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PRELIMINARY ANALYSIS OF CAPITAL COSTS FOR CFC REDUCTIONS FOR FIRST THREE YEARS

(an analysis prepared by the United States of America)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 23 1990

OFFICE OF
AIR AND RADIATION

MEMORANDUM

SUBJECT: Preliminary Analysis of Capital Costs for CFC Reductions for First Three Years

FROM: Eileen
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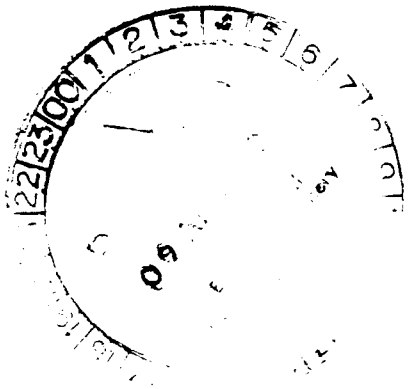
TO: Participants in UNEP Working Group on Financial Modalities

In response to a request from Dr. Tolba, we prepared and presented at the recent working group meeting in Geneva a summary of the potential capital costs that might be incurred by developing countries in shifting out of CFCs and halons during the next three years. The attached memo provides more detailed information which will allow you to better understand the basis for those numbers.

In examining this analysis, it is important to bear in mind that the costs in individual nations may differ significantly based on their specific circumstances. This analysis only seeks to provide a rough and preliminary estimate based on a "prototype" developing nation which by definition does not exist.

Nonetheless, the analysis does provide some useful insights into the type and scope of activities that are likely to be undertaken by developing nations during the next three year period and the potential capital costs associated with those efforts.

We hope this material is helpful and welcome your comments.



ESTIMATES OF CAPITAL COSTS IN DEVELOPING COUNTRIES FOR CFC AND HALON REDUCTIONS: THE FIRST THREE YEARS

This analysis focuses on the capital expenditures that could be incurred in developing countries during the next three years to reduce emissions of CFCs and halons. The three year period represents the initial budgeting and planning cycle for a financial mechanism discussed at the last working group meeting in Geneva (Feb. 26 - March 5).

In identifying the possible CFC and halon reduction steps during the initial three year period, the analysis focussed on:

- technologies that are already well established, and
- technologies that are low cost or cost-effective.

As a result, this analysis assumes that the initial reductions in CFCs and halons will result from actions in the following areas to the extent that they are applicable in a particular developing country:

- aerosols: shift to hydrocarbon propellants;
- packaging foam: shift to HCFC-22;
- polyurethane foam insulation in refrigerators: reduction of 30% by increased use of water in foaming process;
- polystyrene insulation; shift to HCFC 142b/22;
- flexible foams: shift to water blown foam or modified polyols;
- car air conditioning: recycling at servicing;
- solvents: shift to aqueous cleaners; and
- halons: reduced testing, alternative test gas and recycling.

Other possible options for reductions in CFCs and halons are omitted from this list primarily because the technologies will not have been adequately developed during the initial three year period to be available for adoption in developing countries. Such options include shifts to HCFC-123, HFC-134a, and the use of vacuum panels for insulating refrigerators. These options and the higher capital and operating costs associated with retrofitting manufacturing facilities are likely to be incurred in a 5-15 year timeframe and therefore must be considered in estimates of costs for future periods. Thus estimates of expenditures in future periods are likely to be greater than the initial 3 year period.

The following sections present the key assumptions and preliminary cost estimates. The first section presents a more detailed description of each technical option considered in this analysis for reducing CFCs and halons and its costs. The second

presents the aggregation of these costs for an average developing country based on assumptions about the number of manufacturing facilities that must be modified in a typical medium size developing country. The third section presents aggregate estimates of costs of capital expenditures for the first three years based first, on developing countries who are now Parties to the Protocol and second, assuming that additional countries join the Protocol in the near future. The final section summarizes other costs (administrative and technical assistance) related to operation of a comprehensive technical and financial assistance program.

