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(DRAFT)
INCREMENTAL COST POLICIES AND OPERATIONAL INTERPRETATION

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I. INTRODUCTION

Attempts have been made to put into operational terms the assessment of incremental costs of projects supported by the Multilateral Fund in accordance with the principles outlined in the Indicative List of Categories of Incremental Costs. In this regard the Secretariat submitted a document entitled "Further Definition of Incremental Costs" to the Seventh Meeting of the Executive Committee which the Committee took note of. Further, the World Bank submitted at the Ninth Meeting a document entitled "Project Expenditures Eligible for Grant Financing". The Executive Committee took note of the document and requested the World Bank to meet with the other implementing agencies and the Fund Secretariat to revise the paper and to hold a workshop for the benefit of the Executive Committee. This document has been prepared by the Secretariat and is the result of that revision.

It is intended to provide practical guidance to analysts preparing investment project proposals for consideration of funding under the Multilateral Fund. It also raises operational issues that need to be addressed by the Executive Committee. It is hoped that such guidance will facilitate the review and approval of such projects. Other types of activities that may be covered by the Multilateral Fund such as those for the preparation of country programmes or proposals for institutional strengthening are not considered in this document.

The document contains four main sections:

- **Framework for calculating incremental costs.**
- **Operational Interpretations** which describes and makes suggestions for dealing with complex issues that are encountered by project analysts at the operational level.
- **Guidelines for Identification of Incremental Cost Components** which provides a series of templates dealing with incremental cost elements of projects by sector including aerosol, foam, halon, refrigeration and air-conditioning, and solvent sectors as well as production of substitutes (Annex I).
- **Recommendations.**

To ensure that the document remains useful to project analysts, it will be periodically reviewed in accordance with experience gained in the field and future decisions of the Executive Committee.

II. FRAMEWORK FOR CALCULATING INCREMENTAL COSTS

A. Introduction

The Multilateral Fund, established under the Montreal Protocol, is intended to meet all agreed incremental costs of eligible Parties to enable them to comply with the control measures of the Protocol. The Protocol provides an Indicative List of Categories of Incremental Costs (ILCIC). The concept is that, compared to doing nothing, eligible enterprises in Article 5, paragraph 1 countries will find that they will incur costs as a result of phasing out their production and/or use of ODS, and that the agreed eligible incremental portion of these costs should be met.

The Parties to the Montreal Protocol require that "the most cost-effective and efficient option should be chosen, taking into account the national industrial strategy of the recipient party." Some of the most rapid and efficient means of phasing out ODS may involve changes in national industrial strategy. Such changes in strategy, however, may not be made a condition for Fund assistance to help meet the costs of phasing out ODS.

The ILCIC indicates that the type of costs envisaged by the Parties are the costs of specific projects to phase out ODS. The terms "projects" and "costs" are important concepts in discussions pertaining to the Multilateral Fund and require the following clarifications.

- Projects are defined as specific time-bound investments undertaken by specific enterprises and include, inter alia, replacing ODS production capacity with equivalent capacity to produce non-ODS, converting facilities that use ODS to switch to non-ODS, and activities that conserve, reclaim, recycle or destroy ODS. Subsequently, projects are the focus of Multilateral Fund support, not national industrial strategies; the costs that are financed by the Fund are all borne by individual enterprises or agencies. Costs must therefore be calculated at the enterprise level.

- The Multilateral Fund does not necessarily fund project costs per se. Rather, the Fund covers the eligible incremental costs of implementing such projects.

While the ILCIC is still the guiding principle for defining what constitutes incremental costs, the experience of the Implementing Agencies and the Executive Committee in dealing with projects has begun to demonstrate how the approach to calculating incremental costs can be standardized. This document draws from this experience and attempts to provide guidance to those analysts involved in preparing investment projects for submission to the Executive Committee.

B. Incremental Costs

The Fund will pay for only those incremental costs that a country will bear (in respect of the projects sponsored by its enterprises and agencies). The Fund will not finance transfer

payments (such as incremental taxes and duties that might arise). The costs that are eligible for financing are therefore project economic costs, not project financial costs.

C. Framework for calculating incremental costs

The term incremental costs is defined as the difference between the actual cost of the phaseout activity (the project cost) and the baseline cost. To account for the time value of money (simply put, a sum of money today is worth more than the equivalent sum of money in the future), both future project costs and future baseline costs need to be discounted. The definition of incremental costs introduces four additional concepts that are understood to be defined and/or operationally interpreted as the following:

- **Baseline costs.** These are defined as the costs that an ODS-using enterprise incurs to provide an existing level of service. Such costs may include both capital (i.e., one time) costs and recurrent (i.e., operating) costs.

- **Project costs.** These are defined as the costs (both capital and recurrent) that an enterprise or agency incurs in activities leading to phasing out ODS through implementing a specific project.

- **Economic life of the project**. This is usually based upon the equipment lifetime and represents the time horizon over which incremental costs are considered and discounted. It should be determined on the basis of industry norms for the country concerned.

- **Discount rates.** A lump sum grant will reflect the expected net present value of the incremental cost. Therefore a discount rate should be used. The opportunity cost of capital should be used as the discount rate. A standard rate of 10 percent per annum is typically used in all sectors and countries. A different rate may be used only if such a rate can be justified or is established by the relevant agency or institution as the basis for economic analysis.

As discussed above, both of the terms "project costs" and "baseline costs" are composed of capital and recurrent costs. Mathematically, therefore, incremental costs can be expressed as follows:

$$IC = PC(c) - BC(c) + PC(r) - BC(r)$$

where,

IC = incremental costs
PC(c) = project capital costs
BC(c) = baseline capital costs
PC(r) = project recurrent costs
BC(r) = baseline recurrent costs

As this simple equation illustrates, to calculate incremental costs, project analysts must first derive the costs associated with each of the four discrete elements.

D. Baseline Capital Costs

A realistic and credible baseline must be specified. As discussed above, incremental cost is the difference between two costs, the cost of the project and the cost of the specified baseline, the "business as usual" situation. It should be stressed that incremental cost is not the difference between the cost of the project and its own revenue or benefit.

In order to define a credible baseline, project analysts should carefully characterize the existing ODS-using process equipment and assess its remaining useful lifetime and whether it has any salvage value. In some cases, the salvage value may be zero.

