1,553.0 x 1.0 = 1,553.0	35,559.6	7,900.0	2010	2010
CFC-12	1,527.0 x 1.0 = 1,527.0	34,964.3	9,440.0	2010	2010
CFC-113	518.0 x 0.8 = 414.4	9,488.7	2,200.0	2010	2010
CFC-114	16.0 x 1.0 = 16.0	366.4	15.0	2010	2010
CFC-115	14.0 x 0.6 = 8.4	192.3	n/a	2010	2010
Halon 1211	23.0 x 3.0 = 69.0	1,579.9	n/a	2010	2010
Halon 1301	2.0 x 10.0 = 20.0	457.9	n/a	2010	2010
TOTAL	3,607.8	82,609.1	19,555.0		

(*) Projected at an annual rate of 5.2 percent through the year 2010.

(**) Consumption of ODSs will be phased-out prior to the year 2000, except for CFCs needed to recharge existing CFC-based equipment.

TURKISH EMBASSY
197 WURTEMBURG STREET
OTTAWA K1N 8L9

September 21, 1992

Dear Sir,

I have the honour to hereby confirm the official application of the Government of Turkey, as has been conveyed to your Office by the World Bank in the form of Republic of Turkey's Country Program, for the consideration of the Executive Committee of the Interim Multilateral Fund established for the implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer.

Sincerely yours,

Ugurtan Akinci
Ambassador

Mr. Omar El-Arini
Chief Officer
Multilateral Fund
1800, McGill College Avenue
27th Floor
Montréal, Québec
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The World Bank
INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

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August 24, 1992

Mr. Ersen Ekren
Head of World Bank Projects Department
The Undersecretariat of Treasury and Foreign Trade
Ankara
Turkey

Dear Mr. Ekren:

TURKEY: Country Program for the Phaseout of ODS

Further to your August 6, 1992 letter concerning Turkey's Country Program for the Phaseout of Ozone-Depleting Substances (ODS), we have the pleasure to inform you that the report has been updated in consideration of your Ministry's comments and, as requested, will be forwarded to the Secretariat of the Interim Multilateral Fund for the Implementation of the Montreal Protocol for consideration at their October 1992 meeting. An annotation was included in Appendix A of the report explaining that the scope of the proposed projects had changed since the initial preparation of the Country Program and that projects not explicitly identified in the Country Program but addressing key ODS-using sectors could be prepared and presented for funding. We are enclosing ten (10) copies of the Country program report.

Please accept our best regards,

Sincerely Yours,

Akin O. Oduolowu
Acting Chief
Industry and Energy Division
Country Department 1
Europe and Central Asia Region

cc: Mr. Omar El-Arini, Multilateral Fund
Mr. Luis de Azcarate, Turkey Resident Mission

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THE REPUBLIC OF TURKEY
PRIME MINISTRY
THE UNDERSECERATARIAT OF TREASURY AND FOREIGN TRADE

Ref: DEİ-IV-3-II-0 Fax No: 343 Ankara, 06 AUG 1992

Mr. Franco BATZELLA
Division Chief
The World Bank
Washington, D.C.
U.S.A.

Dear Mr. BATZELLA,

With reference to your letter dated July 15,1992 concerning the "Phaseout of Ozone Depleting Substances" we are sending a copy of our comments on the "Country Program of Turkey for Phaseout of Ozone Depleting Substances" for correction of the final text.

As we agreed on the telephone, after making necessary corrections and additions on the Country Program of Turkey, please submit the final text to the Executive Comittee of the Interim Multilateral Fund for the Implementation of the Montreal Protocol on behalf of the Republic of Turkey.

Best regards.

Yours Sincerely,

H. Ersen EKREN
Head of Department

TURKEY

COUNTRY PROGRAM

FOR

PHASEOUT OF OZONE DEPLETING SUBSTANCES

August 1992

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EXECUTIVE SUMMARY

Background

1. The Montreal Protocol is an agreement ratified by over 70 countries worldwide to reduce the emissions of ozone depleting substances (ODSs) through regulation of consumption and production. Under the Montreal Protocol (MP), the participating developed countries have established the Interim Multilateral Fund for the Implementation of the Montreal Protocol (Multilateral Fund) to help developing countries with the cost of meeting the requirements of the Protocol. At the request of the Government of Turkey, the World Bank assisted with the preparation of a Country Program, a requisite activity for assistance from the Multilateral Fund.

2. Turkey ratified the Montreal Protocol on 20 September 1991, and qualifies under paragraph 1 of Article 5 of the Protocol for a ten year delay in the phaseout of ODSs. Turkey also qualifies for assistance from the Multilateral Fund.

3. Before ratifying the Protocol, Turkey passed a law in August 1991, creating a Ministry of Environment and adopted the Montreal Protocol ODS phaseout requirements as part of its regulations.

ODS Use in Turkey

4. Turkey does not produce ODSs, but there are numerous users of ODSs in the country. The bulk of the demand is concentrated in the industries that manufacture and service domestic refrigerators (approximately 10 million refrigerators are currently in use), in air conditioning systems, in the foam industry which produces cushioning, building insulation, packaging, and in aerosols and solvents. These industries contribute to a higher standard of living and, in recent years, have experienced growth exceeding that of the population. Some fire extinguishing materials are also ODSs. Total ODS consumption is estimated to have been 3628 tons in 1990.

5. In Turkey, only the private sector industries use ODSs in significant quantities. Many companies using ODSs already recognize the need to meet the requirements of the Montreal Protocol if they are to expand sales into international markets. These companies are also eager to participate in an ODS phaseout program but are concerned with the cost of doing so while remaining economically competitive.

Methodology for Country Program

6. The methodology for the preparation of the Country Program for Turkey involved an initial data collection and analysis mission to Turkey in October 1990, during which data on the supply and demand for ODSs were collected. In October 1991, the institutional and policy framework was discussed with industry leaders and government officials; ODS phaseout problems and plans were discussed with major consumers of ODSs; and the availability of ODS substitutes was investigated. A set of project activities which may qualify for Multilateral Fund grants was identified, prefeasibility studies, when required, were prepared and costed. A set of ODS phaseout scenarios which spanned a full range of probable activities

ECONOMIC COST TO TURKEY OF PHASEOUT

11. The net incremental economic cost to Turkey for the phaseout of ODSs ranged from US $ 127 M to US $ 232 M (expressed as the net present value in 1991 US dollars) depending on the speed of the phaseout and economic growth conditions through to the year 2010.

12. The primary conclusion drawn from this analysis is that **a prompt ODS phaseout will be beneficial to the Turkish economy.** The determination of reimbursement of these costs is an issue for the Multilateral Fund to decide in accordance with the Montreal Protocol (Annex E).

13. In order of importance to the economic cost to Turkey, the following conclusions were also reached:

(1) The most significant net incremental costs to Turkey are those associated with the potential forced early replacement of domestic refrigerators when virgin CFC-12 is no longer available for recharge. This stems from the fact that there willbe roughly 24 million refrigerators in service in Turkey in 2010, but replacement costs only apply to those continuing to use CFC-12. An early transition to refrigerant HFC-134a for domestic refrigerators will reduce the population of CFC-12 refrigerators in 2010, and hence reduce early replacement costs. The average age of the CFC-12 refrigerator population in 2010 was also a factor. On the accelerated cases, the absence of recycling of CFC-12 refrigerant substantially lowered the average age of CFC-12 refrigerators.

(2) Net incremental operational and administrative costs ranged from US $31 M with the allowable phaseout to US $69 M with the accelerated phaseout. A significant proportion of these additional costs related to the incremental production costs for HFC-134a domestic refrigerators.

(3) The incorporation of recycle/recovery into any phaseout case has the effect of directly reducing ODS consumption. Its primary benefit is to assure local supplies of CFC-12 for recharging refrigerators. Additional savings (not considered in the analysis) should be expected from applying recycle/recovery technology to the conservation of HFC-134a.

(4) Capital requirements were minimal in all cases analyzed. The timing of investments only had a small impact on economic cost.

RECOMMENDED ODS PHASEOUT STRATEGY

14. The optimum strategy for the Government of Turkey is to adopt a set of integrated policies and implement a series of projects in a comprehensive program that supports a phaseout of ODS consumption as soon as is technically feasible. This strategy willaccomplish the complete phaseout of ODSs at the least economic cost to the country and provide the basis for an officially recognized National Ozone Policy to which industry and government leaders can commit and which should be integrated in the national environmental strategy and policy framework.

Policies

15. The following sets of integrated policies are proposed to form the National Ozone Policy (NOP) for Turkey:

1. Announce proposed phaseout schedule;

2. Increase prices of ODSs to levels at or below which ODS substitutes become financially attractive by applying a levy on imported ODSs. This action is also a key step in encouraging the establishment of recycle/recovery projects.

3. Establish a licensing system for ODS users which encourages environmentally responsible handling practices and restricts distribution to registered users.

4. Establish ODS import monitoring policies and procedures which account for all ODSs as required under the Montreal Protocol and from which progress in reducing ODS consumption is tracked to guide appropriate adjustments in programs and policies.

5. Enhance public awareness of the "ozone issue" through media attention. The emphasis should at first be placed on the conservation and recycle/recovery aspects of ODS and subsequently on substitution. This policy should lead to the development of public awareness projects.

6. Create a "Task Force" within the Ministry of Environment to act as a focal point that will provide guidance in the formulation and promulgation of specific policies consistent with the NOP; and

7. Identify, evaluate and expedite the implementation of the projects directed at the reduction of ODS use and adoption of substitute chemicals and technologies with all imported equipment and technologies being exempt from customs duties, sales taxes, etc. Funding of these projects is to be financed in the context of the overall National Ozone Policy.

Projects

16. An initial capital investment project comprising three components is proposed for Turkey. The project consists of:

- building test and development facilities for HFC-134a compressors and ODS-free refrigerators at one of the major refrigerator manufacturers in Turkey, namely Arcelik;

- introduction of recovery and reclamation facilities for CFC-12 from household refrigerators being repaired in the service shop network of Istanbul; and

- recovery and reclamation of CFC-12 from new household refrigerators being repaired in the main Arcelik refrigerator production factory.

The total cost identified for this three-component project is US $5,500,000.

17. Additional smaller scale projects in other ODS-using sectors will be developed in cooperation with the industries involved.

ACTION PLAN

Objectives and Coordination

18. The objective of the Action Plan is to effectively, efficiently and as fairly as possible, phaseout the consumption of ODSs in Turkey in compliance with the Montreal Protocol, as ratified by the Government of Turkey, and in accordance with the recommended ODS phaseout strategy.

19. The Action Plan comprises the investments, policies and implementation actions needed to ensure compliance. The principal agents are the Government of Turkey (which is responsible for the specific policies, referred to here as "National Ozone Policy"), the Bank (which is the implementing agency for the investment projects), and UNDP (responsible for implementing broad-based technical assistance). These three agents must coordinate their efforts to effect the purpose of the Action Plan, i.e. compliance with the terms of the Montreal Protocol.

20. This action plan is consistent with the principles for evaluating and financing incremental costs for ODS phaseout as detailed in the "Indicative List of Categories of Incremental Costs" adopted by the Second Meeting of the Parties to the Montreal Protocol. These principles state that a proposed action destined to reduce ODS consumption should:

- be cost-effective and attuned to the national industrial strategy;
- include a careful review of cost items and avoid double counting;
- feature early adoption of ODS phaseout technologies.

21. The action plan proposed for Turkey is based on the optimum phaseout scenario. With this strategy, action will be initiated in 1992. The phaseout will be mostly completed by 2000 while other minor ODS uses will be phased out by 2010.

Summary of proposed actions

22. The following table outlines the key steps included in the Action Plan. Further discussion of this plan is included in Section 8 of the detailed report.

Other Factors of Significant Importance to the Phaseout Program

23. The following factors will have a direct bearing on phaseout activities, timing and process:

- The future supply and associated costs of alternate refrigerants, solvents, and fire extinguishants and their associated appliances is not known precisely, and the feasibility of some technologies remains to be confirmed. However, the cost of alternatives is expected to approach the cost of existing technologies at some point in the future. It is anticipated that the cost of the available ODS, after an initial period of oversupply, will eventually rise sharply as supplies become greatly diminished with limited production. However, recycled CFC could become available for servicing refrigerators to offset the expected CFC shortages in the late 1990's.

ACTION PLAN SUMMARY
TURKEY

Item	1992-1993	1994-1995	1996-2010
Levy on CFCs	. Establish levies on imported CFCs. The goal is to discourage continued CFC use in foams and to encourage recovery/recycle from refrigerators. . Set levy on methyl chloroform (MCF).	. Increase levy on CFC to levels which encourage use of substitutes and recycle in domestic refrigerators.	. Sustain levy at maximum feasible levels.
Monitoring	. Develop a monitoring sytem for ODS imports within the customs department which meets the following objectives: - complies with reporting requirements of the Montreal Protocol, - tracks progress of ODS phaseout, supports levy collection.	. Monitor progress and issue proper reports to UNEP and others. . Monitor effectiveness of levy.	. Continue monitoring activities.
Public indu[illegible] [illegible]areness	. Direct media attention to advantages of projects on recycle/recovery of CFCs and to the necessity to conserve precious CFC supplies. . Communicate features of National Ozone Policy to the public and to industry.	. Continue to enhance awareness and outreach activities with workshops and seminars. . Announce new policies well in advance of introduction.	. Continue to develop support for phaseout activities.

ACTION PLAN SUMMARY
TURKEY
(continued)

Item	1992-1993	1994-1995	1996-2010
"Ozone Panel"	. Establish joint industry-government panel to encourage dialogue on key issues and to broker agreements on conservation, bans and other policies.	. Continue functions as outlined.	. Continue functions as outlined.
Bans	Formally announce government policy on ODSs. . Recommend new bans as needed, e.g. - carbon tetrachloride - CFC-113 solvents.	. Ban use of CFCs in new central air conditioning. . Ban use of CFCs for rigid and flexible foams.	. Ban use of CFCs as solvents. . Ban use of CFCs in rigid foams. . Ban use of CFC in new domestic refrigerators. . Ban all imports of virgin CFCs.
Licensing	. Conduct workshops for refrigeration service personnel featuring recovery/recycle.	. Establish licensing system for refrigerator service personnel.	. Extend licensing to all ODS users.
Project Identification and Implementation	. Request action plans for ODS phaseout from major users in the foam and refrigeration sectors. . Identify, evaluate and arrange for the implementation of demonstration projects in the key user sectors, especially foam and refrigeration.	. Follow-up action plans. . Continue with project implementation. . Distribute information and project results within user sectors.	. Continue functions as required.

- If phaseout is slow in a fast developing economy, the stock of existing ODS-using plant equipment and products will continue to grow. The result of such a build up will ultimately increase the overall cost of an ODS phaseout.

- The makeup of the NOP will directly influence the cost of phaseout to participating industries. It should be recognized that the eligibility rules under the Multilateral Fund will also create strategic incentives. To the extent that incremental costs incurred by rapid phaseout are reimbursable under the Multilateral Fund's incremental cost rules, higher costs need not be a burden to the developing country. The best approach for formulating the NOP appears to be a combination of elements representing various approaches in a pragmatic way.

- Whatever the speed of the ODS phaseout, there is the need to control costs and prevent inefficiency and waste. Timing of the transition to non ODSs is therefore an extremely important element in the Action Plan.

- Recovery and recycle processes, and procedures offer the least cost way, at present, to reduce ODS emissions and to simultaneously enhance public/industry awareness of the "ozone issue". The economic benefits of recovery/recycle are direct savings of the cost of ODSs which otherwise would have been imported. Financial incentives for recovery/recycle will increase as the excise on imported CFCs is also increased.

- Negative consumer reaction to a CFC phaseout could deter phaseout activities particularly if CFCs are unavailable for repair of failed refrigerator units and premature replacement is forced. An active recycling program for CFCs is essential to protect the consumer by minimizing premature replacements until the majority of in-service refrigerators no longer require CFCs and installed units reach their normal life expectancy.

1.0 INTRODUCTION

Turkey is preparing a Country Program
for the phaseout of ozone depleting substances.
This program is a prerequisite for assistance from
the Interim Multilateral Fund for the Implementation
of the Montreal Protocol. This report encompasses all
items needed to qualify as a Country Program upon acceptance
of the Action Plan by the Government of Turkey.

The Montreal Protocol on Substances that Deplete the Ozone Layer

1.1 The situation that is commonly called "the Ozone Issue" has evolved over the past 60 years. The initial discovery of chlorofluorocarbons (CFCs) led to the development of applications capable of improving the quality of life for most people in the world. The rapid growth in the use of these compounds has been worldwide. In recent years, concern has increased about the accumulation of these compounds at the interface of the troposphere and stratosphere layers of the atmosphere known as the ozone layer.

1.2 Concerns were first raised in 1970 when a new, highly sensitive electron capture detector was invented for the gas chromatograph; measurable quantities of CFCs were detected in the atmosphere as a result of this new development. In 1974, Molina and Roland proposed that the ultimate fate of CFCs in the atmosphere was ultraviolet photodecomposition in the stratosphere with release of chlorine atoms. They suggested that these chlorine atoms might cause a reduction in the total amount of stratospheric ozone through a series of rapid chemical reactions. As technology did not exist at that time to prove this hypothesis, the scientific community, led by government funded agencies, undertook the development of a body of science required to measure trends and predict future ozone amounts in the stratosphere.

1.3 In 1978, the United States took the first step to stop the continued growth of CFC emissions to the atmosphere by banning so-called "non-essential" uses of CFCs such as for aerosol propellants. The United Nations Environmental Programme (UNEP) became the focal point for international attention with the formation of the Coordinating Committee on the Ozone Layer (CCOL). UNEP published scientific assessments and initiated the formation of a global convention culminating in the Vienna Convention for the Protection of the Ozone Layer (adopted on 22 March 1985).

1.4 Concurrent scientific evidence that changes were occurring in the atmosphere was inconclusive until significant temporary changes in ozone over Antarctica were discovered by British scientists in late 1985. World attention then focused strongly on the CFC/ozone issue.

1.5 While the ban in the use of CFCs in aerosol in the United States and other countries initially decreased worldwide use of CFCs, rapid growth resumed in the early 1980s. Computer projections of ozone depletion resulting from sustained growth in CFC emissions at these levels led industry to advocate international efforts to limit long-term growth of CFC emissions. Negotiations of an international agreement began in December 1986 with the support of all of the world's leading CFC producers.

1.6 Ensuing negotiations led to the drafting of the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) in September, 1987. This historic agreement addressed the need to reduce emissions of controlled substances (i.e. CFCs and Halons) to a "safe" level in a way that was acceptable to all countries, including those who were seeking the economic and societal benefits of CFCs enjoyed in developed countries.

1.7 The Montreal Protocol went into effect in 1989; approximately 70 countries have ratified the agreement to date. The principal features of the original Montreal Protocol were:

a) A set of control measures with scheduled reductions in consumption of controlled substances in each member country based on the country's use of these substances in 1986. The use is also based on an Ozone Depletion Potential (ODP) weighted basis (consumption was defined as production plus imports minus exports).

b) A 10-year grace period for developing countries to comply with the Montreal Protocol control measures, provided their annual consumption of controlled substances is less than 0.3 kilograms/capita. Developing countries conforming to this condition are classified as paragraph 1 of Article 5 countries.

c) Restriction on trade of controlled substances with non-parties to the Montreal Protocol.

d) A requirement to reassess control measures at least once every four years.

1.8 A key provision in the Montreal Protocol requiring reassessment of the treaty's control measures was evoked when mounting scientific evidence showed that CFCs were damaging the ozone layer. The Second Meeting of the Parties in London in June 1990 produced an agreement to completely phase out CFC consumption in developed countries by the year 2000 on a modified time schedule. Controlled substances were expanded to include 1,1,1 trichloroethane (methyl chloroform), carbon tetrachloride, and most fully halogenated CFCs. The parties declared their intent to phase out hydrochlorofluorocarbons (HCFCs) at some time in the future. The London agreement also established a technology and financial assistance resource for developing countries, the Interim Multilateral Fund.

1.9 For the purposes of this report, ozone depleting substances (ODSs) are defined as substances currently regulated by the Montreal Protocol as revised in London in June 1990 and given in Annex C to this report. The ODSs most widely used in developing countries are CFC-11 and CFC-12. Methyl chloroform, carbon tetrachloride, CFC-113, CFC-114, CFC-115, Halon 1211, and Halon 1301 are also used but to a significantly lesser extent.

<u>The Interim Multilateral Fund</u>

1.10 The Interim Multilateral Fund (referred to hereafter as the Multilateral Fund), supported by the developed countries that are Parties to the Montreal Protocol, willprovide up to US$ 240 million through the end of 1993 to paragraph 1 of Article 5 Parties in order to:

a) Help defray the incremental costs of the transition from ozone depleting substances to alternative materials and technologies less damaging to the ozone layer;

b) Train people in appropriate disciplines; and

c) Carry out studies which address the specific needs of each developing country.

1.11 The policies, guidelines and administration of the Multilateral Fund are to be implemented by an Executive Committee in cooperation with the World Bank, United Nations Environment Programme (UNEP), and United Nations Development Programme (UNDP).

1.12 The Executive Committee, composed of seven parties operating under paragraph 1 of Article 5 of the Protocol and seven parties not so operating, has been developing operational policies, guidelines and administrative arrangements for the Multilateral Fund since its formation in September 1990. The critical responsibility of the Executive Committee is to consider and, where appropriate, approve Country Programs for compliance with the Montreal Protocol and approve project proposals and net incremental costs for implementation of such programs.

1.13 A secretariat for the Multilateral Fund has been established in Montreal, Canada.

Turkey's Country Program

1.14 Implementation Guidelines and Criteria for Project Selection were approved by the Executive Committee at its Third Meeting in April 1991. In these guidelines, paragraph 1 of Article 5 Parties were invited to develop Country Programs (CP) and projects leading to a complete phaseout of ODSs. At the Second Meeting of the Parties it was established that the functions of the Executive Committee shall include the approval of a CP for compliance with the Protocol and therefore as a prerequisite for assistance from the Multilateral Fund. The implementing agencies (UNEP, UNDP and The World Bank) could aid paragraph 1 of Article 5 Parties in preparing a CP.

1.15 Turkey ratified the Protocol on 20 september 1991 and qualifies under paragraph 1 of Article 5 of the Protocol for assistance from the Multilateral Fund. Turkey has adopted the entire Montreal Protocol as part of its laws and has recently created a Ministry of the Environment.

1.16 The World Bank initiated with Government of Turkey (GOT) assistance a series of reconnaissance activities in Turkey starting by a mission in October 1990. That mission studied the possibilities of reducing and/or eliminating the use of Ozone Depleting Substances (ODS) in Turkey.

1.17 A second World Bank mission went to Turkey in September-October 1991 to update the findings of the October 1990 mission and to assist Turkey in developing a Country Program.

1.18 To accomplish the objectives of the Country Program, the following tasks were undertaken in accordance with the terms of Reference for Country Programs established by the Parties to the Montreal Protocol:

Institutional and Policy Framework - Define the organization and functions of government agencies in Turkey with possible roles in ODS phaseout, including data gathering, policy and standards setting, as well as enforcement;

Phaseout Requirements and Alternatives - Estimate the optimum phaseout of ODS consumption and the time limits for complete ODS phaseout;

Phaseout Scenarios - Identify promising alternative scenarios for accomplishing the ODS phaseout expeditiously within the Montreal Protocol time frame and Government of Turkey policies;

Costs and Benefits of ODS Phaseout - Calculate full and net incremental costs for each recommended action in the ODS phaseout;

Action Plan - Recommend an Action Plan to achieve the ODS phaseout based on the preferred phaseout timetable; and

Project Proposals - Conduct feasibility studies on specific projects needed for ODS phaseout.

Methodology for Phaseout Planning

1.19 The methodology used in developing the phaseout planning process for Turkey was structured to identify the least cost phaseout option to the country and can be summarized as follows:

i) Review and update of the October 1990 mission report;

ii) Development of forecasts of ODS demand unconstrained by the Montreal Protocol through the year 2010. This provided a base level demand profile to be serviced by ODSs and their alternatives throughout the transitional period;

iii) Identification of probable substitutes (alternative chemicals and technologies) for ODSs in order to estimate future availability; probable timing patterns for introduction of substitutes and pr ible unit costs or investments to accomplish the substitution;

iv) Identification of the current institutional and policy framework as well as the industry structure; industry's phase-out plans and actions already taken;

v) Development of scenarios which span a full range of actions open to Turkey for compliance with the Montreal Protocol as a framework for comparison of costs;

vi) Identification necessary projects for accomplishing a phase-out of ODS in coordination with each phase-out scenario. Financial prefeasibility studies were prepared for such projects in order to identify appropriate costs;

vii) Development of a mathematical model with which to estimate net incremental costs to Turkey for select scenarios over a range of differents timings; and

viii) Identification of the optimum strategy to be adopted and an Action Plan to implement the chosen strategy.

1.20 The anticipated rate of transition to alternatives was estimated based on interviews with industry leaders in Turkey, other paragraph 1 of Article 5 Parties and representatives of the United States and Europe.

Phaseout Scenarios

1.21 Two scenarios were developed to cover the range of options open to Turkey for compliance with the Montreal Protocol. The scenarios were:

- **Allowable under the Montreal Protocol** - All transitions to ODS substitutes are delayed until the last possible moment without violating the phase-out requirements of the Montreal Protocol.

- **Accelerated** - The transition to ODS substitutes is accomplished sector by sector within 1-2 years of the technology availability and replacement chemicals becoming available.

At or between the allowable and the accelerated phaseout scenarios there is a scenario that minimizes the net incremental costs of phaseout to the Turkish economy. This scenario is called the "optimum" scenario.

Project Identification

1.22 The methodology for the selection of the projects that are incorporated in this Country Program is presented in the discussion of project proposals in Annex A.

Methodology for Evaluating the Cost of ODS Phaseout

1.23 Evaluating the cost to Turkey for phasing out ODSs required development of a set of optional phase-out scenarios from which costs could be evaluated. In the current climate of rapid change within the ODS user industries, such forecasting is at best an inexact science. The known is where we are today, and the limits to be imposed on ODS use are those established in the Montreal Protocol (Annex E). The largest forecasting problems are estimating the most probable course for the market to follow between these two points. In order to make a forecast, assumptions must be made regarding (1) the growth of demand for products currently produced with the aid of ODSs; and (2) the timing and rate at which ODSs are replaced with alternative chemicals and technologies over the forecast period (1992-2010).

1.24 Constraints on demand estimates were those of the Protocol limits. One point to note is that the constraint is partly determined by the plan adopted -- an accelerated phaseout actually reduces the 1995-1997 baseline from which paragraph 1 of Article 5 Parties derive their phaseout targets.

1.25 An approximation of overall country cost was made (exclusive of Multilateral Fund grants) by using a bottom-up approach based on the major identifiable economic costs. For Turkey, these related assumptions and costs are as follows:

Assumptions and Considerations

- the net incremental cost to the economy in compliance with the Montreal Protocol is defined as the difference between the costs that will be incurred in meeting demand unconstrained by any requirement to phase out CFCs and those incurred in meeting the same level of demand for products but within the constraints of the Protocol. This will take into consideration both increases in costs in some sectors and cost savings in other sectors;

- net incremental costs to industry may be capital costs and/or operating costs. A best estimate of the costs in each category for each industry sector are presented in Chapter 6;

- the unit costs are multiplied by the projected number of units at any given time to give a total cost;

- the costs are included on a cash flow basis with the timing of the cash flow to match the assumed phaseout timing;

- the identified incremental cash flows in each industry sector (in 1991 prices) are calculated for the years 1991 to 2010 inclusive for each phaseout scenario;

- the cash flows associated with the early replacement of domestic refrigerators which cannot be recharged once virgin CFCs are no longer available are calculated. As the early replacements run on after the 2010 cut-off date, these cash flows are included through to the year 2015. This will still exclude some further early replacements that may occur after 2015 in the allowable scenario;

- all prices for CFCs are included at current 1991 US $ levels. Predictions about possible increases in the price of CFCs as supply becomes scarce have not been made. Also, the prices of substitutes are included at the expected long run price, as obtained from the industry in Europe and the USA. This does not take into account the higher current prices of these;

- for each scenario studied, the annual cash flows are discounted to 1991 to give the net present value. This enables the comparison of costs incurred at different points in time by reference to the equivalent cost today, taking into account the time value of resources; and

- a discount rate of 10 per cent is used in the analysis.

