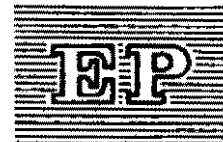




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Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Eleventh Meeting
Bangkok, 10-12 November 1993

COUNTRY PROGRAMME: THAILAND

This document is issued on the basis of a revised Country Programme document submitted by the Government of Thailand on 26 October 1993 in response to comments from the Fund Secretariat.

It consists of:

- a) A revised Country Programme Evaluation Sheet and a revised Country Programme Cover Sheet (both prepared by the Fund Secretariat).
- b) An additional chapter (Chapter 9) to the Country Programme.

THAILAND COUNTRY PROGRAMME EVALUATION SHEET

The Thailand Country Programme is submitted to the Eleventh Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/11/23.

It consists of:

- Letter of Transmittal
- Country Programme Cover Sheet (Prepared by the Secretariat)
- The Country Programme document divided into
 - Executive Summary and eight chapters namely
 - Introduction
 - Consumption of ODS in Thailand
 - Unconstrained Demand for ODS in Thailand
 - Institutional Framework
 - ODS Phase-Out Policies and Measures
 - Introduction to Projects and Activities
 - Action Plan
 - Phase-out Costs.

Thailand imports all its requirements of ozone depleting substances. In 1991, the total consumption was 15,648 tonnes or 8,893 tonnes ODP. The most widely used ODS were CFC-113 (3,200 tonnes ODP), CFC-12 (3,125 tonnes ODP) and CFC-11 (1,897 tonnes ODP). Combined with 1,1,1 trichloroethane (711 tonnes ODP) and carbon tetrachloride (137 tonnes ODP), the electronic and metal and precision cleaning industries were the largest ODS user sector, accounting for 37 per cent. Refrigeration (11 per cent) and air conditioning (26 per cent) also accounted for 37 per cent of the ODS used. Foam blowing (17 per cent), fire extinguishing (6 per cent) and aerosol (3 per cent) made up the rest.

ODS use in Thailand has been characterised by high growth rate. In the five-year period 1986-1991 there has been 300 per cent increase in the ODS consumption; and it is expected that by 2005, the country would exceed the allowable quotas for Article 5 Parties if consumption is unconstrained.

The highest growth rate in the use of ODS has occurred in the domestic refrigerator production and production and servicing of mobile air conditioners. Mobile air conditioners have become popular in recent years. Almost all new cars and light trucks are equipped with air conditioners while approximately 80 per cent of the existing fleet is equipped with air conditioners. In 1990 approximately 407,000 new vehicles entered the market. Production of domestic refrigerators rose from about 267,000 units in 1986 to nearly 1.14 million in 1991.

There is substantial participation of foreign companies in the ODS user industries in Thailand, where wholly owned or jointly owned subsidiaries of foreign companies manufacture products mainly for export. The consumption due to these companies is most significant in the solvent user sector but involvement of major appliance manufacturing companies in the production of domestic refrigeration is also substantial. The growing trend in the domestic refrigerators for export is evident. In 1986, only 3 per cent of the refrigerators produced were exported while in 1991, 33 per cent of the 1.14 million produced were exported.

The following indicates the proportion of ODS consumption in 1991 due to foreign companies and the user sectors where they occurred.

<u>Sector/Sub-sector</u>	<u>Percentage of Consumption Due to Foreign Companies</u>
Electronic Cleaning	90
Metal/Precision Cleaning	80
Refrigeration (manufacture)	33
Appliance insulation foam	33
Flexible polyurethane foam	30
Polystyrene packaging foam	30
Rigid polyurethane foam	10

Three scenarios with estimates of corresponding incremental costs were considered in arriving at the strategy for the phase-out. These are:

- Technology Driven Scenario by which the phase-out is undertaken as rapidly as technology permits. The incremental cost of phase-out by this scenario was estimated to be US \$471 million.
- Delayed Action Scenario which calls for undertaking the least possible action while meeting the Protocol's requirements for phase-out. The total incremental cost of phase-out was estimated to be US \$431 million.
- Least Cost Scenario which attempts to minimize costs while considering possible future implications of actions to be taken in order to determine the appropriate time for phase-out action. The incremental cost of phase-out was estimated to be US \$282 million.

On the basis of analysis of these scenarios a Selected Strategy Scenario which is between the technologically driven and the least cost scenarios was chosen to phase-out in Thailand. According to this scenario, the phase-out of all ODS use would occur by January 1, 1998, except the use for servicing existing air-conditioning and refrigeration equipment.

The total estimated incremental cost by this strategy is approximately US \$439 million. Analysis of this cost of phase-out has been made based on domestic sector end-use and export sector end-use of ODS as well as on industrial sector end-use and consumer sector end-use.

The domestic sector accounts for 94 per cent (about US \$413 million) while the export sector accounts for 6 per cent (about US \$25 million) of the phase-out costs. The incremental costs due to the industrial and consumer sectors are 68 per cent (US \$298 million) and 32 per cent (US \$141 million) respectively. Consumer costs include, increased energy costs for household refrigerators, costs associated with premature retirement of refrigerators, and retrofit costs for mobile air-conditioners. These are costs that could be influenced by several factors including the state of refrigerator manufacturing technologies and development of substitute refrigerants. The country programme acknowledges that the extent of the incremental costs associated with phasing-out the use of export-oriented sector depends on a number of factors, including ownership of firms and the final destination of products, e.g. "a foreign-owned firm producing products intended for export to developed nations would not have its (phase-out) costs reimbursed" by the Multilateral Fund.