E. Project Capital Costs

These are the one-time investments associated with, inter alia, the cost of technology transfer, new equipment, retrofitting existing equipment, training, and testing. Those preparing project proposals must decide which of these should be included in the project as eligible costs. Equipment that should have been procured as part of the existing operation should not be eligible. Project analysts must guard against the possibility of unnecessarily including equipment such as new and additional laboratory, quality assurance equipment, equipment modernization and plant expansion that is not ODS-phaseout related. Projects including such components should be itemized in detail. Costs of components which do not serve the purposes of the phaseout (and which cannot be considered incremental or eligible for any support) should be separated.

Credible estimates of each of the project capital costs should be obtained. Wherever possible, a variety of vendors should be contacted to obtain landed cost estimates. Care must be taken when vendors provide packaged prices that may include additional ineligible capital equipment. As discussed above, because incremental costs include economic and not financial costs, any duties and taxes imposed by the recipient country that are included in the price estimates must be subtracted. Analysts should exercise caution in obtaining price information for new equipment when suppliers and vendors are monopoly producers and account for possible inflated cost estimates.

F. Baseline Recurrent Costs

Just as a credible baseline is needed to determine baseline capital costs, a reliable baseline for recurrent costs is also critical. Analysts must include in the baseline all of the future recurrent costs that would have been incurred in the absence of the phaseout project. Categories of such costs include:, inter alia, consumption of ODS, consumption of raw materials (e.g., chemicals, additives), consumption of electricity, consumption of water, use of labour, and maintenance. For each of these variables, analysts must estimate and state both the unit consumption (e.g., kilograms, person-hours) and the existing cost per unit (e.g., $3/kilogram, $1/person-hour).

Analysts must also provide credible forecasts for the future use and costs associated with the variables beyond the first year that the project is being implemented. Factors to consider include the potential changing cost of ODS and possible rising unit costs associated with projected increases in production. Those preparing projects must specify whether the cost estimates used for ODS and other items in the baseline are average national costs or enterprise-specific costs.

G. Project Recurrent Costs

Enterprises implementing projects to reduce or eliminate ODS may incur various recurrent costs. The types of variables that must be considered are the same as those listed in the above section on baseline recurrent costs. In addition, however, analysts must estimate the use and costs associated with the substitute chemicals and any new raw materials that may be needed to be able to implement the project.

As discussed above in the section on baseline recurrent costs, analysts must project future recurrent costs for each variable taking into account possible changes in either the use or unit cost of each variable. The proposed project will avoid the baseline current costs but will incur project recurrent costs which may be of a different type. Analysts must forecast future price paths for substitute chemicals. Because such forecasts may be difficult, all assumptions should be clearly stated. Wherever possible, the source of forecasts (e.g., chemical suppliers) should be indicated.

Project analysts should take care to assess each enterprise's plant capacity. Although an enterprise might expand beyond its current capacity in future years, the only eligible project recurrent costs for those years are those based on the current plant capacity. For example, suppose a company currently producing 150,000 refrigerators per year expects to increase its production by 10,000 refrigerators per year. If its current plant capacity is 170,000 refrigerators per year, project recurrent costs for years beyond the baseline should be calculated assuming refrigerator production of 160,000 in the first year, 170,000 in the second year, and 170,000 in each year thereafter.

Because companies implementing projects may face variations in the costs of utilities (e.g., electricity, water, etc.) depending on the time of day, season, or geographical location, analysts should also indicate all assumptions used in calculating such costs. If national average utility costs are used, such assumptions should also be stated clearly.

When making grants in respect of project recurrent costs, there is a strong risk that some costs may be reimbursed twice. The most frequently occurring examples of the risk of double-counting occur when costs are estimated on the basis of prices as in the following situations: (1) ODS producers converting to substitutes, and users of these substances; and (2) compressor manufacturers adapting their designs to use substitute substances and their refrigeration customers. In both cases, it is necessary to ensure that either the primary level producer (i.e., the ODS producer or the compressor manufacturer) is provided with financing to cover incremental costs, and does not pass on the higher costs in higher prices, or that the primary level producer is not assisted with the incremental costs, and passes these costs on to

the secondary level manufacturer (i.e., the ODS user or the refrigerator manufacturer) in the form of increased unit prices. In this latter case, the secondary level manufacturer is eligible to receive incremental costs.

H. Calculation of incremental costs

The final part of this section demonstrates how to calculate incremental costs for a specific investment project and how to compute the project grant. To assist with the calculation of incremental costs, a series of templates is provided in Annex I. These templates identify typical incremental cost items incurred by projects in different sectors including aerosol, foam, halon, refrigeration, air conditioning, and solvents as well as in the production of substitutes.

As the equation provided in the beginning of the section suggests, the calculation of incremental costs can be broken down into three steps:

Step 1: Calculate PC(c) - BC(c). This provides the discounted incremental capital costs.

Step 2: Calculate PC(r) - BC(r). This provides the discounted incremental recurrent costs.

Step 3: Add the products of Step 1 and Step 2. The sum of these two elements provides the total incremental costs.

Step 1: Calculate discounted incremental capital costs

The cost information derived for the baseline capital costs and project capital costs should be arrayed as shown in Table I below listing each element and its cost by year. Project capital costs should be entered in year 0. Incremental capital costs per year are computed by subtracting the baseline capital costs from the project capital costs for each of the project's years. In many projects, all project capital costs might be incurred at the start of the project (i.e., in year 0). In other cases, however, project capital costs might be incurred in several stages and be spread out over several years.

Table I
Calculating Discounted Incremental Capital Costs

Year	0	1	2	3	4	5 ...	N
Project Capital Cost							
-- list each item							
Baseline Capital Cost							
-- list each item							

Incremental Capital Costs

As discussed above, costs (or savings) incurred beyond the baseline year need to be discounted to derive a net present value. Essentially, the net present value (NPV) condenses future costs and savings into a measure of net current costs (or savings) using the discount rate. The last row in the Table I (incremental capital costs) is the stream of costs that needs to be discounted. The cost obtained after discounting represents the discounted incremental capital costs associated with implementing a specific project.

Step 2: Calculate discounted incremental recurrent costs

The calculation of discounted incremental recurrent costs should be performed in exactly the same way as the calculation of discounted incremental capital costs. Again, the cost items should be carefully arrayed in a table by year in order to ensure that all variables including those that appear only in the baseline costs or in the project costs are listed (see Table II).

Table II
Calculating Discounted Incremental Recurrent Costs

Year	0	1	2	3	4
Project Recurrent Cost					
-- list each item					
Baseline Recurrent Cost					
-- list each item					
Incremental Recurrent Costs					

The last row in Table II (incremental recurrent costs) is the stream of costs that needs to be discounted. For some years, incremental recurrent costs may be negative numbers indicating net savings in these particular years. This can arise in situations where the costs of a substitute chemical is cheaper than the cost of the ODS it replaced (a discussion on savings and benefits is included in Section II). The cost obtained after discounting represents the net incremental recurrent costs associated with implementing the project.

