



**United Nations
Environment
Programme**



Distr.
Limited

UNEP/OzL.Pro/ExCom/29/62
29 October 1999

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Twenty-ninth Meeting
Beijing, 24-26 November 1999

**POLICY ON HCFC: A DISCUSSION PAPER PRESENTED BY THE
GOVERNMENT OF SWEDEN**

1. Introduction

At every Executive Committee meeting - with the words of the US delegation: "as certain as the sun rises every morning" - the approval of projects including conversion from CFC technologies to HCFC technologies causes discussions, confrontation and from time to time new part-meal decisions. This is obviously an indication that a more comprehensive discussion and decision on the Executive Committee's policy on projects involving HCFC technologies is needed.

The issue at stake is not the choice of one technology over another. In the end, that is the sovereign decision of the enterprise and country concerned as long as the choice is within the applicable rules of the Montreal Protocol. Instead, the issue is the Executive Committee's own responsibility to the Parties of the Protocol with regard to the use of Multilateral Fund money, in light of the fact that HCFCs are controlled substances which should be phased-out and that the Fund is intended as an incentive for early adoption of ozone protecting technologies (see para 1d of the Indicative List of Categories of Incremental Costs, approved by the 4th Meeting of the Parties).

2. Montreal Protocol Decisions on HCFCs

The HCFCs became controlled substances through the Copenhagen Amendment of the Protocol by the 4th Meeting of the Parties (1992) when also a gradual phase-out schedule for developed countries ending 1 January 2030 was decided (Art. 2F). The phase-out schedule for the Art.5 countries was decided by 7th Meeting of the Parties in 1995 and contains a freeze at 2016, based on the consumption in 2015, and a total phase-out by 1 January, 2040, with no intermediate steps (Dec. VII/3). The Copenhagen Amendment has now (30 September, 1999), been ratified by 100 of the 171 countries which have ratified the Montreal Protocol. This includes for instance large countries like Brazil and Indonesia but not China and India.

Article 2F, para 7 states that

"As of 1 January 1996, each party shall endeavour to ensure that:

- a) The use of controlled substances in Group I of Annex C {=HCFCs} is limited to those applications where other more environmentally suitable alternative substances or technologies are not available;"*

To meet the concerns of the Art. 5 countries, the 4th Meeting of the Parties ensured that, notwithstanding the new status of HCFCs, transition from CFCs to HCFCs by enterprises in Art.5 countries would be eligible for funding from the Multilateral Fund (Dec. IV/30, para 3).

The 5th Meeting of the Parties (1993) decided (Decision V/8):

- "1. That each Party is requested, as far as possible and as appropriate, to give consideration in selecting alternatives and substitutes, bearing in mind, inter alia, Article F, paragraph 7, of the Copenhagen Amendment regarding hydrofluorocarbons, to:*
 - a) Environmental aspects;*
 - b) Human health and safety aspects;*

- c) *The technical feasibility, the commercial availability and performance;*
 - d) *Economic aspects, including cost comparisons among different technology options taking into account:*
 - (i) *All interim steps leading to final ODS elimination*
 - (ii) *Social costs;*
 - (iii) *Dislocation costs, etc.*
 - e) *Country-specific circumstances and due local expertise;*
2. *To note that the Executive Committee is taking the above considerations into account as far as information is available.*
3. *To request TEAP .."*

3. Executive Committee Decisions on HCFCs

The Executive Committee has also taken a series of decisions in the same direction, for instance:

ExCom 12/37, para 168 (Mar. 1994):

„... b) meanwhile {=awaiting ongoing TEAP assessment and decisions on Art.5 phase-out obligations, see above}, consideration of the use of HCFC in the MF projects should be sector-specific and approved for use only in areas where more environment-friendly and viable alternative are not available."

ExCom 15/45 para 90 (Dec. 1994):

„..., whenever possible HCFCs should not be used."

ExCom 15/45 para 129, on domestic refrigerator insulation:

*„b) implementing agencies should note a presumption against HCFCs when preparing projects;
c) where HCFC projects were proposed, the choice of this technology should be fully justified and include an estimate of the potential future costs of second-stage conversion."*

ExCom 19/64, Dec. 19/2, para 17 (May 1996):

„a) to take note of decision VII/3 of the Seventh Meeting of the Parties to control HCFCs and to note further that projects involving conversion to HCFCs should be considered in the light of that decision, as well as other relevant factors;

b) that in the future, in cases, where conversion to HCFCs was recommended, the implementing agencies should be requested to provide a full explanation of the reasons why such conversion was recommended, together with supporting documentation that the criteria laid down by the ExCom for transitional substances had been met, and should make it clear that the enterprises concerned had agreed to bear the cost of subsequent conversion to non-HCFC substances; „

ExCom 23/68 requested the Fund Secretariat to incorporate in the evaluation sheets for the Executive Committee meetings information on conversion technology chosen, a comprehensive outline of reasons for selection of the HCFC technology, if used, and, where possible, an

indication on how long an enterprise intended to use a transitional HCFC technology (Dec. 23/20).

