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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
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DRAFT CRITERIA FOR FUNDING HCFC PHASE-OUT IN THE CONSUMPTION SECTOR FOR STAGE II OF HCFC PHASE-OUT MANAGEMENT PLANS (DECISION 72/39)

Background

1. The criteria for funding HCFC phase-out in the consumption sector as adopted in decision 60/44[1] and further elaborated with decisions and guidelines subsequently adopted by the Executive Committee, allowed the submission and approval of stage I of HCFC phase-out management plans (HPMPs) for 139 Article 5 countries[2] (out of 145 countries[3]).

2. Decision 60/44 explicitly included a review by the Executive Committee of the criteria on second-stage conversions "no earlier than the last meeting in 2013", and of eligible incremental costs for HCFC phase-out projects "in 2013". However, at the 69th meeting (April 2013) the Secretariat was requested to prepare an information document for the 70th meeting on this matter (decision 69/24(d)). The Executive Committee continued its deliberations on the criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 based on documents submitted between the 70th and 72nd meetings listed in Table 1.

[1] The criteria covered the determination of the cut-off date for installation of HCFC-based manufacturing equipment, the starting point for aggregate reductions in HCFC consumption, second-stage conversions, and eligible incremental costs of HCFC phase-out projects.

[2] Implementation of the approved HPMPs will result in the phase-out of 7,850 ODP tonnes of HCFCs (equivalent to 24 per cent of the starting point) and over 290 ODP tonnes of HCFC-141b contained in imported pre-blended polyols (i.e., consumption not reported under Article 7 of the Montreal Protocol).

[3] The Article 5 countries with an outstanding HPMP are: Botswana, the Democratic People's Republic of Korea, Libya, Mauritania, South Sudan and Syrian Arab Republic. The HPMPs for the Democratic People's Republic of Korea and Syrian Arab Republic were submitted to the 68th meeting but deferred. The HPMP for the Democratic People's Republic of Korea has been re-submitted to the 73rd meeting.

Table 1. Policy documents on the criteria for funding HCFC phase-out adopted by decision 60/44

Meeting (date)	Document title (number)	Decision
70th (July 2013)	Criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 (decisions 69/22(b) and 69/24(d)) (UNEP/OzL.Pro/ExCom/70/52)	70/21
71st (November 2013)	Criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 (decisions 69/22(b), 69/24(d) and 70/21(c)) (UNEP/OzL.Pro/ExCom/71/57)	
72nd (May 2014)	Criteria for funding HCFC phase-out in the consumption sector for stage II of HCFC phase-out management plans (decision 70/21(d)) (UNEP/OzL.Pro/ExCom/72/39)	72/39

3. In order to facilitate the discussion at the 72nd meeting, the Secretariat submitted a document which updated the criteria as approved by decision 60/44 to *inter alia* reflect the 2020, 2025 and 2040 (complete phase-out) targets rather than the 2013, 2015, and 2020 targets currently specified; the established HCFC baselines for compliance based on actual 2009 and 2010 consumption levels reported by Article 5 countries under Article 7 of the Montreal Protocol (which was not the case when decision 60/44 was adopted); and complementary decisions adopted by the Executive Committee after the 60th meeting[4].

4. During the discussion at the 72nd meeting, some members observed that small and medium-sized enterprises (SMEs) presented a new challenge for the Fund as their economies of scale were not the same as those of larger enterprises that had previously been converted with the assistance from the Fund. It was argued that the same cost-effectiveness thresholds could not be applied as these SMEs would incur higher operating costs especially when associated with the use of technologies involving flammable substances. Other members pointed out that the existing guidelines had already been applied to stage II of HPMPs in some cases. While it might be possible to discuss the minor changes proposed by the Secretariat, reopening the discussions on the existing guidelines may not be productive, especially as they had been the result of a compromise between the positions of Article 5 and non-Article 5 countries. There were concerns, however, that some changes suggested by the Secretariat may have gone beyond the intent of the existing guidelines and clarification was sought on several of these issues.

5. Following informal discussions, the Executive Committee *inter alia* invited members to submit to the Secretariat, by 30 June 2014, any additional information they considered necessary to complete that already contained in document UNEP/OzL.Pro/ExCom/72/39, and requested the Secretariat to prepare a document that contained the additional information for consideration at the 73rd meeting (decision 72/39).

6. The Secretariat has prepared the present document pursuant to decision 72/39. The document briefly presents an analysis of the information submitted by members of the Executive Committee[5], by topic (i.e., cut-off date, second stage conversions, accelerated phase-out of HCFCs, cost-effectiveness and incremental operating costs, deployment of new emerging technologies and refrigeration and air-conditioning servicing sector). It also includes a further analysis of information as requested by some Executive Committee members, and the Secretariat's observations for each topic analysed, where relevant. The document concludes with the draft criteria for funding HCFC phase-out in the consumption sector for stage II of HPMPs updated with the additional information submitted by Executive Committee members. The additional information as submitted by Executive Committee members is contained in Annex I to the present document.

[4] For example, establishment of cost effectiveness thresholds for rigid insulation foam for domestic refrigeration sector, and HCFC-141b contained in imported pre-blended polyols to be included in the starting point for aggregate reductions in HCFC consumption).

[5] Information was received from Australia, China, Japan, Uruguay and the United States of America.

7. For the preparation of the present document, relevant implementing agencies provided additional information specific to project components approved under stage I of the HPMPs, (e.g., systems houses and non-HCFC-141b-based formulations). The Secretariat is appreciative of their inputs.

Comments submitted by Executive Committee members

8. An analysis of the additional information submitted by members of the Executive Committee is presented below.

Cut-off date

9. The cut-off date to consider any project to convert HCFC-based manufacturing capacity during stage I of the HPMP is 21 September 2007. One member (China) noted that policies to control HCFC production and consumption in Article 5 countries were usually issued after that cut-off date. Several (HCFC-based) enterprises established after that date should be incorporated into stage II of the HPMP for conversion. The member requested that some flexibility be considered in funding the conversion of production lines established after the cut-off date of 21 September 2007.

Secretariat's observations

10. The first decision on a cut-off date was adopted at the 17th meeting, where the Executive Committee decided that any projects to convert any ODS-based capacity installed after 25 July 1995 would not be considered (decision 17/7). Since the adoption of the policy on the cut-off date, baseline capacity that was established after 25 July 1995 was not funded. The Executive Committee had to make an adjustment to this policy for projects to phase-out CFCs in metered-dose inhalers (MDI), in response to a request by the Parties to the Montreal Protocol to consider a cut-off date consistent with the reality of the pace of technological advances in the sector (decision XVIII/16[6], September 2007). In response to this request, the Executive Committee decided *inter alia* that it might consider on a case-by-case basis the submission of requests for project preparation for the conversion of CFC-MDI production facilities on the understanding that they must include a comprehensive justification from the country concerned for the need to receive assistance and, as a minimum, detailed information of the production facility (decision 51/34(d)). On this basis, the Secretariat reviewed all MDI projects reviewed in light of decision 54/5(d)(iii) and (iv)[7].