Step 3: Calculate Incremental Costs

The incremental costs for a particular project can be obtained by simply adding the discounted incremental capital costs and the discounted incremental recurrent costs.

I. Computation of proposed project grant

For various reasons, the calculated incremental costs may not be the amount that the proposed project is eligible to receive. The computation of proposed project grant must also take account of decisions made by the Executive Committee on subjects such as retroactive financing, the proposition of foreign ownership of the enterprise in question, and whether the firm in question is operating is an export-only enterprise operating in a tax-free zone.

III. OPERATIONAL INTERPRETATION

A. Introduction

The main guidance for addressing issues related to incremental costs, the Indicative List of Categories of Incremental Costs, was adopted at the same time as the establishment of the financial mechanism. Since then, as investment project proposals have been prepared, reviewed, and approved, a number of operational issues have arisen. Some of these issues have already been addressed by the Executive Committee either in the form of explicit policy decisions or implicitly within the context of project approvals. It is proposed that the latter be formalized as explicit decisions. On the other hand, there are issues that will arise in the course of considering future project proposals. This section of the document presents possible approaches for dealing with these issues and will conclude in a set of recommendations for possible action by the Executive Committee.

B. Issues explicitly decided by the Executive Committee:

The Executive Committee has adopted decisions based on the following papers which were followed by the Implementing Agencies in preparing project proposals and by the Fund Secretariat in reviewing them:

- Retroactive financing of activities;
- Financing of activities of enterprises that are wholly or partly owned by transnational corporations;
- Financing of activities of companies that are wholly or partly owned by countries that are not Parties to the Montreal Protocol;
- Financing of export only enterprises operating in a tax free zone.

They will not be discussed any further in this document.

C. Issues implicitly decided by the Executive Committee:

Some issues were encountered in calculating incremental costs of individual projects and were empirically resolved, but no explicit decision was taken by the Executive Committee. These issues and recommendations for decisions by the Executive Committee are presented below:

1. Economic incremental costs versus financial incremental costs.

As mentioned in Section I, the calculation of economic costs excludes transfer payments. In reviewing project proposals that were submitted to the Executive Committee both the implementing agencies and the Fund Secretariat ensured that no transfer payments were included in the calculation of incremental costs.

The interpretation of this financing policy is based on the fact that it is governments that have accepted the responsibility for ensuring compliance with the Protocol; for undertaking whatever national actions are necessary (short of changing national industrial strategy) to implement the Montreal Protocol; and for distributing the burden of compliance within the country.

If the Parties had undertaken to pay for each enterprise's financial costs, to the extent that these exceeded the economic costs, they would effectively be making the country a grant that exceeded the country's actual additional (economic net incremental) costs. The following examples make this clear:

1.a *Taxes and duties*. Financial incremental costs include incremental taxes and duties, which are financial transfers to governments rather than economic costs. If a grant included these it would not only cover incremental costs but also make an additional transfer to the government, which is not the intention of the Fund. Furthermore, the amount of the transfer would be arbitrary in the sense that it would be determined by the applicable tax law (and thus would vary from country to country in a way not related to expenditures for compliance with the Protocol).

1.b *Excess earnings*. Financial rates of return, to the extent that they exceed the economic cost of capital, incorporate effects such as those of administered prices, administered interest rates, monopoly power, or privileged status of the enterprise. It is not the policy of the Fund to compensate enterprises for purely financial losses such as lost monopoly profits or subsidies.

1.c *Lost economic subsidies*. Even without making excess earnings, an enterprise might benefit from subsidized inputs which the switch to non-ODS alternatives effectively removes. This is a loss to the enterprise but not to the country. (Inputs might, in effect, be subsidized through domestic financial prices being different from economic prices. Subsidies do not necessarily arise from explicit government subventions.)

2. **Transitional period for calculating recurring costs.**

Recurrent costs are those costs associated with a project that are incurred by enterprises on an on-going basis. The ILCIC states that "the incremental recurring costs apply only for a transitional period to be defined." Restricting financial assistance to a transition period would limit the uncertainty that long time horizons introduce to the Fund's liability.

3. **Savings and benefits.**

The ILCIC states that "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...". This has been subject to varying interpretations by the implementing agencies.

In some ODS phaseout projects, there will be benefits or cost savings that accrue to the sponsoring enterprise or agency. The Fund will take these savings and benefits into account. This is interpreted to mean that the Fund will make a grant for the net incremental costs; i.e., for an amount equal to the incremental costs less the value to the sponsor of any savings and benefits that accrue. Therefore the analyst must identify and estimate these savings and benefits. Specific interpretations of this rule are proposed:

3.a *Direct cost savings and benefits*. Where the cost savings and benefits are direct and reasonably certain (such as reduced expenditure on feedstock in the next few years) the full amount will be subtracted from the incremental cost. This is equivalent to considering the savings as avoided baseline costs.

3.b *Uncertain savings and benefits*. Where the savings and benefits are uncertain, the sponsor is taking the risk that it will not be able to realize them.

For example, suppose an aerosol manufacturer invested in new (non-ODS) equipment so that it could use LPG instead of CFC. The lower feedstock prices in the project case than in the baseline case mean that there are savings which would be taken into account when calculating the (reduced) grant amount. To the extent the grant is reduced by the expected savings the company is required to invest its own funds. However, it runs the risk that future demand for its product will not be as high as projected, and therefore that the investment required of it will not be offset by future operational savings.

In principle risk can be treated in the following ways:

i. The risk can be taken into account with a **risk premium** built into the discount rate. The future savings are discounted at high rate, the future costs at a low rate. This method is generally confusing and is not recommended.

ii. The risk to the enterprise can be minimized if the Fund were to make a series of small grants each year on the basis of actual expenditures, either periodically or in the form of an initial advanced followed by a **liquidation** at the end of the four-year period over which operational costs are covered. This method may be used by analysts if they feel that the size of the grant or other circumstances are compelling. However, the method has disadvantages; it adds to the administrative costs of monitoring and disbursement, it may lessen the incentives to the enterprise to make a profit, and it makes budgeting difficult because the commitment is not fully defined.

iii. The risk to the enterprise can be explicitly recognized if the single grant is calculated on the basis of a **conservative estimate of the future savings and costs** (one that is realistic but favourable to the enterprise).