By the selected strategy, the total ODS consumption avoided is estimated to be 604,000 tonnes ODP. On the basis of this avoided consumption, the "average cost" of phase-out is assessed to be US \$726 per tonne. However, on the basis of the consumption elimination profiles, the estimated total consumption till phase-out would be about 61,000 tonnes ODP which results in US \$7.2 per Kg (US \$7,200/tonne) of ODS phased-out.

The chapter on Policy Framework provides insight into the impact that the governments' economic development policies have had on economic growth and rapid industrialization of the Thai economy. The share of the GDP of the manufacturing sector rose from 6.8 per cent in 1960 to 26 per cent in 1990. Investment promotion measures including tax incentives, guarantees against nationalization, land, export and currency transfer rights, reduction in import duties on a range of goods including machinery and computers are seen to also help the phase-out process.

Arising from the government's policy to promote investment and industrial development and desire to "co-operate with all international agencies in their efforts to protect the ozone layer" an Action Plan has been adopted which is aimed at successful implementation of the government strategy to phase out major uses of ODS by 1998. The Action Plan provides legislative and administrative measures to induce and catalyse the phase-out. These include:

- Establishment of National Committee on Implementation of the Montreal Protocol in 1992.
- Enactment of national legislation to control ODS in Annexes A, B and C as hazardous substances in 1992.
- Restrictions on capacity expansion of ODS-user enterprises in 1992.
- Bans on imports of ODS and ODS containing products in accordance with the Protocol
- Announcement of phase-out schedules in 1994
- Designation in 1993 of national institutions to oversee compliance with the Protocol and to assist industry in the development of appropriate investment projects. These institutions are co-operating with the World Bank, UNDP, UNIDO and non-Article 5 governments to develop series of investment projects.

COMMENTS

The analysis of ODS consumption indicates the user-sectors and the level of consumption due to foreign-owned companies or companies in which there is foreign participation. The discussion of the incremental phase-out costs also acknowledges the financial responsibilities of foreign-owned firms in the phase-out. However, although the estimated total incremental cost is based on the total national ODS consumption there was no analysis that clarifies the share of the foreign-owned companies in the phase-out costs.

With regard to eligibility for funding of phase-out projects of firms in Thailand that are wholly or partly owned by transnational corporations, the decision of the Executive Committee on "whether the Fund should finance activities related to enterprises that are wholly or partly owned by transnational corporations" UNEP/OzL.Pro/ExCom/7/30, paragraph 88, should provide the necessary guide when developing such projects.

A list of potential projects to be undertaken to phase-out the ODS is not provided. What is provided only indicates projects that have been either approved or submitted for consideration of the Executive Committee and a number of project summaries of projects which have been approved by the Executive Committee and those for which "permission to proceed" with their development has been given. It has been indicated, however, that Thailand is working with the World Bank to prepare a second set of project proposals consistent with the Action Plan. These projects will stress the conversion of OEMs (Original Equipment Manufacturing enterprises) in the commercial refrigeration sector, recycling and conversion of OEMs in the MAC sector, medium and small solvent users and foams applications. Projects are also planned to be undertaken with the assistance of UNDP, UNIDO and through bilateral assistance from governments. This opportunity could be taken to identify the potential activities and projects to the three year horizon or beyond in view of the adoption of an accelerated phase-out strategy. This would provide a means for co-operation among the agencies involved.

RECOMMENDATIONS

To approve the Country Programme. Account should be taken of the comments in the Evaluation Sheet during the implementation of the Country Programme.

COUNTRY PROGRAMME COVER SHEET

Country : Thailand

Date Received : September 1993

Period Covered : 1993-2010 (See footnotes below)

Lead National Agency : Department of Industrial Works

Lead Implementing Agency : Not indicated

1. Phase-out schedule

Substances	Current Consumption (Tonnes X ODP) in 1991	Planned Consumption till Phase-out Tonnes X ODP ⁽¹⁾	Planned Year of Phase-out
CFC-11	1,897	Annex A ODS: 51,100	2010 ⁽²⁾
CFC-12	3,125		2010 ⁽¹⁾
CFC-113	2,560		1998
CFC-114	50		1998
CFC-115	15		1998
Halon-1211	264	Annex B ODS: 9,600	1998 ⁽³⁾
Halon-1301	120		1998 ⁽⁴⁾
1,1,1 Trichloroethane	711		1998
Carbon Tetrachloride	151		1998
TOTAL	8,893	60,700	

(1) Derived from ODS consumption profiles (Exhibit 9-2 and Exhibit 9-3).

(2) Phase-out target date for recharge of existing equipment only. Use of CFC-11 and CFC-12 for manufacturing of or use in new equipment will cease in 1998.

(3) Use of Halon 1211 in new fire extinguishers will end in 1994.

(4) Use of Halon 1301 in new fire extinguishing systems will end in 1995.