2.0 ODS USE AND ALTERNATIVES

This chapter provides a review of current uses of ODSs in Turkey and available options in preparing for and implementing the complete phaseout of ODSs in accordance with the requirements of the Montreal Protocol

ODS use in TURKEY

Background

2.1 Turkey has no CFC or Halon production facilities. All ODSs used in the country are imported by the factories requiring these for their production or through authorized distributors of international ODS producers. The bulk of the demand is concentrated in the industries that manufacture and service domestic refrigerators as well as in the foam industry. Some ODSs are also used in fire extinguishers and as solvents. The data obtained indicate that, in 1990, only 0.7% of ODSs consumed were Halons.

2.2 In January 1989, the Government of Turkey began using the Brussels Harmonized Classification System for imported chemicals. Prior to that, the total imports reported for CFCs were not broken down by sector by the government; an attempt was therefore made to build up an approximate usage by sector from a synthesis of data obtained piecemeal from industry sources.

2.3 The consumption of CFCs in Turkey has increased from 3,283 tons in 1989 to 3,628 tons in 1990. This increase occured despite a reduction in the use of CFCs as propellants in aerosols. As the aerosol industry is in the process of switching from CFCs to Liquified Petroleum Gas (LPG) as propellent, its consumption of CFC will drop from a high of 1,117 tons in 1989 to 200 tons in 1991.

2.4 Total ODS consumption in 1990 was 3 653 tons, of which 3 628 tons were CFCs and only 25 tons were Halons. Of the 3 628 tons of CFCs, close to 3 100 tons were CFC-11 and CFC-12, the remainder being mainly CFC-113.

2.5 Details on ODS consumption in Turkey are presented in Table 2.1. ODS consumption by sector for 1990 is illustrated in Figure 2.1. Domestic refrigerator foam manufacturing and refrigerant use accounted for over 40% of ODS consumption while the remainder was utilized in aerosol (27,6%), solvents (14,3%), polyurethane foams (13,7%) and air conditioning (2,7%). Sector usage on an ODP weight-basis is along the same lines (see Figure 2.2 for ODP use by sector for 1990).

2.6 This section briefly describes each significant industry sector that uses or handles ODSs in Turkey. Because there is no ODS production in the country, the businesses involved are importers and distributers of ODSs, manufacturers of products that contain or are made using ODSs, and companies servicing refrigeration and air conditioning equipment. All the companies involved with ODSs are in the private sector.

2.7 Importers and Distributers - A number of the world's major producers of ODSs have offices in Turkey. The major users of ODSs, such as refrigerator manufacturers, import directly from the producers. In addition, there are a number of importers (such as Aygaz) who sell to retailers who in turn sell to small users, including service shops. ODSs are imported mostly from Europe, but also from the USA, Brazil and Taiwan.

Table 2.1
ODS CONSUMPTION IN TURKEY

	1986	1987	1988	1989	1990	1991	1992	1993
REFRIGERANTS								
CFC 11	7	10	13	50	53	57	60	64
CFC 12	593	700	778	509	590	650	683	714
CFC 115	0	0	0	0	14	0	0	0
Total tonnes	600	710	791	560	657	707	744	778
FOAM								
CFC 11	1,430	1,840	1,900	1,246	1,454	1,584	1,614	1,645
CFC 12	0	0	0	0	0	0	0	0
Total tonnes	1,430	1,840	1,900	1,246	1,454	1,584	1,614	1,645
AEROSOLS								
CFC 11	200	260	165	91	46	0	0	0
CFC 12	660	950	865	1,000	937	200	10	0
CFC 114	40	50	20	26	16	0	0	0
Total tonnes	900	1,260	1,050	1,117	999	200	10	0
SOLVENTS								
CFC 113 tonnes	100	125	160	360	518	550	650	700
TOTAL CFCs								
CFC 11	1,637	2,110	2,078	1,387	1,553	1,641	1,674	1,709
CFC 12	1,253	1,650	1,643	1,509	1,527	850	693	714
CFC 113	100	125	160	360	518	550	650	700
CFC 114	40	50	20	26	16	0	0	0
CFC 115	0	0	0	0	14	0	0	0
Total tonnes	3,030	3,935	3,901	3,283	3,628	3,041	3,018	3,123
Total ODP tonnes	3,010	3,910	3,869	3,211	3,519	2,931	2,888	2,983
HALONS								
Halon 1211	15	17	20	0	23	40	70	121
Halon 1301	8	8	9	0	2	4	8	16
Total tonnes	23	25	29	0	25	44	78	137
Total ODP tonnes	125	131	150	0	89	160	289	523
TOTAL CFCs AND HALONS								
Tonnes	3,053	3,960	3,930	3,283	3,653	3,085	3,095	3,260
ODP tonnes	3,135	4,041	4,019	3,211	3,608	3,091	3,176	3,506

Sources

1986–88	World Bank Mission report March 1991
1989–90	Totals from Government of Turkey figures as reported to Nairobi; Sector breakdown from discussions with industry
1991–93	Projections

Figure 2.1 CFC USE BY SECTOR IN TURKEY IN 1990

Total 3,628 tonnes

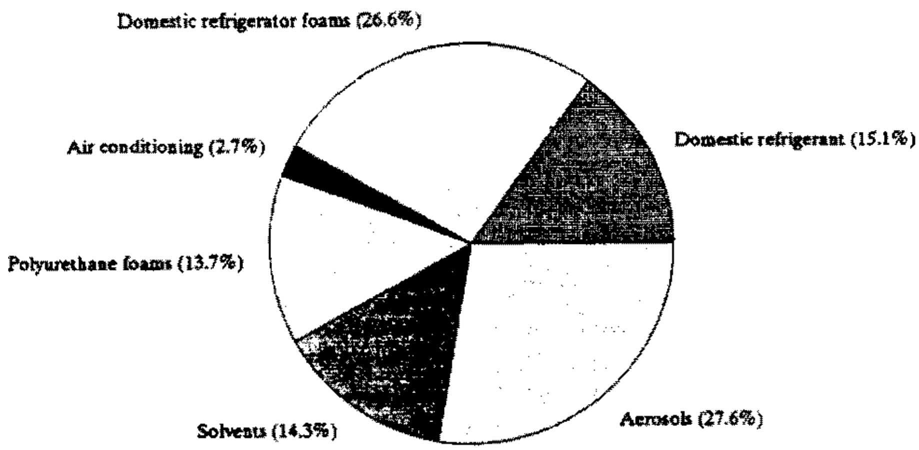
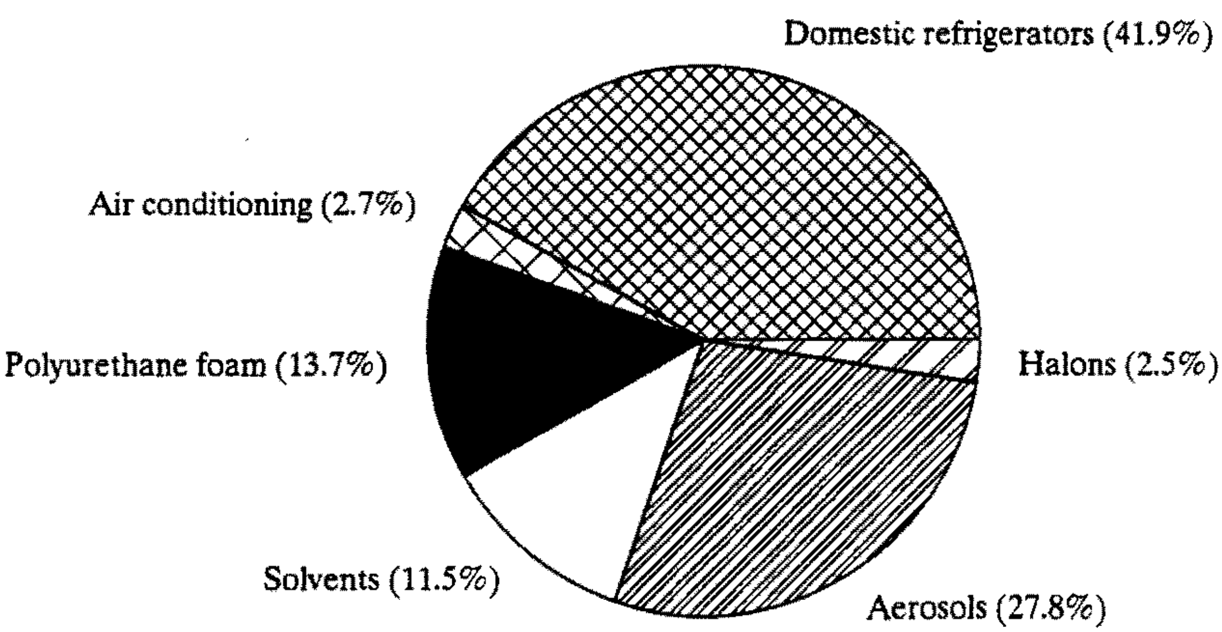


Figure 2.2 ODS USE IN TURKEY IN 1990

Total 3,599 ODP tonnes



2.8 **Manufacturers of Domestic Refrigerators** - There are four domestic refrigerator manufacturers in Turkey: Arcelik, Profilo, Simtel and Vestel. Arcelik and Profilo dominate the market with respective shares of about 54 per cent and 44 per cent. Both Arcelik and Profilo manufacture refrigerator compressors; the other companies import the compressors which they mount in the refrigerators. All the manufacturers blow rigid polyurethane foam as insulation directly into the cavity between the inner and outer skins of the refrigerator cabinets. Each of the four manufacturers is briefly described below.

- ***Arcelik*** - Arcelik is a subsidiary of the major Turkish conglomerate Koç which is the largest privately-owned company in Turkey's Top 500. The company manufactures a wide range of domestic appliances, including washing machines, dishwashers, vacuum cleaners, cookers, air conditioners and refrigerators. They operate a production plant for compressors and refrigerators at Eskisehir. This factory has a capacity of 1,100,000 compressors a year on two production lines and 700,000 refrigerators a year on three production lines. The compressors are manufactured under license from Tecumseh, a United States compressor manufacturer. The company is planning to design its own HFC-134a compressors. To do so, they have already purchased HFC-134a for trial as a substitute refrigerant and will be seeking financial assistance from the Multilateral Fund for test facilities to prove the new compressors before they introduce them commercially.

  The company has conducted trial runs with a 50% reduction in CFC-11 in the foam formulation used for insulating their refrigerators.

  In 1990, Arcelik produced 846,554 compressors and 537,325 refrigerators. The company exported 240,000 refrigerator compressors to the Soviet Union and Africa. Some 69,000 compressors were used as replacement of failed refrigerator compressors in Turkey. Of the refrigerators produced, 75,000 were exported to the United States and Europe.

  Arcelik's exports to countries that are party to the Protocol are threatened if it does not switch to ODS-free designs.

- ***Profilo*** - Profilo is 20 per cent owned by AEG of Germany. The company manufactures a range of household appliances, including washing machines, dishwashers, refrigerators, television sets, and other electronic goods. Their refrigerator manufacturing facility in Cerkezkoy, has a capacity of 600,000 units per year on 2 production lines.

  This company manufactures most of their own compressors based on an old AEG design and imports the remainder from Tecumseh in Brazil, Matsushita in Japan, and Neechi in Italy.

  In 1990, Profilo produced 450,000 refrigerators, of which 50,000 were exported to the United States.

  The company is working closely with AEG on the adoption of substitutes to replace CFCs. They have plans to convert all of their insulation foams to the low (50 per cent) CFC-11 formulation before the end of 1993. In addition, they expect to substitute HFC-134a as the refrigerant in line with AEG plans for ODS-free refrigerators in Europe.

- ***Simtel*** - Simtel began regular production of domestic refrigerators in July 1990 at a plant in Istanbul. Their compressors are imported from Matsushita. In 1990, their total production was 35,000 refrigerators, all for the domestic market.

  Simtel is laying plans to expand production and move to a new plant in Izmir when ODS-free refrigerator technology is available. Once they move, they expect to manufacture refrigerators using new Matsushita compressors designed for HFC-134a.

- ***Vestel*** - Vestel was a new entrant into the Turkish domestic refrigerator market in 1991. It is of a similar size as Simtel. Vestel essentially assembles refrigerators from imported components.

2.9 **Refrigerator Repair Workshops** - It is estimated that there are about 1,500 workshops that repair refrigerators in Turkey. About 410 of these are authorized service centers for Arcelik, 450 for Profilo, and 370 for Simtel. The remainder are small, often family-run businesses. Typically 13.5 kg disposable cylinders of CFC-12 are purchased from local distributors and used in recharging.

2.10 **Chillers/Central Air Conditioners** - Central air conditioning systems based on centrifugal chillers and utilizing CFC-11 are all imported from manufacturers such as Carrier or York in the USA. Imports are handled through local agents. These units are serviced by the engineering team associated with individual buildings or by the manufacturer's agent.

2.11 **Mobile Air Conditioners** - All mobile air conditioning (MAC) units are imported, often already in the vehicles, but sometimes in parts for installation by the vehicle manufacturer in Turkey. Servicing is typically undertaken in the vehicle manufacturer's servicing centers. However, some servicing is undertaken in small workshops once the warranty period has expired.

2.12 **Suppliers of Foam Formulations** - Polyurethane foam formulations (for both rigid and flexible foams) are all imported into Turkey. Some come ready mixed either with or without the CFC-11 component. Dow Vorakim blends the formulations locally from imported components. All of the formulations originate from multinational companies, principally BASF, Bayer, Dow, ICI and Montedison.

2.13 **Rigid Polyurethane Foam Manufacturers** - Apart from the rigid polyurethane foams produced by refrigerator manufacturers for insulation of the refrigerators, rigid polyurethane foams which use CFC-11 as the blowing agent are also produced for building insulation. The six main producers in order of decreasing CFC consumption are Metecnas, Tek Iz, Isopol, Mekon, Portiz and Izopan. In addition, there are some 50 smaller producers, such as Assan, Eczacibasi, Purplast and Yapel. None of these have indicated any immediate plans to convert to low or non-CFC formulations.

2.14 **Flexible Polyurethane Foam Manufacturers** - Flexible polyurethane foams are manufactured by about 15 companies. Some use CFC-11 as the blowing agent, others use methylene chloride or carbon dioxide/water. The main slabstock and mattress producers are Mekan, Idas, Sontas, Orosan, Isbir, Safas, Akmeltem and Songersan, and the principal producers of foams for furniture and car seats are Elele, Pimsa, Songersan, Formfleks and Grammer.

2.15 **Aerosol Filling Operations** - There are eleven aerosol producers in Turkey. Five of these dominate the market: Shell, Unilever, Johnson Wax, Eczacibasi and Bayer. Others include Hektas, Korumatarim, Poliko, Matsan and Aydindimya. Costar in Istanbul acts as a contract filler for some of the smaller producers. Many of these companies have already switched to the use of Liquified Petroleum Gas (LPG) propellants instead of CFCs as LPG is cheaper. Allaerosol insecticides now use LPG. However, some hair spray products still use CFCs as a propellant. The remainder of CFC users in this sector are in the process of phasing out CFCs.

2.16 **Printed Circuit Board Cleaning** - A few companies use CFC-113 for cleaning printed circuit boards.

FORECAST DEMAND FOR ODS BY SECTOR

2.17 Projections of demand in each user sector were made to the year 2010, the cut off date for ODS consumption for paragraph 1 of Article 5 Parties. The unconstrained forecast presented in this section assumes that the Montreal Protocol does not exist, that there are no supply constraints, and therefore defines demand with no substitution. It does not take into account any possible product development or other changes in manufacturing practices as a result of normal progress. This unconstrained demand projection is the starting point for determining the demand for substitutes.

2.18 Figure 2.3 sets out a sectoral forecast of unconstrained demand for CFCs in Turkey between 1990 and 2010. Overall, unconstrained CFC consumption is projected to increase from 3,628 tons in 1990 to 4,774 tons in 2010, an increase of 32 per cent. This corresponds to an annual growth rate of about 1.4 per cent. These figures have been built up from forecasts for each sector, as given below, taking into account the different demand drivers in consumer and industrial markets. It is to be noted that these projections can only be approximate, especially given their long range. They are however indicative of the likely patterns of unconstrained growth in Turkey. A year-by-year forecast of unconstrained demand for CFCs is illustrated in Figure 2.4.

2.19 The assumptions that underlie the unconstrained forecast demand are summarized in Table 2.2.

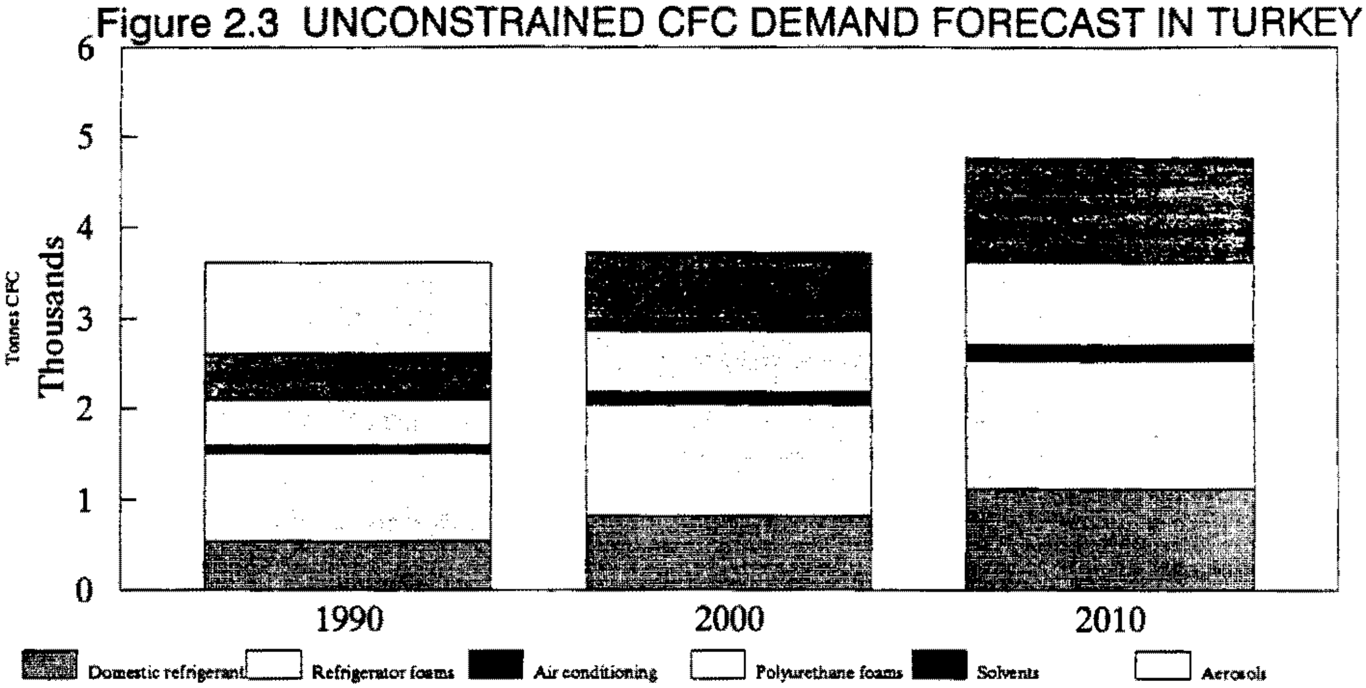


Figure 2.3 UNCONSTRAINED CFC DEMAND FORECAST IN TURKEY
Tonnes CFC
Thousands
0
1
2
3
4
5
6
1990
2000
2010
Domestic refrigerant
Refrigerator foams
Air conditioning
Polyurethane foams
Solvents
Aerosols

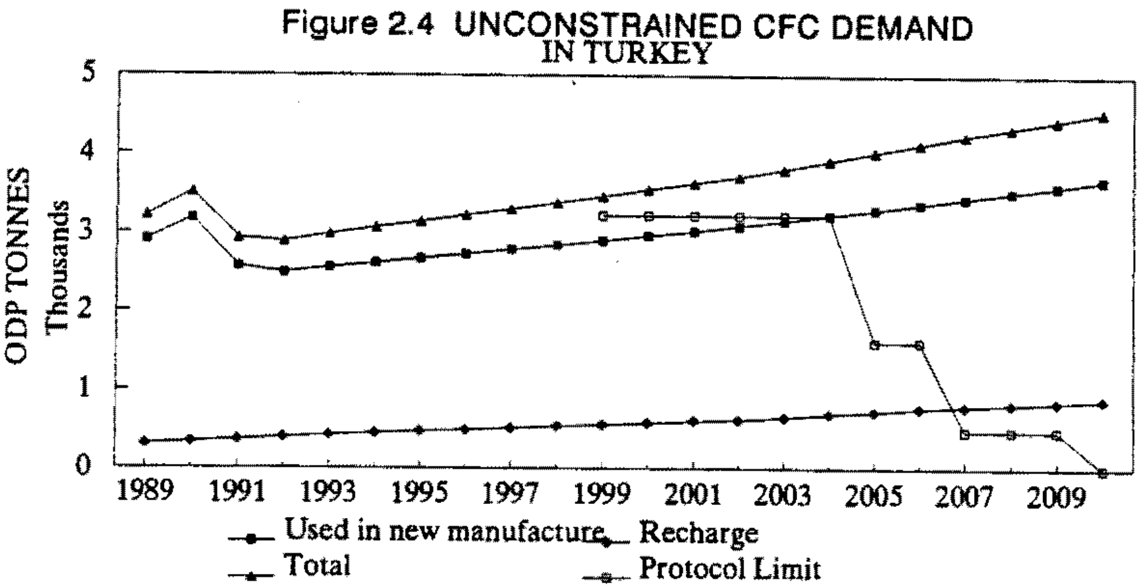


Figure 2.4 UNCONSTRAINED CFC DEMAND IN TURKEY
ODP TONNES
Thousands
0
1
2
3
4
5
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
Used in new manufacture
Recharge
Total
Protocol Limit

Table 2.2. Summary of Growth and Other Assumptions

AREA	GROWTH AND OTHER ASSUMPTIONS	PERIOD
.Population	2.2% annual growth	1992-2010
.GDP	3.0% average annual growth	1992-2010
.Domestic Refrigerator Manufacturers	1.4% average annual growth	1992-2000
	10 million refrigerators in use	in 1990
	17 million refrigerators in use	by 2000
	24 million refrigerators in use	by 2010
	Average life of refrigerator	20 years
-Households	10.5 million	in 1992
	16 million	by 2010
-Refrigerator Failure	3% fail	in first year
	1% fail	in second year
	10% fail	in 14-20 years
.Central Air Conditioning Units (Chillers)	400 units of which 40 added	in 1991
	2% av. annual growth rate	1992-2010
	Average life	20 years
.Mobile Air Conditioners	3% of motor vehicles have air conditioning units	in 1991
	5000 new MAC purchased	in 1990
	2% annual growth rate	1992-2010
	Average life	15 years
.Polyurethane foam	3% average growth rate for rigid and flexible foams Same as GDP	1992-2010
.Solvents	3% average growth rate Same as GDP	1992-2010

3.0 INSTITUTIONAL FRAMEWORK

This chapter of the report evaluates institutional capabilities available for implementing the ODS phase-out in Turkey

Government Agencies

3.1 The organization chart presented in Figure 3.1 outlines the links between the different organizations under the Prime Minister and the Ministries that have an interest in the Ozone Issue.

Prime Minister

3.2 The following four (4) organizations, which are involved in the Ozone Issue, report to the Prime Minister:

Undersecretariat of Treasury and Foreign Trade

3.3 This organization is authorized to issue Regulations and Communiques in relation to maters in Import Regime Decree, to grant permissions and instructions, to make amendments or to take measures that are deemed necessary at each stage of importation, to control or have controlled the import prices, to examine, to conclude the special and compulsory cases. Concerning the Ozone Issue, the specific interest of the General Directorate of Importation will be to control imports of ODSs and products containing ODSs and to introduce custom duties and levies on the ODSs. In addition, the General Directorate of Foreign Economic Relations (Department of World Bank Projects Transport, Infrastructure and Environment Section) will also act as the focal point for deciding whether grants, soft loans, subsidies or other forms of assistance will be given for project financing during the implementation of the Action Plan.

State Planning Organization

3.4 The duties of this organization are to plan, fund, and direct the economic, social as well as the cultural life of the country and to take the appropriate corrective measures if necessary. The specific role of the State Planning Organization in the Ozone Issue will be to establish the measures which have to be taken by industry and government agencies in order to enforce the Action Plan with minimal upset to the economy during the phaseout of ODS.

State Institute of Statistics

3.5 The present duty of the State Institute of Statistics (SIS) with respect to the Ozone Issue is to compile, classify and publish data on the import of chemicals that are controlled by the Montreal Protocol. The specific responsibility of the Department of Environmental Statistics of SIS on the ozone issue will be to record and assess the import and export of ODS in chemical form, and/or as part of a product, and to inform the relevant institutions of these figures as required by the Montreal Protocol.

Turkish Scientific and Technological Research Organization

3.6 The main responsibility of this organization is to organize and finance research. The possible involvement of this organization regarding the Ozone Issue is to find alternative chemicals/compounds and new technologies suited to Turkey's industrial structure.

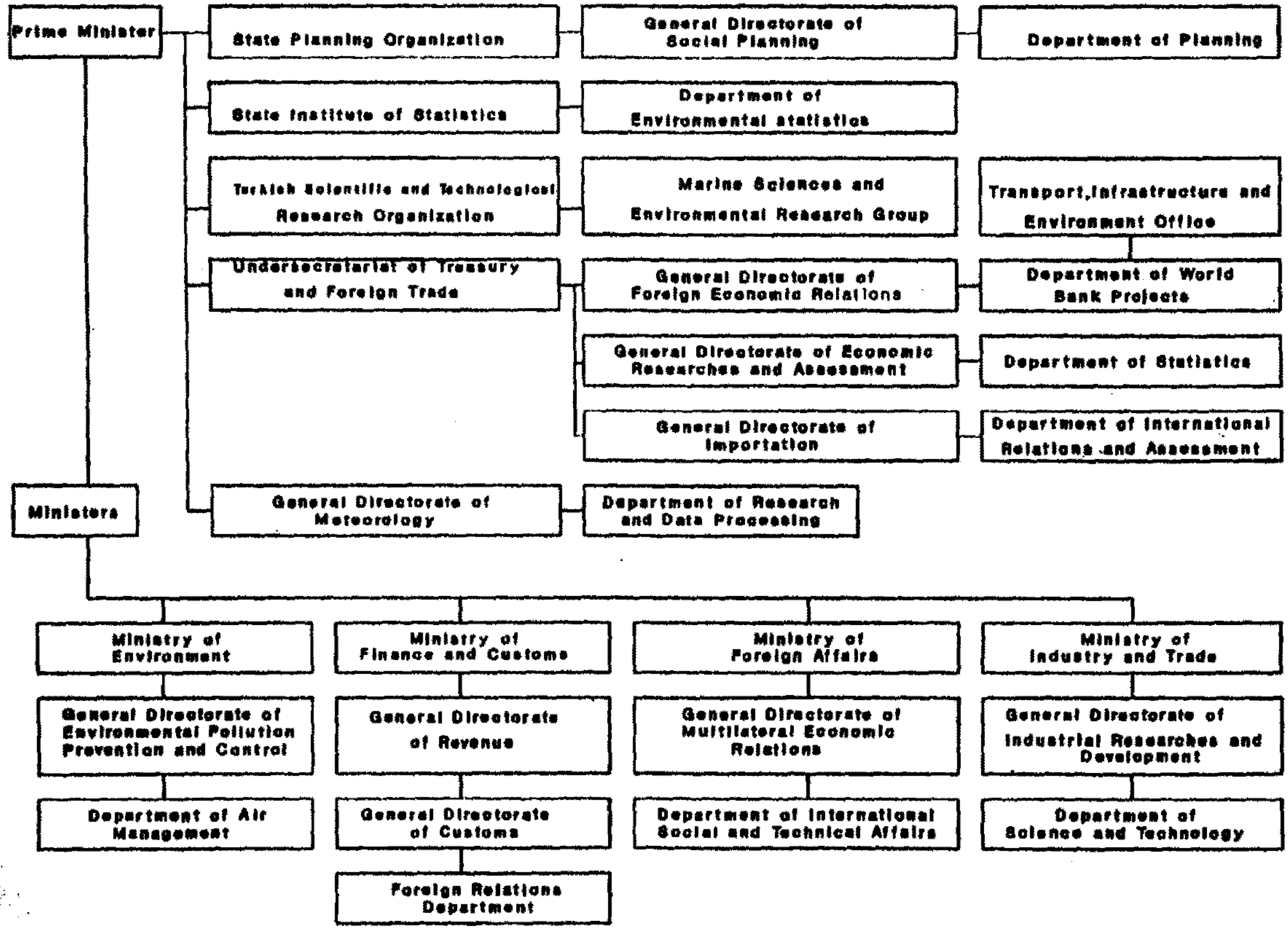


Figure 3.1 Government Organization Chart of Republic of Turkey in "Ozone Issue"

Ministry of Environment

3.7 Prior to the establishment of the Ministry of Environment (in August 1991) as a separate ministry under the Prime Minister, there was an undersecretariat that dealt with environmental issues. The short term duties of this new ministry are: legislation, policy development and enforcement of the environmental protection activities. The specific duties related to the Ozone Issue are to supervise and coordinate international and national activities related to the Montreal Protocol. This ministry would be responsible for the enforcement of the Action Plan.