11. Discussions on the cut-off date for the establishment of HCFC-based manufacturing enterprises commenced at the 53rd meeting where three alternatives were proposed, namely: the day before the 53rd meeting of the Executive Committee (25 November 2007); 31 December 2009; or availability of substitutes[8]. Based on the discussions, the Executive Committee noted that the following cut-off dates for funding HCFC phase-out had been proposed: 2000 (Cap of HCFC production/consumption in one major country); 2003 (Clean Development Mechanism); 2005 (proposal for accelerated phase-out of HCFCs); 2007 (Nineteenth Meeting of the Parties); 2010 (end of the baseline for HCFCs); and availability of substitutes (decision 53/37(k)). Discussions continued at subsequent meetings of the Executive

[6] In adopting this decision, the Parties, inter alia, recognized the potential uncertainty of supplies of pharmaceutical-grade CFCs in the near future and the impact on people's health and local businesses if national manufacturing plants which depend on imports of those substances could not predict their availability; that most of the MDIs used by many Article 5 Parties were imported from non-Article 5 Parties not operating under paragraph 1 of Article 5, and that that decision XVII/14 requested the Parties to take a decision at their 18th meeting to address the difficulties faced by Article 5 Parties on MDI transition.

[7] As an example, the MDI project proposal for India was submitted based on the level of CFC consumption in 2007 and not the level of consumption in 2003, when the national CFC phase-out plan was approved. Accordingly, in approving the project, the level of funding of the MDI project was adjusted on the basis of the CFC consumption in 2003 (UNEP/OzL.Pro/ExCom/56/34).

[8] Paragraph 34 of document UNEP/OzL.Pro/ExCom/53/60.

Committee until the cut-off date of 21 September 2007 was adopted under decision 60/44. Since then, the Secretariat has applied this policy on all HCFC-based manufacturing enterprises included in stages I of approved HPMPs and stage II of the HPMP for Mexico submitted to the 73rd meeting[9].

Second-stage conversions

12. With respect to second-stage conversions, one Executive Committee member (Australia) supported retaining the eligibility of second-stage conversions in projects necessary to comply with the 35 per cent reduction step in 2020, instead of the 67.5 per cent reduction step in 2025 as proposed by the Secretariat in document UNEP/OzL.Pro/ExCom/72/39[10]. The reason for moving this forward was that by 2020 it is expected that most foaming equipment would reach its end-of-life and would anyway need to be replaced. The view is that most foaming machines on the market could operate with non-HCFC alternatives, bringing incremental capital costs (ICCs) to zero by 2020. Although incremental operating costs (IOCs) may remain, the current guidance represented an adequate compromise between those Executive Committee members who supported only limited funding for second-stage conversions and those who supported full funding for such conversions.

13. Another member (Uruguay) was of the opinion that consideration of second-stage conversions should not be limited to meeting compliance targets for Article 5 countries and cost-effectiveness considerations, but should also be based on other factors such as the difficulty of converting only some enterprises within an industry, which could distort local market conditions and competitiveness. Although enterprises that converted from CFC to HCFC technology committed to phasing out HCFCs without assistance from the Fund within the 2040 phase-out schedule, this member's view was that decision XIX/6 (on accelerated phase-out of HCFCs) was based on the understanding that all enterprises that received funding for conversion to HCFC technology would be eligible for second-stage conversion projects.

Secretariat's observations

14. Based on the additional information provided by two Executive Committee members, the modification to the second-stage conversion criterion proposed by the Secretariat in document UNEP/OzL.Pro/ExCom/72/39 has been deleted in the draft updated criteria in the present document.

15. The Executive Committee has approved funding for second-stage conversion projects[11] in several Article 5 countries[12], in light of the principles contained in decision 60/44(b). In all cases that complied with these principles, eligible incremental costs were fully approved by the Executive Committee for these projects allowing for the conversion of all the enterprises to non-HCFC technologies. Moreover, the Executive Committee also decided to approve full funding of eligible incremental costs for second-stage conversion projects to phase out HCFC-141b contained in imported polyols on a case-by-case basis, on the understanding that the governments concerned agreed to make commitments to ban imports of HCFC-141b, both in bulk and in imported pre-blended polyols.

16. The Secretariat will continue to review second-stage conversion projects in light of the existing policies and guidelines for funding the phase-out of ODS (i.e., baseline equipment[13], technology

[9] UNEP/OzL.Pro/ExCom/73/43.

[10] This observation was also supported by another member (the United States of America).

[11] Detailed information on second-stage conversion projects is contained in paragraphs 22 to 31 of document UNEP/OzL.Pro/ExCom/71/57.

[12] These countries are: Brazil, China (solvent sector plan), the Dominican Republic, Egypt, Indonesia, the Islamic Republic of Iran, Jordan, Lebanon, Malaysia, Mexico, Morocco, Viet Nam and Zimbabwe.

[13] Decision 25/48 states that" for foam machines nearing the end of their useful life, the incremental cost of conversion should be based on the cost, from the same supplier, of a new machine, from which has been deducted the cost of a replacement ODS-technology machine, or a proportion thereof calculated according to decision 18/25."

upgrade[14], end of useful life of manufacturing equipment, export to non-Article 5 countries and foreign ownership).

Accelerated phase-out of HCFC

17. With regard to the added criterion for accelerated phase-out of HCFC for non-low volume consuming (non-LVC) countries proposed by the Secretariat in document UNEP/OzL.Pro/ExCom/72/39[15], one Executive Committee member (Australia) was of the view that this may be perceived as an encouragement for such countries to submit proposals for accelerated phase-out, when it is uncertain whether sufficient funds will be available to support such efforts[16], and should therefore not be included. However, should sufficient funds be available, and should compelling cases be made for accelerated phase-out (e.g., the possibility of achieving better cost-effectiveness), the Executive Committee already has the flexibility to consider such proposals on a case-by-case basis, without the need for a specific policy on this issue.

18. Another member (Uruguay) indicated that it was inappropriate to propose a fixed phase-out schedule for all Article 5 countries, given that phase-out progress depends on local circumstances and the technology selected. Another member (China) noted that during stage II, most Article 5 countries are required to phase out an additional 25 per cent of their HCFC baselines for compliance, an amount which may be challenging to address. The member was of the view that the Executive Committee should give full consideration to the specific circumstances of each Article 5 country instead of considering only the ODP value of the HCFC to be phased out.