This method of using a conservative scenario will be the one followed (unless explicit justification is given for using an alternative method and agreed by the Executive Committee.)

3.c *Negative incremental costs*. Where the savings and benefits are particularly large, they may be larger than the incremental costs even when risk and other factors are taken into account. Such projects effectively have a "negative incremental cost"; that is, they are fully justified in economic terms without any consideration of the restrictions imposed by the Montreal Protocol. The Fund will not make grants in these cases. It is important, though, to define the scope of an action precisely, because there may be sub-projects with positive incremental cost that form part of a project that is economically attractive overall. Such sub-projects need to be identified for possible funding, as the Fund does not require enterprises to subsidize the positive incremental cost projects merely because their overall operations are profitable.

Negative incremental costs can arise, for example, in aerosol conversion projects if the cost of the substitute propellant (say LPG) is lower than that of the CFC it replaces by such an amount that the incremental operational savings are greater than the initial capital investment in the protection and new filling equipment. Where this is the case, such projects would be economically attractive in their own right. Grant support from the Fund would not be justified.

3.d *Enterprise Incentive*. Some economically attractive (negative net incremental cost) projects may not go ahead without some form of external assistance because there is a non-price barrier (institutional inertia, shortage of the requisite foreign exchange, etc.). The incremental cost of overcoming such barriers will be investigated on a case-by-case basis to determine if there can be any justification for Fund assistance. (Such assistance might lead to more wide-ranging benefits than those of ODS reduction from the project along; the project might serve a demonstration purpose that would catalyze a number of similar -- but non Fund-supported -- projects elsewhere).

In some cases financial costs might be considered for grant financing. This would be necessary if, as intended by the Parties, "the funding of incremental costs is intended as an incentive for early adoption of ozone protecting technologies."

4. **Viability of enterprise.**

The implementing agencies regard it as too costly and intrusive to make detailed investigations of the commercial prospects of each prospective recipient enterprise for the purpose of determining whether it will remain financially viable over the period in respect of which the grant was made. Only when it is obvious and clearly agreed with the host country that an enterprise is likely to close within the grant period (for reasons unrelated to the Montreal Protocol) will that enterprise be ineligible.

5. **Excess industrial capacity.**

In some sectors in some developing countries, there is excess industrial capacity. Thus the conversion of all this capacity would result in Fund expenditure that is greater than would be strictly necessary to achieve phaseout objectives. Because the national industrial strategy that gave rise to the excess capacity, and which might maintain it, are beyond the purview of the Fund, some degree of overfinancing may be inevitable.

D. Issues that are likely to be encountered:

1. **Double-counting**

When only economic costs are considered, double-counting does not occur. But where costs are estimated on the basis of prices, there is a strong risk that some costs will be double-counted. This is likely to occur in a multi-stage industry, where higher costs translate into higher prices at the next stage. For example, compressor manufacturers could incur higher costs in redesigning and producing new compressors to work with HFC-134a. It is likely that refrigerator manufacturers would claim these higher costs as incremental costs, also.

If the incremental costs of these two projects were added, the increased compressor costs would be double-counted, which must be avoided.

The most frequently occurring examples of the risk of double-counting are:

- substance producers converting to substitutes, and substance users;

- compressor manufacturers adapting their designs to use substitute substances and to their refrigeration customers.

Double-counting can be avoided by adhering to the economic costs, through:

- disallowing, in the incremental cost calculation, the incremental costs of the first stage (substance producers or compressor manufacturers); or

- disallowing their price increases as incremental costs for their customers.

Each method eliminates the double-counting but implies a different grant recipient. The latter approach has the attraction that it is consistent with the project approach and indeed suggests that companies which receive financial assistance should not raise their prices to compensate for the full increase in their costs. This would avoid the companies making excessive profits as a result of both prices, reflected in higher costs, and the receiving of financial assistance.

2. **Premature retirement and enforced idleness**

The indicative list of incremental costs includes this category. However, it raises both conceptual and practical difficulties. At the conceptual level, the question arises as to whether, if the country is including in its incremental economic costs the cost of constructing an industry based on ODS substitutes and alternatives, premature retirement and enforced idleness are incremental costs at all.

An individual ODS producer who is forced out of the business and fails to get into substitute production would argue that he has lost the prospect of a future profit stream. But, if another producer, or a new entrant submitted a project for substitute production, this would replace the redundant capacity, and at the national level the incremental costs are only the costs of new plant. This assumes that there is a profit or value added equivalence between the old and the new capacity, although in different ownerships.

It therefore appears that the inclusion of premature retirement and enforced idleness costs may be a distributional issue concerned with which companies within a country should receive financial assistance from their government, rather than with the level of assistance.

At the practical level, the incremental costs to the enterprise, which closes or reduces throughput, could be regarded as the profit stream foregone. The incremental costs are not related to the residual asset values (although these figures might provide a basis for compensation by government to closing companies).

Unemployment. Where a country closes ODS production capacity and imports substitutes as a result of the Montreal Protocol, the resulting temporary unemployment (a cost to the country) can be addressed through a closure "project: that includes appropriate provision for retraining and worker severance. The latter should not exceed the norms for the country and, to maintain cross-country consistency and to avoid negative incentives, should not exceed some standard amount (say, three months normal salary).

3. Distributional issues

Distributional issues must be addressed to avoid double-counting. A distributional issue is one that concerns the way the cost burden is shared among the enterprises within a country, rather than the total cost to the country. Although incremental costs are more easily calculated and agreed at the enterprise level than at the sector or country level, this focus on individual enterprises makes it difficult to treat distributional issues.

There is an inconsistency between the treatment of existing and start-up enterprises; in particular, the costs to an enterprise of premature retirement and idle capacity consist partly of costs to the country and partly of costs that result from business being lost to other enterprises in the same country.

Another distributional issue is the way costs are passed from one group to another (e.g., from manufacturers to users to consumers). If eligible costs had been defined at the country level, for example, in the country programme, costs that had been shifted from one enterprise to another would not be eligible.

IV. RECOMMENDATIONS

Based on the analysis provided in this document, four recommendations are proposed for Executive Committee consideration. As other issues raised in this document are further developed, additional recommendations should be forthcoming.

The following recommendations are proposed:

A. The Multilateral Fund will not finance such costs as taxes, duties or other such transfer payments, nor the loss of economic subsidies or rates of return in excess of cost of capital which might incorporate non-economic financial effects such as administered prices or interest rates. Funding of the enterprises' financial costs by the Multilateral Fund would effectively be making the country a grant that exceeded the country's actual additional costs, which is not the intention of the Parties.