Ministry of Finance and Customs

3.8 Responsibilities for the Ozone Issue fall upon three departments of the Ministry of Finance and Customs: the General Directorate of Revenue, General Directorate of Customs, and Foreign Relations Department. The General Directorate of Revenue deals with taxes. The General Directorate of Customs is responsible for setting up the statistical positions in the Custom Tariffs, and the Foreign Relations Department is responsible for making the necessary preparations for adopting the International Instruments to the national legislation.

Ministry of Foreign Affairs

3.9 The duties of the General Directorate of Multilateral Economic Relations within this ministry is to act as a link between international and Turkish organizations. The specific role of the department of International Social and Technical Affairs with regard to the ozone issue is the transfer of information from the international institutions to national associations and institutions. The Ministry of Foreign Affairs will ensure that the commitments made by Turkey in its Country Program are followed by government and other organizations within Turkey.

Ministry of Industry and Trade

3.10 One of the responsibilities of the General Directorate of Industrial Research and Development are to study policies regarding Turkish trade in view of existing industry and determine how to apply the policies decided by the government. The specific involvement of the Department of Science and Technology regarding the ozone issue is to collect the information from international organizations through the Ministry of Foreign Affairs as well as other organizations and to set up policies for technology transfer. This department willstudy ways to handle the cost of new alternative technologies and processes and encourage technological transformation leading to ODS phaseout.

Industry Associations and Non Government Organizations

3.11 **The General Union of Chambers of Commerce and Commodity Exchange of Turkey** provides guidance to industrialists in the introduction of new technologies to Turkey. It also collects the views and complaints of industrialists regarding environmental issues. On the Ozone Issue, the General Union of Chambers of Commerce is concerned by the cost of technology transfer and alternative chemicals. It is especially concerned about the small and medium size manufacturers using ODSs. In the transition period towards total ODS phase-out, the Union willprovide assistance and advice to its members.

3.12 **The White Appliances Association** is an association of industrialists that manufacture and sell white appliances (washers and dryers, refrigerator, etc...) in Turkey. The industrialists meet to discuss problems common to their particular industries. Common actions may be recommended by the association and representations made to the authorities.

3.13 **The Environmental Problems Foundation and The Society for the Protection of the Environment and Greening of Turkey** are two of five organizations in Turkey that have an interest in the environment issue. These two groups are the only ones that have an interest in the Ozone Issue. The others deal with biodiversity issues. The Environmental Problems Foundation makes research on environmental problems and publicizes the findings to increase public awareness. The specific interest of the foundation in the Ozone Issue is to research literature, issue bulletins and books, as well as arrange meetings to inform interested parties of policies and trends.

4.0 POLICYFRAMEWORK

The policy framework within Turkey is presented in this chapter of the report with emphasis on those issues which may be relevant for implementing ODS phase-out

Background

4.1 The general policies and the timing of the actions taken in Turkey will affect ODS phase-out costs at both the country level and at the individual enterprise level. An understanding of existing policies and available policy options is therefore needed to estimate net incremental costs. The cost to Turkey (or minimum adjustment cost given the existing economic policy and industrial strategy of Turkey) depends on the implementation plan, which to a certain extent, is constrained by policies which are institutionally feasible for the country. The net incremental financial costs to individual enterprises also depend on overall economic policy, especially tax provisions, and eligibility rules of the Multilateral Fund.

4.2 This report considers Turkey's overall economic policy and the general economic situation of the country and reflects industry's strategy including competition policy, investment and imported components and materials, export strategies as well as tax incentives for particular industries.

Political System and Trends

4.3 The country has a parliament or The Grand National Assembly (TBMM)which, according to the 1982 Constitution, is the sole legislative power in Turkey. The term of TBMM,which has 450 elected members, cannot exceed five years.

4.4 One of the first duties of parliament is to elect a President who may not remain in office for more than seven years. Once elected, the President chooses the Prime Minister who in turn chooses the cabinet. It is to be noted that in October 1991 a new party was elected in Turkey.

4.5 All laws in Turkey have to be approved by the elected Parliament and by the President. Following their approval these laws are published in the Official Gazette.

Economic Conditions

4.6 Turkey is currently in a recession and subject to an inflation rate of between 40% and 70% depending on the source of that information. Large expenditures have been made to develop the country's infrastructures. This development exceeded the projections made in the industries requiring these infrastructures. The deficits in the public sector coupled to these expenditures, which entrained a relatively high foreign debt, were the main contributors to the present recession. The present trend is that Turkish investors who are living abroad are encouraged by the government to return to Turkey. Many of these are returning home and are finding developed infrastructures and other incentives of great interest to them. This augers well for the future. Some financial sources in Turkey thus anticipate interest rates to drop to the 20-25% level within two to three years.

Existing Policies and Precedents

4.7 Parliament has enacted laws that authorize ministries to ban the entrance and ban the use of some chemicals into or within Turkey. By doing so the country has created precedents in the issue of bans and permits. Some of these are:

- the restriction of the use of phosphates in detergents;
- the Ministry of Agriculture and Rural Affairs established a list of banned chemicals and banned the use of DDT in 1985 (law number 6968);
- the Undersecretariat of Environment, through the Environmental Council of Ankara, put a restriction on the sulphur content of coal entering Ankara;
- the Ministry of Health had previously banned the use of LPG as aerosol propellants. This ban has now been lifted;
- the Ministry of Health issues permits for the import of cosmetics, pesticides, insecticides, CFC-11, CFC-12 and CFC-114 used by the cosmetics industry; and
- the Ministry of Environment is presently drafting a regulation in which it will have the authority to issue permits. This has followed the Montreal Protocol becoming law in Turkey (Official Gazette of 20 June 1990 - N° 20554).

Incentives and Taxation Systems

Business Regulations and Incentives

4.8 The government of Turkey encourages the spirit of free enterprise. Before applying control measures, the government studies the practices of other nations and multilateral organizations. The regulations in the European Community (EC) and the General Agreement on Tariffs and Trade (GATT) are among those that the Government usually studies. It is worthy to note that Turkey has filed an application to join the EC.

4.9 The Government can thus apply a number of actions to encourage industry to use non ODS substitutes or to discourage the use of ODSs. These are discussed below.

Incentives

4.10 **Investment incentives** - Incentives are generally a mix of tax incentives (allowance on capital investment in addition to the accelerated depreciation already available under the corporation tax law and customs duty exemptions), as well as non-tax incentives (taxable cash investment grants, low interest credits and exemption from certain fees and charges).

4.11 **Investment incentive allowance** - The investment incentive allowance is a deduction from taxable income for corporation tax purposes. The deduction is claimed in the year of investment on that portion of the investment for which the investing entity does not claim government-sponsored finance or interest subsidies.

Tax Concessions

4.12 **Tax reduction** - As described earlier, the principal tax concession granted is the investment incentive allowance: a percentage of the fixed capital investment is deductible in determining taxable income, without a time limit. However, the amount deducted is subject to income tax. In addition, under the tax regulations and without reference to investment incentives, movable fixed assets may be depreciated at rates of up to 25 percent per annum straight line or 50 percent declining balance.

4.13 **Postponement of import VAT** - Import VATis usually postponed until output VATis available for offset purposes.

Customs Duty Exemption

4.14 Imports of certain machinery and equipment (to be defined by the Treasury) are exempt from customs duty whether these are part of an incentive program or not.

Finance and Interest Subsidies

4.15 In recent years, interest rates in Turkey have been relatively high (60 -70 %), accordingly, local financing has been both scarce and expensive. For specific projects the government may grant, as an incentive, permission to obtain loans at subsidized rates of interest on the Central Bank's rediscount credit, both for capital investment, medium and long term loans as well as for operating loans.

Resource Utilization Support Fund Premium

4.16 The Resource Utilization Support Fund premium is a cash grant calculated as a percentage of the equity in the fixed capital investment of the project. The total amount receivable cannot exceed 50 percent of the project's total fixed capital investment in certain regions and 40 percent in other regions. The premium received may either be recorded as other income, which is included in the corporation tax base, or as a reduction in the cost of the assets concerned, in which case the depreciation base is correspondingly reduced.

5.0 RESPONSE TO THE MONTREALPROTOCOL

This chapter of the report describes the actions taken to date by the government of Turkey as well as by industry in response to the Montreal Protocol

General

5.1 The government of Turkey has reacted favorably to the Montreal Protocol. Industry, however, is generally waiting for the government to declare its policy on ODS phaseout before they act. A brief description of the government and industry responses to the Montreal Protocol follows.

Government Responses to the Protocol

5.2 Even before acceding to the Montreal Protocol, Turkey had introduced, as part of its laws, the entire Montreal Protocol. This was published in the Resmi Gazette No. 20554 on 20 June 1990.

5.3 The Government of Turkey acceded to the Montreal Protocol after the Parties to the Protocol agreed that Turkey could operate as an Article V country. As a result, the President of Turkey signed the letter of accession to the Montreal Protocol on September 20, 1991.

Conference on the Environment Under the Coordination of the Ministry of Environment

5.6 Government of Turkey officials, research institutions and interested parties were invited to attend a Meeting on the Montreal Protocol which was coordinated by the Ministry of Environment. The main recommendations that dealt with the Ozone Issue are as follows:

- to calculate the cost of introducing substitutes and related technologies by taking into account all of the small, medium and large size CFC and Halon users;
- to initiate a voluntary phase-out program by the larger users of ODS;
- to cooperate with the Ministry of Industry and Trade in order to collect reliable data from industries and to make inventories of ODS imported as well as exported;
- to introduce incentives to industries to switch to ODS alternatives and introduce new technologies;
- to define administrative structures and mechanisms and to assign the responsibilities to the governmental institutions in order to give them the proper authorities to allow them to enforce the provisions of the Montreal Protocol; and
- to provide the public with information on the situation with regards to the depletion of the Ozone Layer and to train persons on these matters.

<u>Industry Responses to the Protocol to Date</u>

5.7 The industry's response to the Montreal Protocol has varied from industry to industry within each sector using ODSs. One common observation is that industry is generally aware of the requirements to switch to non ODSs in the future.

In the refrigeration sector, some companies such as Arcelik and Profilo are obtaining information on the available technologies and are investigating the costs of production of non-ODS refrigerators.

In the aerosol industry, market forces have influenced the changeover from ODSs to LPG for insecticides and pesticides. However, in the cosmetics sector, the switch has not completely been made.

The foam industry on the other hand has not switched to CFC substitutes because of cost and the lack of experience in the use of alternate blowing agents, as is the case for rigid foams.

6.0 PHASEOUT PLANNING

Careful planning of ODS phase-out will allow a smooth economic transition for Turkey. This chapter describes alternative substances and technologies and their net incremental costs to the economy. The optimum phaseout scenario is also identified.

Background

6.1. The planning of a cost effective ODS phaseout policy requires the determination of net incremental costs for substitution to alternative chemicals and technologies in processes currently using ODS. Availability of alternative technologies was considered along with the capabilities of local industries. Scenarios which provide a framework upon which overall costs can be compared serve as an analytical tool over a range of timings considered to be within the realm of probability. The discussion which follows covers the details of the planning process used to provide a cost basis for recommendations incorporated in the phaseout strategy.

Availability of Technology

6.2 With the exception of rigid insulating foams, Halons, and specific medical devices using CFCs, developed technology exists today to accomplish a complete phase-out of ODSs over a period of 2-4 years.

6.3 **Status of Technical Development** - The phase-out of ODSs requires substitutes or alternatives to be available for each application. The effort to establish substitution technology is being led by major companies manufacturing and using ODSs. The process is well under way. Substitutes for ODSs may be regarded as falling into three main categories:

- **currently in use.** Some substitute technologies are proven and are already in widespread use in many countries. For example, Liquefied Petroleum Gas (LPG) has almost entirely replaced CFCs as propellants in aerosols in developed countries and in many developing countries. The transition is almost complete in Turkey. In many countries rigid polyurethane foams are already using as little as half of the previous CFC-11 as a blowing agent by the introduction of techniques using a water-CFC-11 mixture;

- **under development.** A number of potential substitutes have been identified and are presently being investigated. These include HFC-134a as a replacement refrigerant for CFC-12. The technology has been developed and effort is now going into establishing commercial production. It is expected that the first HFC-134a domestic refrigerator will be on the commercial market in Europe in 1993. Some car air conditioning units already use HFC-134a (in the 1992 Model S of Mercedes Benz); and

- **not yet identified.** In a few instances, research is continuing to find suitable substitutes. For example, satisfactory substitutes for some specialized uses of Halons have not yet been identified.

What follows is a brief overview of the availability of technology in the key ODS using sectors of the Turkish economy.

Refrigerators/Freezers/Air Conditioners

There are 5 key technologies needed to displace ODS use in industries which use ODS refrigerants:

- Refrigerant Fluid
- Lubricating Oil
- Compressor
- Insulation
- Servicing Procedures

Refrigerant Fluid

6.4 **Drop-in Substitute for Recharge** - The ternary blend of HCFC-22, HCFC-124 and HFC-152a that has been developed by DuPont is a drop-in substitute for CFC-12 as a refrigerant. There is therefore the opportunity to use this blend for the recharging of domestic refrigerators once virgin CFC-12 is no longer available. This subsistute will penetrate specific markets but is unlikely to have much impact on Turkey in the foreseeable future. HFC-134a will most likely be the refrigerant of choice to replace CFC-12 in domestic refrigerators, automobile air conditioners and CFC-12 chillers. Supplies of HFC-134a are commercially available today. Dupont, the world's largest global fluorocarbon producer, has recently announced a major HFC-134a capacity expansion due on line in 1993. Supplies will most likely be adequate into the late 1990s and price will decline to about 4 to 5 times that of present day CFC-12.

Lubricating Oil

6.5 Two oils, PAG and Polyester, have demonstrated compatibility with refrigerant HFC-134a. The oils currently used with CFC-12 refrigerant systems are totally inadequate for HFC-134a service. The alternative oils are commercially available today although the price is up to 20 times higher than that for the oils that can be used with CFC-12. The choice of type of oil is made by the user, based on his estimate of equipment life and service conditions. The Polyester Oils are more expensive and generally last longer than the PAGs. These will find application in most new domestic refrigerators. Auto air conditioners will probably also use PAGs.

Compressors

6.6 The thermodynamic properties of HFC-134a are different from those of CFC-12. This will require that compressors used in domestic refrigerators be redesigned. Together with the new oil and HFC-134a, the new compressors should operate with the same energy efficiency as comparable CFC-12 systems. Any loss in efficiency will derive from other factors (e.g. insulation). At least one compressor manufacturer in Turkey is presently investigating the use of the newly designed HFC-134a compressor.

Insulation

6.7 **Foam blowing agent** - There are likely to be two stages in the phase-out of CFCs from the rigid polyurethane insulating foam in refrigerators:

- an initial reduction of 50% of the CFC-11 usage can be achieved by substituting with water. This technology has already been successfully introduced in Europe. It requires no significant changes in production facilities. However, the system requires additional polyol to compensate for the reduction in CFCs; and

- the changeover to a completely new blowing agent such as HCFC-123 can only occur when toxicity testing clearance is obtained in 1994 or until a less developed blowing agent such as HCFC-22, HFC-134a or HFC-152a is adapted to the refrigerator foam requirements. It is assumed that this issue will be fully resolved only by 1995.

Servicing Procedures

6.8 CFC-12 is the only refrigerant presently used for servicing domestic refrigerators, thereby creating a long-term demand for it. Special "blends" which are compatible with CFC-12 have been developed and are undergoing life tests but won't be commercially available until 1995. It has been assumed that these "blends" will only penetrate a small portion of the refrigerator service market and CFC-12 use may continue past the year 200, following which, refrigerators unable to be serviced will either be scrapped or will be recharged with "blends". Earlier adoption of "blend" technology will be an issue for the market to decide.

Chillers/Central Air Conditioning Plants

6.9 All Chillers/Central Air Conditioning Plants using CFC-11 are imported into Turkey. Technology is available today to convert CFC-11 chillers in hotels and offices to HCFC-123 without any major investments in equipment changes. HCFC-123 is currently produced by Dupont, however, special handling precautions are needed pending completion of toxicity testing in 1994.

Mobile Air Conditioning

6.10 All mobile air conditioning (MAC) units are imported into Turkey. These use CFC-12 as refrigerant. The production of MACs using HFC-134a has begun and should integrate the market as the availability of CFC-12 decreases.

Foams

6.11 **Polyurethane Foams** - Flexible foams are likely to change from CFC-11 to carbon dioxide and methylene chloride as a blowing agent.

Solvents (CFC-113, methylchloroform, carbon tetrachloride)

6.12 CFC-113 used in the vapor degreasing of electronic printed circuit boards can be replaced by aqueous cleaning systems. This will generally require slightly increased batch sizes, heaters to warm the water baths and for drying, and the installation of effluent treatment facilities. The forecasts assume that there will be a gradual transition to other solvents as prices rise and supplies of ODS solvents diminish. Ample technology is available globally to satisfy needs as they emerge.

Halons

6.13 Replacement chemicals for Halons are traditional CO_2, dry powder and water fire extinguishants. It is expected that alternative chemicals for high technology fire protection as well as for specialized uses willnot be on the market before the turn of the century. In any case, Turkey's consumption of these is very small in comparison to the total ODS consumption of the country.

Aerosols

6.14 The changeover from CFCs to LPG as propellant in aerosols is expected to be completed by the end of 1991, as it is more economical for aerosol fillers to use LPG.

Stockpiling

6.15 Stockpiling is an alternative to, or can be used in combination with, recycling to provide a continuing supply of CFCs for recharge once virgin CFCs are no longer available. A stockpile could be built up from two possible sources:

- additional virgin CFCs imported, taking advantage of any headroom that Turkey may have within the Protocol limits, although this is against the spirit of the Protocol as it willincrease total emissions to the atmosphere; or

- collection and reuse of CFCs.

In either case, there are logistical difficulties with storage and ensuring that the stockpile is only used to service recharge demand. Nevertheless, closer examination of practical options for stockpiling, principally as a means of avoiding early replacement of refrigerators, merits consideration.

Recovery, Recycling and Reclamation

6.16 Significant opportunities to conserve existing supplies of CFC by capturing and reusing these from existing facilities lie primarily in the refrigerant sector.

6.17 Both conservation and recycling are practical activities that involve either better management of ODS use or recovery and reuse of ODSs that would otherwise be vented to the atmosphere. The terminology associated with reuse of ODSs is as follows:

- **Recovery** - This describes the collection of ODSs from refrigeration or other closed systems (without allowing them to escape into the atmosphere) and storage without testing or processing;

- **Recycling** - This is the process of "cleaning" used ODSs by oil separation, filtration, drying and/or chemical treatment. The purified ODSs are returned to a standard acceptable for reuse in the same type of refrigeration or other closed systems from which they have been collected. Recycling is often performed on site or in a service shop; and

- **Reclamation** - This involves the reprocessing of used ODSs by distillation and other means so that they meet the same specifications as virgin ODSs. Reclamation is usually performed in a central facility having analytical capabilities.

6.18 A recovery and recycling industry might develop principally for domestic refrigerator recharging, as described below.

A simple portable recovery device would be used to collect the small amount (typically 300 gr) of CFC-12 from the refrigeration system before the start of repair work. The recovered CFC-12 would be taken back to a distribution center and would be combined with other used CFC-12 from refrigerators. This CFC-12 would be reprocessed in a reclaim machine which removes impurities such as moisture, carbon particles and metal swarf. Costs for such a pilot project are given as part of the project described in Annex A.

Costs of Substitution

Incremental Cost Issues

6.19 Incremental costs of substitution to non ODSs comprise:

- capital costs (such as development costs and the costs of modifying existing facilities, where necessary);
- additional operating costs; and
- costs associated with the early replacement of some domestic refrigerators once no further CFCs are available for recharging.

6.20 The likely unit costs, quoted in US dollars at 1991 prices, that will be incurred in each sector are discussed below. These are by no means definitive, but indicate a best estimate on the basis of information currently available.

Basic Assumptions

6.21 For the purposes of outlining and costing a phase-out program in Turkey, a single substitute has been identified for each application. For many applications, this is based on the substitutes that Turkish industries are selecting. Current uses and likely substitutes are listed in Table 6.1, together with an estimate of the earliest point in time at which they are assumed to be commercially available and used in Turkey. This list is not to be interpreted as a set of recommendations for particular substances to be adopted for particular applications. Where the choice is still not clear cut, it reflects no more than a judgement as to the likely choices of substitutes. Companies are making their own commercial decisions as to which substitute or alternative to adopt.

Domestic Refrigerators

6.22 The phaseout of CFC-12 as the refrigerant and of CFC-11 as the blowing agent for the insulating foam are two separate and independent processes. Each is considered in turn below.

6.23 **Refrigerant** - The new refrigerant HFC-134a requires a redesigned compressor for which there are associated development costs. No significant modifications should be required to the compressor manufacturing facilities (that is, no significant retooling will be needed).

6.24 Based on the experience of compressor and refrigerator manufacturers in the U.S.A. and Brazil, there will be net incremental production costs for the new cooling systems. These are expected to be:

- the additional cost of the new lubricant at about US $2.30 per compressor;
- a more expensive drier costing an extra US $0.50 per refrigerator; and
- improved enamel insulation on the motor wiring, costing about US $ 0.50 extra per refrigerator.

For these compressors that are imported, they are expected to cost an additional US $1.20 to reflect development costs.

6.25 The estimated long-term sale price of HFC-134a is taken to be five times the current international CFC-12 bulk sale price of about US$3,000 per ton (net of any import or other duties imposed by the Government of Turkey). This estimate is reported by companies currently developing HFC-134a. However, the new refrigeration systems will use about ten per cent less refrigerant. The additional cost of the first charge will therefore be about US$3,50 per refrigerator.

6.26 **Incremental cost of a CFC-free refrigerator** - Contacts with industry have indicated that additional production costs of about US $ 8 per refrigerator are expected. A typical mid-range model of 350 liters (approx. 12.5 cu ft) currently sells in Turkey for about US $ 400. Therefore, the projected additional cost is about 2 per cent of the current selling price.

6.27 The latest evidence from developments in the U.S.A.and Europe indicate that non-CFC refrigerators will be at least as energy efficient as current refrigerators, even though HFC-134a is thermodynamically less energy efficient than the existing CFC-12. The combination of redesigned compressors and new, less viscous lubricants is considered by European refrigerator manufacturers likely to result in energy savings. No consideration is given to incremental energy consumption in this analysis.

6.28 **Early Replacement of Domestic Refrigerators** - There will be significant costs associated with the forced replacement of domestic refrigerators when the equipment fails and cannot be recharged given that CFCs are no longer available. The number of units likely to be affected is estimated on the basis of the number of refrigerators that would have been recharged in any year if CFCs were still available. The cost to the consumer of forced replacement is represented by the timing difference between the actual early replacement and normal replacement. The cost of a new refrigerator is therefore included in the cash flow as the net timing effect, equivalent to including the full cost incurred at the time of early replacement and an equal and offsetting credit at the projected time of normal replacement.

6.29 This additional demand for replacement of refrigerators will increase the required supply of refrigerators and will therefore impact on refrigerator manufacturers. For simplicity of presentation, the costs are included at the full cost (US $ 400) of a replacement refrigerator.

6.30 The scale of these early replacement costs can be reduced by the use of recovery and recycling and/or stockpiling, which can extend the period of time for which CFCs are available for recharging.

Table 6.1
Current Uses of CFCs in Turkey and Assumed Substitutes

	Current use	Substitute assumed	Assumed earliest use in Turkey
Domestic refrigerators			
– refrigerant	CFC 12	HFC 134a	1995
– polyurethane insulating foam	CFC 11	50% CFC 11	1992
		HCFC 22	1997
Centrifugal chillers			
– refrigerant	CFC 11	HCFC 22	1993
Moblie air conditioning			
– refrigerant	CFC 12	HFC 134a	1993
Polyurethane foam			
– rigid (excluding refrigerator insulation)	CFC 11	50% CFC 11	1992
		HCFC 22	1997
– flexible	CFC 11	Carbon dioxide and methylene chloride	1993*
Solvents			
– electronics cleaning	CFC 113	Water and surfactants	1993

Insulation

6.31 As stated above, changes to CFC-11/water with addition of polyol requires no significant changes in production facilities. This adds approximately 2 to 3 per cent to the overall cost of the raw material formulation compared to the existing formulation. This information is according to companies selling the new formulations.

6.32 In the case where HCFC-123 will be used as the blowing agent, the costs are less certain since HCFC-123 is a gas at room temperature. In view of the uncertainties with these costs, none are included in this analysis.

Chillers/Central Air Conditioning Plants

6.33 There are no significant capital costs associated with the conversion of manufacturing facilities since chillers/central air conditioning plants are imported into Turkey. The only incremental cost will be the additional cost of the substitute refrigerant, HCFC-22. This is estimated to be US $100/ton, based on current prices before import and other duties imposed by the Government

Mobile Air Conditioning

6.34 Since Turkey does not manufacture mobile air conditioning units, the only incremental cost as far as Turkey is concerned is the additional cost of the new refrigerant, HFC-134a.

Foams

6.35 Flexible foams will switch from CFC-11 to carbon dioxide and methylene chloride as a blowing agent and will have negligible costs to modify the blowing nozzles and flow lines. However, additional costs for handling these blowing agents may be incurred. Methylene chloride is less expensive than CFC-11 and less is required to perform the same task. Therefore, there will be operating cost savings associated with this substitution. Based on the present prices, this will amount to a saving of US $824 per ton of CFC-11 replaced.

Solvents

6.36 The use of aqueous cleaning systems as based on experience in Europe, will require capital cost expenditures estimated at US $ 20,000 (based on a batch operation equivalent to an existing unit with an annual consumption of 10 tons of CFC-113). It is estimated that operating costs will decrease by US $ 1,500/ton of CFC-113 replaced, although this will be offset by the additional cost of the surfactant equivalent to US $ 5,820/ton of CFC-113 replaced.

Halons

6.37 As alternatives to halons are not expected until about the year 2000 and in view of the relatively low consumption of these chemicals in Turkey, no net incremental cost was considered in the present analysis.

Aerosols

6.38 As the changeover from CFCs to LPG as propellants in aerosols is expected to be completed 1992, the associated cost savings have not been included in the calculations made in this document.

Alternative Strategies

6.39 The following elements are addressed in this section:

- review of the Protocol requirements for ODS phase-out;
- identification of the most likely ODS phase-out scenario in Turkey based on current industry plans and market forces. This describes likely phase-out timings in each industry sector and builds these into the aggregate profile for Turkey; and
- construction of a hypothetical scenario that leaves CFC phase-out as late as possible while keeping Turkey within the Protocol consumption limits.

6.40 These scenarios provide the basis for an assessment of the net incremental cost of phase-out to Turkey (discussed later in this chapter), in order that the optimum option can be identified.

Ozone Depleting Potential - The Protocol defines limits for the "consumption" of ODSs, rather than for emissions to the atmosphere. Consumption is expressed in tons of the substance multiplied by its ozone depleting potential (ODP), where ODP is a number, assigned in the Montreal Protocol, which represents the relative damage each substance does to the ozone layer. ODP figures are given in Annex E. It is to be noted that CFC-11 is used as the reference substance with an ODP of 1. Consumption is defined as production plus imports minus exports and minus any ODSs destroyed by approved technologies. Since there are no ODS production facilities in Turkey and no destruction plants, consumption is therefore equal to imports of ODS and products containing ODS less any exports.

Protocol Ceiling - The Montreal Protocol imposes limits for phase-out of individual groups of ODSs separately. The focus of this report is on CFCs as the 1990 consumption of halons was 89 ODP tons or 2.5 % of the 3608 ODP tons consumed for that year.

ODSs according to the Montreal Protocol - The base which defines the 100 per cent ceiling is the average of consumption in 1995, 96 and 97, or 0.3 kg per capita if this were lower. Each party to the Montreal Protocol must ensure phase-out in all sectors of its economy in order to stay within these limits. This is illustrated in Figure 6.1.