A. COST ESTIMATES OF TECHNICAL OPTIONS

Cost Effective Controls for Developing Countries

Sector:	Aerosol Propellants
Option:	Hydrocarbons, Relocate plant
Cost of Conversion:	
Capital Investment:	$50,000 to $750,000
Operating Costs;	Reduced
Comments:	Hydrocarbons cost less than CFCS, usually resulting in an overall net gain for the producer and a cheaper product for consumers. Annual savings of $85,000 to $1 million

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Sector:	Aerosol Propellants
Options:	Hydrocarbon Propellants, add filling room
Costs of Conversion:	
Capital Investment:	$25,000-$500,000 depends on plant size
Operating Costs:	Reduced
Comments	Hydrocarbons cost less than CFCs, usually resulting in an overall net gain for the producer and a cheaper product for consumers. Annual savings of $85,000 to $1 million Conversion includes special systems to safely handle flammable propellants during product filling and storage

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Sector:	Aerosol Propellants

Options:	Compressed Gases as Propellants
Costs of Conversion:	
Capital Investment:	$45,000 to $120,000
Operating Costs:	Annual savings similar to hydrocarbon propellants
Comments:	Costs include special technology capable of handling high vapor pressure gases such as air, nitrogen, or CO_2

Sector:	Packaging Foam
Option:	HCFC-22
Cost of Conversion:	
Capital Investment:	$50,000 to $150,000
Operating Costs:	Equivalent to use of CFC-12
Comments:	Average capital investment $75,000; higher per line costs for smaller firms

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Sector:	Polyurethane Foam Insulation for Refrigeration
Option:	Increased water blowing (30-50% reduction of CFC-11)
Cost of Conversion:	
Capital Investment:	Little to no investment ($20,000)
Operating Costs:	Increase of up to 10% of current foam costs ($1-5/unit)
Comments:	Costs could be higher if there is a reduction in energy efficiency; however, with 30% substitution -- no impact on efficiency; with 50% substitution -- possible increase of energy cost of up to 10%

Sector:	Polystyrene Insulation
Option:	HCFC-22/142b or 142b alone
Cost of Conversion:	
Capital Investment:	Possible increased ventilation due to flammability -- not necessary if blended with HCFC-22
Capital Investment:	None

Operating Costs:	Increased 10%
Comments:	Plant conversions already taking place worldwide

Sector:	Flexible Foams -- Molded and Slabstock
Option 1:	Water blowing
Cost of Conversion:	
Capital Investment:	None
Operating Costs:	Up to 10% increase
Option 2:	New Polyol
Cost of Conversion:	
Capital Investment:	Up to $50,000
Operating Costs:	Up to 15% increase

Sector:	Household Refrigeration
Option:	Reduced charge
Cost of Conversion:	
Capital Investment:	$50,000 (mostly engineering)
Operating Costs:	No cost increase

Sector:	Mobile Air Conditioning
Options:	Recycling
Cost of Conversion:	
Capital Investment:	$1,000 to $5,000 per machine
Operating Costs:	$1-2.00 net revenue per use
Comments:	There are costs for filters and maintenance of the recycling equipment; the $1-2.00 is net revenue

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Sector:	Halon
Options:	Avoid discharge tests, reduce training
Cost of Conversion:	
Capital Investment:	Training and organizing
Operating Costs:	Very high savings

Sector:	Halon
Options:	Recycling of portable and wheeled units
Cost of Conversion:	
Capital Investment:	$1,000 to $3,000 per machine
Operating Costs:	$10-200 net revenue per use
Comments:	There are costs for filters and maintenance of the recycling equipment

Sector:	Solvents
Options:	Aqueous Cleaning
Costs of Conversion:	
Capital Investment:	$10,000 to $130,000 per machine
Operating Costs:	$1,800 to $25,000 substantial reduction compared to CFC solvents
Comments:	Overall costs for aqueous cleaning will be less than solvent cleaning; net savings; technology widely available