ExCom 26/70 Dec. 26/26 decided, after a lengthy and heated debate:

- „a) That the full information provided in the project document should be included in the project evaluation sheet;*
- b) That where, upon review by the Fund Secretariat, a project proposal requesting HCFC technology was considered to provide inadequate information justifying the choice of that technology, the project should be submitted for individual consideration by the Sub-Committee on Project Review.“*

4. Current Practise

The HCFC application which causes the ongoing controversy at the Executive Committee is almost entirely linked to the use of HCFC 141b as foam blowing agent for integral skin foam, refrigeration insulation and other products involving rigid polyurethane foam.

At the 20th ExCom, the Fund Secretariat presented a review of the use of HCFC and non-HCFC in approved projects during 1992-1996. The study indicates that HCFCs are used in 34 - 39% of the approved projects in the three categories mentioned above (the Secretariat stresses that before 1994, HCFCs were considered the most viable substitutes for CFCs).

The number of projects including conversion to HCFC technology for such applications at each meeting is still quite high. Generally, projects are submitted to the Executive Committee for blanket approval unless other issues than the choice of technology warrants individual consideration. The 23th ExCom asked therefore the Secretariat to analyse the trend particular in the foam sector. The new analysis (attached) shows a decreasing trend in integral skin (17.6 % in 1997 against 38.5 % in 1996), a fairly stable situation for refrigeration insulation (a 29.9 % in 1997 against 29.3% in 1996) and a substantial increase for other types of rigid foam (88.9% in 1997 versus 60.6% in 1996 and 16.3% in 1995). The secretariat contributes this development to the approval two large projects from one country in 1997 and a significant increase in the number of projects from smaller users.

In 1998, the downward and stable trends of HCFC 141b in integral skin and refrigeration projects, respectively, had changed drastically. The percentage of HCFC 141b projects were now at 65.5% for integral skin and at 62% for refrigeration (94.5% for commercial refrigeration and 42.5% for domestic refrigeration. The rigid insulation foam stayed at 71% (i between the 1996 and 1997 values). The increasing use of HCFC 141b is further accentuated at the first meeting in 1999, with 87% HCFC 141b projects for integral skin, 92.5% for rigid insulation and 100% for commercial refrigeration.

5. Justifications given for the choice of HCFCs

HCFC 141b as foam blowing agent is used for a wide variety of products. In the refrigeration sector, HCFC 141b is used for insulation in domestic refrigerators as well as for insulation in commercial refrigeration equipment of various types and sizes. In the construction industry, HCFC 141b is used for pre-fabricated products such as insulated wall panels and doors and pipe insulation, as well as for spray insulation on the site. In addition, HCFC 141b is used for a variety of other products such as thermoware, cool boxes, water heaters, boxfoam for miscellaneous applications, etc. Integral skin foams are used in particular for furniture (armrests, etc.) and automotive interior parts. The technical, commercial and practical requirements and the size of the production facilities vary with the applications and hereby also the potential for use of other foam blowing agents than HCFC 141b.

The alternatives to HCFC 141b currently available are primarily hydrocarbons (cyclo-, n- and iso- pentanes) and water-based systems. Other HCFCs (HCFC 22 and blends of HCFC 141b and HCFC 22) and HFC 134a are also available but not widely applied. New liquid HFCs (HFC 245 and HFC 356) are under development and are considered as potential future drop-in replacements for HCFC 141b.

The reasons cited for not choosing a non-ozone-depleting alternative are basically of four types (although interrelated):

- technical concerns
- safety concerns
- costs (investments and operational costs)
- commercial concerns

The *technical concerns* include issues such as inferior quality of the end products and difficulties in processing. Water-based systems give products with a lower insulation value and lower cell stability. Water-based systems can also lead to an unacceptably high increase in reaction temperature, leading to severe scorching and even spontaneous combustion. Reduced insulation value can, for some but not all products, be compensated by larger thickness. Lower cell stability can be compensated by higher density, requiring more raw material. This will in both cases lead to higher operational costs. Water-based systems are therefore said to be most applicable to relatively less critical applications, such as in situ foams and thermoware (source: UNDP's consultant Bert Veenendaal). For refrigeration and most panel applications the insulation value is said to be too critical and thickness changes not feasible. Gaseous alternatives (HCFC 22 and HFC 134a) are said to be relatively difficult to process and, because of a high diffusion rate, only applicable to closed products such as sandwich panels and refrigerators. HFC 134a is also less energy efficient and expensive compared to other alternatives.