Secretariat's observations

19. At its 64th meeting, the Executive Committee considered the issue of HPMPs that proposed to address more than 10 per cent of the baseline by 2015[17], and agreed to continue to consider those HPMPs on a case-by-case basis. The Executive Committee also agreed that it could, if need be, continue its discussion on establishing a policy on that issue at a future meeting[18]. This was the basis that prompted the Secretariat to add a criterion for accelerated phase-out of HCFCs in document UNEP/OzL.Pro/ExCom/72/39. On the basis of the additional information provided by Executive Committee members, the criterion for accelerated phase-out of HCFCs proposed by the Secretariat has been removed.

Cost-effectiveness and incremental operating costs

20. Additional information on cost-effectiveness, interlinked with the introduction of low-global warming potential (GWP) alternatives and the conversion of SMEs, was received from four Executive Committee members, as described below.

[14] The Committee decided that costs associated with avoidable technological upgrades should not be considered as eligible incremental costs and therefore should not be funded by the Multilateral Fund. A methodology developed for the quantification of technological upgrades will be used as guidance in the calculation of incremental costs (decision 18/25).

[15] "Projects which accelerated the phase-out of HCFCs beyond the 35 per cent reduction step in 2020 for Article 5 countries that had total consumption above 360 metric tonnes used in both the manufacturing and refrigeration servicing sectors, and that had a strong national level of commitment in place to support the accelerated phase-out, could be considered on a case-by-case basis. Those Article 5 countries should include in their Agreement with the Executive Committee, the level of reduction from their HCFC baseline for compliance by a fixed year."

[16] The observation was also supported by another Executive Committee member (the United States of America).

[17] Paragraphs 7 to 10 of document UNEP/OzL.Pro/ExCom/64/17 on the overview of issues identified during project review.

[18] Paragraphs 61 to 63 of document UNEP/OzL.Pro/ExCom/64/53.

21. One member (Australia) was of the view that the current cost-effectiveness thresholds are adequate in most cases for funding the transition from HCFCs in small enterprises and towards low-GWP alternatives in general. In fact, the current cost-effectiveness thresholds, taking into account the 25 per cent additional funding for low-GWP alternatives, are higher than the requested costs of conversion under most HPMPs, and significantly higher than the average cost-effectiveness of projects in approved HPMPs, as shown in Table 2[19].

Table 2. Analysis of cost-effectiveness values of HCFC approved projects

Sector	CE threshold (US$/kg)	CE thresholds +25% (US$/kg)	Average CE approved HCFC projects (US$/kg)
Rigid polyurethane foam	7.83	9.79	5.63
Extruded polystyrene foam	8.22	10.23	4.09
Commercial refrigeration	15.21	19.01	7.50*

(*) For both commercial refrigeration and air-conditioning.

22. Another member (Uruguay) indicated that the current cost-effectiveness values were defined at the 16th meeting in March 1995 (i.e., 19 years ago). The threshold of US $9.79/metric kg for rigid foam would correspond today to US $13.72/metric kg based on the gross domestic product (GDP) deflator[20] or US $15.29/metric kg based on the consumer price index (CPI) deflator[21].

23. Another member (the United States of America) referred to information contained in the document on cost-effective conversions of SMEs during stage I of HPMPs[22], where the cost-effectiveness of conversion projects to low-GWP alternative technologies in Kuwait and the Philippines varied between US $2.22/metric kg and US $5.34/metric kg. The member also indicated that in stage I there were already examples of highly cost-effective transitions for SMEs that should only get easier during stage II of HPMPs. Another member (China) indicated that although stage I of the HPMPs mainly focused on large-size enterprises, whose conversion to non-HCFCs was relatively cost-effective, more and more SMEs (with lower technology capability and limited financial resources as compared to larger enterprises) would be addressed during stage II and beyond with much higher conversion costs, particularly when low-GWP alternatives were introduced[23]. If sufficient funding could not be provided, SMEs would not be willing to convert, which would directly affect the achievement of the 35 per cent reduction target. Therefore, due consideration should be given to the conversion of SMEs using low-GWP alternatives.

24. With regard to low-GWP alternatives available in some sectors, one member (China) indicated that Article 5 countries are facing difficulties and challenges in the areas of technology selection and funding support, and that the 25 per cent additional funding above the threshold would not be sufficient to introduce these alternatives. The member suggested that the Secretariat consider the difficulties and challenges in the introduction and application of low-GWP alternative technologies in Article 5 countries, and propose indicative costs based on information from demonstration projects. Another member (the United States of America) emphasized that it "would not be appropriate to include the costs of demonstration projects when determining average costs of conversions. Demonstration projects, as their name suggests, serve a particular purpose: to demonstrate a new technology. The Executive Committee approves such projects on a case-by-case basis because, among other issues, the costs of those projects will vary on a number of factors. As a general matter, demonstrations should cost significantly more to

[19] UNEP/OzL.Pro/ExCom/71/57.

[20] The GDP deflator (implicit price deflator for GDP) is a measure of the level of prices of all new, domestically produced, final goods and services in an economy.

[21] The CPI measures changes in the price level of a market basket of consumer goods and services purchased by households.

[22] Table 2 "Analysis of HCFC phase-out investment projects in rigid PU foam" contained in document UNEP/OzL.Pro/ExCom/71/57.

[23] The observation was also supported by another Executive Committee member (Uruguay).

implement than a conversion project using the same technology, and therefore they should generally not be used as a basis for cost comparison of simple conversion projects".

25. With regard to IOC several Executive Committee members provided additional information as summarized below:

(a) Australia noted that the IOCs for HCFC-141b in polyurethane (PU) foam (US $1.60/kg) and HCFC-22/HCFC-142b in extruded polystyrene (XPS) foam (US $1.40/kg) might not allow adequate consideration of emerging low-GWP alternatives. Accordingly, Australia suggested to modify the text of the criterion in decision 60/44 to take into account that the current IOCs were determined based on average IOCs of hydrocarbon-based technologies (rather than on "new emerging technologies based on un saturated HFCs" as proposed by the Secretariat in document UNEP/OzL.Pro/ExCom/72/39);

(b) China noted that the levels of IOCs in the current criteria are not sufficient to cover the actual IOCs when introducing some alternative technologies, and expected these levels to be increased in stage II of HPMPs;

(c) Uruguay pointed out that the duration of the IOCs should be significantly increased, since one year is not sufficient to introduce new alternative technologies. If the Executive Committee decides to further introduce low-GWP alternative technologies, IOC duration should be increased to four years as was the case in the early stages of the Montreal Protocol; and

(d) The United States of America, using information available to the Executive Committee[24], indicated that previous experience in the Multilateral Fund has shown that costs decrease over time as technology matures, experience and know-how increases, and seemingly new technologies become standard technology choices. It would be helpful if the Secretariat provided estimates of the historic experience of costs decreasing over time for different sectors and applications.