6.41 **Unconstrained Demand in Turkey and the Protocol Limits** - The starting point for developing phaseout scenarios is the forecast of unconstrained demand as described earlier. This is illustrated in Figure 2.4, which shows unconstrained demand in ODP tons and compares the demand forecast to the Protocol phase-out limits.

Accelerated Phase-Out Scenario

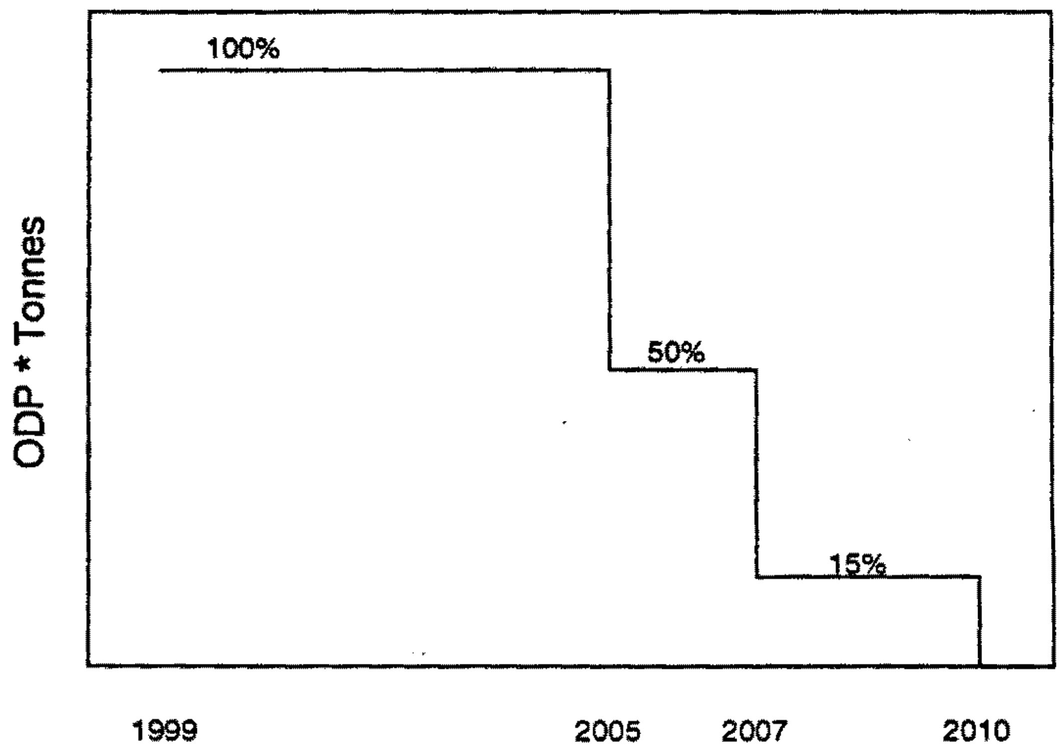
6.42 The optimum phaseout scenario for Turkey is one in which phaseout occurs as early as possible and consistent with technology availability ("accelerated" phaseout). This optimum scenario was determined by modelling a variety of timings in each affected sector. Following communications with producers of CFCs and industry in the U.S.A, Europe and elsewhere with regard to the present state of new technologies, it is estimated that a realistic timetable for the transfer of such technology to Turkey broadly accords with the

Figure 6.1

MONTREAL PROTOCOL

CFC PHASE-OUT PROFILE FOR ARTICLE 5 COUNTRIES

(as amended in June 1990)



Percentages are based on the lower of average consumption in the years 1995 to 1997, and 0.3 kilogrammes per capita plans of Turkish industry. This scenario is likely to require government actions to ensure that everyone is working to a similar schedule and therefore recognizes the lead times required by the government to introduce the necessary control measures.

6.43 Figure 6.2, illustrates the accelerated (most likely) phase-out profile in Turkey. The 100 per cent Montreal Protocol ceiling is based on the average of 1995-97 consumptions and is therefore lower than the ceiling based on unconstrained demand. This is because the demand for CFCs has already begun to decline before 1995. The small residual demand for CFCs post 1998 relates to recharging needs. It is assumed that there is a continuing supply to satisfy this within the Montreal Protocol limits.

6.44 Construction of this most likely scenario allows to ascertain whether this is optimal in the sense of incurring the least economic cost to Turkey.

6.45 The graph in Figure 6.2 represents the most likely aggregate phase-out profile for Turkey as a whole, but is actually built up sector by sector, as described in Annex F.

Allowable Phase-out Scenario

6.46 Theoretically, phaseout could be delayed as long as possible so as to just meet the Protocol limits for Paragraph 1 of Article 5 Parties. This scenario is referred to as the "delayed" phase-out and is illustrated in Figure 6.3. The scenario assumes (unrealistically) that there will not be any phaseout independent of government measures, although many companies in Turkey already have plans of phasing out ODSs. It also assumes that there will continue to be a supply of CFCs available for Turkey to import, even though many of its current suppliers may have terminated production in this century

6.47 Although this option is hypothetical, it is described here in order to assess the cost implications for Turkey of delaying phaseout.

6.48 The aggregate phaseout profile for Turkey as a whole is built from the individual sector responses as described in Annex F. The aggregate profiles are illustrated in Figures 6.2. and 6.3.

Practical Considerations for Phase-out Timing

6.49 The Montreal Protocol prescribes the latest possible timing for phase-out of CFCs. However, there are also a number of practical considerations for the Government of Turkey in deciding on the phase-out timing it will adopt. These are as follows:

- some of the major users of CFCs in Turkey (principally aerosol fillers and refrigerator manufacturers) are already formulating plans to change to substitutes, independent of government directives. This is largely a function of the trading positions of these companies with Europe and elsewhere, in relation to technical cooperation, import of components and export of finished goods. International market forces will also drive some phase-out of CFCs. The Government of Turkey may wish to follow a strategy that is consistent with these forces;

Figure 6.2 ACCELERATED PHASE-OUT OF CFCs IN TURKEY

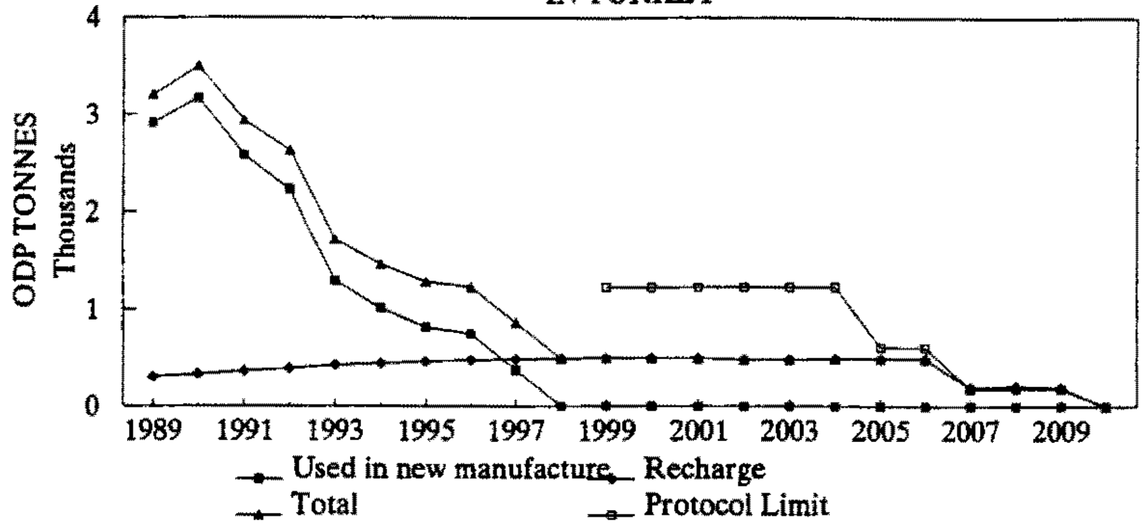
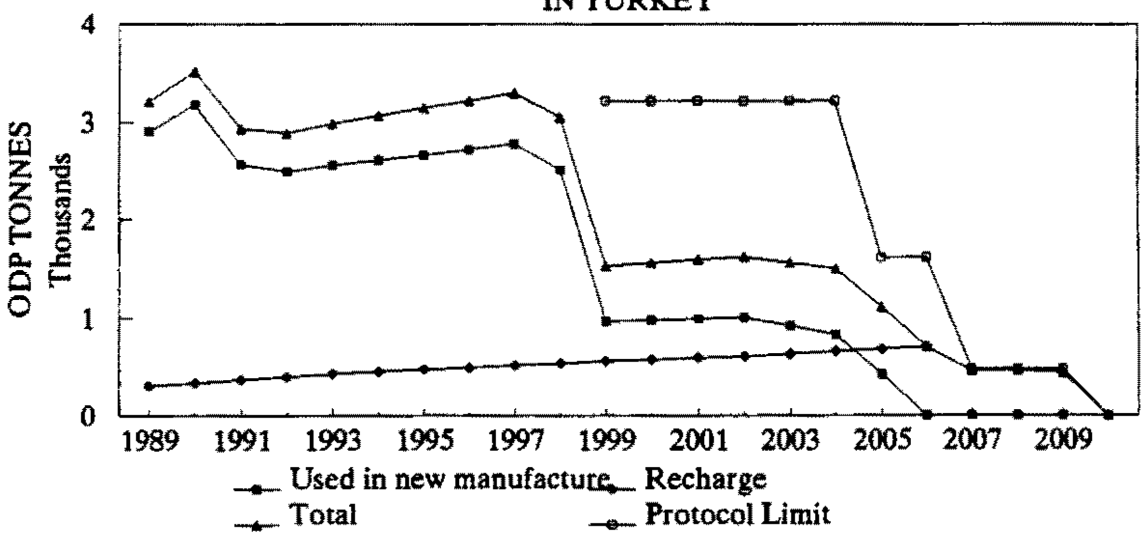


Figure 6.3 ALLOWED PHASE-OUT OF CFCs IN TURKEY



- the future availability of CFCs from producers in Europe and the USA might well decline over the next five years: these producers will shut down their production capacity in line with the production demand in their home markets as the phase-out limits for developed countries are imposed. This starts with the 50 per cent consumption limit in 1995. Although the Protocol allows for some continued production to meet the needs of paragraph 1 of Article 5 Parties, it is not yet clear that this will be a commercially viable option for the producers. Turkey may be able to secure supply from other paragraph 1 of Article 5 Parties, or may choose to phase-out its consumption within the known supply pattern;

- In addition, there is growing concern about the current extent of depletion of the ozone layer and more rapid phaseout may be recommended. The Multilateral Fund has, amongst its aims, the objective of providing incentives for early action.

6.50 These issues indicate that phaseout may be most likely and most desirable in Turkey well in advance of the deadlines set in the Montreal Protocol.

Incremental Costs to TURKEY

6.51 This section estimates the net incremental costs to the Turkish economy based on the scenarios described previously.

Key Assumptions

6.52 There are many uncertainties inherent in making forecasts of the sort entailed in developing a Country Program for ODS phaseout. Therefore, any cost calculations can only be indicative. The figures presented here should not be taken as any more than order of magnitude indications of possible outcomes.

6.53 The cost calculations are based on the demand forecasts and phase-out scenarios already described. In addition, a number of further fundamental assumptions underlie the net incremental costs calculations. These are set out below:

- the net incremental cost to an economy in compliance with the Montreal Protocol is defined as the difference between the costs that will be incurred in meeting demand unconstrained by any requirement to phase-out CFCs and those incurred in meeting the same level of demand for products but within the constraints of the Protocol. This will take into consideration both increases in costs in some sectors and cost savings in other sectors;

- net incremental costs to industry may be capital costs and/or operating costs;

- the unit costs are multiplied by the projected number of units at any given time to give a total cost;

- the costs are included on a cash flow basis with the timing of the cash flow to match the assumed phase-out timing;

- the identified incremental cash flows in each industry sector (in 1991 prices) are calculated for the years 1991 to 2010 inclusive for each phase-out scenario;

- the cash flows associated with the early replacement of domestic refrigerators, which cannot be recharged once virgin CFCs are no longer available, are calculated. As the early replacements run on after the 2010 cut-off date, these cash flows are included through to the year 2015. This will still exclude some further early replacements that may occur after 2015 in the delayed scenario;

- all prices for CFCs are included at current 1991 US $ levels. Predictions about possible increases in the price of CFCs as supply becomes scarce have not been made. Also, the prices of substitutes are included at the expected long term price, as obtained from the industry in Europe and the USA. This does not take into account the higher current prices of these;

- for each scenario, the annual cash flows are discounted to 1991 to give the net present value. This enables the comparison of costs incurred at different points in time by reference to the equivalent cost today, taking into account the time value of resources; and

- a discount rate of 10 per cent is used.

Results

6.54 The estimated economic costs to Turkey of compliance with the Montreal Protocol vary according to the timing of phaseout. Based on all the assumptions about projected demand, suitability of phaseout measures and likely costs of substitution, the economic costs of phaseout to Turkey may be summarized as follows:

	Optimum phase-out scenario US $ Million	Allowable Phase-out scenario US $ Million
Incremental capital costs	2	1
Incremental operating costs	69	31
Forced early replacement costs	56	200
Total	**127**	**232**

6.55 It is worth re-emphasizing here that these are only indicative figures given all the uncertainties inherent in their calculation. It is also to be noted that it is up to the Multilateral Fund to decide which costs will qualify for assistance.

6.56 The total costs are dominated by the potential costs associated with forced early replacement of domestic refrigerators.

6.57 A variety of phaseout timings intermediate between the two extremes of the accelerated and allowable scenarios were analyzed. This analysis showed that any timing later than the accelerated scenario increases the total cost, since the reduction in incremental production costs is more than offset by the additional early replacement costs. This is not taking into account the effects of any potential recycling, which is examined in more detail below. However, it seems unlikely that all the unsatisfied recharge demand can be met from recycling. Therefore, although recycling could reduce the early replacement costs, it is unlikely to alter the choice of timing of phaseout for minimum economic cost.

6.58 The most likely phaseout scenario is the one that represents the optimum in terms of least economic cost to Turkey.

6.59 **Cash Flow Patterns** - The net present value figures given above do not show the anticipated timing of cash flows. These are illustrated in the graphs in Figures 6.4 and 6.5.

6.60 Figure 6.4 shows the incremental annual cash flows from 1990 to 2015 corresponding to the accelerated (optimum) phase-out scenario, distinguishing between incremental capital costs, operating costs (these are steadily increasing, reflecting higher unit cost and increasing demand) and the projected costs related to forced early replacement of domestic refrigerators.

6.61 Figure 6.5 shows the corresponding cash flows for the delayed scenario to the same scale. The incremental operating costs begin later with the allowable phase-out, but the forced early replacement costs are significantly higher since a much higher proportion of the total refrigerator population in 2010 will be based on CFCs than in the accelerated scenario. The refrigerator population figures (based on the average 20 year life described in the section on current and forecast demand for CFCs) in Turkey in 2010 are as follows:

Refrigerant in Refrigerators	Optimum phaseout	Allowable phaseout
CFC-12	7 Million	17 Million
HFC-134a	17 Million	7 Million
Total	24 Million	24 Million

Recovery and Recycling Estimated population of refrigerators in Turkey in 2010

6.62 From the above analysis one can conclude that there is an opportunity to avoid some of the early replacement costs if CFCs are recycled and are therefore available for recharge after virgin CFCs are no longer available.

6.63 Based on the phaseout scenarios examined, recharge with virgin CFCs is constrained from 2007 (assuming that there is continuing CFC supply after complete phaseout in developed countries) and none is possible from 2010 (the date at which paragraph 1 of Article 5 Parties' consumption must be zero).

6.64 A recycling programme might be introduced in, say, 2000 to allow time for it to have fully penetrated the market by 2007 when recycled CFCs are actually needed for refrigerator recharge. The extent to which the early replacement costs are reduced depends on the effectiveness of the recycling programme. This reduction is partly offset by the costs of recycling, which are discussed in the section on the costs of substitution.

Figure 6.4 ANNUAL INCREMENTAL COSTS
ACCELERATED PHASE-OUT

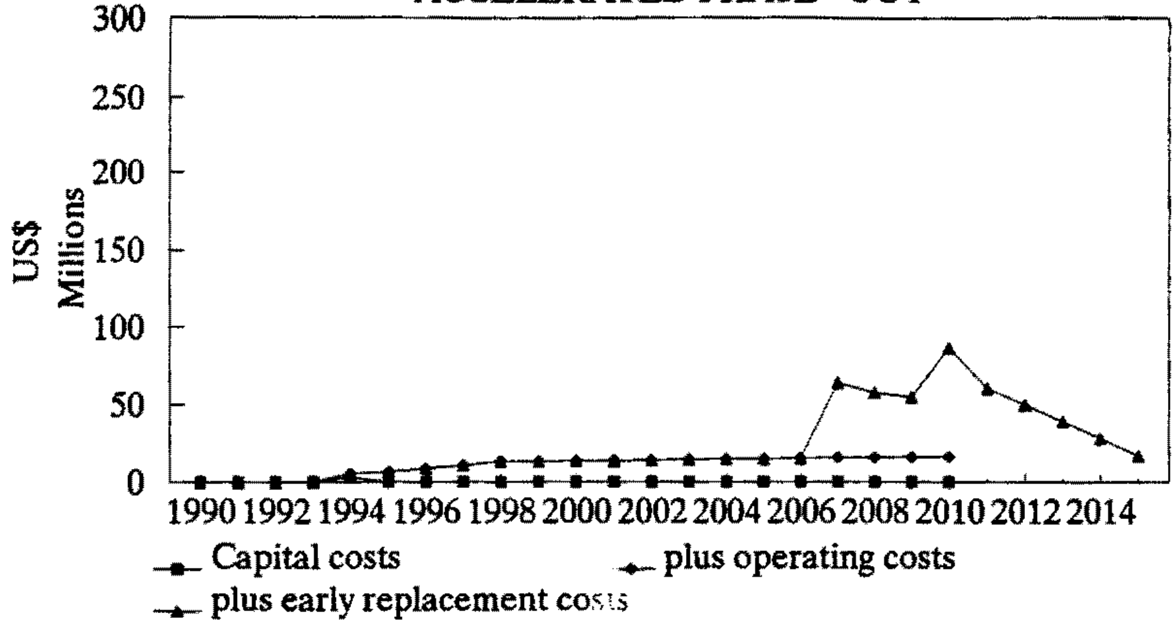
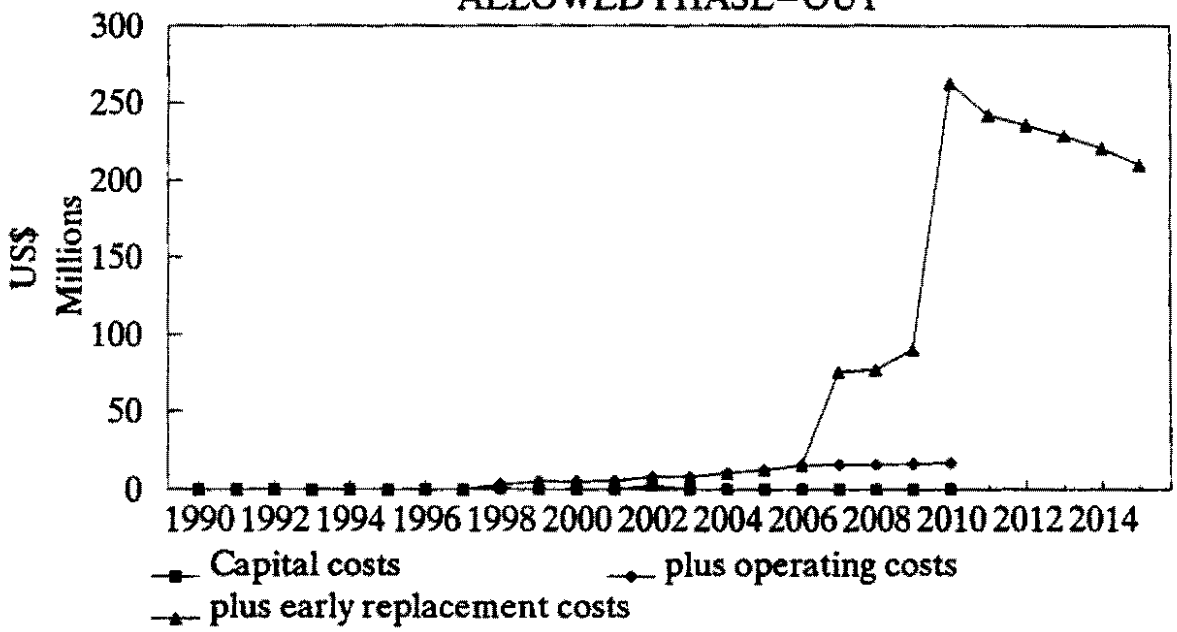


Figure 6.5 ANNUAL INCREMENTAL COSTS
ALLOWED PHASE-OUT



6.65 For illustration, two recycling cases are considered:

- **limited recycling**, where it is assumed that about 50 per cent of the CFCs are recovered from refrigerators being repaired. It is impractical to collect any CFCs from refrigerators reaching the end of their useful lives. In this example there will only be sufficient volumes of recycled CFC to recharge a proportion of the refrigerators that would otherwise have to be replaced early; and

- **substantial recycling**, where it is assumed that about 75 per cent of the CFCs are recovered from refrigerators being repaired, and about 25 per cent of the CFCs from refrigerators reaching the end of their useful lives.

6.66 The effect of these programs on the net present value of the early replacement costs, taking into account the costs of the proposed recycling schemes, are estimated as follows:

	Early replacement costs (US $ Million)	
	Optimum phaseout	**Allowable phaseout**
No recycling	56	200
Limited recycling	34	117
Substantial recycling	10	71

6.67 There is a strong argument for the introduction of recovery and recycling schemes in advance of these suggested timings to supply CFCs for recharge if virgin supply becomes restricted sooner, as phase-out proceeds in developed countries.

6.68 Recycling schemes could technically be introduced immediately. This would reduce demand for virgin CFC and thus reduce overall emissions to the atmosphere. However, this is an expensive process, especially in Turkey where there is likely to be a very low utilization of recovery machines since the number of refrigerator repairs per workshop is quite low. This is exacerbated by the relatively low cost of virgin CFC-12 in Turkey compared to elsewhere in the world. The cost savings associated with the reduced purchases of virgin CFC if recycled CFC is available are unlikely to be sufficient even to cover the operating costs of the recovery/reclaim process. If the capital costs are also taken into consideration, the process is even less economically viable.

<u>Conclusions</u>

6.69 The net incremental costs to Turkey of phase-out of CFCs vary with the timing of the introduction of substitutes and alternatives. Phaseout as soon as technically possible represents the least cost option for Turkey and is most in tune with prevailing international market forces and the plans of Turkish industries. It is therefore in everyone's best interest and is the preferred option.

6.70 The most significant net incremental costs to Turkey are those associated with the potential forced early replacement of domestic refrigerators when virgin CFCs are no longer available for recharge. Recovery and recycling schemes, perhaps in combination with stockpiling, could provide CFCs for recharging after virgin CFCs are no longer available and thus could significantly reduce the number of forced early replacements. Effective recovery and recycling programs should be encouraged to this end, balancing the cost of such programs against the early replacement cost avoided.

7.0 PROPOSED STRATEGY STATEMENT BY THE GOVERNMENT

As a requirement of the Montreal Protocol, the Government of Turkey has to define a strategy in which it will explain how the country will phase out ODSs.
This chapter proposes such a strategy statement.

7.1 It is proposed that the Government of Turkey adopts an integrated ODS phaseout strategy which is in line with current Turkish industry plans and prevailing international market forces. This corresponds to an ODS phaseout as soon as is technically feasible and is the option that incurs the least economic cost to the economy. The government should introduce phaseout measures in order to ensure that industries in Turkey are working to the same schedule. The strategies and policies which will be adopted by the Government of Turkey should be outlined in a National Ozone Policy.

7.2 The recommended policies are compatible with the existing institutional and policy framework of Turkey. These policies utilize market forces and negotiated agreements with industry to accomplish phaseout goals in a cost effective and equitable manner.

7.3 Public acceptance of the costs and inconveniences accompanying the ODS phaseout is an essential ingredient in achieving a prompt and effective phaseout. It is recommended that the government of Turkey actively support programs directed at elevating public awareness in particular reclycle/recovery activities and provide early announcement of its intentions to both the public and to industry in order to encourage appropriate action.

7.4 Each policy option is based on various assumptions and parameters on technology availability, phaseout targets, demand and future costs. These assumptions and parameters were introduced and detailed in the previous chapter of this report.

7.5 It is recommended that the following set of policies be part of the National Ozone Policy (NOP):

- Strengthen the Ministry of Environment by increasing technical and financial resources to a level consistent with growing environmental needs within Turkey;

- Establish a licensing and/or permit which provides better control of imports and encourages environmentally responsible handling practices and restricts distribution to users who qualify through approved programs;

- Establish ODS import monitoring procedures which account for all ODSs as required under the Montreal Protocol, and from which progress in reducing ODS consumption can be tracked to make appropriate adjustments in programs and policies;

- Create a "Task Force" within the Ministry of Environment as a focal point that will provide a guiding role in the formulation and promulgation of specific policies consistent with the NOP. The "Task Force" would also function to develop voluntary agreements within industry to establish specific end-use bans consistent with the overall objectives of the ODS phaseout program. The Ministry of Environment will adopt Ministerial Decrees to support the voluntary agreements;

- Expedite implementation of specific projects directed at reduction of ODS use and adoption of substitute chemicals and technologies. All imported equipment and technologies should be exempted from customs levies, duties, sales taxes, etc.;

- Public awareness of the "Ozone Issue" should be enhanced through media attention for ODS reduction technologies;

- Introduce a levy on ODS to double its cost-including-freight (CIF) price at the time of application of the levy. This will provide a stimulus for:

  a. the substitution of CFC-11 by HCFC-22 in new central air conditioning plants;

  b. the use of only 50 per cent of the current amount of CFC-11 in blowing rigid polyurethane foams; and

  c. the use of methylene chloride or other agents in the manufacture of flexible and rigid polyurethane foams;

- Introduce a levy on CFC-113 to increase its CIF price approximately fourfold of the price at the time the levy is introduced, thus encouraging a switch to the use of aqueous cleaning agents;

- Introduce a levy on CFC-12 to increase its CIF price to the prevailing CIF price of HFC-134a to promote the use of alternative refrigerants in new equipment and to provide an incentive for recycling CFC-12 for recharge; and

- A further increase in the tax on CFC-11 to provide a stimulus to introduce a completely new blowing agent for rigid polyurethane foams.

7.6 Eventually, bans would be introduced for the use of CFCs in the following applications:

- new central air conditioning units;

- polyurethane foams, excluding refrigerator insulation;

- CFC refrigerants in new refrigerators and air conditioners;

- electronics cleaning; and

- refrigerator insulation foams.

7.7 The proposed strategy would allow for the continuing import of CFCs for recharging purposes until 2010.

8.0 ACTION PLAN

The Action Plan defines the specific actions, policies and institutional responsibilities towards supporting project activities by the Government of Turkey to achieve complete and optimum phase-out of ODS use within the time constraints imposed by the Montreal Protocol

Plan Development

8.1 The objective of the Action Plan is to effectively, efficiently and as fairly as possible phase-out the consumption of ozone depleting substances in Turkey earlier than its obligations towards the Montreal Protocol.

8.2 The Action Plan comprises the investments, policies and implementation actions needed to ensure compliance. The principal agents are the Government (which is responsible for the specific policies, referred to here as "National Ozone Policy"), the World Bank (which is the implementing agency for the investment projects), and UNDP (responsible for implementing broad based technical assistance). These three agencies must synchronize their actions to effect the purpose of the Action Plan, i.e. reduce ODS emissions as early as technically possible and within the terms of the Montreal Protocol.

8.3 This action plan is consistent with the identified optimum phaseout timing and the principles for evaluating and financing net incremental costs for the ODSs phaseout as detailed in the "Indicative List of Categories of Incremental Costs" adopted by the Second Meeting of the Parties to the Montreal Protocol. In summary these are:

- cost-effective and efficient strategy;
- analysis which credits savings and avoids double accounting; and
- features early adoption of ozone protecting technologies.

8.4 The following section provides a summary of the Action Plan proposed for Turkey based on the optimum phaseout strategy. In this scenario, action is initiated in 1992 and the phaseout is completed by 2010.