The *safety concerns* are of two kinds, what could be called "*true*" *safety concerns* and *cost-related safety concerns*. Hydrocarbons are flammable and explosive. This is the main reason cited against use of hydrocarbons which for many products is said to have good or even excellent technical properties. In small enterprises with untrained workers the flammable and explosive properties of the hydrocarbons can be a true safety problem. The same is relevant for

spray in-situ applications where the operations move from one site to another which makes the necessary safety precautionary measures unfeasible. The high reaction temperature in a process using water-based systems can create a fire hazard if not controlled. Local regulations can prohibit use of flammable chemicals in a certain area. It is not feasible to expect local regulations to be changed and it is not reasonable to require the enterprise to move a different location. However, it should be noted that the widely employed HCFC 141b shows a certain flammability as well. Although this substance is less flammable than hydrocarbons, under certain conditions it can catch fire and form explosive mixture with air.

Most concerns about the flammability are, however, related to the *costs*. Hydrocarbons require explosion-proof equipment and other safety motivated changes in existing equipment and the plant set-up. Pre-blended polyols which are commonly used by smaller enterprises cannot be used and pre-mixing equipment is therefore necessary. Outdoor or underground storage of the hydrocarbon tanks might be necessary.

Technical requirements can also increase the cost. Hydrocarbons require high pressure machines while HCFC 141b can use low pressure machines. HCFC 141b is basically a drop-in chemical which can be used in existing equipment with limited changes.

Commercial reasons cited include limited availability in the country, at least at affordable prices. This is in particular relevant for enterprises using small quantities and in situations where most other enterprises in the country have decided to use HCFC 141b. Some customers, e.g. in the construction industry, do not accept products containing flammable blowing agents. Inferior technical properties and/or higher costs can make the products uncompetitive. Finally, a corporate policy and long term planning, in particular in multinational companies, can dictate the use of HCFC for an interim period, generally with the intention to move to liquid HFC alternatives (HFC 245 or HFC 356) when these are fully developed.

6. ExCom Decisions of Relevance for the Choice of HCFC Technology

Cost-effectiveness thresholds

Based on requirements in the Indicative List of Categories of Incremental Costs approved by the 4th Meeting of the Parties (para 1a), the Executive Committee decided at its 3rd Meeting to give priority to projects with a potential for the most cost-effective and efficient reduction in the emission of controlled substances (ExCom 3/18 Rev.1 Annex III, section IV)

At its 16th Meeting, the Executive Committee decided to set up cost-effectiveness thresholds for investment projects. In the relevant foam sub-sectors, the cost-effectiveness threshold for integral skin is US\$ 16.86/kg ODP phased out, for polystyrene/polyethylene (not yet so frequent in submitted projects) US\$ 8.22 and for rigid polyurethane US\$ 7.83 (ExCom 16/20, paras 32c and 32d). The cost effectiveness thresholds apply to the combined investment and operational costs, calculated as they are deemed eligible for support from the Fund. In principle, the threshold values are intended to establish priorities only, indicating that all eligible costs should be expected to be paid at some future time. In reality, however, they establish the limit for the

support given to enterprises. Enterprises are invited to pay costs above the threshold on their own or to find other counter-part funding to cover such costs.

Conversion to HCFC 141b requires low investment costs while the operational costs are higher than e.g. for hydrocarbons. For water-based systems, it is also primarily the operational costs which are high. Conversion to hydrocarbons requires high investment costs but low operational costs. The investment costs are relatively independent of the size of the operation. Operational costs in the foam sector are considered eligible for funding for a period of two years, except for domestic refrigerators where the period is six months. The UNDP's consultant Bert Veenendaal notes that a minimum annual CFC consumption of about 50 tonnes is required for a hydrocarbon projects to be fully funded, while a consumption of 20 tonnes is enough for an HCFC 141b project. Most of the projects which are now coming to the Executive Committee have a consumption in the range of 10-50 tonnes. As the bigger enterprises were targeted first, we are likely to see more and more projects with a low or relatively low consumption.

Discount for safety investments

In order to balance the high safety investment costs for hydrocarbon technology, the Executive Committee decided at its 20th Meeting to introduce a discount factor of 35 % when calculating cost-effectiveness in domestic refrigerator projects.