B. Given the uncertainty associated with projecting future cash flows, recurrent costs will be considered for a transitional period of up to 4 years only from the start of operations.

C. The policy of the Fund is to take savings and benefits into account when determining the grant amount. Savings and benefits over the entire economic life of the project be taken into account. Where the savings and benefits of the project are uncertain, the estimate of the present value should, while remaining realistic, be made conservatively. The savings and benefits must be discounted to the net present value.

D. Incremental costs will not be financed by the Fund where there is evidence of double-counting.

ANNEX I

GUIDELINES FOR IDENTIFICATION OF INCREMENTAL COST COMPONENTS

This section provides a series of "templates of categories of costs that are considered as incremental costs of projects". The purpose of the templates is to develop as far as possible, clear and unambiguous definitions of incremental costs for particular cases to provide guidance during project preparation or appraisal, on the types and levels of incremental costs which the Fund could meet. Although not exhaustive for all situations, sample project(s) are provided for each of the sectors, namely:

Aerosol
Refrigeration and Air-Conditioning
Foam
Halon
Solvent
Production

The templates will be reviewed and/or supplemented with additional templates as necessary on the basis of experience gained in the field and development in technology.

In each case, the list of incremental costs is organized to reflect the applicable indicative cost headings contained in Annex VIII of the Report of the Fourth Meeting of the Parties to the Montreal Protocol - Indicative List of Categories of Incremental Costs. These come under three broad headings, namely:

1) Patents, designs and royalties;
2) Capital costs;
3) Operational costs.

The templates do not provide specific costs but rather indicate:

1) Areas where incremental costs may be accepted.
2) Areas where incremental costs may not be accepted.
3) Areas where there will be acceptable benefits.

A period of four years is taken as transition period for operational costs.

Key to the Templates

The following is the key to the templates:

- "X" denotes Acceptable Costs
- "Y" denotes Acceptable Benefits
- "O" denotes Unacceptable Costs
- Horizontal rows indicate the list of incremental costs.
- Vertical columns indicate the duration of transition period.

INCREMENTAL COST TEMPLATES

Aerosol Sector
Foam Sector
Refrigeration and Air-Conditioning Sector
Solvent Sector
Halon Sector
Production Sector

AEROSOL SECTOR

Project: **Switching over from a CFC to an hydrocarbon based propellant**

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
• New storage and delivery facilities	X	0	0	0
• New filling equipment	X	0	0	0
• Fire safety	X	0	0	0
• Retraining	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Excess maintenance cost	X	X	X	X
• Gas commodity cost	Y	Y	Y	Y

NOTES

1. Patents, designs and royalties:

   These costs are not acceptable.

2. Capital costs:

   - New storage and delivery facilities

     The incremental costs would be the cost of stationary storage tanks or facilities to accept delivery of movable containers and related piping less the disposal value of the old storage equipment.

   - New filling equipment

     New filling equipment may be acceptable. In general, the incremental costs would be the cost for new equipment of the same filling capacity less the disposal value of the old equipment.

- Fire safety

  These costs are acceptable. The use of butane or propane would require the installation of fire safety systems due to the potentially explosive nature of the gases. The costs of installing fire safety systems, however, varies depending on the type of system chosen. When temperate weather and natural ventilation are present, open system allows the wind to carry away any amount of hydrocarbon that may appear due to leaks. This is a concept known as "open-air filling rooms" (OAFR). Compared to closed gassing rooms, OAFR offers various advances such as low cost equipment and relatively less extensive training.

  The cost of relocating a filling plant to a low risk site can be considered on a case-by-case basis.

- Retraining

  A one-time retraining cost may be acceptable to retrain staff to use the new equipment and to comply with safety regulations.

- Research and development

  These costs are not acceptable.

3. Operational costs:

   - Gas commodity cost

     Butane and propane are cheaper to buy than CFCs. There is therefore a recurring net saving from substituting one for the other. The level of this benefit should be ascertained.

     Some aerosol applications should use deodorized gases. It may be the case that an allowance has to be made that some of the "commodity saving" involved in the CFC-Hydrocarbon substitution is lost if deodorized gases are not readily available in the developing country and deodorization costs are therefore incurred.

FOAM SECTOR

Project: Manufacturer of flexible low density foams, substituting for CFC-11 with other foam blowing agents

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
• Improved safety, ventilation	X	0	0	0
• Metering system, temperature control equipment	X	0	0	0
• Retraining	X	0	0	0
• Research & development	0	0	0	0
3. Operational costs:				
• Methylene chloride	X	X	X	X
• Chemicals, additives	X	X	X	X
• HCFC blowing agent	X	X	X	X
• Savings in volume of CFCs	Y	Y	Y	Y

NOTES

Methylene chloride is the prime alternative blowing agent to CFC-11 in the manufacture of flexible polyurethane foam for conventional applications using new polyol/water formulations.

1. Patents, designs and royalties

   These costs are not acceptable.

2. Capital Cost

- Improved safety, ventilation

  Improvement of containment systems for worker health and safety are acceptable. The use of methylene chloride would require upgrading or installation of a new ventilation system due to its higher toxicity.

- New metering and temperature control equipment

  New polyol/water formulations and methylene chloride allow the reduction of CFC-11 consumption. However, in some instances it requires maintaining rather strict control

of temperature and delivery of all the ingredients during the foam blowing process. The purchase of new metering and temperature control equipment may be required.

- Retraining

  One-time retraining cost may be acceptable to retrain staff to use the new equipment and to comply with safety regulations.

- Research and development

  These costs are not acceptable.

3. Operational cost

   Methylene chloride costs are substantially cheaper than CFC-11. It will lead to the substantial net offsetting benefits. The changes in the ratio and types of catalysts and other additives resulting from the replacement of CFC-11 may have a limited impact on the overall benefits derived from the conversion.

   HCFC technology could be used to substitute CFC-11 for blowing modified or super-soft foams for special applications. Although HCFC technology may not involve substantial equipment modification, there might be operational incremental cost because of the higher cost of HCFCs.

Project: Manufacturer of rigid foams, substituting for CFC-11 with other foam blowing agents

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
• Equipment	X	0	0	0
• Retraining	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Increased volume of material and more expensive blowing agents used	X	X	X	X
• Savings in volume of CFCs	Y	Y	Y	Y

NOTES

CFC-11 is used as a blowing agent in the production of rigid Polyurethane (PUR) foams (slabstock, appliance insulation and sprayed foams). A three phase approach is generally applied for the purpose of a demonstration of possible projects for complete elimination of CFC-11 in foam blowing operations in Article 5 countries.