Recommended Government Actions

8.5 The following is a summary of actions recommended for the various ministries and agencies with active roles in the implementation of an ODS phaseout. These recommended actions and proposed timetable are summarized in Table 8.1.

Ministry of Environment

- Announce and publicize intentions;
- Initiate an intensive public awareness campaign;

TABLE 8.1: ACTION PLAN SUMMARY FOR TURKEY

Item	1992-1993	1994-1995	1996-2010
Levy on CFCs	. Establish levies on imported CFCs. The goal is to discourage continued CFC use in foams and to encourage recovery/recycle from refrigerators. . Set levy on methyl chloroform (MCF).	. Increase levy on CFC to levels which encourage use of subsitutes and recycle in domestic refrigerators.	. Sustain levy at maximum feasible levels.
Monitoring	. Develop a monitoring sytem for ODS imports within the customs department which meets the following objectives: - complies with reporting requirements of the Montreal Protocol, - tracks progress of ODS phaseout, supports levy collection.	. Monitor progress and issue proper reports to UNEP and others. . Monitor effectiveness of levy.	. Continue monitoring activities.
Public Industry Awareness	. Direct media attention to advantages of projects on recycle/recovery of CFCs and to the necessity to conserve precious CFC supplies. . Communicate features of National Ozone Policy to the public and to industry.	. Continue to enhance awareness and outreach activities with workshops and seminars. . Announce new policies well in advance of introduction.	. Continue to develop support for phaseout activities.

TABLE 8.1: ACTION PLAN SUMMARY FOR TURKEY
(continued)

Item	1992-1993	1994-1995	1996-2010
"Ozone Panel"	. Establish joint industry-government panel to encourage dialogue on key issues and to broker agreements on conservation, bans and other policies.	. Continue functions as outlined.	. Continue functions as outlined.
Bans	Formally announce government policy on ODSs. . Recommend new bans as needed, e.g. - carbon tetrachloride - CFC-113 solvents.	. Ban use of CFCs in new central air conditioning. . Ban use of CFCs for rigid and flexible foams.	. Ban use of CFCs as solvents. . Ban use of CFCs in rigid foams. . Ban use of CFC in new domestic refrigerators. . Ban all imports of virgin CFCs.
Licensing	. Conduct workshops for refrigeration service personnel featuring recovery/recycle.	. Establish licensing system for refrigerator service personnel.	. Extend licensing to all ODS users.
Project Identification and Implementation	. Request action plans for ODS phaseout from major users in the foam and refrigeration sectors. . Identify, evaluate and arrange for the implementation of demonstration projects in the key user sectors, especially foam and refrigeration.	. Follow-up action plans. . Continue with project implementation. . Distribute information and project results within user sectors.	. Continue functions as required.

- Incorporate into the draft environmental policy statement by the Ministry of the Environment a policy statement along the lines of the proposed strategy statement presented in Chapter 7;

- Incorporate in the draft modified environmental law or related regulation of licensing and\or permit system in order to monitor all sales of ODSs in Turkey. A license would be required for all imports and internal purchases of ODS as chemicals;

- Set up an administration system for licenses and\or permits;

- Establish a task force including representatives from relevant government departments, industry and the Union of Chambers of Commerce. Initiate consultation within this task force;

- Finalize and publish the Government's policy statement including agreed timings for each measure;

- Prepare the required new directives for the environment fund levy within the existing Environmental Fund; and

State Institute of Statistics

- Collate data from customs and licensing on CFCs entering and leaving Turkey.

Customs Department

- Arrange the mechanism to record all CFCs imported and exported both as chemicals and in products containing CFCs; and

- Implement the levy collection mechanism.

State Planning Organization

- Provide necessary support and approvals for policy development and implementation.

Undersecretariat of Treasury and Foreign Trade

- Introduce principles related to the control of imports of ODSs and products containing ODSs.

- Prepare any necessary legislation for the introduction of levies and bans.

- Grant permissions and instructions, make amendments or take measures that are deemed necessary at each stage of import.

- Control and have controlled the import prices of ODS.

- Participate in the establishment of financial flow mechanisms.

Union of Chambers of Commerce

- Coordinate industry inputs to policy discussions and implementation processes; and
- Disseminate up-to-date information to relevant companies.

Management Action Plan

8.7 The Management action plan should include the establishment of a management unit for projects receiving assistance from the Multilateral Fund. It should also include the establishment of a monitoring unit for the phase-out program in order to implement the Action Plan.

Proposed Projects

8.8 The Country Program will be submitted to the Multilateral Fund which may provide financial assistance for selected projects. The initial project pipeline for Turkey consists of the following three main components:

- test, development and production facilities for HFC-134a compressors and ODS-free refrigerators for one of the major refrigerator manufacturers in Turkey, Arcelik;
- introduction of recovery and reclamation of CFC-12 from household refrigerators being repaired in a network of service shops in the Istanbul area; and
- recovery and reclamation of CFC-12 from new household refrigerators being repaired in Arcelik's refrigerator production factory.

8.9 The total incremental cost identified for these projects is US$ 5.4 million. A breakdown of these costs is given in the following section. Details on the proposed projects are presented in Annex A. Additional smaller scale projects will be identified in other ODS-using sectors.

Budget and Financing Program for Identified Projects

8.10 In order to promote early phaseout of ODSs in the foam and refrigeration sectors, demonstration projects will be identified, evaluated and implemented. These projects can be submitted to the IMLF for funding.

8.11 Since the proposed project budget is larger than US $ 500,000, it must be approved by the Executive Committee of the Multilateral Fund to obtain fund assistance.

8.12 The table below gives a breakdown of project costs by component and by year of implementation. Administration cost has been added to the project costs.

Sub-project	1992	1993	1994	Total x 1000 US$
Test facilities	1,632	389	388	2,409
Recovery and reclaim from service shops	245	214	124	583
Recovery and reclaim from production factory	79			79
Subtotal	1,956	603	512	3,071
Adm. costs (13%)	254	78	66	398
Total	2,210	681	578	3,469

Funds Handling Mechanism

8.13 Once the incremental costs of the proposed project (described in Annex A) are approved by the Multilateral Fund, appropriate funds handling mechanism will be set up.

ANNEX A

TURKEY: Montreal Protocol Country Program

PRELIMINARY PROJECT PROPOSAL
(SUBJECT TO FURTHER DEFINITION)

NOTE: The project descriptions and budget estimates provided in this Annex present information that was generated in October 1991, during the Country Program preparation mission. Since then, the projects have been further defined on the basis of technical work by the proposed recipient company and the World Bank and will be presented to Multilateral Fund for the Implementation of the Montreal Protocol under separate cover. Additional projects which are eligible for Multilateral Fund assistance could be identified and presented at a later date.

PRELIMINARY PROJECT PROPOSALS
(AS OF OCTOBER 1991)

A.1 INTRODUCTION

This project proposal encompasses the following three components:

1. Purchasing of the equipment and technical support necessary to facilitate the switch from CFCs to non ozone depleting substances (ODSs) in the production of household refrigerators;

2. Recovery and reclamation of CFC-12 from household refrigerators being repaired in service shops; and

3. Recovery and reclamation of CFC-12 from household refrigerators being repaired in a refrigerator production facility. This project is the result of a cooperative effort between various Ministries of the government of Turkey, Arcelik, A.S., (a household refrigerator manufacturer) and representatives of a World Bank Mission to Turkey undertaken between September 17, 1991 and October 2, 1991.

A.2 GOALS

The implementation of this project will assist in carrying out the mandate of the Montreal Protocol and its Interim Multilateral Fund (IMLF)in phasing out the use of ODSs in Article countries in an expeditious and cost effective manner at the same time conserving critical CFC supplies and eliminating unnecessary emissions.

A.3 BACKGROUND

Country background

Household refrigerators and freezers are significant users of CFCs in Turkey. In 1990, approximately 1,000,000 refrigerators and freezers were produced in the country. Each of these units contains 0.20 to 0.30 kg of CFC-12 in the refrigeration system. Approximately 1.0 kg of CFC-11 is used in producing the polyurethane cabinet insulation. The total number of refrigerators and freezers in use in 1990 is estimated to be 10,000,000.

Company background

Arcelik is the largest producer of refrigerators in Turkey. In 1990, they produced 537,325 units. This company has been producing refrigerators for over 30 years. During this period they have had technical know-how arrangements with several well known companies in the U.S. and Europe. It is one of the two companies in Turkey producing hermetic compressors for use in its products.

Depth of manufacturing integration is unusually high. For example, they draw copper wire from rods in the several different diameters necessary for the hermetic motors required for their compressors, coat the wire with the special electrical insulation enamel used in hermetic refrigeration systems, punch out, assemble and wind stators and aluminium cast the motor rotors. The original know-how to make hermetic motors was obtained through a licensing agreement with the U.S. General Electric Company which is no longer in effect. The technology for the mechanical portion of the compressor has been and is still sourced from the U.S. Tecumseh Products Company of the U.S.A.

Arcelik presently manufactures two series of compressors each with four different capacities. The older version is the "AE" series that has been well known throughout the international market for many years. A more recent design is known as the " AZ" series. This smaller compressor is used on smaller sized products in moderate climates. This design has not been used extensively in the U.S. and it is reported that Tecumseh is concentrating their development work on alternate refrigerants on the larger "AE" model, thus they might not be able to provide Arcelik with timely technical information on the "AZ" models.

Arcelik also has a limited agreement with Bosch-Seimens, Germany. This agreement covers very specific models of refrigerators (4 in this case) and provides technical information on the current models. It does not provide for assistance on modifications to the models that might involve alternate CFCs.

A.4 CFC-12 HOUSEHOLD REFRIGERATOR TECHNOLOGY ANALYSIS

Since the late 1930's, CFC-12 has been the standard refrigerant used in vapor compression cycle household refrigerators. The unique properties of CFC-12, its low toxicity, superior heat transport properties and non-flammability have contributed to its world wide acceptance as the refrigerant of choice in the millions of high efficiency refrigerators. The chemical stability of CFC-12, its compatibility with desiccants, lubricating oils, compressor metallic components and the synthetic electrical motor insulation materials have allowed the production of highly developed heat exchangers, compressors, piping and control systems.

The refrigeration system of a household refrigerator can be compared to a small chemical factory. The refrigerant and its associated compressor lubricant (which circulates around the system with the refrigerant), is subjected to very high temperatures and pressures during the compression stroke while at the same time being exposed to various metallic materials that may act as catalysts for chemical breakdown. The lubricant must be miscible with the refrigerant and it must return to the compressor to insure lubrication and not be trapped in the cold evaporator. Through the years the household refrigerator industry has seen significant incidents of catastrophic product failures (failures of large groups of products of a discrete design) primarily due to unforeseen chemical reactions such as carbonaceous deposits on compressor valves, motor insulation deterioration, system component corrosion, obstructions in small bore tubing, etc.

A.5 THE SWITCH TO ALTERNATE REFRIGERANT HFC-134a

The change to a refrigerant, such as HFC-134a that is, by definition, less stable that its predecessor (in order that it does not deplete the ozone layer) is a major concern for a refrigerator manufacturers. Because Arcelik manufacturers both the electrical motor and the mechanical compressor. It is particular vulnerable to risk. Those refrigerator manufacturers who purchase compressors from original equipment manufacturers (OEM's) will not have to bear the development cost and warranty risks inherent in the motor and compressor. Due to the somewhat different thermodynamic characteristics of HFC-134a from CFC-12, the compressor displacement and the motor output will have to be optimized for the new refrigerant. Due to the increased solvent potential of HFC-134a and its associated polyester lubricating oil, the motor wire insulating enamel is expected to require reinforcement. It is anticipated that the required product design changes will require little or no modification of manufacturing equipment.

A.6 USE OF CFC-11 IN POLYURETHANE REFRIGERATOR INSULATION

Polyurethane is the most common material used in refrigerator insulation. It is anticipated that, after appropriate refrigerator performance testing in the temperature controlled test cells, the shift to formulation utilizing 50% less CFC-11 will be possible without significant production equipment modification. There is a slight increase in material costs for this formulation which may defer its introduction until the change is dictated by market forces. The timetable for eliminating all of the CFC-11 in the cabinet insulation is indeterminate. One of the best candidates for replacing CFC-11 is HFC-123, however, additional toxicity testing will be required.

A.7 PROJECT ELEMENTS FOR CONVERTING REFRIGERATORS TO NON-ODSs

Table I contains a list of equipment, personnel training and technology transfer requirements necessary for Arcelik to meet the incremental requirements to accomplish the timely and cost-effective phaseout of ODS from its manufacturing operations. The development facilities will provide the capabilities to conduct performance and life testing of the refrigerators, its individual components as well as the materials that make up these components and minimize the financial and economic risk of such a major product change.

A.8 PROJECT ELEMENTS FOR THE RECOVERY AND RECLAMATION OF CFC-12 FROM HOUSEHOLD REFRIGERATORS THAT ARE BEING REPAIRED.

BACKGROUND

Recovery and reclamation of CFC-12 from household refrigerators that are being serviced is a conservation and emission reduction measure that can be implemented without delay. Refrigerant recovery and recyling technology is receiving acceptance worldwide.

The technology involved in handling and processing used refrigerant is developing very rapidly. There are many companies in the U.S., U.K., and Europe now producing machines of various types to be used in this field. The Air-Conditioning & Refrigeration Institute has issued "Standard for Performance of Refrigerant Recovery,Recycling And/Or Reclaim Equipment" Standard 740-91. In the U.S., the Underwriters Laboratory also tests recovery machines to certify that they meet Society of Automotive Engineers (SAE) specification SAE J1990 for equipment and SAE J 1991 for refrigerant purity.

One of the more recent developments is the availability of machines whose manufacturers claim have the capability of reclaiming refrigerants to meet the new product specifications.

A.9 CFC-12 RECOVERY & RECLAMATION IN THE PRODUCT SERVICE OPERATION

BACKGROUND

Arcelik has 410 franchised service shops throughout Turkey. They are carefully controlled by company owned regional service centers. The service shops operate 570 service trucks. About 30 % of compressor changes are made in the home and the remainder are brought to the shop for repair. There are 90 service shops in the greater Istanbul area would participate in this project.

The typical compressor replacement procedure is to unsolder the compressor and drier, allowing the refrigerant to be emitted to the atmosphere, resolder the new compressor and drier, evacuate the system with a vacuum pump charge with CFC-12, check for leaks with a halogen leak detector, and operate the refrigerator to check for proper performance.

A.10 RECOVERY/RECLAMATION PROJECT IMPLEMENTATION FOR THE PRODUCT SERVICE OPERATION.

This project provides for the establishment of a central reclamation center and testing laboratory to which recovered refrigerant from compressor replacements will be delivered for reclamation in preparation for reuse. Fifteen service shops at a time will be provided with recovery machines. Every three months after that, another fifteeen shops will be provided with the machines. This will allow for proper training and project evaluation. Thus the program will take approximately eighteen months to provide all 90 shops with recovery machines. The technical personnel will be assigned for two years in order to monitor and evaluate the project and plan for its expansion as appropriate.

The reclamation center will be available for processing refrigerant from other entities that may be established.

The financial information on this portion of the project is shown in Table II.

A.11 RECOVERY AND RECLAMATION PROJECT FOR FACTORY PRODUCTION

This portion of the project provides for the establishment of a central reclamation center in the production plant. Each of the three assembly line repair areas will be equipped with a refrigerant pump connected by piping to the reclamation station. When it is necessary to remove the refrigerant from a defective refrigerator, the refrigerant will be pumped to the reclaim unit where it will be processed and returned to the main factory charging system.

The financial information for this portion of the project is shown in Table III.

TABLE I

EXPENDITURES RELATING TO THE DEVELOPMENT ACTIVITY REQUIRED TO IMPLEMENT THE ENGINEERING CHANGES NECESSARY TO FACILITATE THE SWITCH FROM CFC-12 TO THE ALTERNATE REFRIGERANT HFC-134a AND EVALUATE MODIFIED POLYURETHANE FOAM INSULATION FORMULATIONS.

This project will be realised over a three-year period.

1. EQUIPMENT	U.S. $
Controlled ambient test cells. 2 cells, 4 stations each	200,000
Data acquisition for test cells	100,000
Falex + Sealed tube test equipment	50,000
Tangent Delta, wire test equipment	50,000
Compressor calorimeter	275,000
Compressor life test stands 40 stands x 1,200	48,000
Refrigerator component operation X - Ray	410,000
Refrigerator component calorimeter calorimeters	150,000
Refrigeration system software	30,000
Insulation conductivity measurement equipment	30,000
TOTAL FOR EQUIPMENT	$ 1,243,000

2. PERSONNEL REQUIREMENTS:

Title	Costs/year	# years	Number required	Total
Project Leader	45,000	3	1	135,000
Project engineers	27,000	3	1 compressor	81,000
			2 refrigerator	162,000
			1 insulation	81,000
			1 laboratory	81,000
Technicians	16,000	3	3	144,000
	TOTAL FOR PERSONNEL			**$687,000**

3. TECHNOLOGY TRANSFER EXPENSES:

a) Expenses for out of country travel for conferences, seminars, consulting, education, etc. for project engineers

Personnel	No. required	No. of trips per year	Total trips per year
Project Leader	1	3	3
Project Engineers	5	1 (each)	5
		Total trips	8

Budget per trip:	Total Cost $
Transportation	1,000
Living expenses ($300 x 10 days)	3,000
Other expenses (conference fees, etc.)	1,000
Total	$5,000
Cost for one year: ($5,000 x 8)	$40,000
Cost for three year project: ($40,0000 x 3)	$120,000

b) Expenses within country travel supplies, production facilities, universities, government agencies for project personnel

Personnel	No. required	No. of trips per year	Total trips per year
Project Leader	1	6	6
Project Engineers	5	3 (each)	15
Project Technicians	3	1 (each)	3
		Total trips	24

	Cost $
Cost per trip:	1,000
Cost for one year: ($1,000 x 24)	24,000
Cost for three-year project: ($24,000 x 3)	72,000

c) <u>Expenses for outside consultancy, royalties, testing:</u>

<u>Defined consultancy needs per year:</u>

Refrigeration technology	2 weeks
Compressor technology	2 weeks
Materials chemistry	2 weeks
Polyurethane technology	1 week
Measurement technology	1 week
Software technology	1 week
Total	9 weeks

Budget for outside country consultant:

Consultant fee: ($700 day x 7 days)	$4,900
Transportation:	$1,500
Living expenses: ($300 per day)	$2,100
Total per week	$8,500
Total cost per year: (9 x $8,500)	$76,500
External projects, laboratory analysis, testing, etc. per year:	$20,000
Total for outside consultancy per year:	$96,500
TOTAL CONSULTANCY EXPENSES FOR THREE YEARS:	$289,500

TOTAL PROJECT COSTS:

EQUIPMENT:	$1,243,000
PERSONNEL:	687,000
TECHNOLOGY TRANSFER:	481,500
SUB TOTAL	$2,411,500
Contingency 10%	$241,150
TOTAL	$2,652,650

TABLE II

A PROJECT FOR THE RECOVERY, RECYCLE, AND RECLAIM OF CFC-12 IN SERVICE SHOPS IN THE METROPOLITAN AREA OF ISTANBUL.

THIS IS A PHASED IN PROJECT BEING COMPLETED IN A PERIOD OF 2 YEARS.

This project will install recovery machines in 90 service shops over the period of 1.5 years. To support the recovery ctivity a central " reclaim " facility (one that is capable of purifying used refrigerant to the extent that it will meet specifications for new refrigerant such as Air Conditioning and Refrigeration Institute Specification 700-88) will be established . This facility will include a capability to test recovered or reclaimed refrigerant to ascertain its degree of purity.

The plan is to introduce recovery machines in groups of 15 with a time lapse of 3 months between each group during which time instructions in the theory and use of these machines will be given to the service personnel who will be operating the equipment.

Project Expenses:

* Equipment:

Recovery Machines: 90 @ $1,200 landed cost:		$108,000
Spare Parts:		10,000
Reclaim Plant:		144,000
Refrigerant Testing Laboratory:		100,000
Refrigerant transfer containers:		10,000
TOTAL EQUIPMENT COST		**$372,000**
* Service Technician Training: 90 @ $500:		$45,000
* Project Supervision & Training personnel:		
1 Project Engineer @ $27,000 P.A.	$ 27,000	
3 Technicians @ $16,000 P.A.	$ 48,000	
Sub Total P.A.	$ 75,000	
This personnel required for two years: 2 x $75,000		$150,000
* Consultants: 4 weeks @ $ 4,000 / week		$16,000
GRAND TOTAL		**$583,000**

Financial inputs:
Assumptions:

Each of the 90 machines recovers the charge from one refrigerator per day.
Each refrigerator contains .30 kg. of refrigerant.
There are 275 working days per year.
The recovery is 95% efficient.
R-12 costs US $ 2.36 / kg.

Then the quantity of refrigerant recovered each year is:
90 x 1 x .30 x 275 x .95 = 7,054 kgs / year.

The gross saving is 7,054 x 2.36 = $ 16,647 / year.

Financial data is based on information obtained from:
Refrigerant Reclaim Ltd., Unit 1, Sandleheath Industrial Estate,Fordingbridge, HANTS SP6 1PA

TABLE III

A PROJECT FOR THE RECOVERY AND RECLAIM OF R-12 FROM DEFECTIVE REFRIGERATORS AT A REFRIGERATOR PRODUCTION FACILITY.

This project involves the recovery of refrigerant from refrigerators that have been determined , during factory testing , to be defective and require that the refrigerant be removed in order to make repairs. The project involves providing a recovery machine for each repair station (three in this case) , the installation of a reclaim machine at the refrigerant incoming facility and installing the required connecting piping. The recovered refrigerant will be piped to the reclaim machine and the cleaned refrigerant returned to the incoming stock of new refrigerant .

EQUIPMENT COSTS:

Reclaim station		$ 35,454
Recovery pumps		$ 16,523
Piping + labor		$ 3,568
Discharge couplings		$ 16,800
	Sub Total	$ 72,345
	Contingency 10%	$ 7,235
	TOTAL	$ 79,580

REFRIGERANT RECOVERED:

Average recovery 16 kgs per day for 275 working days per year.

16 x 275 = 4,400 kgs per year saved.R-12 @ $ 2.36/ kg.
Then 4,400 x $ 2.36 = $ 10,384 savings per year.

Financial data based on information from:
A'GRAMKOW A/S, Augustenborg Landevej 19, DK-6400 Sonderborg, Denmark and
Servi-I-Quip Inc., 127 Wallace Ave., Dowingtown, Pa., 19335, U.S.A.

COMPANY NAME : ARCELIK

PROJECT DESCRIPTION:

EXPENDITURES RELATING TO THE DEVELOPMENT ACTIVITY REQUIRED TO IMPLEMENT THE ENGINEERING CHANGES NECESSARY TO REDUCE THE RISKS OF CHANGING FROM CFC-12 TO THE ALTERNATE REFRIGERANT HFC-134a.

DURATION OF THE PROJECT: This is a three year project.

BUDGETARY ESTIMATES:

1. EQUIPMENT	U.S. $
Controlled ambient test cells. 2 cells, 4 stations each	200,000
Data acquisition for test cells	100,000
Falex + Sealed tube test equipment	50,000
Tangent Delta, wire test equipment	50,000
Compressor calorimeter	275,000
Compressor life test stands 40 stands x 1,200	48,000
Refrigerator component operation X - Ray	410,000
Refrigerator component calorimeter calorimeters	150,000
Refrigeration system software	30,000
Insulation conductivity measurement equipment	30,000

TOTAL FOR EQUIPMENT = $1,243,000

2. PERSONNEL REQUIREMENTS

Title	Costs/year	# years	Number required	Total
Project Leader	45,000	3	1	135,000
Project Engineers	27,000	3	1 compressor 2 refrigerator 1 insulation 1 laboratory	405,000
Technicians	16,000	3	3	144,000
	TOTAL FOR PERSONNEL			= $687,000

3. TECHNOLOGY TRANSFER EXPENSES

a. Expenses for out of country travel for conferences, seminars, consulting, education, etc. for project engineers.

Personnel	# of trips per year	Total trips per year
Project leader	3	3
Project engineers (5)	1 each	5
		8
Total		

Budget per trip:	
Transportation	= $1,000
Living ($300/day x 10 days)	= $3,000
Other expenses (conf., fees, etc.)	= $1,000
	= $5,000
Total	
For one year 8 x 5,000	= $40,000
Cost for the three year project: 3 x $40,000	= $120,000

b. Expenses for within country travel to suppliers, production facilities, universities, government agencies for project personnel.

Personnel	# of trips per year	Total trips per year
Project Leader	6	6
Project Engineers (5)	3 each	15
Project Technicians (3)	1 each	3
		24
Total		

Cost per trip	= $1,000
Cost for one year = 24 x $1,000	= $24,000
Cost for the three year project = 3 x $24,000	= $72,000

c. Expenses for outside consultancy, royalties, testing:

Defined consultancy needs per year:

Refrigeration technology	2 weeks
Compressor technology	2 weeks
Materials chemistry	2 weeks
Polyurethane technology	1 week
Measurement technology	1 week
Software technology	1 week
Total =	9 weeks

Budget for outside country consultant:

Consultant fee = $700/day x 7 days =	$4,900
Transportation =	$1,500
Living ($300/day) =	$2,100
Total/week =	$8,500

Total cost/year = 9 x $8,500 = $76,500

External projects, laboratory analysis, testing, etc. per year = $20,000

Total for outside consultancy per year = $96,500

Total consultancy expense for three yea$289,500

TOTAL PROJECT COSTS:

EQUIPMENT =	$1,243,000
PERSONNEL =	$687,000
TECHNOLOGY TRANSFER =	$481,500
TOTAL	$2,411,500

ANNEX B

ODS PHASE-OUT ALTERNATIVES

REFRIGERATION AND AIR CONDITIONING

B.1 Chlorofluorocarbon (CFC) refrigerants were developed in the early 1930s. They provided a safe alternative to ammonia, sulfur dioxide and isobutane, which at the time were the cooling fluids commonly used in home refrigerators and air conditioners. While other applications have resulted from CFC development, cooling applications grew most rapidly. Today, the fluorocarbon family of compounds account for nearly all cooling fluids used by the refrigeration and air conditioning industry in the vapor compression systems which have become the industry standard.

B.2 For satisfactory performance in the vapor compression common to most units, a refrigerant must not only have favorable thermophysical properties but also be non-flammable, basically non-toxic, and inert to materials of construction. Fluorocarbons have achieved their prominence because they posses the unique combination of properties which best satisfy these sometimes conflicting requirements.

B.3 Refrigeration systems using fluorocarbons as the cooling fluid are common in all sectors of modern society. The most common units are the domestic refrigerators and freezers found in nearly all developed countries' homes and in a growing number of households in developing countries. At retail stores, food display cases are refrigerated to extend shelf life and prevent spoilage. At the wholesale level, large warehouses and transport vehicles (trucks, trains, and ships) are refrigerated to expand the market areas for their products. Industrial plants use refrigeration to sustain desired operating conditions and to prevent loss of volatile substances. Finally, air conditioning utilizes refrigerants to cool air in a variety of environments, including most mechanical forms of human transportation, in many homes and most modern office buildings and hotels. Air conditioning is particularly important in the warmer regions of the world.

Market Segmentation

B.4 Due to the wide range of applications for CFC, the industry ordinarily segments users as follows:

By the type of device utilizing fluorocarbons

By the end-use served by the device

By the servicing of the device.

B.5 Within each segment there are usually only one or two CFCs with physical properties best suited to the application. These CFCs naturally serve most of the users within the segment.

Commonly Used CFCs for Refrigeration and Air Conditioning	
Refrigeration	
Commercial Units	
Food Storage	CFC-12; R-502
Industrial Machines	CFC-12
Transport Units	CFC-12; R-502
Home Refrig/Freezers	CFC-12
Vending Machines	CFC-12
Air Conditioning	
Large Buildings	CFC-11; CFC-12; HCFC-22
Mobile Units	CFC-12
Room and Package Unit	HCFC-22
Heat Pumps	HCFC-22

Alternatives to Chlorofluorocarbon Refrigerants

B.6 There are several options for replacing CFCs in the vapor compression systems commonly used in refrigeration and air conditioning equipment. The Technical Options Report prepared in May 1989 under the auspices of the United Nations Environment Programme identified the following options described below for replacement of CFC cooling fluids:

Use of HFC-134a.