A similar discounting factor has not been considered necessary in other rigid polyurethane projects. The reason given was that the statistical analysis done by the Secretariat (ExCom 20/65) showed that *“on average, projects using hydrocarbon technology were already below the cost-effectiveness threshold for the sector, and thus would not be disadvantaged for consideration for funding.”* (the paper from the Secretariat does not show the size of the CFC consumption in the projects on which this analysis was based).

Umbrella projects

A higher cost-effectiveness threshold for individual enterprises is allowed in umbrella projects, provided that the overall average is kept within the general applicable limits. However, in these projects implementing agencies are expected to achieve economy of scale by applying the same technology in a series of similar enterprises. It can therefore be impossible for one enterprise to chose e.g. hydrocarbon technology if the other enterprises decide to use HCFC 141b technology.

Change of technology

With regard to projects already approved, the 22nd Executive Committee decided that

„(a) there is a presumption that the technology selected in all projects will be mature and that the projects will be implemented as approved;

(b) for projects approved after the adoption of these guidelines:

(i) projects are to be implemented as approved;

- (ii) *exemptions will be considered in the following circumstances:*
 - a. *the only option would be cancellation of the project; or*
 - b. *the project approved is for conversion to a transitional technology, and the revised proposal is for conversion in a single step to a non-transitional technology;*
- (iii) *such proposals will be submitted to the Executive committee for individual consideration, together with the Secretariat's review and recommendations;*
- (iv) *the revised proposals will be implemented within the level of funding already approved.*“ (ExCom 22/79 Rev.1, Dec. 22/69; para 95)

Therefore, as of July 1998, enterprises which would reconsider its choice of HCFC 141b technology and decide to move to a technology which does not deplete the ozone layer can do so only if it keeps within the same level of funding.

Costs of the final conversion

The Executive Committee has tackled the question of the costs for the final conversion from HCFC to zero-ozone-depleting substances by informing the enterprises that the Multilateral fund will not pay the cost of the final transition (see ExCom 19/64, Dec. 19/2, cited above).

7. Implications for the Ozone Layer

Atmospheric scientists have monitored a rapid increase in the level of HCFC 141b in the atmosphere.

The Scientific Assessment Panel, in its Synthesis Report to the 10th Meeting of the Parties in November 1998, rated global elimination of HCFC emissions by the year 2004 as the third most important action that could be taken to enhance the recovery of the ozone layer (after eliminating emissions of Halon 1211 and Halon 1301).

In the same report, the Technical and Economic Assessment Panel notes that development of HFC replacements for HCFC 141b for thermal insulating polyurethane, poly-isocyanurate, and phenolic foams is ongoing and that products such as HFC 245fa and HFC 356mfc are likely to be commercially available around the beginning of 2002; „however, uncertainty over costs, availability, and long-term environmental management of greenhouse gases is slowing development“.

It should be noted that there is substantial uncertainties with regard to the length of time the use of HCFCs by enterprises choosing this technology will last. The Protocol contains no controls on HCFC production in either developed nor developing countries. The controls on HCFC consumption in developing countries do not include any intermediate steps between a freeze at 2015 level and a full phase-out by 2040. Many Art.5 countries have not yet even ratified that commitment. By placing the responsibility for the cost of the final transition on the enterprises themselves, the Executive Committee has deprived itself of its tool to trigger the conversion to non-ozone-depleting substances. It is therefore entirely up to the enterprises and the Art. 5 government policies to decide when, in the period up to 2040, they want to abandoned the use of

HCFC 141b. It is likely that the operational costs of the alternatives will be an important factor in the enterprises decisions and, indirectly, may-be also in the countries' policy decisions.

8. Considerations

The justifications referred to above as „technical“, „commercial“ and „true safety reasons“ will have to be respected (unless there are obvious reasons to believe that they are based on misinformation in which case it is for the implementing agency and the Fund Secretariat rather than the Executive Committee to discuss them further with the enterprise). As stated by several Executive Committee members, it is not possible for the Executive Committee to force an enterprise to produce a product it believes to be unsaleable. Trying to do so will most likely mean that the enterprise instead sticks to CFCs as long as the national government allows it.

The cost justification is a different issue as it is highly influenced by the Executive Committee's own policy. In the absence of grants from the Multilateral Fund, any enterprise would do a long term evaluation, balancing immediate investment costs against long term operational costs. In addition, it would take into account both capital and potential operational costs for a second conversion from HCFC to a non-controlled substance and, in doing so, consider the costs, technical properties, risk of government restrictions, etc. with regard to potential alternatives for a „final“ solution.