26. With regard to systems houses[25] in relation to SMEs, two Executive Committee members included additional information as summarized below:

(a) China indicated that the conversion of systems houses would be an important means to assist in the phase-out of HCFC during stage II of HPMPs. Thus, more consideration should be given to funding systems houses; and

(b) The United States of America indicated that the Executive Committee had provided technical assistance for systems houses to a number of Article 5 countries. It would be useful for the Secretariat to provide some estimates of the level of savings that could be

[24] The report on the study on alternatives to CFCS in rigid foam applications (UNEP/OzL.Pro/ExCom/36/34) stated that "HCFC-141b dropped from US $5.45/kg in 1993 to US $3.40/kg in 1998, a reduction that is typical of pricing trends once a product is introduced, production is optimised, economies of scale increase and competition becomes established in the marketplace. Enterprises that received funding in 1993 when the price of HCFC-141b was at US $5.45/kg were overcompensated for the incremental operating costs that they actually incurred". Also, paragraph 54 of document UNEP/OzL.Pro/ExCom/54/54 stated that "in case of CFC-phase-out, capital costs, but even more so the costs of items related to IOC (compressors, oils, refrigerants), usually decreased over time, and showed also significant variations in different markets."

[25] Reference to systems houses was first made at the 58th meeting where it was noted "that commercialisation and penetration in Article 5 countries of non-HCFC technologies in the foam sector would be assisted through the involvement and funding of systems houses. This approach would also have an impact on the calculation of ICCs and IOCs at the country and enterprise levels." (Paragraph 24(d) of document UNEP/OzL.Pro/ExCom/58/47).

expected through the systems house approach. Further elaboration of the expected savings, particularly for SMEs, would be welcome, seeing as the point of providing resources to systems houses was to ease the transition of SMEs.

Secretariat's observations

27. The evaluation of the incremental costs of Multilateral Fund projects has been based on the general principles[26] agreed by the Parties to the Montreal Protocol at their 2nd meeting. Since the adoption of these principles, the Executive Committee has agreed on policies and guidelines on ICCs and IOCs in different industrial applications, based on the experience gained during the operation of the Fund.

28. Pursuant to the request by one member, the Secretariat undertook a further analysis of the changes in prices of HCFC-141b replacing CFC-11 as foam blowing agent and HFC-134a replacing CFC-12 as refrigerant in domestic and commercial refrigeration manufacturing enterprises[27]. Except for a few cases, the prices of HCFC-141b and HFC-134a reduced over time, as shown in Table 3.

Table 3. Historical prices of HCFC-141b and HFC-134a in Multilateral Fund projects

Country	Price variation (US$)		%change
HCFC-141b			
Argentina	4.10 (1998)	2.10 (2001)	-48.78
Brazil	4.00 (1995)	3.00 (2002)	-25.00
China	2.50 (1996)	2.40 (1998)	-4.00
India	3.50 (1996)	3.50 (2001)	0.00
Indonesia	3.60 (1995)	3.00 (2002)	-16.67
Malaysia	4.00 (1994)	3.00 (2001)	-25.00
Nigeria	3.50 (1996)	3.50 (2001)	0.00
Thailand	4.00 (1994)	2.50 (2000)	-37.50
Venezuela (Bolivarian Republic of)	3.14 (1997)	3.60 (2002)	14.65
HFC-134a			
Algeria	5.75 (1994)	6.40 (2004)	11.30
Argentina	15.60 (1994)	8.00 (1999)	-48.72
China	8.00 (1995)	7.00 (2002)	-12.50
Colombia	11.00 (1994)	7.60 (2002)	-30.91
India	8.50 (1995)	7.50 (2000)	-11.76
Iran (Islamic Republic of)	7.00 (1995)	7.00 (2001)	0.00
Jordan	7.07 (1994)	7.80 (2001)	10.33
Nigeria	5.75 (1995)	4.50 (2000)	-21.74
Pakistan	7.00 (1996)	6.00 (2001)	-14.29
Thailand	8.00 (1994)	5.60 (1998)	-30.00

29. With regard to the concern of the levels of IOCs not being sufficient to cover the IOCs for some specific alternatives, the Secretariat notes that the Executive Committee addressed this concern during the phase-out of CFCs by approving several investment projects where IOCs were over fifty per cent of the

[26] The most cost-effective and efficient option should be chosen, taking into account the national industrial strategy of the recipient Party; consideration of project proposals for funding should involve the careful scrutiny of cost items listed in an effort to ensure that there is no double-counting; savings or benefits that will be gained during the transition process should be taken into account on a case-by-case basis, according to criteria decided by the Parties and as elaborated in the guidelines of the Executive Committee; as the funding of incremental costs is intended as an incentive for early adoption of ozone protecting technologies, the Executive Committee shall agree which time scales for payment of incremental costs are appropriate in each sector.

[27] The foam and refrigeration sectors were selected for the analysis, given the large number of projects that were converted in various different countries from all regions, over several years. Furthermore, the majority of the HCFC consumption in the manufacturing sectors is related to these two sectors.

total eligible costs[28]. Furthermore, during the phase-out of HCFCs this concern has also been recognized in documents considered by the Executive Committee, *inter alia*:

(a) The analysis of new approaches on second-stage conversions, determination of the cut-off date and other outstanding HCFC policy issues submitted to the 58th meeting[29] where it was stated that "IOCs could be significant, in particular for liquid HFC-based technologies, mainly due to the higher cost of the replacement chemical."; and

(b) The criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 submitted to the 70th meeting[30] and 71st meeting[31], where it was "noted that some low-GWP alternatives to HCFCs used in the foam and refrigeration sectors (such as gaseous unsaturated HFCs) are emerging in the markets. As these are new molecules, they will have higher prices than the HCFCs being replaced. In this regard, the maximum level of IOCs, particularly in the foam sector, might limit their introduction for certain applications."

30. Based on the above observations, and as suggested by one Executive Committee member (Australia), the text proposed by the Secretariat on IOCs in document UNEP/OzL.Pro/ExCom/72/39 has been modified as follows:

> "The Executive Committee will consider, on a case-by-case basis, funding higher levels of incremental operating costs than indicated in paragraph (f)(iv) above when required for the introduction of low-GWP technology other than hydrocarbon-based technologies"

31. With regard to the duration of IOC, at its 55th meeting (July 2008), the Executive Committee discussed for the first time the issue of eligible incremental costs for HCFC phase-out[32], and decided, *inter alia*, to defer to its first meeting in 2010 any decision on policies for the calculation of IOCs[33] or savings from HCFC conversion projects, or on the establishment of cost-effectiveness thresholds, in order to benefit from the experience gained by reviewing HCFC phase-out projects as stand-alone projects and/or as components of HPMPs prior to that meeting (decision 55/43(c)(ii)).