B.7 This appears to be one of the best long term alternative refrigerants. Most equipment manufacturers have based their long term plans on using HFC-134a to replace CFC-12 in new refrigeration systems. Compression equipment must be redesigned to optimize energy efficiency. More importantly, the standard lubricant used in CFC-12 systems must be replaced with one which is compatible with HFC-134a. Such lubricants are commercially available but are significantly more costly than the CFC-12 lubricants. Alternative lubricants are polyester and polyalkaneglycol (PAG) oils. The polyester oils are the most stable as well as the most expensive. They are the lubricant of choice for long-service equipment such as domestic refrigerators. PAGs are the lubricant of choice for automotive air conditioners which have an average service life of only 5-7 years in the developed world.

Replacement of CFC-11 with HCFC-123.

B.8 Low pressure water chiller systems used for air conditioning in most large office buildings, hotels, and similar structures commonly employ CFC-11 as the refrigerant. These systems form an integral part of each building structure and represent a major investment component. Replacing such systems is not feasible. Retrofitting existing water chiller units to use an alternative refrigerant such as HCFC-123 is the most appealing option for eliminating CFC-11 use at this time. Field testing of such retrofits has been underway by major manufacturers for several years. The technology for accomplishing the retrofit is readily available. Equipment modifications include minor changes in elastomeric and motor components; however, system capacity is reduced by up to 10 percent. Toxicity testing of HCFC-123 must be completed before this technology can be widely applied. Preliminary tests have indicated that exposure of workers to HCFC-123 vapors must be limited.

Use "drop-in" ternary blends.

B.9 A series of ternary fluorocarbon mixtures (HCFC-22; HFC-152a; HCFC-124), referred to as "blends", have been designed as "drop-in" replacements for CFC-12. The primary feature of these "blends" is that they simulate quite closely the thermodynamic properties of CFC-12. They are also compatible with the same lubricant as is used with CFC-12. The "blends" have the potential to satisfy the long-term service requirements for equipment, such as domestic refrigerators and auto air conditioners currently using CFC-12. "Blends" are also considered to have potential as an interim substitute for HFC-134a in cases where equipment designs are retrofit for "blends" rather than redesigned for HFC-134a.

B.10 From the perspective of a developing country with limited technological resources, the primary disadvantages of "blends" include the following items:

- Most "blends" are proprietary mixtures patented by DuPont and are therefore not available from multiple sources.
- "Blends" tend to lose one component more rapidly than the others. Hence, there is a composition and performance drift with time. Restoring the system to an original composition can require chemical analysis and special metering of components.
- The "blends" require two components which although available are in short supply on the world market (HCFC-124 and HFC-152a).
- Life testing of equipment retrofitted with "blends" is at a relatively early stage. Such testing must be satisfactorily completed prior to global acceptance of this technology.

B.11 On balance, the economic advantages of "blends" outweigh the disadvantages primarily because of the large installed base of equipment (e.g. refrigerators) which can complete their useful life without requiring CFC-12 for servicing. "Blends" would offset this potential economic cost.

B.12 The future for "blends" in developing countries is one of gradual growth commencing about 1995 as supplies of CFC-12 become scarce. Growth, however, will be constrained by supply of technology and materials from the United States.

Conservation of available CFC resources.

B.13 Significant quantities of CFC-12 are wasted during servicing of defective refrigeration equipment. Some of the wastage is the result of diagnostic procedures which use CFC-12 as a test gas. Additional wastage occurs when improper recharging equipment is used by inexperienced service personnel. Proper service procedures for devices such as domestic refrigerators have the potential to reduce CFC-12 imports in some countries by over 50 percent. While conservation practices which reduce wastage of CFCs are cost effective, traditional CFC prices will need to increase significantly to support the required changes within the equipment service community.

Retrofit of Existing Equipment for HCFC-22

B.14 Specialty equipment, such as water coolers, use small CFC-12 refrigerant units which can be replaced with similar HCFC-22 units. Equipment redesign efforts are small, while the HCFC-22 technology is well proven in devices such as window air conditioners. The obvious advantage for such redesign is that HCFC-22 has an ODP of only 0.05. The added cost of the HCFC-22 compression system, and the added cost of the redesign are disadvantages which will be overcome as supplies of CFC-12 decrease, and prices for CFC-12 escalate.

Use of Ammonia.

B.15 This option is only a viable consideration for new installations, as ammonia will not function in existing equipment. Ammonia has good thermodynamic properties and good heat and mass transfer properties and is the lowest-priced refrigerant available today. Under specific operating conditions it has a high coefficient of performance. Ammonia is toxic and flammable, characteristics which are important safety concerns when public exposure to leakage is a possibility.

B.16 Application of ammonia as a significant replacement for CFC-11 or CFC-12 refrigerant is unlikely.

Recovery - Recycle - Reclamation of CFCs

B.17 Opportunities to conserve existing supplies of CFC by recapturing and reusing CFCs from existing facilities exist primarily in the refrigerant sector. Refrigerants are usually contained in a sealed systems and are amenable to recapture during routine repair or maintenance. Flexible foams release their contained CFCs during the first few days following manufacture. Closed-cell rigid foams slowly release their CFCs over a period of several years. Aerosol products release their CFCs immediately upon use.

B.18 Refrigeration and air conditioning equipment (e.g. home refrigerators, auto air conditioners, etc.) require periodic repair or maintenance during which it is usually necessary to remove the CFC refrigerant before the appropriate service procedure can be performed. A common repair is to locate and seal a leak thru which CFC escaped. Another common repair is to replace of the hermetically sealed compressor-motor unit because the motor is burned-out. Both repairs require discharging any residual refrigerant in the system before commencing the mechanical phase of the repair procedure. Large commercial and industrial system users employ periodic preventative maintenance to protect their investments. A common component of maintenance procedures is replacement of used CFC refrigerant with virgin material to remove contaminants (water, air, degraded oils, metal particles) from the system. The used CFCs are often discharged to the atmosphere.

B.19 Different types of equipment use different refrigerants; they must **not** be mixed. A refrigeration device must not be recharged with a refrigerant other than that for which it was originally designed without consultation with the manufacturer of the original equipment.

B.20 Conservation of refrigerants used in existing facilities requires: 1) isolation of the refrigerant within the system; 2) coupling the system to an external container; 3) conveying the refrigerant from the system to the external container; 4) purification of the recovered refrigerant, and 5) recharging equipment with pure refrigerant. There are three terms which best define the various phases of these activities in the refrigeration and air conditioning sector - recovery, recycle, reclaim.

> **Recovery:** To remove refrigerant in any condition from a system and store it in an external container without testing or processing.
>
> **Recycle:** To purify refrigerant for reuse by oil separation, filtration, drying, and/or chemical treatment. This procedure is usually (but not necessarily) performed on a job site or in a service shop and the purified CFC is returned to the equipment from which it was originally recovered.
>
> **Reclaimation**: To reprocess recovered refrigerant by distillation and other means so that it meets new product specifications. Reclamation is usually performed in a large scale centrally located facility with extensive analytical capabilities.

B.21 Recovery is the essential first step that must be taken before the refrigeration system is opened to the atmosphere. By definition the quantity of refrigerant recovered will not exceed its initial charge (e.g. 150-300 grams for a home refrigerator). Recovery of small quantities of refrigerant is possible but is generally not cost effective at current CFC prices. One such recovery system uses evacuated bags into which the refrigerant is vented. The bags are then sent to a central facility where their contents are pumped into a storage tank for reclamation.

B.22 To recycle refrigerants, specially designed machines are directly coupled to the refrigerant system charging line; refrigerant is processed through a variety of purification devices in the machine; the system is evacuated of all residual gases; virgin refrigerant is added to replace system losses, and the recycled refrigerant is returned to the system. The recycle procedure can be interrupted prior to the evacuation step in order to inspect or repair system defects.

B.23 The recycle procedure is particularly useful for large systems which are pre-equipped with the necessary valves and recovery tanks (e.g. large centrifugal chillers). Special recycle machines are available for minimizing refrigerant loss during periodic maintenance. Owners of large systems are often reluctant to use recycle procedures because they believe the risk of inadequate purification is excessive. In such instances, it is feasible to recover the used refrigerant for reclamation and reuse in other facilities.

B.24 Reclamation of used refrigerant is a complex task requiring precise identification of all materials being handled to avoid cross contamination with other refrigerants and/or acceptance of dangerous substances in combination with the refrigerants. Purification generally requires large distillation facilities similar to those used during CFC manufacture.

FOAMS

B.25 CFCs are used in the foam sector for processes which expand plastic materials to create insulation, cushioning, packaging products, floatation devices, and shoe soles. Foams compete with fiberglass, paper, polyester fiberfill, and natural fibers for application in end-products. CFCs are used as blowing agents because they have suitable volatility and low toxicity, are non-reactive and non-flammable, and are cost effective. When retained in the foam cell structure, their low thermal conductivity imparts excellent insulation characteristics to the foam. CFCs in combination with other agents are also used to decrease foam density and increase softness of flexible foams. CFCs cool the exothermic reaction in the production process and protect the product against overheating and burning.

Market Segmentation and Alternatives

B.26 The primary plastic types and their respective CFC blowing agents are:

Polyurethane	CFC-11
Polystyrene	CFC-12
Polyolefins	CFC-11/12/114
Phenolic	CFC-11/113

Polyurethane

B.27 Polyurethane foam is produced by in-situ catalytic polymerization of a polyol and a reactive isocyanate [toluene diisocyanate (TDI) or diisocyanate-diphenylmethane (MDI)] in the presence of a blowing agent (CFC-11, methylene chloride, or CO2). The specific ingredients used depend on the foam characteristics desired. Flame retardants are added to meet end user specifications. Since the process is catalytic, exothermic, and initiates at ambient conditions, ingredients are mixed in their proper proportions at the point of their introduction into the process.

B.28 Polyol/blowing agent/catalyst systems are frequently premixed by suppliers so that reaction can be initiated simply by adding the isocyanate. Premixing reduces the need for storage and mixing facilities at the user's plant and usually improves quality control. Large manufacturers, however, prefer to mix their ingredients on site.

B.29 Foam products are classified as:

Flexible--Open cell structure--flexible and elastic foams for cushioning in home and office furniture, bedding, carpet underlay, and car seats.

Semi-Rigid--Open cell structure--moderate elasticity for safety padding in vehicle interiors (instrument panels, arm rests, door panels, etc).

Rigid--Closed cell structure for acoustic and thermal insulation--panels in housing and for insulation of home refrigerators.

Integral Skin--Compact outer skin with a gradual change over to a fine cellular core; high rigidity and surface hardness, low weight--desks, windows, electronic parts, and shoe soles.

B.30 CFC-11 requirements vary with the type of foam being produced. As an ingredient, CFC-11 accounts for 10-30 percent of the finished foam weight. Methylene chloride can be used to replace CFC-11 in most flexible foam applications on an equimolar basis; however, methylene chloride toxicity (suspected carcinogen) is a concern which must be delt with in the process environment by use of protective equipment to avoid worker exposure to fumes released during foam formation.

B.31 Polyurethane foams can also be expanded by carbon dioxide (CO2) which is generated in-situ by a reaction between water and isocyanate. These so-called "water blown" foams are not as soft as "CFC blown" foams and must be specially formulated to achieve acceptable product quality. Partial water substitution for CFC-11 has been demonstrated to reduce CFC requirements without significant loss of performance in rigid foams.

B.32 Home refrigerators contain significant quantities of rigid foam which is formed in place at the point of manufacture to insulate the interior compartment and to add stability to the external shell. Refrigerator manufactures usually mix their ingredients on site. CFC-11 requirements have been reduced at several locations by up to 50 percent by employing a combination of "water blown" and CFC-11 expansion methods with special polyols.

B.33 HCFC-22 has shown promise as a direct replacement for CFC-11 without major formulation adjustment. Although HCFC-22 is a gas (boiling point -40.8C) at ambient conditions, its extremely good solubility in polyols and polyurethane systems allows it to be used with only minor equipment modifications. On a weight basis, approximately 60-65% of the amount of CFC-11 is needed to reach CFC-11 equilibrium free rise densities thereby reducing net cost of manufacture. HCFC-22 blown foam cell structures tend to be somewhat finer and may require formulation adjustment to stabilize the foam. However, the finer structure improves insulation value and partially offsets the higher thermal conductivity of HCFC-22 as compared to CFC-11.

B.34 HCFC-123 (ODP=0.02) and HCFC-141b (ODP=0.15) are also potential blowing agents for polyurethane foams. HCFC-141b must be handled as a flammable liquid. HCFC-123 has been assigned a 100 ppm AEL (Acceptable Exposure Level) and will require special handling. Both materials are being extensively tested for toxicity as part of the Program for Alternative Fluorocarbon Toxicity Testing (PAFT), sponsored by major global fluorocarbon manufacturers. Scheduled dates for reporting results of the PAFT two-year chronic inhalation exposure tests are:

PAFT Reporting Dates - Two-Year Tests	
HCFC-123	mid-1992
HCFC-141b	mid-1993

B.35 Application of HCFC-123 and HCFC-141b as commercial blowing agents, even on a small scale, prior to completion of the PAFT tests is unlikely. Early tests have indicated a need to establish an ALV of 10 ppm as a precaution. Also, world capacity for production of these materials will be limited until it is clear that toxicity is acceptably low and that there will be sufficient demand and justification for the required capital investment.

B.36 In summary, it is technically possible to reduce CFC consumption in the polyurethane foam industry by at least 80 percent using a combination of process modifications and currently available blowing agent/polyol systems. Complete elimination of CFCs will require development of new blowing agent systems, probably HCFC-based, or changes in design of the end-products as new technologies (e.g. vacuum panels) emerge.

Polystyrene

B.37 There are two types of polystyrene foam: rigid boardstock for insulation, and rigid sheet for disposable food service and packaging products. Both types of foam are produced by an extrusion process in which CFC-12 is dispersed in molten polystyrene under high pressure. As the mixture leaves the extruder, the CFC-12 vaporizes and causes the plastic to expand uniformly. The high moisture resistance of polystyrene makes it practical and cost effective for applications where water is present. Since polystyrene is thermoplastic, sheets can be molded into special shapes for packaging foods, meats and eggs. These applications are of environmental concern because they contribute to solid waste and are not biodegradable.

B.38 HCFC-22, in combination with hydrocarbons, can be substituted for CFC-12 in the manufacture of most extruded polystyrene sheet products. HCFC-22 has FDA approval in the U.S. for food packaging, provided HCFC-22 concentration is <5ppm at the time of food contact. Other HCFCs and HFCs are being considered as CFC-12 replacements. All must await completion of toxicity tests and all will need special approval for use in contact with foods. In the mean time, natural products and plastic sheets can and will displace most applications for polystyrene sheet.

B.39 HFC-152a is gaining acceptance as a blowing agent for polystyrene in facilities equipped for handling flammable gases, such as propane.

Other Foams

B.40 Polyolefin foams account for only five percent of all foams and include products made from polyethylene and polypropylene resins which occasionally include other resins as modifiers. The process technology for polyolefins is essentially the same as that used for polystyrene except that the blowing agent is usually a mixture of CFC-114, CFC-12, and/or CFC-11. Specific properties of polyolefin foams meet the requirements for packaging of high value goods such as furniture and electronic devices where the package must be designed to provide a high degree of product protection. Substitute packaging materials and systems do not usually meet the high performance requirements of these products.

B.41 Hydrocarbons, and HCFC-22/HCFC-142b mixtures are used today to replace CFC-12 in polyolefin foam manufacture. Although some process modifications are necessary. Replacement with LPG and inert gases such as CO_2, N_2O and N_2 has been effective in most cases with the exception of medical applications. The special characteristics of CFCs have made them essential and irreplaceable in this application.

B.42 Closed cell phenolic foams are produced by the acid-catalyzed polymerization of a phenolic resin using CFC-11 and CFC-113 as the blowing agent. These foams serve a speciality market in high performance insulation and as such account for less than one percent of all foams. They offer better insulating value than other materials due to the low thermal conductivity of the CFCs which are fully retained within the foam for extended periods of time. They also have improved fire resistance, low smoke generation, and high temperature resistance. End-uses are for roofing insulation and other high-end applications in the construction industry. HCFC-123 and HCFC-141b appear to be suitable alternatives to the CFCs currently used; however, their higher thermal conductivities may require process refinements, and use is unlikely until toxicity issues are resolved.

AEROSOLS

B.43 Aerosol propellants are defined as volatile fluids capable of expelling active ingredients from a sealed container at or below 105 degrees Fahrenheit. Propellants such as CO_2 have been used for over 100 years to dispense sodas and other food products, but as CFC supplies became abundant in the 1950s and 1960s, their unique properties led to the rapid growth of a large aerosol industry. By 1974, aerosol propellant applications accounted for about three-fourths of the world CFC consumption. The market was saturated with a wide variety of aerosol products 50-60 percent of which used CFCs as a propellant. The major applications were shaving creams, hair sprays, antiperspirant sprays, perfumes, insecticides and repellants, polishes, paints, oven cleaners, air fresheners, and laundry aids.

Key Events

B.44 In 1974, Rowland & Molina, in response to concern about the environmental effects of CFC aerosols, proposed a theory that CFCs could initiate a cycle of ozone destruction in the upper atmosphere. By 1978, the United States had banned the use of CFCs in aerosols, except for a few speciality applications such as medical items. Europe later asked their manufacturers to undertake a voluntary 30 percent reduction in CFC aerosol uses, and other countries instituted their own regulatory bans.

B.45 The net effect of these policies was that by 1980, although the total number of aerosol units produced equalled 1974 production, alternative aerosol propellants and delivery systems had replaced most CFC aerosols in the United States. The major countries of Europe continued to use CFCs in 60-70 percent of their aerosols. Worldwide, CFCs in aerosols declined to one-third of the total CFCs produced. At that point the market stabilized until depletion processes in the ozone layer were confirmed, and the Montreal Protocol was signed. Most worldwide producers of CFC containing aerosols then adopted partial conversion to alternatives and are continuing to phase out CFC use ahead of Protocol requirements. Developing countries continue to use CFCs but are also converting their plants to alternatives; an increasing number of countries have imposed CFC specific bans on use as aerosol propellants.

Alternative Propellants by Market Segment

B.46 For the purposes of this study, the market for CFC aerosol propellants was segmented into Cosmetics, Household Products, and Other Aerosol applications.

Cosmetics

B.47 Major applications of CFCs in cosmetics include hair sprays, antiperspirants, perfumes and colognes, skin care products, shaving creams, and other personal products. These applications account for 30-50 percent of all aerosol production in most countries. Active ingredients can vary widely. Propellants must meet special requirements of compatibility with all components in the system.

B.48 Propellants must be non-toxic, inert, odorless, and preferably non-flammable. CFC-12 and CFC-114 are commonly used in combination with various alcohols and water. Alternative non-CFC delivery systems such as pumps and sticks have satisfied half of the cosmetic market needs, but most consumers still prefer aerosols. Propellants such as deodorized liquid petroleum gas mixtures (LPG) are one CFC substitute but are often flammable during use. Dimethyl ether (DME) is also flammable but is used because of its compatibility with water based formulations. There is no universal alternative for cosmetic applications, as each has its own specific requirements and preferences.

Household Products

B.49 Household products account for approximately 30-40 percent of the demand for aerosol propellants. These products include laundry aids, furniture polishes and cleaners, oven cleaners, air fresheners, insecticides, and insect repellants. They usually compete with similar non-aerosol products but are preferred based on the performance of their delivery system. The most commonly used CFCs are CFC-11 and CFC-1B. Replacement with LPG has been satisfactory. One company, Johnson Wax, converted all of their CFC aerosols to LPG propellant in 1975 and has had satisfactory performance opposite competitive products ever since.

Other Aerosols

B.50 Miscellaneous aerosol propellant applications account for the balance of demand and include paints, coatings and finishes, lubrication products, automotive products, speciality insulation systems, food products, and medicines. CFC-11 and CFC-12 are commonly used. Replacement with LPG and inert gases such as CO_2, N_2O and N_2 have been effective in most cases with the exception of medical applications, where the special characteristics of CFCs have made them essential and difficult to replace.

SOLVENTS

Background

B.51 The unique solvent characteristics of chlorinated hydrocarbons and fluorocarbons has led to a wide range of solvent applications where cleaning efficiency and product quality are enhanced significantly as a direct result of using the solvent.

B.52 Three industries rely on solvents for sustaining product integrity.

Electronics - where residues must be removed from components (electronic chips, circuit boards, etc.) without damaging the substrate or the primary parts.

Metal Parts Manufacture - where heavy residues of oils, greases , and cuttings must be effectively removed before assembly, painting, or packaging.

Dry Cleaning (clothing) - often included in the scope of the solvent business because of the large volume used, but not included in this study because ODSs are not ordinarily used as solvents.

B.53 Major ODS solvents classified as controlled substances under the Montreal Protocol are trichlorotrifluoroethane (CFC-113), carbon tetrachloride (CTC), and 1,1,1 trichloroethane (methyl chloroform).

CFC-113

B.54 This chlorofluorocarbon solvent has been the solvent of choice for high-end electronics applications and its use grown with that of the computer business during the 1980s. It is also preferred for the cleaning of precision parts, machine tools, and other metal components. In these applications, the solvents often contain about 2% CFC-11.

Carbon Tetrachloride

B.55 While CTC has been widely used in the past as a solvent for general cleaning, its toxic properties have mitigated its present day use. Today, it is only used as a solvent where low-cost is the only consideration and there is no human exposure. Other applications for CTC are as the primary raw material for CFC-11/12 manufacture, and as an ingredient for certain pesticides and pharmaceuticals

Methyl Chloroform

B.56 First used as a solvent to replace carbon tetrachloride in cold cleaning, methyl chloroform is now used for both cold cleaning and vapor degreasing and is highly effective whether used hot or cold and the method is dip, spray, wipe, flush or ultrasonic. Additives are frequently used to enhance corrosion protection and solvent stability.

Alternative Solvents

B.57 With few exceptions, the "ozone issue" and the Montreal Protocol restrictions have prompted solvent users to seek and apply alternative non-ODS solvents to their operations. These efforts have been largely successful without sacrificing cleaning effectiveness. The attention directed at solvent containment and reclamation has paid cost dividends. One measurable result of the transformation to non-ODS solvents has been an 80% reduction in CFC-113 use in the United States since 1986. Methyl chloroform has displaced some of the CFC-113; in time, these applications will move to 1,1,1 trichlorethylene. Every application usually has one or more options that can be adopted. These include use of terpenes, organic and alcohol-based solvents, and longer range HCFC solvent blends if toxicity testing is completed with satisfactory results. In other instances, process changes which eliminate the need for solvent cleaning (e.g. no clean fluxes) are proving satisfactory.

HALONS

B.58 Halons are used extensively as effective fire extinguishants in hand-held units (Halon 1211) and in central systems (Halon 1301). Commercial aircraft and modern military equipment (tanks, aircraft, and ships) have all adopted Halon systems for fire protection.

B.59 Except for Halon consumed in equipment testing or during a fire event, all Halon is still contained in its original container. Because of its effectiveness in extinguishing fires without damaging electronic or other equipment or without toxic or other impacts on humans, Halons are strongly preferred over other extinguishants. There are other fire extinguishants that users can adopt in place of Halons (water, dry chemical, CO_2) at the expense of effectiveness. A chemical substitute with all of the unique properties of Halons has not yet been identified; however, by using alternatives in applications where use of Halons is non-essential, the reduction in the consumption will be appreciable.

ANNEX C

PHASEOUT SCHEDULE FOR CONSUMPTION OF CHEMICALS REGULATED BY MONTREAL PROTOCOL

	Starting date for implementation	Developed countries	7/1/89	1/1/92	1/1/93	1/1/95	1/1/97	1/1/00	1/1/05
		Developing countries (Article 5 Parties)	1/1/99	1/1/02	1/1/03	1/1/05	1/1/07	1/1/10	1/1/15
	Controlled substances	Base year [1/]	Consumption limit (as % of base year)						
ANNEX A	CFCs (11, 12, 113, 114, 115)	1986	100%	100%	100%	50%	15%	0%	0%
ANNEX A	Halons (1211, 1301, 2402)	1986		100%	100%	50%	50%	0%	0%
ANNEX B	All other CFCs	1989			80%	80%	15%	0%	0%
ANNEX B	Carbon tetrachloride	1989				15%	15%	0%	0%
ANNEX B	Methyl chloroform	1989			100%	70%	70%	30%	0%

Note: 1) For Article 5 Parties, the base consumption rate is average annual consumption of controlled substances for period or maximum, whichever is lower.

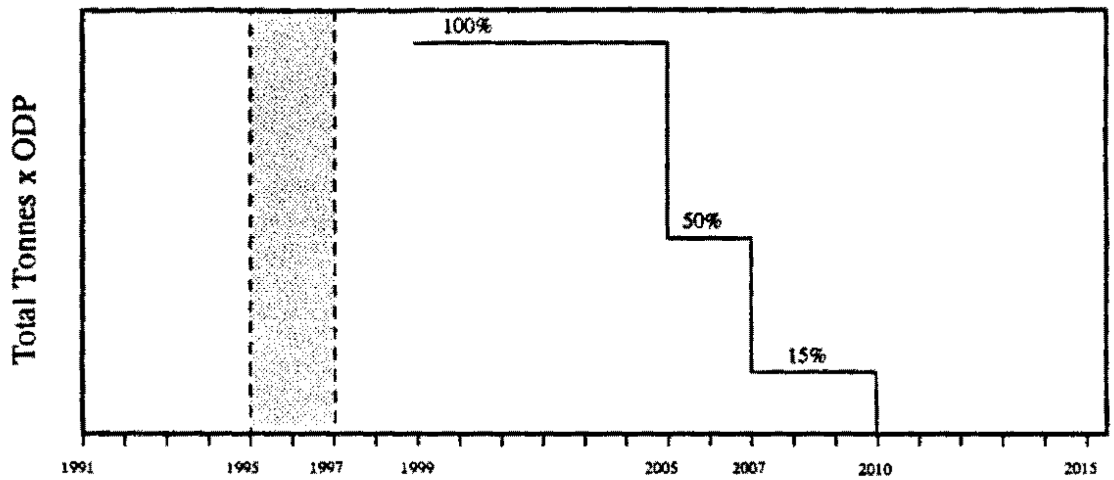
	Period	Maximum
ANNEX A	1995-1997	equivalent to 0.3 kg/capita
ANNEX B	1998-2000	equivalent to 0.2 kg/capita

2) Allowable production is 10% greater than consumption (but no less than 15% of base year consumption).

3) Production means actual amount produced minus amount destroyed (subject to approval) minus amount consumed as feedstock. Recycled substances are not considered to be production or consumption.