Phase I is a 50 per cent CFC reduction using new polyol/water formulation. Phase I may require replacement of low pressure foam injection equipment by the high pressure variety resulting in improved foam quality and hence improved insulation values.

Phase II will replace 100 per cent of CFCs with HCFC-based blowing agent. It involves the use of either HCFC-141b or HCFC-142b/HCFC-22 binary blend as foam blowing agents. Additional capital equipment may be required in the latter case during this stage.

Phase III is based on the introduction of non-ODS as blowing agents. This technology has still not been adequately tested.

1. Patents, designs and royalties

   These costs are not acceptable.

2. Capital costs

   - Capital equipment

     New capital equipment may be acceptable, but the level of costs would depend on the option of HCFCs and the equipment which is already available.

   - Retraining

     A small retraining cost may be acceptable to retrain staff to use new equipment and new formulation.

   - Research and Development

     These costs are not acceptable.

3. Operational Costs

New CFC-11 reduced formulation provides foam insulation with more density and consequently increased volume of material is involved. HCFC substitutes are more expensive. New plastics for inner liner of appliances may also prove to be more expensive. Operational Costs can also include test runs to adapt new technology to local circumstances.

HALON SECTOR

Project: Substitution of Halon 1301 by non-ODS extinguishants in existing Halon 1301 fixed fire extinguisher systems

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
• New fire extinguishing systems	X	0	0	0
• Disposal of halon in the old extinguishing system	X	0	0	0
• Retraining	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs	Y	Y	Y	Y

NOTES

General

Extinguishing systems using Halon 1301 can be replaced, with few exceptions; particular objects, sections of rooms and whole rooms can be protected by CO_2 systems, water sprinkler systems or foam flooding systems, and combinations of these systems.

There are also transitional measures, such as reductions of halons vented into the atmosphere through the use of technical training and organizational measures, as well as halon recovery and recycling. The pattern of incremental costs is similar to recovery and recycling in the refrigeration sector.

1. Patents, designs and royalties

   These costs are not acceptable.

2. Capital costs

   • New fire extinguishing systems

     The incremental costs will be the one-time capital costs of purchasing and installing the new fire extinguishing systems.

- Retraining

  There is a need for some initial retraining in operational and maintenance procedures.

3. Operational costs:

   There would be savings in operating the new systems due to the lower cost of non-ODS extinguishants.

Project: Substitution of Halon 1211 by non-ODS extinguishants in existing Halon 1211 portable/mobile fire extinguisher systems

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital cost				
• New fire extinguishers	X	0	0	0
• Retraining	0	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Saving on halon refill	Y	Y	Y	Y

NOTES

General

Extinguishers using Halon 1211 can be replaced with:

- portable halon fire extinguishers could be substituted with powder, water, CO_2 and foam extinguishers;
- mobile halon fire extinguishers systems could be substituted with fire blankets and semi-fixed CO_2 extinguishing systems.

There are also transitional measures, such as reductions of emissions by improving valve and filling devices, as well as halon recovery and recycling. This case is similar to that shown in refrigeration recycling template.

1. Patents, designs and royalties:

   These costs are not acceptable.

2. Capital costs:

   - New fire extinguishers

     The incremental costs will be the one-time capital costs of purchasing the new fire extinguishing equipment.

   - Retraining

     There is no need for significant one-time retraining as training is a continuous process.

3. Operational costs:

   There is a recurring operating cost saving equal to the difference between the cost of the halon refill which the user would have had to pay if he kept the halon extinguisher, and the cheaper cost of halon alternatives such as CO_2.

REFRIGERATION AND AIR CONDITIONING SECTOR

Project: Manufacturer of refrigerator compressors using CFC-12 as refrigerant, converting facilities to produce compressors utilising CFC substitutes (HCFC-22 or HFC-134a) as refrigerants.[1]

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties				
• License costs	X	0	0	0
2. Capital costs:				
• Equipment and Retooling	X	0	0	0
• Retraining	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Lubricants(in case of HFC-134a refrigerant)	X	X	X	X

NOTES

1. Patents, designs and royalties:

   The switch from CFC-12 to HFC-22 or HFC-134a would require a different compressor unit due to the different thermodynamic and pressure requirements of the refrigerants. This could involve additional costs for the licence of the new designs, which are assumed as a payment in the form of a licence fee; royalties could be paid instead, over a period of time.

2. Capital costs:

   • Equipment and Retooling

   There may be a need for retooling in the manufacturing and assembly processes to comply with the new equipment and new designs.

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[1] The same approach can be applied for conversion of CFC-12 based compressor manufacturing facilities to HFC-134 technology in mobile air-conditioning.

- Retraining

  Retraining may be required.

- Research and development

  R&D costs are covered by licence fee or royalties.

3. Operational costs:

   There may be some operating cost increases due to new lubricants compatible with the use of HFC-134a.

Project: Conversion of CFC-12 based manufacturing facilities to produce refrigerators utilizing HFC-134a as a substitute.

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties:				
• Licence costs	X	0	0	0
2. Capital costs:				
• Equipment and Retooling	X	0	0	0
• Retraining	X	0	0	0
• Research and development	X	0	0	0
3. Operational costs:				
• Seals and connection materials, and new lubricants	X	X	X	X
• Compressors	0	0	0	0
• Price difference between HFC-134a and CFC-12	0	0	0	0

NOTES

General

HFC-134a is not a drop-in substitute, and there is a need for changes in materials, design and production processes to cope with the different thermodynamic/pressure properties of HFC-134a.

1. Patents, designs and royalties:

   The switch from CFC-12 to HFC-134a is likely to involve incremental costs in buying new designs and incurring licence fees.

2. Capital costs:

   - Equipment and Retooling

     There is a need for new equipment and retooling/refitting costs to implement the new designs.

   - Retraining

     Retraining is necessary.

   - Research and development

     The switch from CFC-12 to HFC-134a may involve incremental costs in the form of additional R&D.

3. Operational costs:

HFC-134a is not a drop in substitute for CFC-12; there are some incremental conversion costs for:

- new lubricants
- new seals and connection materials.

- Compressors

  There are also incremental recurring costs for: new compressor units (due to different thermodynamic and pressure requirements of the refrigerants).

In the case of the incremental compressor costs, to avoid double counting, it is necessary to ensure that:

- either the compressor manufacturer is being assisted with the incremental costs of producing compressors utilising HFC-134a, and thus the refrigerator manufacturer faces no incremental costs because the compressor manufacturer will not pass on his higher costs in higher prices;

- or the compressor manufacturer is not assisted with the incremental costs of producing compressors utilizing HFC-134a, but passes these costs on to the refrigerator manufacturers in the form of higher unit prices.