32. However, at the 57th meeting (March-April 2009), during the discussion on second-stage conversions and determination of the cut-off date for the installation of HCFC-based manufacturing equipment[34], one member proposed a new approach for calculating incremental costs by shifting IOC from direct payment to beneficiary manufacturing plants to payment to Article 5 governments based on a percentage of the ICC associated with the conversion from HCFCs to the most cost-effective alternative

[28] The Secretariat undertook an analysis of 1,559 approved CFC phase-out projects to alternative technologies in the foam and refrigeration manufacturing sectors, and noted that in 197 projects (i.e., 12.6 per cent of the total), IOCs were over fifty per cent of the total eligible costs. The higher IOCs were mainly related to the introduction of water-based blowing technologies, the use of HCFC-141b and liquid carbon dioxide in foam applications, and HFC-134a as a refrigerant.

[29] Annex II of document UNEP/OzL.Pro/ExCom/58/47.

[30] Paragraph 95 of document UNEP/OzL.Pro/ExCom/70/52.

[31] Paragraph 106 of document UNEP/OzL.Pro/ExCom/71/57.

[32] Paragraphs 20 to 35 of document UNEP/OzL.Pro/ExCom/58/47 on cost considerations surrounding the financing of HCFC phase-out.

[33] The application of IOC as agreed by the Executive Committee for those sectors/sub-sectors where HCFC technologies were chosen for phasing out the use of CFCs in Article 5 countries is: (i) no operating costs for compressors; (ii) for domestic refrigeration, ten per cent of incremental cost to be paid up front, or six months of IOC calculated at current prices and paid up-front, or IOC for a duration of one year adjusted according to prevailing costs at the time of disbursement, when the modified plant was operating, whichever is greater; (iii) two years for commercial refrigerator, rigid and integral skin foam manufacturing plants; and (iv) four years for aerosol enterprises.

[34] Based on document UNEP/OzL.Pro/ExCom/57/60.

technology available[35]. The Executive Committee continued discussions (in plenary and in contact groups) on eligible incremental costs and other outstanding HCFC policy issues (i.e., second-stage conversions, cut-off date, starting point for aggregate reduction in HCFC consumption) at its 58th meeting[36], 59th meeting[37] and 60th[38] meeting, when the criteria for funding HCFC phase-out in the consumption sector in Article 5 countries was agreed (decision 60/44).

33. At that time, in reviewing the proposed approach[39] the Secretariat identified a few issues associated with it, *inter alia*, that it would require an analysis of the ICC associated with two or more technologies for each project proposal, which could become more complex in cases where several enterprises were covered under umbrella or sectoral/sub-sectoral phase-out projects. In some instances, the approach would not be equitable for all enterprises[40], while in others, the resulting IOC would depend on the baseline equipment at the enterprise level[41]. Also, the proposal to pay IOC to governments would require that the lead bilateral or implementing agency for the HPMP reports back to the Committee on the utilization of those resources.

34. After further analysis of the proposed approach, the Secretariat formulated alternative methodologies to determine IOC that could be used in HCFC phase-out projects in the foam and refrigeration manufacturing sectors during stage I of HPMPs[42], which resulted in the following criteria:

(a) For foam projects:

(i) IOC would be considered at US $2.25/metric kg of HCFC consumption that would be phased out at the manufacturing enterprise;

(ii) For systems-house projects, IOC would be eligible only when their downstream HCFC-based foam enterprises are also part of the project, and would be calculated on the basis of the total HCFC consumption of all the foam-producing enterprises involved that would be phased-out; and

(iii) The transitional period for applying IOC would be one year;

(b) For refrigeration and air-conditioning projects:

(i) IOC would be considered at US $8.10/metric kg of HCFC-22 consumption phased out at the manufacturing enterprise; and

[35] To pay 5 to 10 percent of the lowest eligible agreed ICC of the HCFC phase-out project, or the average of agreed ICC associated with the HCFC sector concerned. For those cases in which governments do not want to/or cannot receive the calculated eligible IOC for designing a country-appropriate climate incentive programme, only the IOC associated with training and testing the new alternative technology would be paid directly to the manufacturing enterprise, without including any payment for the purchase of the alternative chemical).

[36] UNEP/OzL.Pro/ExCom/58/47. The discussion during the meeting could be found in paragraphs 149 to 157 of document UNEP/OzL.Pro/ExCom/58/53.

[37] UNEP/OzL.Pro/ExCom/59/52. The discussion during the meeting could be found in paragraphs 228 to 231 of document UNEP/OzL.Pro/ExCom/59/59.

[38] UNEP/OzL.Pro/ExCom/60/46. The discussion during the meeting could be found in paragraphs 190 to 198 of document UNEP/OzL.Pro/ExCom/60/43.

[39] Comments on the approach for the calculation of eligible incremental costs for HCFCs from Executive Committee members are contained in Part 2 of Annex I to document UNEP/OzL.Pro/ExCom/55/47.

[40] For example, in cases where the ICC is for retrofit of baseline equipment, the associated IOC would be small (i.e., US $1,500 to US $7,000) but much higher for enterprises selecting hydrocarbon technologies (i.e., up to US $78,000).

[41] For example, enterprises with a lower baseline would receive higher IOC than an enterprise with a higher level of technology.

[42] The proposed methodologies are contained in Annex II to document UNEP/OzL.Pro/ExCom/58/47.

(ii) The transitional period for applying IOC would need to be established.

35. However, in subsequent discussions, the Executive Committee agreed on the criterion on eligible incremental costs as set-out in decision 60/44. Subsequent to the adoption of the criteria in decision 60/44, the Executive Committee decided that the IOCs for the aerosol sector should be determined on the basis of one-year duration (decision 62/9).

36. With regard to the request to the Secretariat by one member to propose indicative costs based on information from demonstration projects, at its 55th meeting the Executive Committee invited bilateral and implementing agencies to submit a limited number of demonstration projects for the conversion of HCFCs in the refrigeration and air conditioning sub-sectors to low-GWP technologies to identify all the steps required and to assess their associated costs (decision 55/43(f)). In this regards, the Secretariat notes that at its 71st meeting, the Executive Committee considered progress reports of three demonstration projects in the refrigeration and air conditioning sub-sectors[43]. Based on information contained in the reports, IOCs were related to compressor cost (approximately at US $7.50/kg), sealing of electrical components (US $16.00/kg) and increased time needed for installation (US $20.00/kg). Incremental savings were achieved with the heat exchangers (US $5.00/kg) and the refrigerant (US $0.50/kg). Conversion and related improvements to the systems resulted in increased energy efficiency (2 to 3 per cent for compressors and 5 to 12 per cent of air-conditioning units) as compared to HCFC-22-based systems.