Sector:	Solvents
Options:	Engineering Controls
Costs of Conversion:	
Capital Investment:	$1,900 to $60,000 per machine
Operating Costs:	Will cut the costs of operating the solvent machines in half; substantial net savings
Comments:	Technology widely available; excellent short term option for existing equipment

B. AGGREGATE ESTIMATES FOR "MODEL" DEVELOPING COUNTRY

Assume the following characteristics for a middle sized developing country:

- 10 packaging foam facilities; conversion costs $750,000;
- 10 household refrigerators; conversion costs $200,000;

- 40 aerosol filling plants; conversion costs $0.5 million to $2 million;
- 500 mobile air conditions service shops; conversion costs $500,000 to $2.5 million;
- 50 halon systems; conversion costs $50,000 to $150,000;
- 100 conveyorized degreasers; conversion costs $5 million;
- 1,000 open top vapor degreasers; conversion costs $5 million.

Total Investment: $12.1 million to $15.6 million. This investment could occur in two to five years depending on the ability of developing countries to organize effective technology acceptance projects.

Note that these are cost effective technologies. Overall the cost savings from operations could pay back the total investment resulting in a net gain, but some individual technologies have continual higher operating costs.

Very large developing countries like China and India would require two-four times the above investment. Small countries would require proportionally less relative to population/income. Not all developing countries have manufacturing facilities in each of these use areas.

C. ESTIMATE OF TOTAL COSTS

I. Countries Now Party to the Protocol

The final step estimates the capital expenditures over the next three years for developing nations who are now Parties to the Protocol. The analysis assumes that 6 Parties fall roughly into the category of the "model" assumed in this analysis. They are Egypt, Malaysia, Mexico, Singapore, Thailand, and Venezuela. Assuming an average total expenditure of $14 million per country during the next 2-5 years results in total expenditures for these countries of approximately $84 million during this period.

For smaller developing countries, the analysis assumes that costs will be roughly 20% of those incurred by the average developing country ($3 million each). There are 18 developing nations currently Party to the Protocol that fall within this category. Total expenditures for these countries are estimated to be $54 million.

The expenditures for the 24 developing nations now party to the Protocol totals about $138 million for a 2-5 year period. For roughly the next three years, the total amount would be approximately $100 million.

II. An Expanded List of Parties

Several large developing countries are not now Parties to the Protocol. If India or China were to join the Protocol in the near future, given the larger scale of their economies, an estimate of their expenditures in the next three years to reduce CFC and halon use would be substantially greater than the "average" case assumed above. In addition, other possible countries including Brazil could also become Parties in the near future and would further add to the total capital expenditures that could be incurred during the initial three year period. Based on very rough approximations of the costs for these countries being two-four times the cost for the model described above, an additional $50-100 million could be required during the initial three year period. Under this scenario total three year estimated costs would be between $150-200 million.

D. OTHER ASSOCIATED COSTS

In addition to capital expenditures by developing countries Party to the Protocol, other costs related to a financial mechanism involve establishing an executive body or coordinating committee to oversee the operation of the funding mechanism and developing a strong technical assistance component.

The functions of the executive body/coordinating committee is to develop policies under which the financial mechanism operates. The goal here will be to create a small, streamlined operation which allows the Parties to maintain effective coordination of funding (bilateral and multilateral) and technical assistance activities without creating a costly, cumbersome bureaucracy. The costs of staffing and operating this part of the program should be about $1 million annually.

For financial assistance to be effective, it must contain a strong technical assistance component. Specific activities that could be undertaken include:

- additional country-specific studies;
- country-specific reduction plans and strategies;
- sector-specific reduction technology/retrofit studies;
- training materials and workshops;
- distribution of materials and technical clearinghouse;
- regional workshops.

Technical assistance activities should be under the direction of the Parties and centralized to achieve maximum efficiency. Expenditures of about $3-4 million annually would seem appropriate.

E. SUMMARY OF COSTS (Total for first three years)

I. Capital Expenditures

Current Parties $100 million

Expanded	$50-100 million
II. Coordinating Body/Executive Committee	$3 million
III. Technical Assistance	$9-12 million
ESTIMATED TOTAL	$112-215 million