2. Government Action Plan

Year	Description of Action	Sector	Intended Effect
1992	Appointment of the National Committee on the Implementation of the Montreal Protocol	All	To formulate and facilitate the ODSs phaseout policies.
1992	Including substances listed in Annexes A, B, and C as hazardous substances under the 1992 Hazardous Substance Control Act.	All	Ensuring compliance of timetable set for reducing ODSs consumption.
1992	Imposing a requirement that all applications for new factory establishment and expansion using ODSs must be accompanied by specific phaseout plans.	All	Discouraging the use of ODSs in new production facilities.
1992	Ban the import of controlled substances in Annexes A and B from countries not parties to the Montreal Protocol	All	Ensuring the compliance with the Article 4 of the Montreal Protocol.
1992-1998	Enhancement of the transfer of alternative technologies via the cooperation of the government and various international industrial organizations	All	Facilitating the attempt of private sectors in taking on an early ODS phaseout schedule.
1993	Lifting an import duty on alternative chemicals; reducing an import duty on equipment that has a direct effect of reducing the emission of ODSs	All	Encouraging an early phaseout of ODSs.
1993	Implementing a ban on import of products containing controlled substances from countries not parties to the Montreal Protocol	All	Ensuring the compliance with Article 4 of the Montreal Protocol.
1993	Follow up the tripartite cooperation program, DIW/USEPA/MITI, initiated in 1992. Under this program, multinational companies using ODSs are committed to follow the phaseout schedule of developed countries.	All	Ensuring the compliance of timetable set for reducing the consumption of ODSs
1993	Ratification of the Copenhagen Amendment of the Montreal Protocol.		

Year	Description of Action	Sector	Intended Effect
1993	Establishment of the Ozone Layer Protection unit within DIW. The unit will provide information and consultation for industry in terminating the use of ODSs	All	Ensuring the compliance of timetable set for reducing ODSs consumption.
1993	Appointing Industrial Finance Corporation of Thailand as the agency responsible for managing and disbursing funds received for ODS phaseout projects in Thailand.	All	Establishing a financial mechanism for channelling funds from the Multilateral Fund to enterprises.
1993	To ensure meeting of phaseout targets, import quotas will be issued.	All	Establishing the method to set reference for ODS reduction.
1993-1998	Government will work closely and amicably with the Federation of Thai Industry in adopting necessary measures proposed in Chapter 6.	All	Ensuring timely compliance on reduction of controlled substances as schedules in the country program without unnecessary confrontation with industry.
1994	Ban on the import of Annex C substances from the countries not parties to the Montreal Protocol.	All	Ensuring the compliance with the Copenhagen Amendment of the Montreal Protocol.
1994	Announcement of Phaseout Schedules of ODS.	All	Ensuring timely compliance on reduction of controlled substances as schedules in the country program.
1994-1996	Ensure timely implementation of the first tranche of investment projects.	Solvents, Refrigeration, Foam Blowing	Elimination of approximately 1,156 ODP weighted MT cut of the total current ODS consumption of 8,893 ODP weighted MT.

3. Project Summary

Only a summary of projects approved by the Executive Committee and those for which permission to proceed has been given, has been provided.

4. Cost of Activities and Projects in Country Programme

Cost of implementing the Country Programme: US \$ 439 million

Cost effectiveness* US \$ 7.2/Kg

* Based on total consumption till phase-out derived from the ODS consumption profiles.

CHAPTER 9: PHASEOUT COSTS

This chapter discusses the potential economic costs to Thailand of complying with the provisions of the Montreal Protocol. Costs for different phaseout scenarios are presented that take into account the predicted future demand for ODS applications, the costs of alternative technologies, and interim phaseout targets. The costs presented are incremental costs; that is, they represent the costs above those that would be incurred in the absence of the Montreal Protocol provisions. The costs are computed based on the guidelines put forth by the World Bank for the Multilateral Fund Executive Committee, and are based on a consultant's study done for the Thai Government that was supported by the World Bank.¹

9.1 Phaseout Scenarios and Calculation of Incremental Costs

Any feasible phaseout strategy for Thailand must (1) lead to compliance with the Protocol and (2) not rely on any technologies prior to the date they are available in Thailand. With just these two constraints, however, there are thousands of feasible strategies. This section presents the set of feasible strategies that were analyzed by the consultants and are considered most important for evaluating the phaseout of ODSs in Thailand.

The costs for the phaseout scenarios were calculated using a computer model developed to calculate incremental costs to a country of the ODS phaseout. This model develops a strategy to minimize costs while meeting conditions specified for a particular phaseout scenario.

Given the Montreal Protocol phaseout schedule, three phaseout scenarios are of prime interest for Thailand. These scenarios are described below; costs for each are discussed.

1. *Technology Driven (or Fastest Possible) Scenario:* Thailand could undertake a phaseout that is as rapid as technology permits. This implies adopting each ODS alternative technology as soon as it becomes available and converting facilities as fast as possible. Such a scenario can also be expected, by definition, to be costlier than a *least cost* strategy for a 2010 phaseout, but will result in the *fastest possible* phaseout of ODSs for Thailand.

¹ "Operational Interpretations of Incremental Costs and Eligible Expenditures," prepared by the Environment Department, The World Bank for the Interim Multilateral Fund under the Montreal Protocol on Substances that Deplete the Ozone Layer, June 1992.