37. In one of the demonstration project document[44] it was reported that although the actual IOC was significantly higher than the cost-effectiveness threshold of US $6.30/kg, they were associated with the product initiation and were expected to decrease in future, albeit not at the level of the threshold. In addition, the methodology for applying safety measure (related to the use of a flammable refrigerant) was being refined. In further discussing high level of IOCs reported in the demonstration projects, UNIDO reported that they were carefully assessed to achieve high accuracy. However, these costs were calculated when work on development of standards was still on-going, the level of production of air-conditioning units was small, and substantial increases in production efficiency had not yet been achieved. In addition, the alternative technology being introduced has never been utilized in mass production. The purpose of these demonstration projects was not to prove the applicability of a well-known technology under the circumstances prevailing in Article 5 countries, but to develop for mass production a completely new technology with its own learning curve. During the transition period until the technology had achieved a certain level of maturity, the products based on the new technology will be more costly to manufacture. The air-conditioning manufacturing enterprises that decide to utilize this technology are convinced that, after this transition period, they will manufacture a product which can commercially compete with other technologies. This indicates that IOCs are expected to be substantially lower than those indicated in the project document.

[43] The progress reports of the following three projects are contained in Part V of document UNEP/OzL.Pro/ExCom/72/11/Add.1: Demonstration sub-project for conversion from HCFC-22 to propane at Midea Room Air Conditioner Manufacturer Company (UNIDO); demonstration project for HFC-32 technology in the manufacture of small-sized commercial air source chillers/heat pumps at Tsinghua Tong Fang Artificial Environment Co., Ltd. (UNDP); and demonstration project for conversion from HCFC-22 technology to ammonia/CO2 technology in the manufacture of two-stage refrigeration systems for cold storage and freezing applications at Yantai Moon Group Co. Ltd. (UNDP).

[44] Demonstration sub-project for conversion from HCFC-22 to propane at Midea Room Air-conditioning Manufacturing Company, implemented by UNIDO (CPR/REF/61/DEM/503).

38. With regard to the concerns on providing sufficient assistance to phase-out HCFCs in SMEs, the Secretariat notes the special consideration that the Executive Committee has given to these enterprises. Specifically:

(a) At the 19th meeting, (May 1996), the Executive Committee decided for a trial period of 18 months, to consider an umbrella project as eligible for funding if it met several conditions, *inter alia*: the overall cost-effectiveness of the umbrella project fell within the sectoral threshold established; and no individual enterprise proposal had a cost-effectiveness threshold more than 100 per cent above the established threshold (decision 19/32);

(b) At the 20th meeting (October 1996), the Executive Committee noted the decisions already taken which could assist SMEs in LVC countries, and as part of terminal umbrella projects, and decided *inter alia* to make recommendations to the 22nd meeting for options to advance phase-out in the SME sector, including the possibility of a funding window with appropriate cost-effectiveness thresholds (decision 20/41);

(c) At the 22nd meeting (May 1997), the Executive Committee noted *inter alia* that several representatives expressed concerns that advancing phase-out in the SME sector required moving beyond relying on "a project approach" and focusing, instead, on other types of support measures to assist individual Article 5 Parties to meet the ODS control schedules (decision 22/66);

(d) At its 25th meeting (July 1998), the Executive Committee allocated US $10 million for a funding window designed to facilitate pilot conversions of significant groups of small firms in the aerosol and foam sectors from non-LVC countries. The Committee also decided that group projects should: be at a level of US $1 million or less; have an overall cost-effectiveness of no more than 150 per cent of the level of the current cost-effectiveness threshold values; use the most cost-effective technologies reasonably available; and consider the possibility of centralized use of equipment and industrial rationalization (decision 25/56);

(e) However, the special window for SMEs was removed at the 28th meeting (July 1999) (decision 28/23).

39. During the phase-out of HCFCs, systems houses have played an important role in facilitating the introduction of non-HCFC-141b-based technologies in their downstream foam enterprises including SMEs in several Article 5 countries[45]. As reported to the 70th[46] and 71st[47] meetings, through the systems house approach, it is expected that the demand for HCFC-141b, particularly by a large number of SMEs, will be reduced, and that the overall cost of the conversion will also be reduced, as many enterprises will choose to convert to one of the non-HCFC-based formulations even before stage II commences[48].

[45] Funding has been approved for Brazil, Egypt Mexico, Nigeria and South Africa for the development and optimization of methyl formate pre-blended polyols to be supplied to their local clients as well to those in other countries; and for technical assistance in India (US $3,436,500), the Islamic Republic of Iran (US $225,500); Malaysia (US $970,000) and Thailand (US $224,003) without an amount of HCFC to be phased out respectively, except for Thailand with a nominal associated amount of 4.4 mt of HCFC-141b to be phased out.

[46] UNEP/OzL.Pro/ExCom/70/52.

[47] UNEP/OzL.Pro/ExCom/71/57.

[48] In the additional information provided for the current document, one Executive Committee member (the United States of America), made reference to this statement.

40. More specifically, in the cases of the HPMPs for India[49] and Malaysia[50], financial support was provided to the locally-owned systems houses to ensure availability of cost-effective alternatives, particularly to SMEs; to reduce ICCs and IOCs required for their conversion; and to contribute to the overall reduction in the use of HCFCs in the foam sector at the time of stage II.

41. Progress reports on the implementation of projects related to systems houses have been recently provided for Brazil, India, Mexico, Malaysia, Nigeria and South Africa showing efforts to promote the adoption of new formulations by foam enterprises downstream from the systems houses. However, at this time, there is limited information available on the actual costs of conversions of downstream foam enterprises (ICC) and the prices of non-HCFC-141b pre-blended polyol systems (IOC). There are also uncertainties whether low-GWP based pre-blended polyols could be developed and scaled-up. For example:

(a) The systems houses project component of stage I of the HPMP for Brazil is under implementation; although it is too early to determine the actual costs of the alternative polyol systems, the costs of methyl formate- and methylal-pre-blended polyol systems seem to be lower than those based on HFCs although higher than HCFC-141b-based systems. It also appears that development of systems and trials have been more expensive than anticipated and have been co-funded by the system houses;

(b) During implementation of stage I of the HPMP for China, hydrocarbon pre-blended polyols are being developed by local systems houses to assist enterprises that cannot establish hydrocarbon storage and pre-blending stations *in situ* due to financial, safety and technical reasons. While actual costs are not yet available, reductions on ICCs could be expected[51], while based on preliminary experience so far gained, IOCs are higher than anticipated, due to a higher cost of cyclopentane as previously anticipated and the resulting higher foam density. In spite of reductions on ICCs, the cost-effectiveness threshold is still a barrier for smaller enterprises to adopt hydrocarbon-based pre-blended polyols;

(c) The systems houses in India and Malaysia are currently making all efforts to develop pre-blended polyols with lower-GWP blowing agents (cyclopentane with a special polyol, methyl formate, and unsaturated HFCs). The main challenge is limitation of

[49] The HPMP noted that with the technologies available at that time, the cost of converting the foam SMEs in the country would be over US $16 million. By providing technical assistance to systems houses, the costs for converting the SMEs can be reduced by up to 50 per cent, and substantial savings can also be realized in the remaining foam enterprises (not categorized as SMEs). Upon completion of the systems house component, many enterprises will choose to convert to one of the customized formulations even before stage II commences. (UNEP/OzL.Pro/ExCom/66/38).