In this cost template it is assumed that the former case applies. Therefore there is no allowance for incremental prices of compressors for the refrigerator manufacturer.

It would also be acceptable to assess incremental costs using the alternative approach.

- Price difference between HFC-134a and CFC-12

There are also recurring incremental operating costs, due to the purchase of the more expensive HFC-134a compared to CFC-12. Again, to avoid double counting, it is necessary to ensure that:

- either the CFC producer in this Article 5 country is already assisted with the incremental capital and other costs of producing HFC-134a, and thus the refrigerator manufacturer should not incur incremental commodity prices;

- or the CFC producer is not assisted with the incremental costs of producing HFC-134a, but passes these incremental costs on to the refrigerator manufacturer in the form of higher unit prices.

In this cost template it is assumed that the former case applies. It would also be acceptable to assess incremental costs using the alternative approach.

Project: Conversion of CFC-12 based commercial refrigeration manufacturing facilities to produce refrigerators utilising HCFC-22 as a substitute.

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties				
• Licence costs	X	0	0	0
2. Capital costs:				
• Retooling	X	0	0	0
• Retraining	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Compressors, seals, and insulation materials	X	X	X	X
• Price difference between HCFC-22 and CFC-12	X	X	X	X

NOTES

General

Commercial refrigeration equipment primarily uses CFC-12 as a refrigerant. HCFC-22 is not a drop-in substitute, and there is a need for changes in design to cope with the different thermodynamic/pressure properties of HCFC-22.

1. Patents, designs and royalties

   There may be incremental costs in buying-in new designs and incurring licence fees.

2. Capital costs:

   - Retooling

     There is a need for retooling in manufacturing and assembly processes to implement the new designs.

   - Retraining

     A small retraining cost may be acceptable.

   - Research and development

     No additional research and development may be required, if new designs are acquired under licence agreement.

3. Operational costs:

   There may be incremental recurring costs for: new compressor units (in case that the compressor manufacturer is not assisted with the incremental costs of producing compressors utilizing HCFC-22), new seals and insulation materials, and HCFC-22 commodity costs (in case that CFC producer is not assisted with the incremental costs of producing HCFC-22).

Project: Retrofitting of mobile air conditioners to enable them to utilize HFC-134a.

	Year			
	1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0

	Year 1	2	3	4
2. Capital costs:				
• Lubricants, hoses, connections, and desiccant	X	0	0	0
• Retraining	0	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
• Additional labour cost	X	X	X	X
• Commodity costs	0	0	0	0

NOTES

1. Patents, designs and royalties:

   These costs are not acceptable.

2. Capital costs:

   HFC-134a is not a drop-in substitute for CFC-12, but can be used if some components of the unit are changed, including:

   - new lubricants;
   - desiccant;
   - new hoses made from materials with lower permeability;
   - more resistant materials for hose connections.

3. Operational costs:

   - additional labour cost is eligible;
   - commodity costs.

   There is a recurring incremental operating cost, which is due to the purchase of the more expensive HFC-134a compared to CFC-12, for the purpose of replenishing refrigerant losses during operation.

   Nevertheless, to avoid double counting, it is necessary to ensure that:

   - either the CFC producer is already assisted with the incremental capital and other costs of producing HFC-134a, and thus the refrigerant user should not incur incremental commodity prices;

- or the CFC producer is not compensated for the incremental costs of producing HFC-134a, but passes these incremental costs on to the refrigerant user in the form of higher unit prices.

In this cost template it is assumed that the former case applies, which is consistent with the assumptions made in the incremental cost template of the CFC producer.

Project: Establishment of refrigerant recovery and recycling facilities, and central collection and recycling facilities to clean CFCs.

	Year 1	2	3	4
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
(1) Refrigerant recovery and recycling				
• Suitable recovery and recycling units for on-site recycling	X	0	0	0
• Training	X	0	0	0
• Research and Development	0	0	0	0
(2) Central collection and recycling facilities				
• Plants and equipment	X	0	0	0
• Training	X	0	0	0
• Research and development	0	0	0	0
3. Operational costs:				
(1) Refrigerant recovery and recycling				
• Additional labour time involved	X	X	X	X
• Increased revenue from recycled CFC price premium	Y	Y	Y	Y
(2) Central collection and recycling facilities				
• Labour cost	X	X	X	X
• Materials, energy	X	X	X	X
• Revenues	Y	Y	Y	Y

NOTES

1. Patents, designs and royalties:

   These costs are not acceptable.

2. Capital costs:

   (1) Refrigerant recovery and recycling

   - Purchasing suitable mobile containers, recovery and recycling equipment, to collect and process used CFCs on site.

   - Training in recycling techniques.

   (2) Central collection and recycling facilities.

   - one-time capital costs for setting up and installing collection and recycling plant and equipment;
   - some initial staff training.

3. Operational costs:

   (1) Refrigerant recovery and recycling

   - some additional labour time involved in the evacuating of used CFCs from appliances and storing/recycling them compared to using virgin CFCs.

   (2) Central collection and recycling facilities

   - On-going operating labour, energy and raw material costs.

SOLVENT SECTOR

Project: Conservation of CFC-113/Methylchloroform use

Technology: Costs listed under three options:

- Ensuring a "closed" cleaning system;
- Recycling solvents;
- Increasing efficient use of solvents.

	Year 1	2	3	4
Conversion of existing equipment				
1. Patents, designs and royalties	0	0	0	0
2. Capital costs:				
CLOSED SYSTEM				
- Automating cleaning process to ensure closed system	X	0	0	0
- Cleaning and assembly modifications: joints, small apertures modifications to minimize gas loss	X	0	0	0
- Operating sequence modifications	X	0	0	0
SOLVENT RECYCLING				
- Modification or new air circulation and vapour adsorption system to improve air suction and condensation	X	0	0	0
- Installing solvent catch basin	X	0	0	0
- Gravity separation and/or new filtration and/or distillation equipments	X	0	0	0

EFFICIENT USE OF SOLVENT

	Year 1	2	3	4
- Retrofit/redesign batch degreaser	X	0	0	0
- Retrofit automatic hoists (batch degreasing)	X	0	0	0
- Addition of extra cooling coils on inlets/outlets (in-line cleaners)	X	0	0	0
- Amend cleaner configuration to handle output from two or more soldering machines (in-line cleaners)	X	0	0	0
• Retraining				
All measures	X	0	0	0
• Research and Development				
All measures	X	0	0	0

3. Operational costs:

CLOSED SYSTEM

- Savings in volume of cleaning materials used	Y	Y	Y	Y
- Reduction in labour used (Automation)	Y	Y	Y	Y

SOLVENT RECYCLING

- Additional labour time spent	X	X	X	X
- Excess energy costs	X	X	X	X
- Savings in volume of cleaning materials used	Y	Y	Y	Y

EFFICIENT USE OF SOLVENTS

- Savings in volume of cleaning materials used	Y	Y	Y	Y

NOTES

Automation of the cleaning process, so that systems is closed, can result in a CFC loss reduction of the order of 20 to 30%. The use of condensation techniques or adsorption equipment can reduce CFC consumption of closed systems by 50%.