2. *Delayed Action Scenario*: An alternative strategy to the *technology driven* strategy described above would be to do the least possible while meeting the Protocol's requirements for a phaseout. Such a strategy would attempt to minimize costs in each year without considering future consequences of actions taken in any year. This would be the scenario if Thailand adopted an approach that was not forward looking. For example, converting to use of alternative refrigerants in household refrigerators is expensive on a per unit of ODS use avoided relative to most other controls. Given this, the *delayed action* strategy would imply converting refrigerator plants to an alternative refrigerant as late as possible relaying on the other 'cheaper' controls to meet the targets in earlier years. However, because costs in future years (because of the service needs of the stock of refrigerators) are not considered in such a strategy, the refrigerators using CFC-12 will have to prematurely retired starting in 2010 once ODSs are no longer available. This would lead to high costs overall, definitely higher than a *least cost* strategy and possibly higher than even the *fastest possible* phaseout in some cases.
3. *Least Cost Scenario*: This strategy also attempts to minimize costs, except that unlike the *delayed action* strategy this strategy does consider future consequences of actions taken in any year. Considering the example above, manufacturing refrigerators in any year results in costs in future years because those refrigerators will need to be serviced and, in the worst case, will have to retired prematurely if ODSs are not available to meet their servicing needs. Given this, the *least cost* strategy would imply converting refrigerator plants to an alternative refrigerant earlier than in a *delayed action* scenario where only the costs in that year were considered. How much earlier depends on the trade-off between the discounted costs of converting to alternative technologies earlier versus the discounted costs of premature retirements and retrofits if conversion is delayed. Such a plan, like the *delayed action* strategy above, assumes that the government would develop a comprehensive phaseout plan that specifies which actions would be taken over time.

A *delayed action* strategy would not be preferred in view of the fact that the costs associated with such a strategy will be higher than those for a *least cost* strategy and the adoption of alternative technologies will be much later than a *technologically driven* phaseout by 2010. However, the *technologically driven* phaseout does not take into account any logistical and institutional considerations, and the *least cost* strategy focuses only on minimizing costs of a phaseout without considering the other factors, such as competitive advantages associated with having manufacturing facilities that use state-of-the-art technologies and maintaining export markets by exporting that contain ODS substitutes. Considering this, the Thai Government has chosen a strategy between the *technologically driven* and *least cost* strategies, called the *selected strategy* scenario. This strategy is a modified version of the strategy recommended for Thailand by the consultants that the Thai

Government believes more accurately considers the industrial and institutional conditions in Thailand.

The majority of the discussion that follows is about the predicted costs of phaseout following the selected strategy.

9.2 Key Assumptions

A number of assumptions underlie the analysis of costs and were built into the computer model used to estimate phaseout costs. Among the most important are the following:

- Cost-saving ODS alternatives or controls do not offset total costs. Rather, these alternatives are assumed to occur at zero cost. The reason for this is that cost-savings controls *should* occur regardless of the Montreal Protocol because of the economic incentives to implement cost-saving options. It could be argued that various market failures hinder the adoption of cost-saving ODS alternatives, and that because the Montreal Protocol effectively overcomes these barriers the benefits of these alternatives should be attributed to the Protocol. Such an approach will reduce the costs of a phaseout, but was not used in estimating costs.
- Cost-saving (or no-cost) ODS alternatives and controls were assumed to be implemented as soon as they are available. Again, economic incentives should lead firms and individuals to take advantage of these savings as soon as they can. For the purposes of estimating costs, the earliest possible actions were assumed to occur in 1993.
- Both domestic and export-related ODS solvent cleaning were assumed to phase out the use of ODSs simultaneously – in the slowest phaseout scenarios no later than the year 2000 for CFCs and 2005 for 1,1,1-trichloroethane, the year in which developed country signatories to the Protocol can no longer import products manufactured with ODSs. It is assumed that firms would find it difficult to maintain separate manufacturing processes for domestic and export products (especially where domestic use is a fraction of total use), and thus would find it advantageous to switch all operations to non-ODS alternatives. This assumption was made only in the solvent cleaning sector because it is the only sector in which exports dominate manufacturing activity.
- All recycling and recovery controls were assumed to start at least as early, if not prior to, the start of conversion to alternatives in the relevant end uses. In addition, it is assumed for purposes of

calculating the incremental cost per kilogram of ODS use avoided that these recycling and recovery controls will continue to be used for equipment using the alternatives to ODSs.

- No stockpiling of ODSs was assumed as this would be against the spirit of the Protocol. However, ODSs recovered or recycled were assumed to offset use, and therefore, offset imports of ODSs.
- The analysis was carried out until the year 2015. However, only costs incurred through the year 2010 were considered for phasing out CFCs and halons, with the exception of any premature retirement or retrofit costs. The costs of phasing out 1,1,1-trichloroethane, as well as premature retirement and retrofit costs, were considered through to 2015. These costs were added to determine the total cost under each scenario. In some cases, adopting an alternative results in permanent recurring costs, as when a chemical substitute is less energy efficient or if an alternative costs more. Theoretically, such costs continue indefinitely; they were assumed to stop by 2015 to provide some bound on the analysis.