[50] The HPMP noted that there were promising emerging alternatives at the foam enterprise level, but it could take two years for them to be commercially available in Malaysia. The project component aimed to equip local systems houses so that they could immediately supply polyols pre-blended with alternative blowing agents at the downstream SMEs. It would be expected that a significant number of SMEs in the rigid foams sector would adopt the emerging alternatives prior to the 2015 compliance target. This could result in reduction of HCFC consumption and could significantly reduce the cost of conversion at SMEs, by an amount at least equal to the investments made at the systems houses during stage I (UNEP/OzL.Pro/ExCom/65/41).

[51] As reported by the World Bank, delivering hydrocarbon pre-blended polyols in drums as compared to cyclopentane delivered in bulk results is capital savings as enterprises do not have to invest in cyclopentane storage tank and delivery systems (including pumps and piping) and safety equipment. Additional savings will be realized as enterprises do not need to invest in pre-mixing equipment and safety measures, and separate access for delivery of drums to the storage room (i.e., saving of over US $200,000 compared to a traditional cyclopentane-based foam project with blending in situ could be expected). In addition, hydrocarbon-based pre-blended polyols could be used by foam enterprises using much less than 5.5 ODP tonnes (50 mt) of HCFC-141b. Annex II of document UNEP/OzL.Pro/ExCom/72/40.

technical options, which will take at least one to one-and-a-half years to commercialize such pre-blended polyols. As regard to the cost, these are subject to market factors and commercial terms. Currently, the costs of alternative blowing agents are higher than HCFC-141b. In some cases, such as unsaturated HFC, it is speculated that the price is about 10 times higher. This, however, depends on the commercial availability and the quantity to be procured by the systems houses. At this stage, there is a uncertainty in the markets on such alternatives;

(d) Although the systems houses project component in stage I of the HPMP for Mexico is well advanced, cost experience is limited to only some individual spray foam users. It appears that the retrofit costs (i.e., ICCs) are sufficient to introduce methyl formate pre-blended polyols, while IOCs will be only related to an introductory period. However, for foam applications with low densities (i.e., below 35 kg/m^3), HFCs or unsaturated HFCs might be needed as a co-blowing agent. The actual costs of polyol systems based on methyl formate or methylal will depend on the specific formulation and the sub-sectors. With higher production levels in the future it could be expected that these polyol system costs could compete with HCFC-based systems; however, it will depend on many different factors;

(e) Preliminary information on the systems house component of stage I of the HPMP for South Africa indicates that the price of methyl formate pre-blended polyol systems is about 7 per cent higher than that based on HCFC-141b.

42. Additional information received from implementing agencies noted that in several Article 5 countries there are no systems houses that could provide technical support to downstream foam enterprises particularly SMEs. The costs associated with the conversion of these enterprises would need to be assessed based on capital investment needed and IOCs which will depend on the alternative technology selected (e.g., HFOs, water-blown, methyl formate). These considerations would have a significant impact on the business continuity of SMEs.

Deployment of new emerging technologies

43. One Executive Committee member (Japan) requested additional information on the deployment of new emerging technologies based on unsaturated HFCs, such technologies or reference to existing documents where this issue has been addressed.

Secretariat observations

44. The Secretariat notes as follows[52]:

(a) The document on revised analysis of relevant cost considerations surrounding the financing of HCFC phase-out submitted to the 55th meeting[53], included information on a new low-GWP blowing agent (HBA-1) where hydrocarbons could not be used to replace HFC-134a for one-component foams. It was expected that the blowing agent would be

[52] The additional information on unsaturated HFCs requested by the Executive Committee members was related to the foam sector. Additional information on these substances is also available. For example, the discussion paper on minimizing adverse climate impact of HCFC phase-out in the refrigeration servicing sector meeting (UNEP/OzL.Pro/ExCom/70/53/Rev.1) indicated that although some HFOs and HFO-based mixtures (e.g., HFC-1234yf, HFC 1234ze(E), HCFC 1233zd(E) were currently produced, they were not yet commercially available in most Article 5 countries. As all except HCFC-1233zd(E) were classified with low flammability, their introduction would require the adoption of regulations, standards and codes of practice for the safe us of low flammable refrigerants and training of refrigeration technicians.

[53] Annex III of document UNEP/OzL.Pro/ExCom/55/47.

commercially available in July 2008, in time to enable compliance with the requirements of the European F-Gas Regulation;

(b) The document on criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 submitted to the 70th meeting[54] and 71st meeting[55], reported that the use of HFO-1234ze technology as co-blowing agent in the manufacture of XPS has good prospects as an alternative technology, providing acceptable thermal insulation and structural properties. However, further optimization of density and surface will be required, and further trials will also be required to reduce flammability of the HFO-1234ze/DME blend and to improve thermal insulation performance by reducing the amount of DME;

(c) The Technology and Economic Assessment Panel (TEAP) report pursuant to decision XXIV/7[56] indicated that HFOs seem to offer a competitive level of performance with minimum or no capital investment. However, the costs and global availability of HFOs in general are still unclear. Manufacturer's information indicates that HFOs would be commercially available between late 2013 and 2015, but their availability would be limited to specific applications in non-Article 5 countries. Even in these markets, it is expected that HFOs will be co-blended with other blowing agents to obtain better performance and/or reduce cost increase; and

(d) The document on the overview of approved HCFC demonstration projects and options for additional projects to demonstrate climate-friendly and energy-efficient alternative technologies to HCFCs submitted to the 72nd meeting[57] reported that under their HPMPs several countries (e.g., India, Malaysia and Saudi Arabia) have received assistance for their local systems houses to introduce HFO-based formulations. The acceptance of this technology in the different sub-sectors is currently unclear since benefits over available technologies have to be balanced with the presumed substantial increase in the cost for the blowing agent.

45. With regard to the deployment of other emerging technologies not based on unsaturated HFCs in Article 5 countries, information was made available at the 72nd meeting under the document on the overview of approved HCFC demonstration projects and options for additional projects to demonstrate climate-friendly and energy efficient alternative technologies to HCFCs. This information is summarized in Table 4.