Project: Non-ODS technologies

Technology: Cost listed under three options:

Option A :	elimination of need for cleaning or "no-clean" (controlled atmosphere or low solid flux soldering)
Option B :	aqueous and semi-aqueous cleaning
Option C :	alternative solvents (terpenes, organic, alcohol based solvents and HCFC solvent blends).

	Year 1	2	3	4
Conversion of existing equipment				
1. Patent, design and royalties				
All options	0	0	0	0
2. Capital costs:				
Option A (Electronics cleaning)				
- New soldering equipment, to eliminate need for cleaning altogether	X	0	0	0
Option B (Electronics, Precision and Metal cleaning)				
- New equipment for aqueous and semi-aqueous cleaning systems	X	0	0	0
- Water treatment equipment	X	0	0	0
- Redesigning of line layout and manufacturing processes	X	0	0	0

	Year 1	2	3	4
- Adapting aqueous system to mechanical handling (e.g., rinsing, brushing, steam jet, ultrasound)	X	0	0	0
- Surface of products changes e.g., blind holes, welts, cracks, capillary boring	X	0	0	0
Option C (Electronics, Precision and Metal Cleaning)				
- New equipment for alternative solvents cleaning systems	X	0	0	0
- Redesigning of line layout and manufacturing processes	X	0	0	0
- New fire and/or toxicity safety equipment	X	0	0	0
• Retraining				
All Options	X	0	0	0
• Research and Development				
All Options	X	0	0	0
3. Operational costs				
Option A				
(i) controlled atmosphere soldering:				
• costs of inert gas consumption	X	X	X	X
• costs of eliminating solvents (savings)	Y	Y	Y	Y
(ii) low solid flux soldering:				
. increase in flux costs	X	X	X	X
. eliminated solvent costs (savings)	Y	Y	Y	Y

		Year 1	2	3	4
Option B					
(i)	Labour costs in water treatment	X	X	X	X
(ii)	Excess energy costs	X	X	X	X
(iii)	Savings in material costs	Y	Y	Y	Y
Option C					
Savings in material costs		Y	Y	Y	Y

NOTES:

1. Patent, design and royalties:
   These costs are not acceptable.

2. Capital Costs and

3. Operational Costs

Option A (No-clean)

(i) Controlled atmosphere (inert-gas) soldering

An inert gas (such as nitrogen) is used to reduce the oxide layer formation normally associated with soldering. This option would involve changes in soldering equipment and would necessitate additional costs for an inert gas to achieve the required atmospheric changes.

(ii) Low-solid flux soldering

No-clean options include the use of low-solids fluxes in printed circuit board manufacture. The cost of adjustment of soldering equipment would be needed. Increase in flux costs would be savings from not using solvents. It would lead to the substantial net offsetting benefits.

Option B (Aqueous and Semi-aqueous Cleaning)

Aqueous and semi-aqueous cleaning processes are used in a variety of applications in Electronics, Precision and Metal Cleaning.

This option would require the purchase of relevant aqueous and semi-aqueous cleaning equipment. In addition there may be incremental costs for redesigning the layout of the cleaning processes and adapting the aqueous and semi-aqueous system to existing mechanical handling equipment. Increase in labour costs in water treatment and excess energy costs would be

balanced against savings in material costs. New closed-loop aqueous cleaners would also minimize the discharge of contaminated water by recycling the water; reducing operating costs.

Aqueous and semi-aqueous cleaning cause a water pollution problem which may be costly to deal with depending on the size of the operation and the legal requirements. Recycling and water treatment equipment, with associated capital costs, may be needed.

Option C (Alternative Solvents)

Alternative solvents include trichloroethylene, perchloroethylene and methylene chloride, hydrocarbons, ketones and alcohols, and HCFCs and new fluorinated compounds.

Some of these require careful handling due to their flammability, and toxicity, and there may be incremental costs for investment in fire and safety equipment. Also, some of the alternative solvents may require new equipment.

There would be operational savings due to less expensive cleaning material.

Retraining and Research and Development

(All Options)

R&D costs are likely to be incurred as substitute processes would need to be suitably tailored to the specific applications for which they are considered. In addition, there are incremental costs for retraining staff in the new operational, maintenance and, possibly, safety requirements, for the substitute processes.

PRODUCTION SECTOR

Project: CFC manufacturer converting plant for production of CFC substitutes

	Year 1	2	3	4
Conversion of product manufacturing facilities				
1. Patents, designs and royalties				
• Licence costs	X	0	0	0
2. Capital costs:				
• New plant/equipment	X	0	0	0
• Retraining	X	0	0	0
• Research and development	X	0	0	0
• Salvage value of plant	Y	0	0	0
3. Operational costs	X	X	X	X

NOTES

1. Patents, designs and royalties

   The new technology (excluding HCFC-22 technology) would require payment to the process patent holder. This is assumed to be a payment in the form of a licence fee; royalties could be paid instead, over a period of time.

2. Capital costs:

   • New plant equipment

   These would depend on the type of substance that is substituted in place of CFC production:

   • some CFC-11/CFC-12 plants cannot be easily converted to HCFC-22. Therefore, CFC-11/CFC-12 plants will have to be replaced with new plants producing HCFC-22. Some CFC-11/CFC-12 plants (swing type design production plants) can be switched to produce HCFC-22 with low capital costs. However, converting to HFC and other HCFC substitute production other than HCFC-22 is likely to involve the replacement of existing CFC production facilities.

   • Retraining

   Retraining will be required to absorb the new technology.

- Research and development

  The cost of research to adapt technology to local circumstances may be acceptable.

- Salvage value of plant

  The present value of plant net of all accelerated depreciation allowances already written off, is judged as an acceptable benefit.

3. Operational costs:

   The new manufacturing processes may incur higher operating costs, including the cost of raw materials.