The existence of Multilateral Fund grants distorts this evaluation already at its first stage. The costs calculations under the Fund takes only two years operational costs into account (in the case of domestic refrigerators only six months). We do not question this as a criteria for payment from Fund, but we must be aware of its distortive effects on the enterprises' choice of technology. As shown above, as a result of the cost effectiveness thresholds, enterprises choosing technologies with high investment costs and low operational costs can receive full grants only if they have a large annual consumption of blowing agent, while only less than half of that consumption is needed if the enterprise chooses an interim HCFC solution due to its lower investment costs.

Furthermore, in connection with the choice of technology in Multilateral Fund supported projects no evaluation is done of the costs for a final ODS elimination, as requested by Decision V/8 of the Fifth Meeting of the Parties. This decision notes that the listed considerations (including cost comparisons of all interim steps leading to final ODS elimination) is taken into account by the Executive Committee „as far as information is available“. The Executive Committee's own decision 15/45 para 129 c) requires also an estimate of the potential future costs of the second-stage conversion. But no information in this regard seems to be requested in the guidelines and templates for preparation of Fund supported investment projects or is at least not presented to the Executive Committee.

In both ways, the Executive Committee's own criteria promote the use of HCFC solutions which might not have taken place in the absence of the Multilateral Fund. The requirements for economy of scale in umbrella projects and the need for implementing agencies to show cost-effectiveness add further to this. It is uncertain whether the choice of alternative technologies based upon these criteria is in the long term economic interest of the enterprise concerned.

9. Proposal

The considerations made under item 8 indicate that certain parameters, mostly short-time economic criteria, influence decisions on choices of technology. However, the choice made by an enterprise will determine its future economic situation for a much longer time period than considered from a point of view determined by the criteria currently applied by the Multilateral Fund. From an enterprise's perspective an initial benefit could eventually turn out to be an economic disadvantage over a longer period.

Article 5 countries could benefit from additional information with regard to policy, technical, and economical issues. Specifically, companies in developing countries require comparative information on the short- and long-term economic and environmental implications in order to make well-informed decisions about their alternative technologies to replace CFCs and other ODS. Similarly, National Ozone Units require clear and consistent guidance from the Executive Committee about the preferred alternative technologies, in order to inform and guide companies seeking to develop investment projects.

We therefore propose to prepare a study which takes up the economic aspect separated from the technical and especially political questions. It shall compare the costs of alternative technical choices from the enterprise's perspective. In particular, the study must take into account both capital costs and operational costs for a period corresponding to a sound economic enterprise judgement. It should include conversion cost calculations for both the interim solution, i.e. HCFC technology, and for the final conversion to a non ozone-depleting alternative. Moreover, it should carry out comparative estimations for transitions without an interim step, and make separate cost calculations

- a) assuming support from the Fund at currently applied rules, and
- b) assuming that the enterprise had to carry all costs.

The study should provide the best available up-to-date information to Article 5 countries. Such information should include details of already approved conversion projects, for example as case studies, in order to benefit from the existing experience.

As a general principle, the study must be designed in such a way that it will be accepted by all Parties as unbiased and neutral information. Political statements and technical arguments from relevant stakeholder could be included, if necessary, in an annex to provide additional background information.

In order to ensure complete independence from existing technical or political positions, the study should be carried out or managed by a person or body accepted as neutral with regard to the questions discussed above. The study should be undertaken by external economic experts. To avoid overlap with ongoing work of Panels and Committees of the Protocol, relevant bodies should assist and provide input.

It should be recalled that a technical study in the refrigeration sector has been prepared by UNEP, i.e. *Study on the Potential for Hydrocarbon Replacements in Existing Domestic and Small Commercial Refrigeration Appliance*. In addition, UNEP has been requested in decision ExCom 27/42 to conduct the project „Fact sheet describing win-win technology options relative to the Kyoto and Montreal Protocols“. To take advantage of UNEP’s experience we propose that the Executive Committee ask UNEP to manage this study.

Finally, the Executive Committee might wish to decide whether its scope should be restricted to those sectors elaborated above (foam sector and insulation applications in the refrigeration sector) or it should encompass other HCFC applications such as HCFC-22 refrigerants.

In conclusion, we therefore propose that the Executive Committee request UNEP to conduct a study which compares the costs of alternative technical choices to replace the use of CFCs in rigid and integral skin foam applications (including the refrigeration sector) [*alternatively*: in all foam and refrigeration applications] from the enterprise’s perspective, taking into account the foreseeable costs for a final conversion to non ozone-depleting alternatives, and to allocate an appropriate budget to conduct this study.