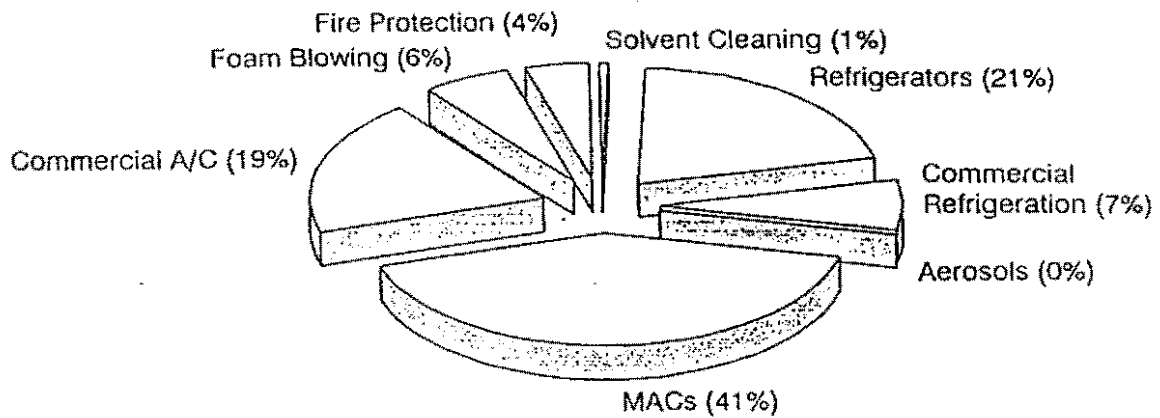
9.3 The Selected Scenario

The estimated total incremental social costs of complying with the Montreal Protocol under the *selected* scenario, that chosen by Thailand, are US\$439 million. As shown in Exhibit 9-1, about 94 percent of all costs are attributable to phasing out use of ODSs for domestic purposes. Of these, most of the costs occur in the refrigeration and air-conditioning sectors. Air-conditioning accounts for 60 percent of all domestic costs, and refrigeration accounts for another 28 percent. This is because of the high per kilogram cost of converting to alternatives as well as large amounts of ODP-weighted use in these sectors.

The ODS consumption patterns under the selected strategy are shown in Exhibits 9-2 and 9-3. In all instances the consumption is below the levels set by the Protocol. Furthermore, as is seen from these exhibits, phaseout of all ODS use occurs by January 1, 1998, with the exception of ODS use for servicing existing air-conditioning and refrigeration equipment. ODS use for servicing continues until 2010 and is likely to be allowed even under a revised Protocol that may require an earlier phaseout date.

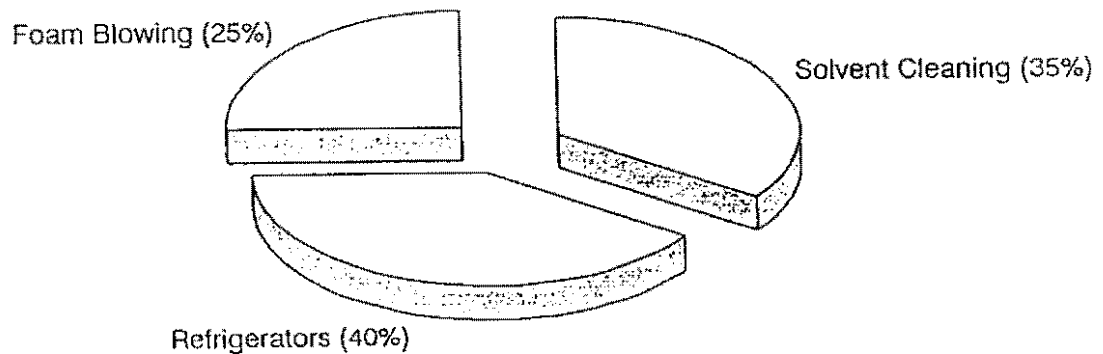
Exhibit 9-1 Phaseout Costs by End Use Under the Selected Plan