Figure C.1

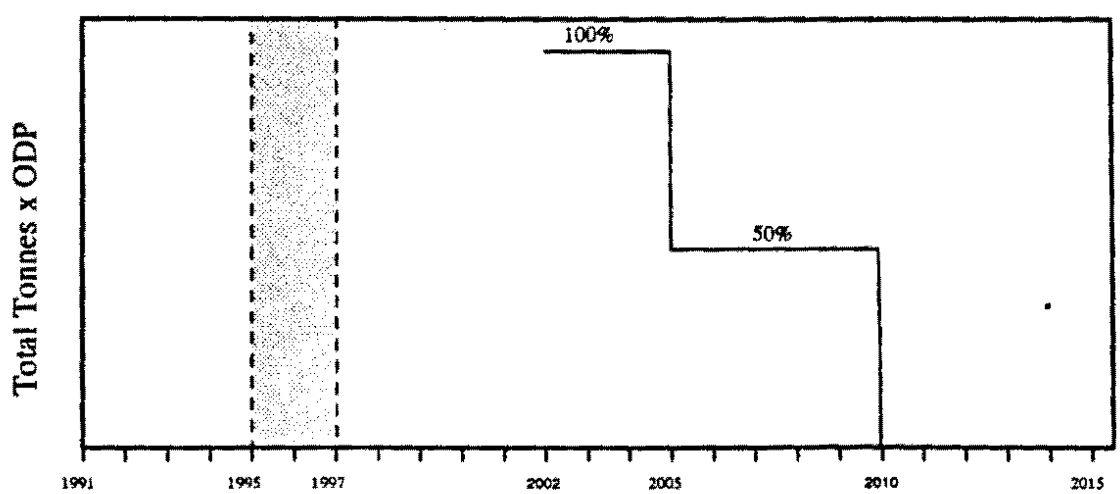
Protocol Phase-Out Profile
CFCs in ANNEX A Group I



Percentages are based on average consumption in the years 1995 to 1997
Dates apply to countries operating under Paragraph 1 of Article 5

Figure C.2

Protocol Phase-Out Profile
HALONS in ANNEX A Group II

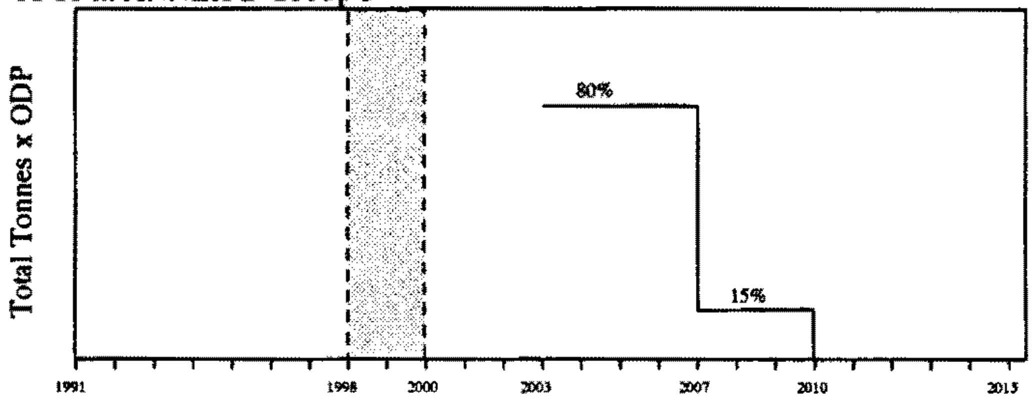


Percentages are based on average consumption in the years 1995 to 1997
Dates apply to countries operating under Paragraph 1 of Article 5

Figure C.3

Protocol Phase-Out Profile

CFCs in ANNEX B Group I

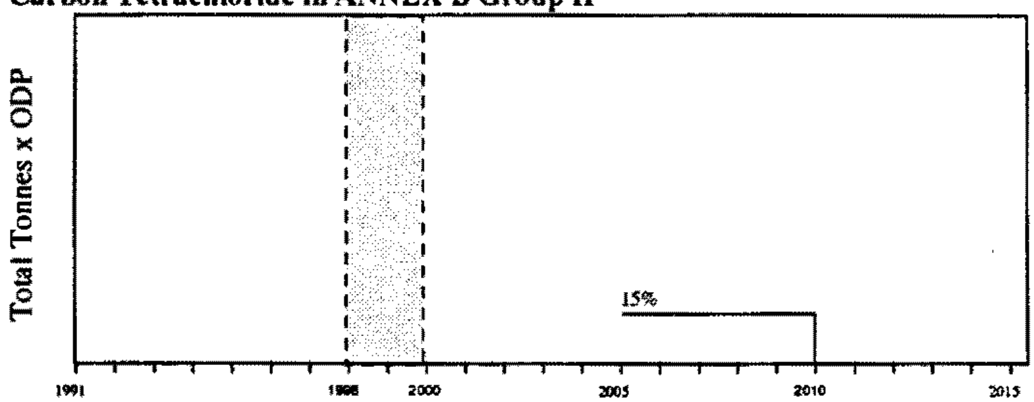


Percentages are based on average consumption in the years 1998 to 2000
Dates apply to countries operating under Paragraph 1 of Article 5

Figure C.4

Protocol Phase-Out Profile

Carbon Tetrachloride in ANNEX B Group II

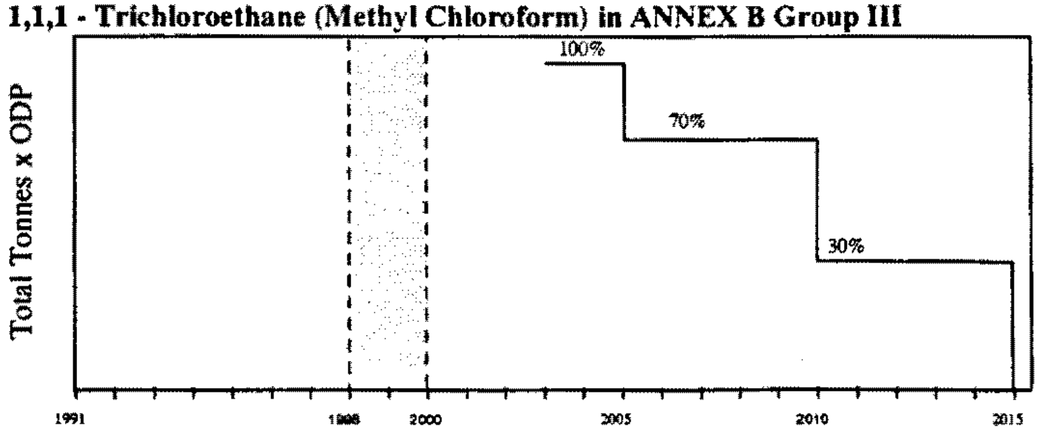


Percentages are based on average consumption in the years 1998 to 2000
Dates apply to countries operating under Paragraph 1 of Article 5

Figure C.5

Protocol Phase-Out Profile

1,1,1 - Trichloroethane (Methyl Chloroform) in ANNEX B Group III



Percentages are based on average consumption in the years 1998 to 2000
Dates apply to countries operating under Paragraph 1 of Article 5

Controlled substances

Group	Substance	Ozone Depleting Potential */
Group I		
$CFCl_3$	(CFC-11)	1.0
CF_2Cl_2	(CFC-12)	1.0
$C_2F_3Cl_3$	(CFC-113)	0.8
$C_2F_4Cl_2$	(CFC-114)	1.0
C_2F_5Cl	(CFC-115)	0.6
Group II		
CF_2BrCl	(halon-1211)	3.0
CF_3Br	(halon-1301)	10.0
$C_2F_4Br_2$	(halon-2402)	(to be determined)

*/ These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically.

The following annexes shall be added to the Protocol:

Controlled substances

Group	Substance	Ozone Depleting Potential */
Group I		
CF_3Cl	(CFC-13)	1.0
C_2FCl_5	(CFC-111)	1.0
$C_2F_2Cl_4$	(CFC-112)	1.0
C_3FCl_7	(CFC-211)	1.0
$C_3F_2Cl_6$	(CFC-212)	1.0
$C_3F_3Cl_5$	(CFC-213)	1.0
$C_3F_4Cl_4$	(CFC-214)	1.0
$C_3F_5Cl_3$	(CFC-215)	1.0
$C_3F_6Cl_2$	(CFC-216)	1.0
C_3F_7Cl	(CFC-217)	
Group II		
CCl_4	carbon tetrachloride	1.1
Group III		
$C_2H_3Cl_3$	1,1,1-trichloroethane (methyl chloroform)	0.1

*/ This formula does not refer to 1,1,2-trichloroethane.

ANNEX D

MISSION CONTACTS IN TURKEY

17 September - 02 October 1991

WORLD BANK MISSION TO TURKEY - 17 Sept - 02 Oct, 1991
ORGANIZATIONS CONTACTED

UTFT (HDTM)	Republic of Turkey, Prime Ministry Undersecretariat of Treasury and Foreign Trade General Directorate of External Economic Relations Department of World Bank Projects Transport, Infrastructure and Environment Office
MOE (CB)	Republic of Turkey, Ministry of Environment Air Management Department Istanbul Cad No. 88 06060 Iskitter Ankara Tel: 3423900
SPO (DPT)	Republic of Turkey, Prime Ministry State Planning Organization General Directorate of Social Planning Department of Planning Yeni Basbakanlik Binusi, Necatibey, Devlet, 16 Floor, Ankara Tel: 230 87 20 (Local 6641) Fax: 231 93 68
SIS (DIE)	Republic of Turkey, Prime Ministry State Institute of Statistics Department of Environmental Statistics Address: Necatibey Cad. 114, 06100 Ankara Tel: 118 74 20 Fax: 125 33 87
MFA (DB)	Republic of Turkey, Ministry of Foreign Affairs General Directorate of Multilateral Economic Relations Department of International Social and Technical Affairs Address: Balgat, Ankara Tel: 287 25 55 (Local 1919) Fax: 287 16 44

UTFT (HDTM)	Republic of Turkey, Prime Ministry Undersecretary of Treasury and foreign Trade General Directorate of Economic Research and Assessment Department of Statistics Address: Halkbank Binasi, Eskisehir yolu, Bahcelievler, Ankara Tel: 231 34 87 Fax: 118 21 54 118 69 23
MIC (STB)	Republic of Turkey, Ministry of Industry and Commerce General Directorate of Industrial Researches Department of Science and technology Address: Tandogan, Ankara Tel: 299 08 93 Fax: 230 87 04
MFC (MGB)	Republic of Turkey, Ministry of Finance and Customs Foreign Relations Department Address: Ilkadim Cad. Dikmen, Ankara Tel: 417 1498 Fax: 417 1172
TUBITAK	Republic of Turkey, Prime Minister Turkish Scientific and Technological Research Organization Marine Sciences and Environmental Research Group Address: Tubitak, Ataturk Bulvari N° 221, Kavaklidere, 06100 Ankara Tel: 342 08 77 Fax: 127 74 89
MIC (STB)	Republic of Turkey Ministry of Industry and Commerce General Directorate of Industrial Research Department of Science and Technology Address: 128 Maltepe, Tandogan, Ankara Tel: 230 61 16 Fax: 230 87 04/229 58 93 231 72 80 230 81 47
GUCCCE (TOBB)	General Union of Chambers of Commerce and Commodity Exchange of Turkey Department of Industry and Commerce Address: 149 Ataturk Bulvari, Ankara Tel: 117 87 25 Fax: 118 32 68

EPFOT (TCV)	Environmental Problems Foundation of Turkey Kennedy Cd. 33/3, 06660 Kavaklidere, Ankara Tel: 125 55 08 Fax:
IBRD	International Bank for Reconstruction and Development 211 Ataturk Bulvari, Ankara Tel: 168 45 27 Fax: 168 45 26
UNIDO	United Nations Industrial Development Organization 197 Ataturk Bulvari, Ankara Tel: 126 60 17 Fax: 126 13 72
UNDP	United Nation Development Programme 197 Ataturk Bulvari, Ankara Tel: 126 54 85 Fax: 126 13 72
SIMTEL	Simtel group of Companies Munzevi Kisla Cad. N° 6 Topcular/Eyup, Istanbul Tel: 577 32 24 Fax: 567 55 93 567 07 00
ICI	ICI Turkey Ltd. ICI han, Rihtim Cad. 231-233, Tophane 80030 Istanbul Tel: 151 40 60 Fax: 143 36 34
BASF	BASF/ELASTROGRAN BASF Turk Boya ve Kimya Ltd Sti Defterdar Yokusu No. 3 80040 Tophane, Istanbul Tel: 151 65 00 Fax: 144 16 73
AYGAZ	Aygaz Anonmin Sirketi Buyukdere Caddesi 145/1 Aygaz Han, 80300 Zincirlikuyu, Istanbul Tel: 166 95 81 Fax: 172 40 67
ARCELIK	Arcelik A.S. Cayirova 41460, Istanbul Tel: 395 45 15 Fax: 359 27 27
PROFILO	Cerkezkoy, Tekirdag/Turkey Tel: (9 18 56) 29 70 Fax: (9 18 56) 13 96

TCK	Turkiye Cevre Koruma Ve Yesillendirme Kurumu Muhurdarbagi Sok. N° 6,Kodikoy, Istanbul Tel: 338 00 17 Fax: 338 55 92
SABUZ	Tarlabasi Cad. Pelesenk Sk.4/1, Beyoglu, Istanbul Tel: 156 37 79 Fax: 150 92 26 150 59 64
KUVVET	Tarlabasi Altinbakkat Sok. 30, Beyoglu, Istanbul Tel: 150 63 15 Fax: 156 34 65
TSKB	Turkiye Sinai Kalkinma Bankasa AS. Industrial Development Bank of Turkey Meclisi Mebusan Cad. 137 80040 Findikh, Istanbul Tel: 149 21 39 Fax: 143 29 75

WORLD BANK MISSION TO TURKEY - 17 Sept - Oct 02, 1991
MISSION CONTACTS

UTFT	Mr. Bulent OZGUN-Deputy General Director
UTFT	Mr. Ersan EKREN-Head of Department
UTFT	Ms. Birsen AKTUGAN-Environment Section Head
UTFT	Ms. Aysen KULAKOGLU-Expert on Environmental Issues
GDEER	Mrs. Saadet DENIZ-World Bank Projects Dept. Agriculture Div. Chief
MOE	Ms. Serpil BAGCI-Head of Department
MOE	Ms. Fatma CAN-Technology & Economy Department
SPO	Mr. Hilmi SABUNCU-Head of Department
SPO	Mr. Necati ESSIZ-Specialist in Social Planning
SPO	Mrs. Sema ALPAN-Dept. of Social Planning
SIS	Ms. Selma GUVEN-Head of Environmental Statistics
MFA	Mr. Akin ALPTUNA-Deputy D/G
MFC	Mr. Beyazit BALCI-Head, Foreign Relations Department
MFC	Mrs. Hulya TUZUM-Director, Foreign Relations Department
MIC	Mrs. Senel TEKELI-Deputy General Director
GUCCCE	Miss Meftune EMIROGLU-Section Head
GUCCCE	Mrs. Gukiz TEZEREN-Expert
TUBITAK	Assoc. Prof. Dr. Altan ACARA-Head of Department
TUBITAK	Ms. Tulay SARISOY-Chemical Engineer
EPFOT	Mr. Engin URAL-Secretary General
TSKB	Mr. Ahmet DEMIREL-Assistant General Manager
ICI	Mr. Orhan TOKCAN- Business Manager
ICI	Ms. Aysegul DENKEL-Chemicals and Polymers Section
BASF	Mr. Oner BOYER-Product Manager Polyurethanes
AYGAZ	Mr. Fersun YESILKAYA-Chemical Department Manager
SIMTEL	Mr. Ersin SENCIL-Industrial Coordinator
ARCELIK	Mr. Refik UREYEN-Research Department Head
ARCILIK	Mr. Levent ALATLI-Investment Engineering Manager
ARCELIK	Dr-Ing.(habil) M. Yalcin-Research Manager - TANES Applications
ARCELIK	Dr. Kemal TUGCU-Research Manager Systems Applications
ARCELIK	Mr. Ender ONOZ-Technical Manager Applications
ARCELIK	Mr. Atilla ILBAS-System Manager, Central- Service
ARCELIK	Mr. Raif ESKINAT-Refrigerator Technical Manager
ARCELIK	Mr. Ihsan CATMANER-Chief Engineer
ARCELIK	Mr. Ahmet O. ARPACIOGLU-Technical Manager, Compressors.
ARCELIK	Mr. Riza YARBAS-Eskisehir Service Centre Manager
PROFILO	Mr. Harum URE-Factory Research and Development
PROFILO	Mr. Erkan OZEN-Factory, R+D, Ass. Mng/Planning & Value

PROFILO	Mr. Nedim SEZER-Analysis
PROFILO	Mr. Erkan OZEN-Computor programmer
PROFILO	Mr. Metin UZCE-General Manager Central Service Centre
SPOENAG	Mr. Mehmet Serif PINAR-Member
SPOENAG	Ms. Muge PINAR-Member of the Executive Committee
SABUZ	Mr. Mehmet T. ZIRTILOGLU-Foreign Trade Manager
SABUZ	Mr. Ismail ELHAN-Director
KUVVET	Mr. Vrej OZBULBUL-Director
UNDP	Mr. Henning BRATHAUG-Environmental specialist
UNDP	Mr. Patrick DUFFY-Environment Expert
UNDP	Mr. Adalat KHAN-Deputy Resident Representative
UNDP	Dr. Seyhan AYDINLIGIL-Senior Programme Officer
UNIDO	Dr. Kamal HUSSEIN-Director
UNDP	Mr. Edmund J. CAIN-Resident Coordinator
UNDP	Mr. Philippe DUAMELLE-Junior Professional Officer
IBRD	Mr. William Herbert RATFORD-World Bank Senior Operations Officer
IBRD	Mr. Eugene VERNIGORA-Environment Expert

ANNEX E

MONTREAL PROTOCOL REVISIONS

"Multilateral Fund"

Second Meeting of the Parties
London, U.K. - June 27-29, 1990

Article 10: Financial mechanism

1. The Parties shall establish a mechanism for the purposes of providing financial and technical cooperation, including the transfer of technologies, to Parties operating under paragraph 1 of Article 5 of this Protocol to enable their compliance with the control measures set out in Articles 2A to 2E of the Protocol. The mechanism, contributions to which shall be additional to other financial transfers to Parties operating under that paragraph, shall meet all agreed incremental costs of such Parties in order to enable their compliance with the control measures of the Protocol. An indicative list of the categories of incremental costs shall be decided by the meeting of the Parties.

2. The mechanism established under paragraph 1 shall include a Multilateral Fund. It may also include other means of multilateral, regional and bilateral cooperation.

3. The Multilateral Fund shall:

(a) Meet, on a grant or concessional basis as appropriate, and according to criteria to be decided upon by the Parties, the agreed incremental costs;

(b) Finance clearing-house functions to:

(i) Assist Parties operating under paragraph 1 of Article 5, through country specific studies and other technical cooperation, to identify their needs for cooperation;

(ii) Facilitate technical cooperation to meet these identified needs;

(iii) Distribute, as provided for in Article 9, information and relevant materials, and hold workshops, training sessions, and other related activities, for the benefit of Parties that are developing countries; and

(iv) Facilitate and monitor other multilateral, regional and bilateral cooperation available to Parties that are developing countries;

(c) Finance the secretarial services of the Multilateral Fund and related support costs.

4. The Multilateral Fund shall operate under the authority of the Parties who shall decide on its overall policies.

5. The Parties shall establish an Executive Committee to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources, for the purpose of achieving the objectives of the Multilateral Fund. The Executive Committee shall discharge its tasks and responsibilities, specified in its terms of reference as agreed by the Parties, with the cooperation and assistance of the International Bank for Reconstruction and Development (World Bank), the United Nations Environment Programme, the United Nations Development Programme or other appropriate agencies depending on their respective areas of expertise. The members of the Executive Committee, which shall be selected on the basis of a balanced representation of the Parties operating under paragraph 1 of Article 5 and of the Parties not so operating, shall be endorsed by the Parties.

6. The Multilateral Fund shall be financed by contributions from Parties not operating under paragraph 1 of Article 5 in convertible currency or, in certain circumstances, in kind and/or in national currency, on the basis of the United Nations scale of assessments. Contributions by other Parties shall be encouraged. Bilateral and, in particular cases agreed by a decision of the Parties, regional cooperation may, up to a percentage and consistent with any criteria to be specified by decision of the Parties, be considered as a contribution to the Multilateral Fund, provided that such cooperation, as a minimum:

(a) Strictly relates to compliance with the provisions of this Protocol;

(b) Provides additional resources; and

(c) Meets agreed incremental costs.

7. The Parties shall decide upon the programme budget of the Multilateral Fund for each fiscal period and upon the percentage of contributions of the individual Parties thereto.

8. Resources under the Multilateral Fund shall be disbursed with the concurrence of the beneficiary Party.

9. Decisions by the Parties under this Article shall be taken by consensus whenever possible. If all efforts at consensus have been exhausted and no agreement reached, decisions shall be adopted by a two-thirds majority vote of the Parties present and voting, representing a majority of the Parties operating under paragraph 1 of Article 5 present and voting and a majority of the Parties not so operating present and voting.

10. The financial mechanism set out in this Article is without prejudice to any future arrangements that may be developed with respect to other environmental issues.

Article 10A: Transfer of Technology

The following Article shall be added to the Protocol as Article 10A:

Article 10A: Transfer of Technology

Each Party shall take every practicable step, consistent with the programmes supported by the financial mechanism, to ensure:

(a) That the best available, environmentally safe substitutes and related technologies are expeditiously transferred to Parties operating under paragraph 1 of Article 5; and

(b) That the transfers referred to in subparagraph (a) occur under fair and most favorable conditions

Annex IV

APPENDICES TO DECISION II/8 ("FINANCIAL MECHANISM") ADOPTED BY THE SECOND MEETING OF THE PARTIES

Appendix I

INDICATIVE LIST OF CATEGORIES OF INCREMENTAL COSTS

1. The evaluation of requests for financing incremental costs of a given project shall take into account the following general principles:

(a) The most cost-effective and efficient option should be chosen, taking into account the national industrial strategy of the recipient party. It should be considered carefully to what extent the infrastructure at present used for production of the controlled substances could be put to alternative uses, thus resulting in decreased capital abandonment, and how to avoid deindustrialization and loss of export revenues;

(b) Consideration of project proposals for funding should involve the careful scrutiny of cost items listed in an effort to ensure that there is no double-counting;

(c) Savings or benefits that will be gained at both the strategic and project levels during the transition process should be taken into account on a case-by-case basis, according to criteria decided by the Parties and as elaborated in the guidelines of the Executive Committee;

(d) The funding of incremental costs is intended as an incentive for early adoption of ozone protecting technologies. In this respect the Executive Committee shall agree which time scales for payment of incremental costs ar appropriate in each sector.

2. Incremental costs that once agreed are to be met by the financial mechanism include those listed below. If incremental costs other than those mentioned below are identified and quantified, a decision as to whether they are to be met by the financial mechanism shall be taken by the Executive Committee consistent with any criteria decided by the Parties and elaborated in the guidelines of the Executive Committee. The incremental recurring costs apply only for a transition period to be defined. The following list is indicative:

(a) <u>Supply of substitutes</u>

(i) Cost of conversion of existing production facilities:

- cost of patents and designs and incremental cost of royalties;
- capital cost of conversion;
- cost of retraining of personnel, as well as the cost of research to adapt technology to local circumstances;

(ii) Costs arising from premature retirement or enforced idleness, taking into account any guidance of the Executive Committee on appropriate cut-off dates:

- of productive capacity previously used to produce substances controlled by existing and/or amended or adjusted Protocol provisions; and
- where such capacity is not replaced by converted or new capacity to produce alternatives;

(iii) Cost of establishing new production facilities for substitutes of capacity equivalent to capacity lost when plants are converted or scrapped, including:

- cost of patents and designs and incremental cost of royalties;
- capital cost;
- cost of training, as well as the cost of research to adapt technology to local circumstances;

(iv) Net operational cost, including the cost of raw materials;

(v) Cost of import of substitutes;

(b) Use in manufacturing as an intermediate good

(i) Cost of conversion of existing equipment and product manufacturing facilities;

(ii) Cost of patents and designs and incremental cost of royalties;

(iii) Capital cost;

(iv) Cost of retraining;

(v) Cost of research and development;

(vi) Operational cost, including the cost of raw materials except where otherwise provided for;

(c) End use

(i) Cost of premature modification or replacement of user equipment;

(ii) Cost of collection, management, recycling, and, if cost effective, destruction of ozone-depleting substances;

(iii) Cost of providing technical assistance to reduce consumption and unintended emission of ozone-depleting substances.

Appendix II

TERMS OF REFERENCE OF THE EXECUTIVE COMMITTEE

1. The Executive Committee of the Parties is established to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements including the disbursement of resources, for the purpose of achieving the objectives of the Multilateral Fund under the Financial Mechanism.

2. The Executive Committee shall consist of seven Parties from the group of Parties operating under paragraph 1 of Article 5 of the Protocol and seven Parties from the group of Parties not so operating. Each group shall select its Executive Committee members. The members of the Executive Committee shall be formally endorsed by the Meeting of the Parties.

3. The Chairman and Vice-Chairman shall be selected from the fourteen Executive Committee members. The office of Chairman is subject to rotation, on an annual basis, between the Parties operating under paragraph 1 of Article 5, and the Parties not so operating. The group of Parties entitled to the chairmanship shall select the Chairman from among their members of the Executive Committee. The Vice-Chairman shall be selected by the other group from within their number.

4. Decisions by the Executive Committee shall be taken by consensus whenever possible. If all efforts at consensus have been exhausted by no agreement reached, decisions shall be taken by a two-thirds majority of the Parties present and voting, representing a majority of the Parties operating under paragraph 1 of Article 5 and a majority of the Parties not so operating present and voting.

5. The meetings of the Executive Committee shall be conducted in those official languages of the United Nations required by members of the Executive Committee. Nevertheless the Executive Committee may agree to conduct its business in one of the United Nations official languages.

6. Costs of Executive Committee meetings, including travel and subsistence of Committee participants from Parties operating under paragraph 1 of Article 5, shall be disbursed from the Multilateral Fund as necessary.

7. The Executive Committee shall ensure that the expertise required to perform its functions is available to it.

8. The Executive Committee shall meet at least twice a year.

9. The Executive Committee shall adopt other rules of procedure on a provisional basis and in accordance with paragraphs 1 to 8 of these terms of reference. Such provisional rules of procedure shall be submitted to the next annual meeting of the Parties for endorsement. This procedure shall also be followed when such rules of procedure are amended.

10. The functions of the Executive Committee shall include:

(a) To develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources;

(b) To develop the three-year plan and budget for the Multilateral Fund, including allocation of Multilateral Fund resources among the agencies identified in paragraph 6 of decision II/8;

(c) To supervise and guide the administration of the Multilateral Fund;

(d) To develop the criteria for project eligibility and guidelines for the implementation of activities supported by the Multilateral Fund;

(e) To review regularly the performance reports on the implementation of activities supported by the Multilateral Fund;

(f) To monitor and evaluate expenditure incurred under the Multilateral Fund;

(g) To consider and, where appropriate, approve country programmes for compliance with the Protocol and, in the context of those country programmes, assess and, where applicable, approve all project proposals or groups of project proposals where the agreed incremental costs exceed $500,000;

(h) To review any disagreement by a Party operating under paragraph 1 of Article 5 with any decision taken with regard to a request for financing by that Party of a project or projects where the agreed incremental costs are less than $500,000;

(i) To assess annually whether the contributions through bilateral cooperation, including particular regional cases, comply with the criteria set out by the Parties for consideration as part of the contributions to the Multilateral Fund;

(j) To report annually to the meeting of the Parties on the activities exercised under the functions outlined above, and to make recommendations as appropriate;

(k) To nominate, for appointment by the Executive Director of UNEP, the Chief Officer of the Fund Secretariat, who shall work under the Executive Committee and report to it; and

(l) To perform such other functions as may be assigned to it by the Meeting of the Parties.

IMPLEMENTATION GUIDELINES[1]

SECTION II

FRAMEWORK FOR ACTIVITIES SUPPORTED BY THE FUND

II.1 COUNTRY PROGRAMMES

1. The Executive Committee shall invite each Party operating under paragraph 1 of Article 5 and wishing to receive support from the Multilateral Fund to develop a country programme and projects in accordance with paragraph 10(g) of the Terms of Reference of the Executive Committee.

2. The country programme is expected to contain inter alia:

(a) a review of recent production, imports, applications and use of controlled substances by the main producers, users, and consumers. Where information is available it would be useful to indicate links to multinational producers or users;

(b) a description of the institutional framework governing controlled substances - (Government agencies, collaborating NGOs, consumer groups, industry associations);

(c) a description of policy framework, regulatory and incentive systems;

(d) a description of government and industry activities in response to the Protocol;

(e) a statement of strategy for implementation of the Protocol, indicating the respective roles of Government, supporting multilateral and bilateral agencies;

(f) an action plan encompassing investment and technical assistance projects, pre-investment studies, and any additional policy analysis required;

(g) a timetable for each activity, and for action plan review;

(h) a budget and financing programme for the above activities.

3. In developing its country programme and/or individual project, a Party may request technical assistance, other services and support from the implementing agencies within their respective areas of expertise and within the context of work programmes approved by the Executive Committee.

[1] UNEP/OzL.Pro/ExCom/3/18, Annex III, pg. 29.

4. A Party operating under paragraph 1 of Article 5 shall submit its country programme to the Executive Committee for its consideration and approval in accordance with paragraph 10(g) of Appendix II of Annex IV to the Report of the Second Meeting of the Parties.

5. A country programme approved by the Executive Committee shall serve as a basis for project preparation and further cooperation between the Party and the implementing agencies. However, individual projects prepared prior to the completion of a country programme shall also qualify for funding if consistent with project eligibility criteria (see section III) approved by the Executive Committee.

II.2 WORK PROGRAMS

1. The Executive Committee shall invite implementing agencies and other appropriate agencies depending on their expertise, to develop work programmes in cooperation with recipient countries in order to receive support from the Multilateral Fund.

2. Work programmes should specify:

(a) types of activities and projects on which agreement has been reached between the implementing agency and the concerned Party;

(b) types of activities and projects which must be sufficiently defined to allow the Executive Committee to review and monitor these activities;

(c) means of coordinating with other implementing agencies;

(d) time frame for action;

(e) expected outcomes; and

(f) estimated budget by major categories and fiscal quarters.

3. The Executive Committee shall approve work programmes based on project eligibility criteria, on an annual basis and review progress under these programmes semi-annually.