Domestic Phaseout Costs by End Use



Domestic Costs: U.S. \$413.4 million

Export Phaseout Costs by End Use



Export Costs: U.S. \$25.2 million

Exhibit 9-2 Remaining ODS Use Under the Selected Plan - Domestic Sector

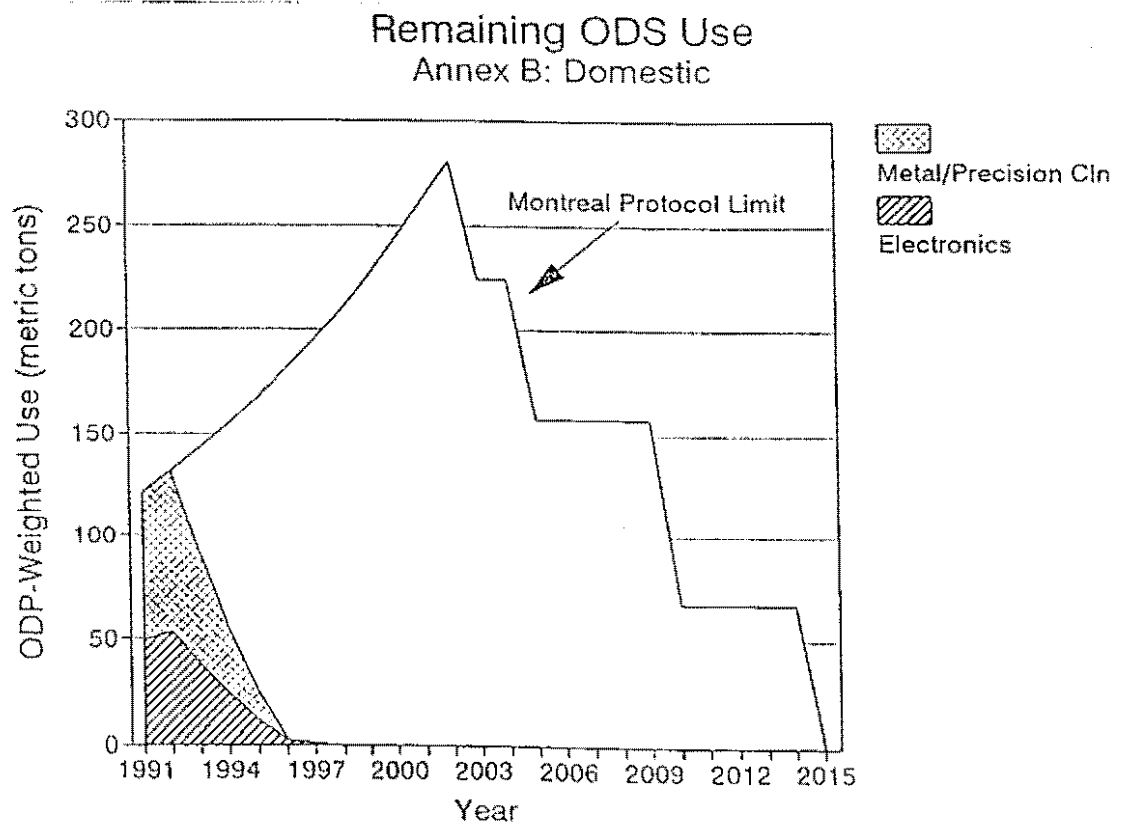
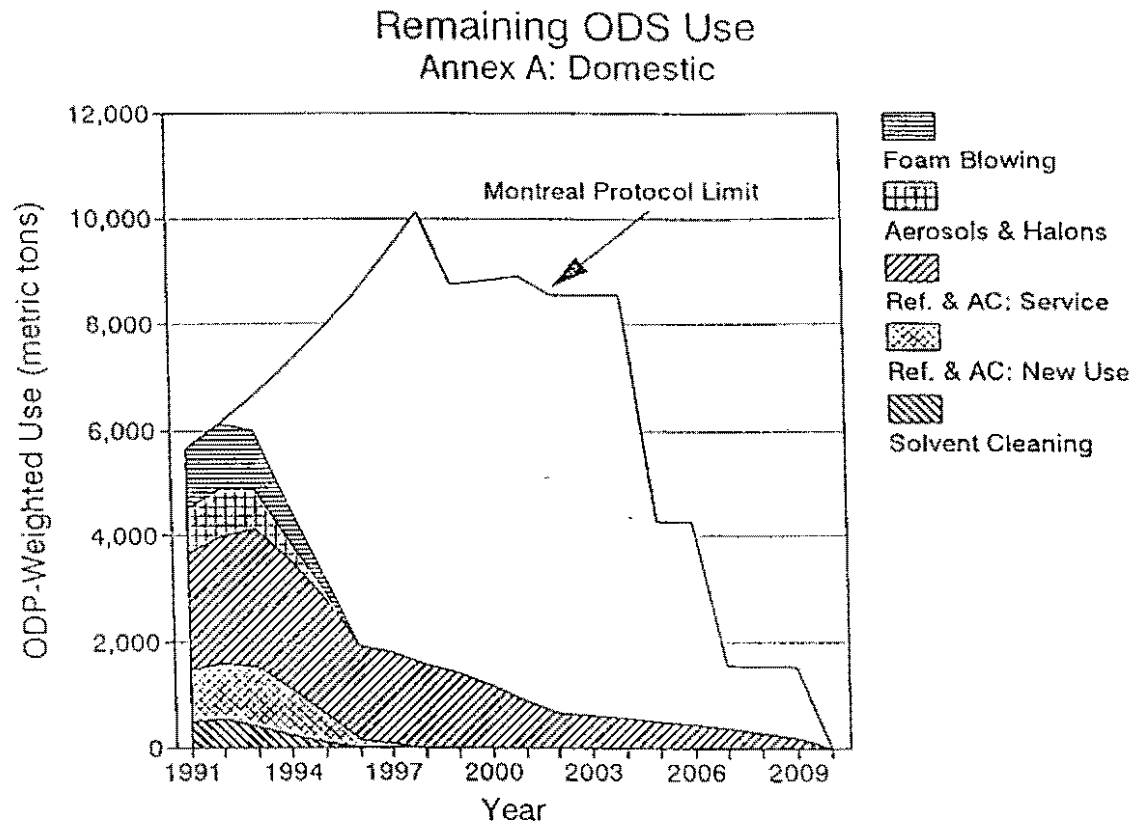
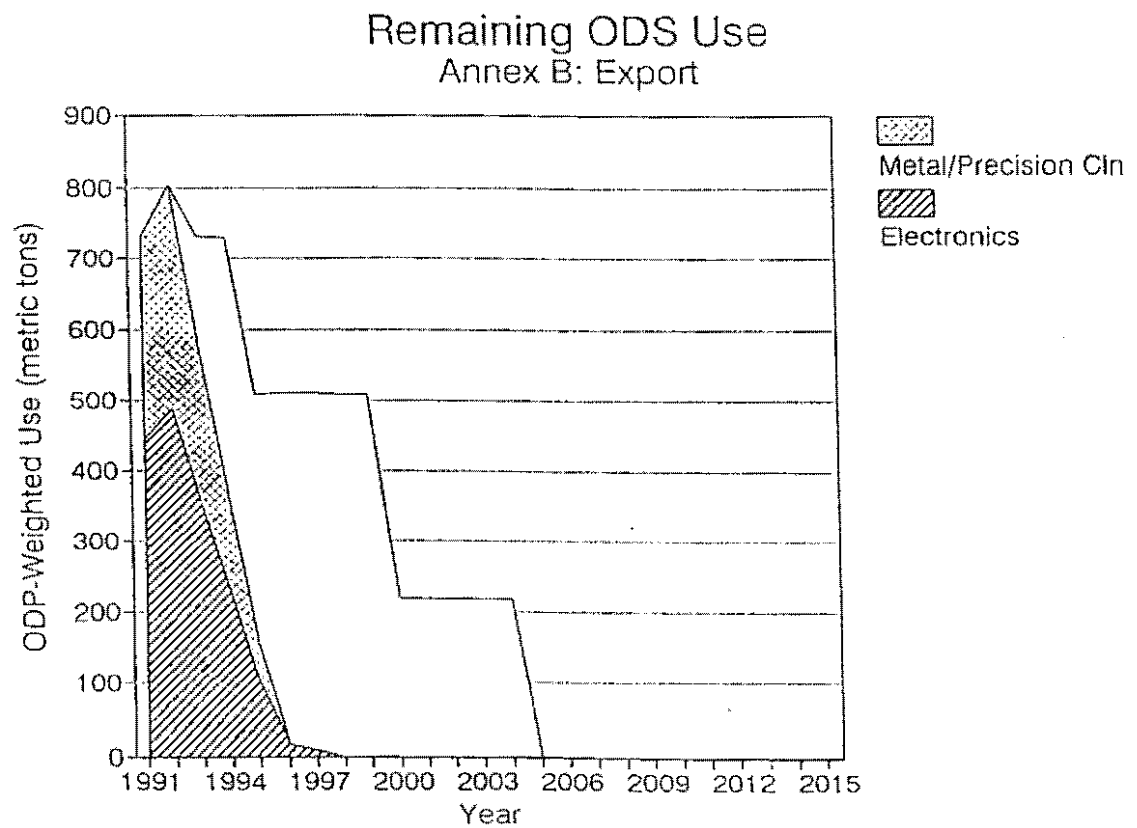
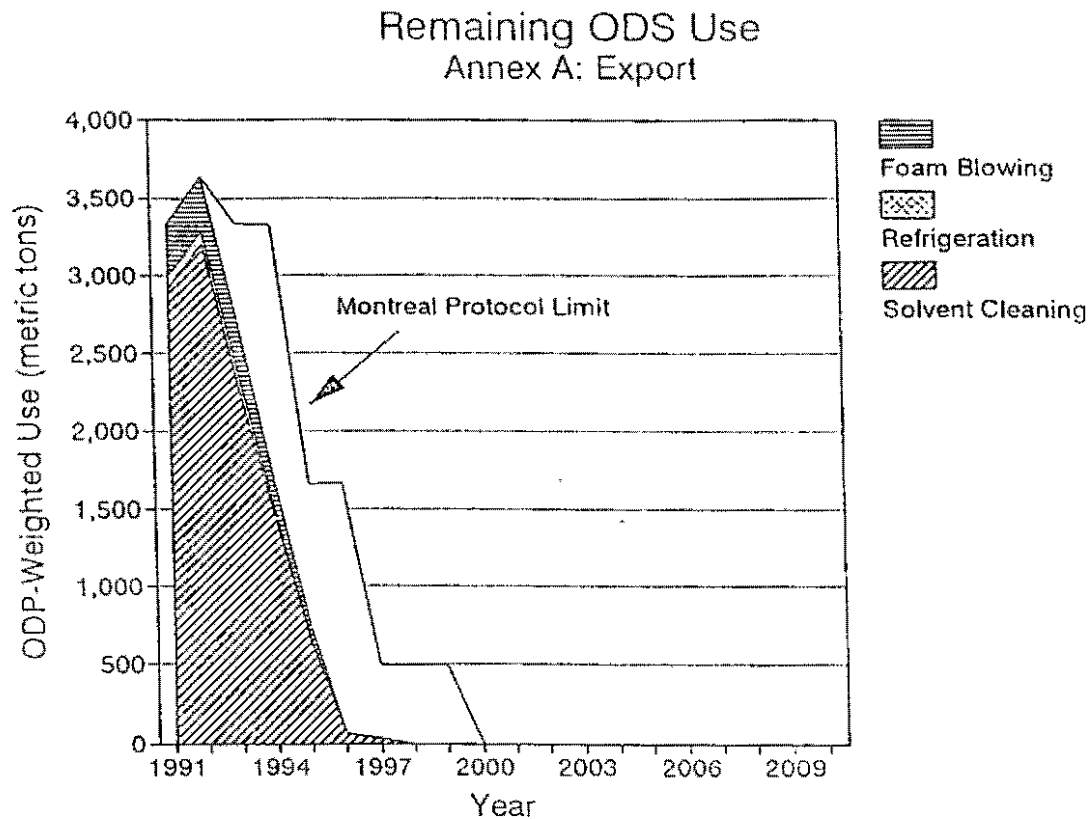


Exhibit 9-3 Remaining ODS Use Under the Selected Plan - Export Sector

Industry versus Consumer Costs

From a social cost perspective it is not important to distinguish between consumer and producer costs. This classification, breakdown, however, gives some indication of how total costs will be split. Estimates of industry costs dominate estimates of consumer costs. Over two-third of all costs are borne by industry and the remainder by consumers.² Consumer costs as defined for this analysis include (1) increased energy costs for household refrigerators;³ (2) costs associated with the premature retirement of refrigerators; and (3) retrofit costs for mobile air-conditioners (MACs). In addition, for mobile air conditioners and refrigerators, consumers and producers are assumed to split retooling costs equally. This implies that manufacturers are able to pass on half of the costs associated with conversion to alternatives to consumers. The actual extent to which costs are passed on to consumers depends on the nature of supply and demand in markets for ODS-based products in Thailand and internationally.

Not all scenarios result in consumers incurring premature retirement or retrofit costs. These costs are only incurred if the move to alternative refrigerants in new refrigerators and MACs is significantly delayed. Under the Thai Government's strategy, the transition to alternative refrigerants in household refrigerators and MACs will start in 1994. Given an average of 15 and seven year lifetimes respectively, there is no stock of either refrigerators or MACs remaining by the year 2010. Therefore, the forward looking strategy adopted by the Government will avoid premature retirement and retrofit costs incurred by consumers.

Given the long lifetimes of chillers (assumed to be 25 years in the consultant's analysis), even starting conversion to alternatives in 1994, as will be done under the policy, results in some retrofit costs in 2010; these costs amount to five percent of all domestic costs.

Domestic versus Export Costs

Domestic costs constitute about 94 percent of all the total estimated costs of complying with the Protocol under this scenario. It is possible that domestic costs could be an even larger portion of total costs. This is because a significant portion of export-related costs will ultimately be incurred outside of Thailand – in part by foreign-based multinationals operating in Thailand, and in part by the consumers of Thai products in other nations. The extent to which these costs will be borne by foreigners depends on a number of factors, including supply and demand conditions in the relevant markets as well as policies of parent companies in the case of foreign owned firms and the governments of the countries they are based in.

² This result depends on an assumption made in the incremental cost model that most conversion costs are absorbed by industry.

³ New household refrigerators using HFC-134a are assumed to have a one percent energy penalty relative to refrigerators using CFC-12. Even though the thermodynamic penalty is about three percent, an improved design is considered to offset a substantial portion of this penalty.

The extent to which incremental costs associated with phasing out use of ODSs in the export-oriented sector depends on a number of criteria, including ownership of firms and the final destination of the product. For example, incremental costs incurred by a Thai-owned firm manufacturing products intended for use in other developing countries are eligible for reimbursement. On the other extreme, a foreign-owned firm producing products intended for export to developed nations would not have its costs reimbursed.

Under the Thai Government's strategy, the total ODP-weighted ODS use avoided is about 604,000 metric tons at an average cost of US\$726 per ton.⁴ These estimates are summarized for all scenarios in Exhibit 9-4 below.

9.4 Summary of Findings

Exhibit 9-4 summarizes the key cost and ODS savings estimates for Thailand's selected strategy and the three scenarios analyzed by the consultants.

The key findings of the analysis are:

- The incremental costs of complying with the Montreal Protocol for the *selected* phaseout strategy is US\$439 million. Of this amount, \$413 million can be attributed to ODS reductions in domestic uses, and \$25 million to ODS reductions in the production of export goods. The phaseout under this strategy occurs in 1998, except for use of ODSs required to service existing equipment which continues through 2010.
- The *least cost* phaseout strategy results in a cost of \$282 million, but involves a relatively slow transition to ODS alternatives in the near future. For example, many controls are not implemented until much later in this decade or until after the year 2000. Phaseout with this strategy occurs in 2006 for CFCs (except for CFCs required to service existing equipment), 2010 for halons, and 2005 for 1,1,1-trichloroethane. The reduced costs of this strategy primarily result from the discounting of expenditures that are pushed out further into the future.
- Costs are \$431 million if actions are delayed for as long as possible without regard to future consequences. Under this *delayed action* phaseout strategy, domestic costs are \$415 million, primarily because of the premature retirement and retrofit costs of domestic refrigeration equipment, which account for over 75 percent of all domestic costs.

⁴ ODS use avoided is calculated through 2010 for CFCs and halons and 2015 for 1,1,1-trichloroethane. ODS use avoided due to premature retirements and retrofits is also included through 2015.

Phaseout of CFCs and halons is not completed until 2010, and 1,1,1-trichloroethane is phased out in 2005.

- The *technologically driven or fastest possible* phaseout strategy of ODSs would cost Thailand \$471 million. This would involve making the conversion in each sector as soon as the technologies become available. Phaseout under such a strategy can be completed by 1996 for all ODSs, except for use of ODSs required to service existing equipment. However, unlike the *selected* strategy, this does not take in account logistical considerations and time required for institutional strengthening and other important activities.

Exhibit 9-4 Summary of Key Evaluation Criteria for Phaseout Scenarios

Scenario	Phaseout Date ^a		Total Costs (mm \$)	Total ODS Use Avoided ^b (Tons)	Average Cost of ODS Use Avoided (\$/ton)	Domestic Costs		Export Sector Costs		Premature Retirement and Retrofit Costs		Industry Costs		Consumer Costs	
	Annex A ODSs	Annex B ODSs				mm \$	% of Total Costs	mm \$	% of Total Costs	mm \$	% of Domestic Costs	mm \$	% of Total Costs	mm \$	% of Total Costs
Selected	1998	1998	439	604,000	726	413	94%	25	6%	34	8%	298	68%	141	32%
Least Cost	2010 ^c	2005	282	550,000	512	265	94%	17	6%	72	27%	181	64%	101	36%
Delayed Action	2010	2005	431	542,000	796	415	96%	17	4%	314	76%	167	39%	264	61%
Technology Driven	1996	1996	471	618,000	763	443	94%	28	6%	18	4%	314	67%	158	33%

^a Phaseout date indicated is for all ODS use except for use in servicing existing equipment. All ODS use ceases in 2010.

^b Total ODS avoided is shown to the nearest thousand metric tons.

^c CFC use, except for servicing existing equipment, ceases in 2008.

Note: Numbers may not add due to rounding.