4. The implementation of any aspect of the Work Programme shall be subject to the availability of funds. In the event of a shortage of available funds the Executive Committee shall provide guidance to the implementing agencies concerning priorities for implementation (see section IV).

5. Each implementing agency is responsible for implementation and supervision of projects within its work programme. The agency shall report to the Executive Committee annually on the progress of the work programmes.

II.3 PROJECT APPROVALS

1. Project proposals where the agreed incremental costs exceed $500,000 shall be considered and approved by the Executive Committee.

2. Project proposals where the agreed incremental costs are less than $500,000 shall be approved by the implementign agencies within the context of an approved work programme and after confirmation by the Fund Secretariat on the availability of funds and contributions in-kind.

3. Project proposals not developed in cooperation with implementing agencies shall be submitted to the Secretariat for transmittal to the appropriate implementing agencies for inclusion in their next work programme.

ANNEX F

DETAILED PHASE-OUT SCENARIOS BY USER SECTOR

This annex sets out the phase-out pattern in each user sector for the two principal scenarios:

- accelerated phase-out;
- allowed phase-out.

1. Accelerated Phase-Out by Sector

This section presents diagrams (at the end of the Annex)illustrating the most likely responses of each industry sector to market forces and reflects their current plans where these exist. It assumes supporting government phase-out measures to ensure that all sectors respond in this time frame. The speed of changeover in each sector is constructed in line with industry estimates where available.

Domestic Refrigerators

Figure F.1 illustrates unconstrained ODS demand projections and Figure F.2 illustrates the most likely ODS phase-out profile for domestic refrigerator manufacturers.

There are separate lines on each graph for:

- the CFC-11 used in the insulating foam;
- the CFC-12 used in new refrigerators;
- the CFC-12 required for recharge; and
- the resultant total CFC demand in the sector. There are four significant steps in the phase-out graph:
- the introduction, starting in 1992 and completed in 1993, of foam systems using 50 per cent less CFC-11 than conventional systems. This is already technically possible and in widespread use in Europe, although there are some cost penalties that are delaying its adoption in Turkey;
- the complete phase-out of CFC-11 in the foam over a period of 2 years (starting in 1997) as it is replaced by HCFC-22. The exact technicalities of this are not yet fully resolved. Hence the long lead time assumed;

- a phase-in of HFC-134a refrigerant to replace CFC-12 in new refrigerators over four years beginning in 1995. This is broadly in line with Turkish manufacturers plans. It allows time for its full commercial introduction in Europe, expected in 1993;

- a curtailment of recharge with virgin CFCs from 2007, as constrained by the Protocol 15 per cent limit.

Central Air Conditioning Plant

The graphs in Figure F.3 and F.4 illustrate unconstrained and accelerated phase-out profiles. There is a single phase-out step in 1993, corresponding to the switch to HCFC-22 in all new units. Most central air conditioning systems in Turkey already use HCFC-22, and therefore it is feasible for all new units to use HCFC-22.

Residual recharge demand for CFC-11 is not met after 2007, as virgin CFC supply is constrained by the 15 per cent limit in the Protocol.

Mobile Air Conditioning

In this sector, there is also a distinction between CFC-12 consumption for new units and for recharge demand, as shown in Figure F.5 and F.0. Use of CFC-12 in new units decreases over six years (starting gradually in 1993) as HFC-134a is introduced. The first HFC-134a air conditioners have already been introduced by Mercedes into some of their top of ?? cars. It is likely to take a few years for this to spread to most mobile air conditioners.

The demand for CFC-12 for recharge is not met from 2007 onwards, as virgin CFC supply is constrained by the 15 per cent limit in the Protocol.

Polyurethane Foams

The graphs in Figures F.7 and F.8 illustrate unconstrained and accelerated ODS phase-out in both rigid foams and flexible foams (excluding refrigerator insulation).

For flexible foams, there is a single phase-out step in 1993 when methylene chloride replaces CFC-11. Methylene chloride is already widely used in many polyurethane foams. It is assumed that rigid foam manufacturers begin the transition in 1993 and have fully converted by 1994.

Aerosols

The phase-out of ODS from aerosols is illustrated in Figure F.9. Complete phase-out is expected by 1993 as the conversion to LPG is almost complete.

Solvents

There is an assumed conversion to aqueous cleaning over two years beginning in 1998.

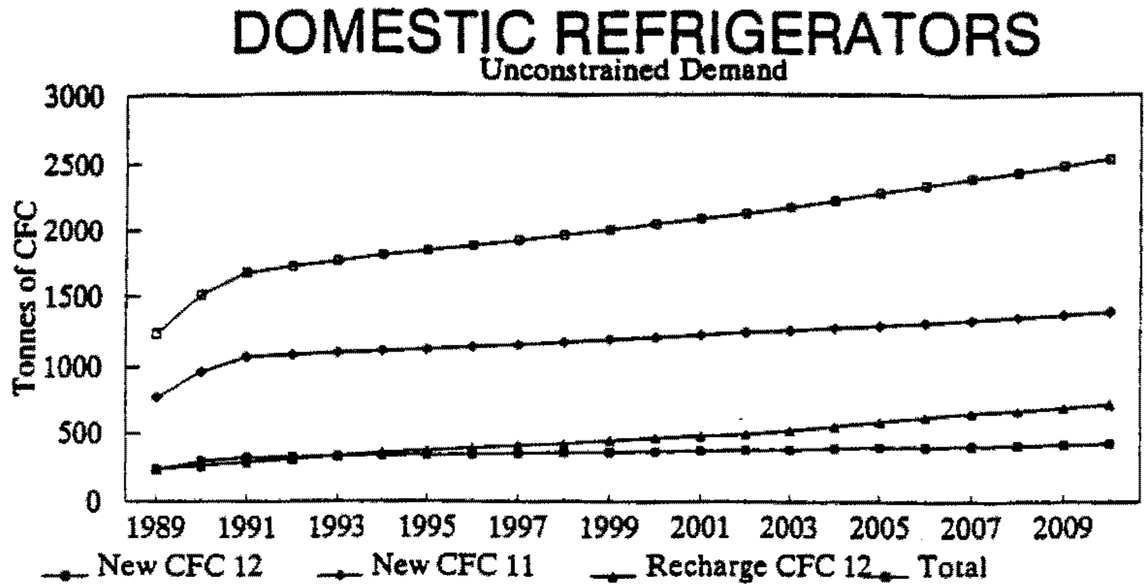


FIGURE F.1

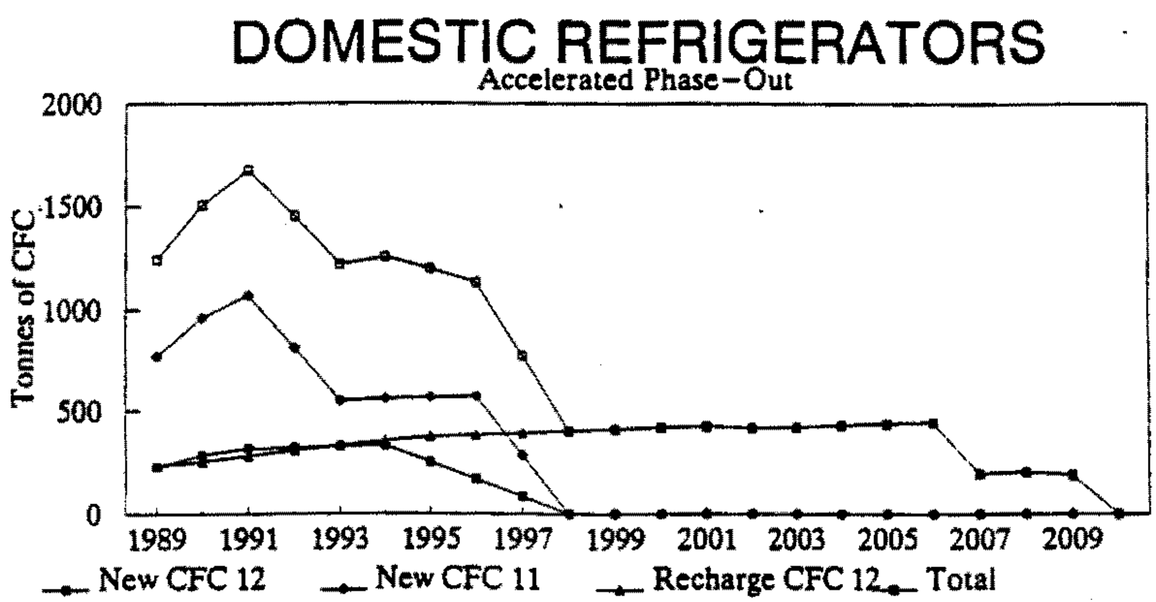


FIGURE F.2

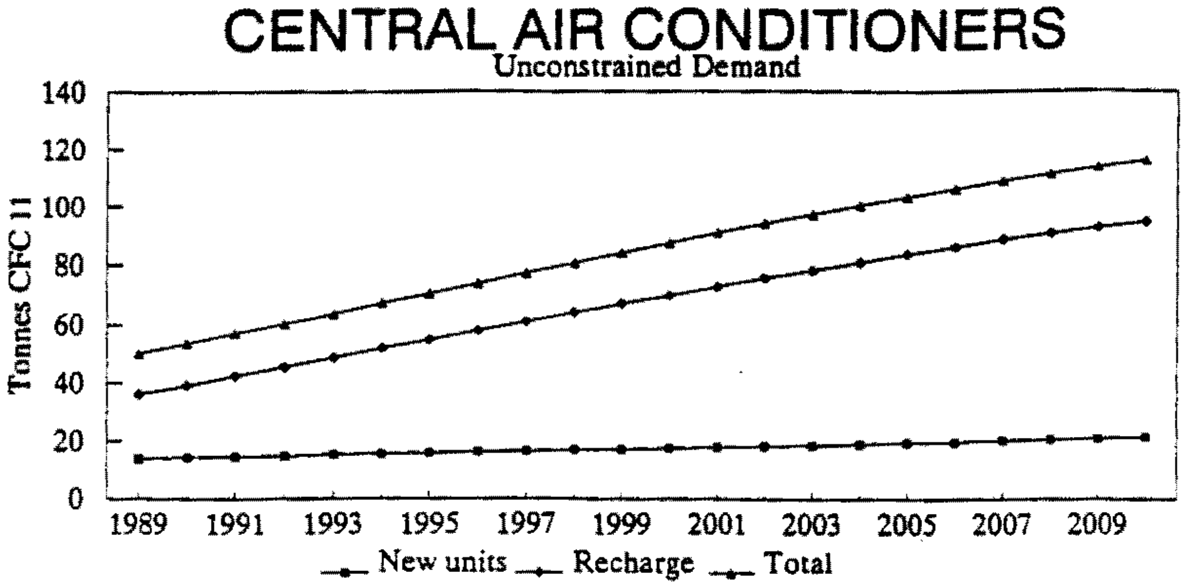


FIGURE F.3

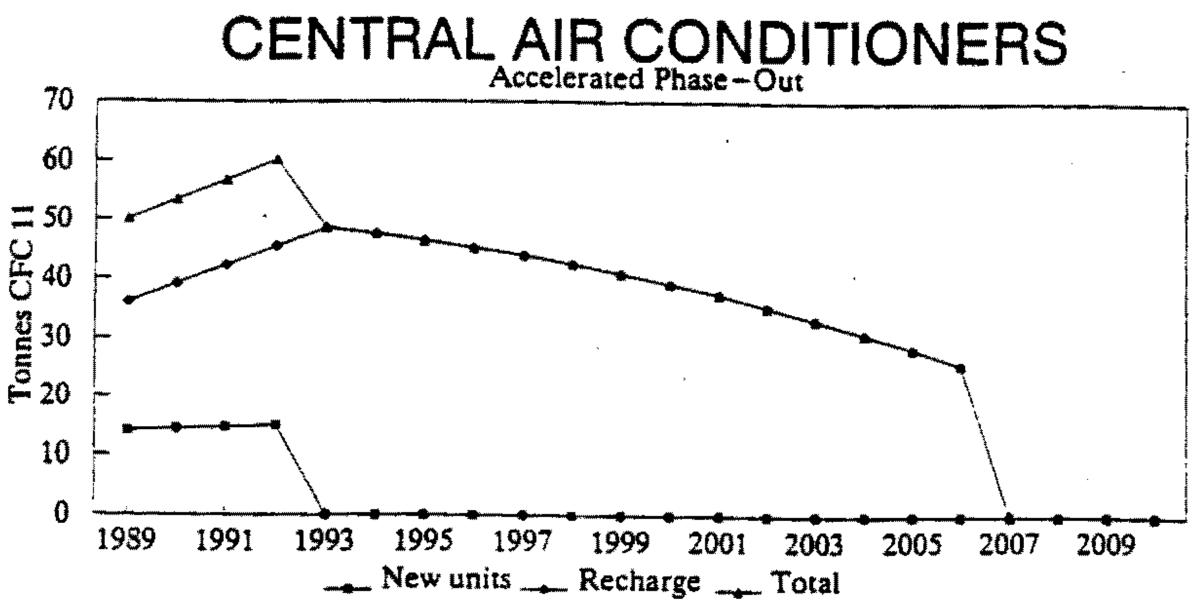


FIGURE F.4

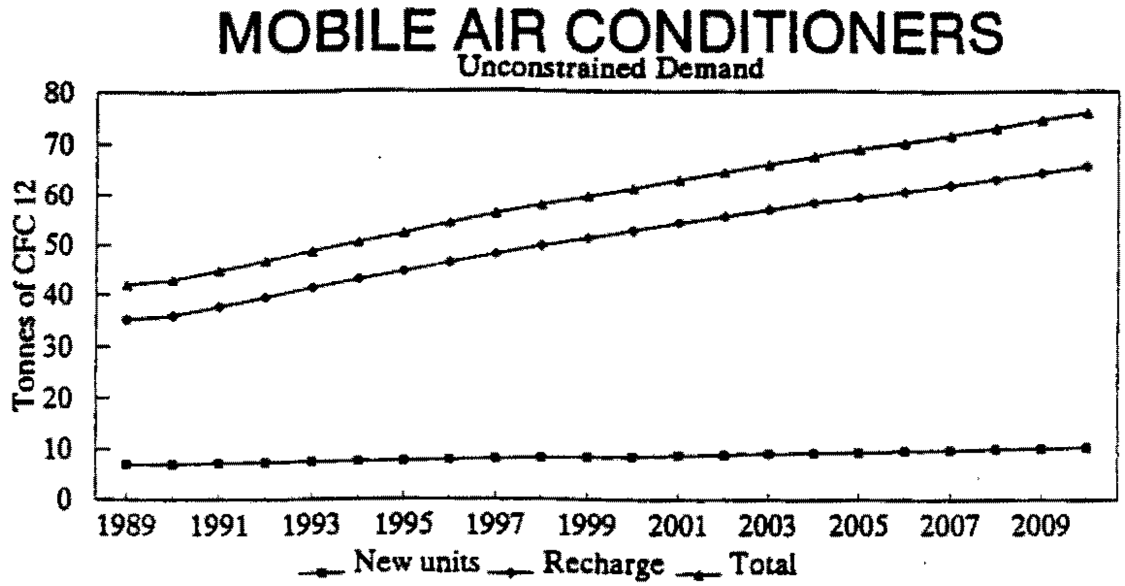


FIGURE F.5

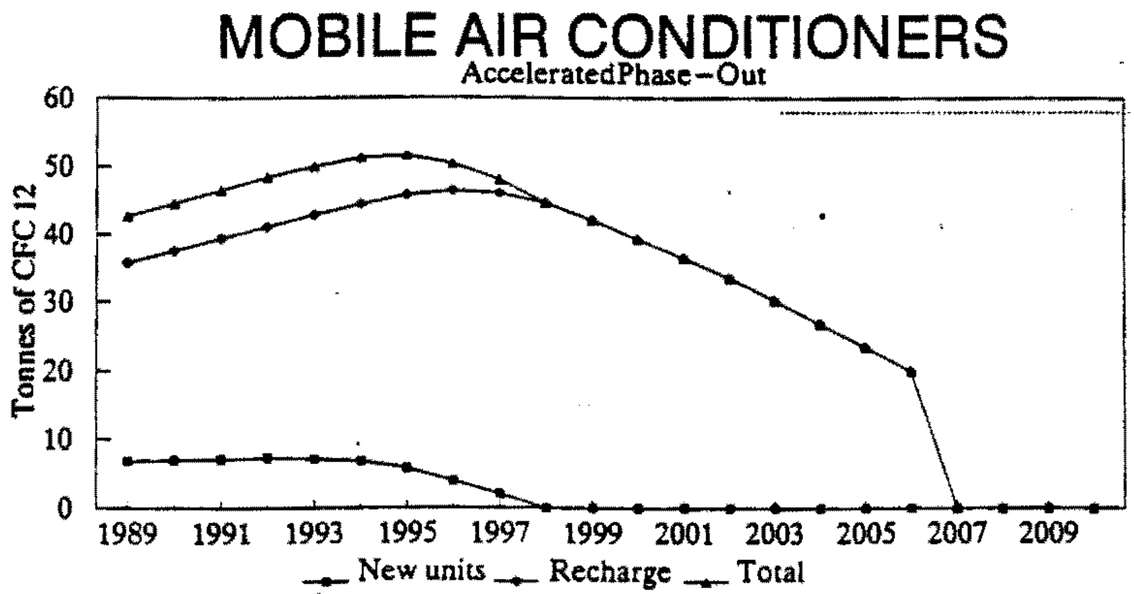


FIGURE F.6

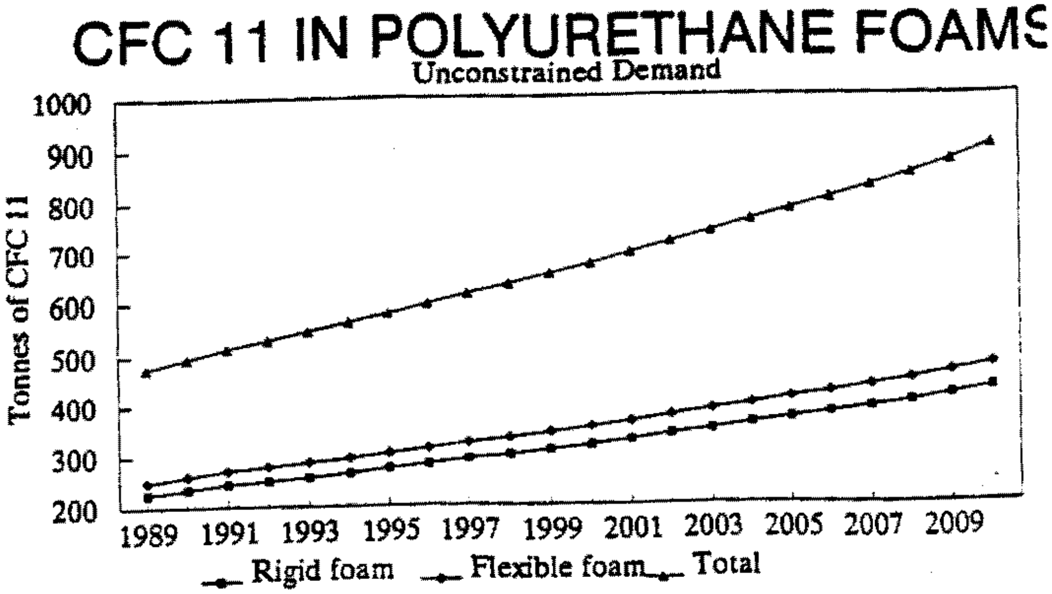


FIGURE F.7

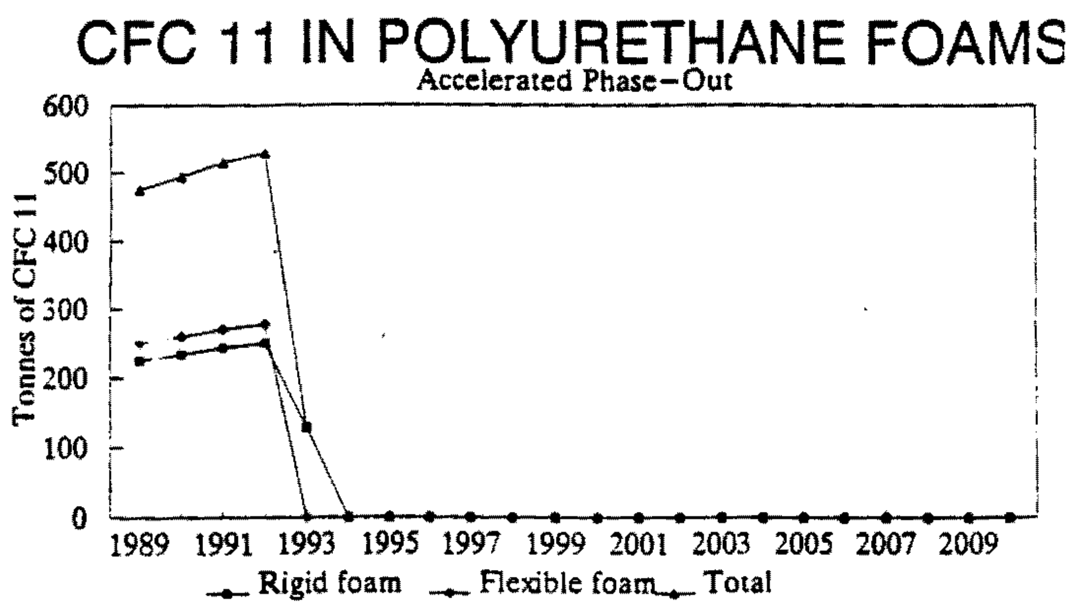
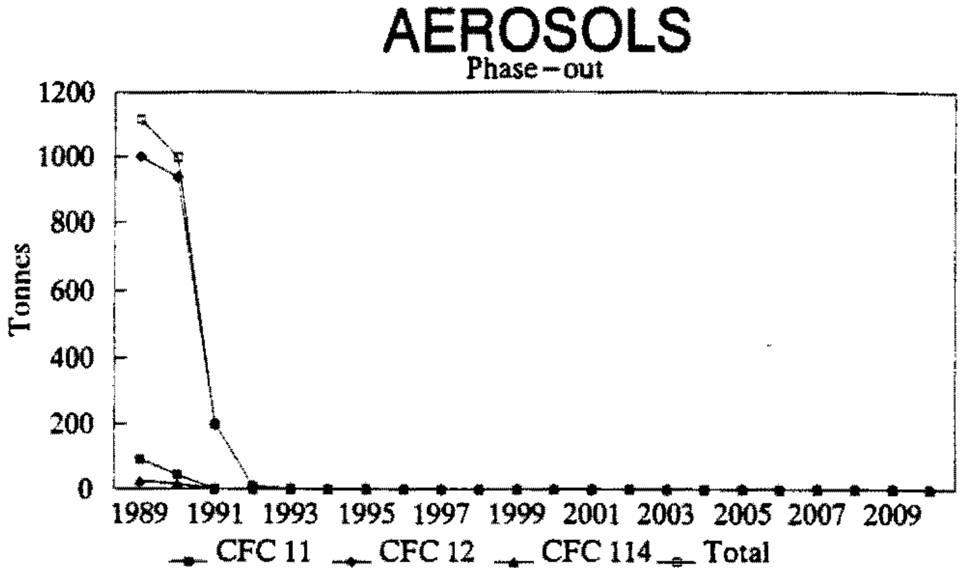


FIGURE F.8



AEROSOLS
Phase-out
Tonnes
1200
1000
800
600
400
200
0
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
CFC 11
CFC 12
CFC 114
Total

FIGURE F.9

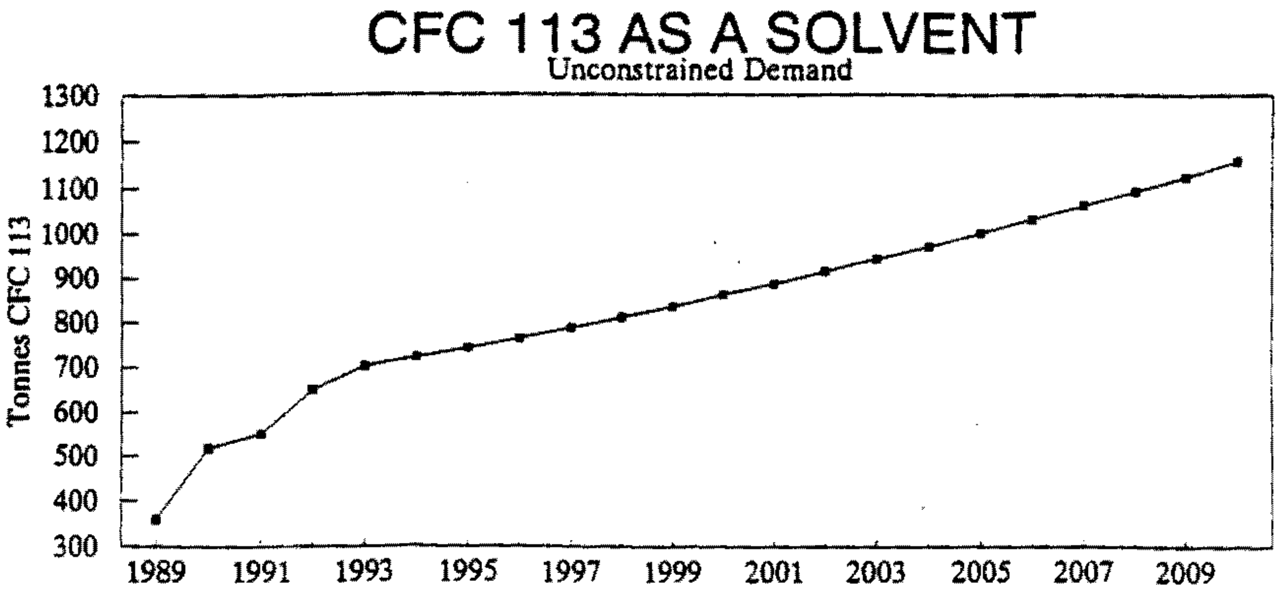


FIGURE F.10

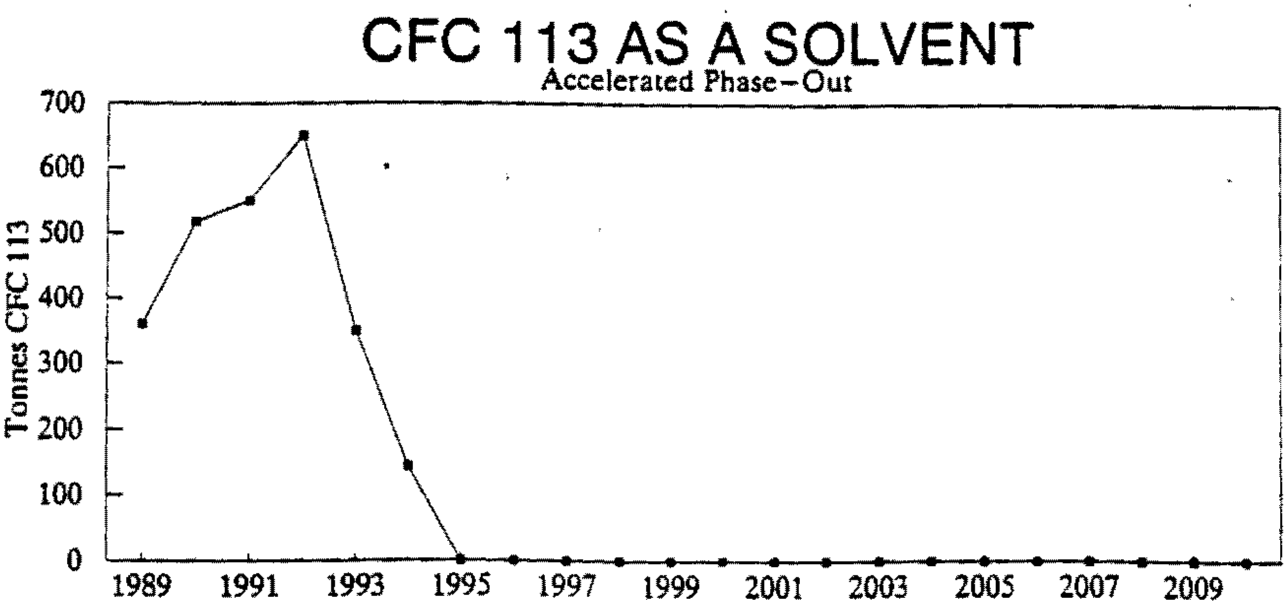


FIGURE F.11