Table 4: Penetration of non-HCFC alternative technologies in Article 5 countries

Sector	Technology	Countries with ongoing projects	HCFC phase-out (mt)
Foam	Methyl formate	Brazil, Bosnia and Herzegovina, Cameroon, the Dominican Republic, Egypt, El Salvador, Indonesia, Jamaica, Mexico, Nigeria, South Africa, Trinidad and Tobago	5,000
	Methylal	Brazil, Mexico	300
	Supercritical CO_2	The Philippines	43
	Pre-blended HC	China, Egypt and Mexico	*n.a.
Refrigeration/ air-conditioning	Ammonia/CO_2	China, Indonesia	*n.a.
	HC-290	Armenia, China, Serbia	3,741
	HFC-32	Algeria, Indonesia, Thailand	4,594

[54] UNEP/OzL.Pro/ExCom/70/52.
[55] UNEP/OzL.Pro/ExCom/71/57.
[56] TEAP Task force report on additional information to alternatives on ODS, September 2013.
[57] UNEP/OzL.Pro/ExCom/72/40.

Sector	Technology	Countries with ongoing projects	HCFC phase-out (mt)
Solvent	Iso-paraffin/siloxane (KC-6)	China	*n.a.

*Not yet available.

46. An additional project under current implementation relates to demonstrate potential low-GWP alternative technology for the air-conditioning sector in high-ambient temperature countries. The project has designed to address *inter alia:* challenges related to the availability of low-GWP refrigerants; technical issues including final products, components, and accessories; energy efficiency standards and codes; and technology transfer[58].

Refrigeration and air conditioning servicing sector

47. One Executive Committee member (China) indicated that HCFC phase-out in the refrigeration servicing sector would be more challenging during stage II of HPMPs as compared to stage I, given the diversity of alternative technologies and operating parameters (e.g., pressure, flammability). During stage II, in addition to typical activities in the servicing sector (e.g., recovery and recycling), other activities would need to be implemented, such as research, dissemination and demonstration of alternative technologies. Therefore, the cost-effectiveness threshold for the refrigeration servicing sector is not sufficient to address the needs of Article 5 countries.

48. Another Executive Committee member (Uruguay) indicated that available alternative refrigerants were more expensive than HCFC-22 and more complex to manage (e.g., zeotropic[59] mixtures, flammability and safety-related issues; training of technicians). Alternative technologies to replace HCFC-141b for servicing refrigeration circuits were also more expensive. In view of key considerations to minimize the adverse climate impacts in the refrigeration servicing sector in decision 72/41, it became necessary to review the cost-effectiveness threshold and propose a minimum level of funding for all Article 5 countries that would have to phase out up to 20 metric tonnes (mt) of HCFCs to achieve the 35 per cent reduction from their HCFC baselines. For all other countries, funding should be set at US $6.00/metric kg.

Secretariat's observations

49. The Executive Committee adopted decision 72/41 based on the information and analysis presented in the document on minimizing adverse climate impact of HCFC phase-out in the refrigeration servicing sector[60]. Key considerations on the refrigeration servicing sector which are contained in the document, and which could be relevant to the discussion on the criteria for funding stage II of HPMPs, are summarized below:

(a) Article 5 countries face the challenge of selecting alternatives to replace the installed base of HCFC-22 equipment. Under the existing conditions it can be expected that HCFC-based equipment at the end of its useful life will be replaced by HFC-based equipment (which is already taking place in many countries), except for specific applications where the use of ammonia could be extended, the use of CO_2 could be introduced with opportunities to reduce refrigerant charge in the systems, or the use of

[58] To address these issues, 65 prototypes are being built in association with local manufacturers and technology providers, among others. Local manufacturers will test four different unsaturated HFCs, HFC-32 and hydrocarbons in window air conditioning units, split units, ducted split units and packaged air-conditioning units. The project will also prepare a study on long-term feasible technologies for air-conditioning, including district cooling.

[59] A zeotropic mixture is a chemical mixture that never has the same vapour phase and liquid phase composition at the vapour–liquid equilibrium state.

[60] UNEP/OzL.Pro/ExCom/72/42 (containing a note by the Secretariat) and UNEP/OzL.Pro/ExCom/70/53/Rev.1.

not-in-kind technologies (e.g., absorption) could be introduced in chillers or other applications if cost-effective. Over the last few years, several Article 5 countries have selected HC-290 and/or HFC-32 technologies to replace the HCFC-22 technology in the manufacturing of refrigeration and air-conditioning equipment[61];

(b) As many of the alternative refrigerants available or being developed are classified with some level of flammability, regulations, codes of practices, and standards must be adopted to ensure safe introduction of these technologies. The necessary legal framework to adopt, implement and enforce regulations, codes of practice, and standards for the use of flammable refrigerants should be determined (customs training, test facilities) before operation of such equipment is allowed;

(c) Refrigeration training programmes would be more relevant now than during the CFC phase-out period. Training programmes that would integrate preventive maintenance, enhance installation quality, and improve the energy efficiency of equipment could minimize adverse climate impact. Training programmes will also need to integrate a rigorous approach to safe handling of flammable refrigerants and an understanding of related regulations and standards;

(d) Certification systems for technicians should be supported, or even made mandatory, through regulations in the country. Given the long-term benefits that a proper certification system for technicians brings to the safe and restricted use of flammable refrigerants and the potential reduction of emissions of refrigerants into the atmosphere, due consideration should be given to developing such certification systems during HPMP implementation;

(e) In several Article 5 countries, HC-290 is currently being used for retrofitting, operating and/or filling HCFC-22-based refrigeration and/or air-conditioning equipment (it appears that market conditions may be favourable for this practice, as it is taking place independently of efforts under the HPMPs). The Secretariat raised concerns regarding the use of hydrocarbon-based refrigerants in systems designed for non-flammable refrigerants, in places where it appears that there are no policies and regulations allowing the use of flammable refrigerants, limited technical capacity for properly servicing and maintaining equipment charged with flammable refrigerants; and the associated risks to technicians and end-users.

50. Decision 72/41 is limited to inviting bilateral and implementing agencies to consider the information contained in the document on minimizing adverse climate impact of the HCFC phase-out in the refrigeration servicing sector when assisting Article 5 countries in the preparation and implementation of activities in this sector. The decision also encourages Article 5 countries to consider, as needed and feasible, the development of regulations and codes of practice, the adoption of standards for the safe introduction of flammable and toxic refrigerants; measures to limit the import of HCFC-based equipment, actions to facilitate the introduction of energy-efficient and climate-friendly alternatives, and to focus technician-training activities on *inter alia,* the safe handling of refrigerants.

[61] The Multilateral Fund has approved projects for the manufacturing of air-conditioning units in Algeria, Indonesia and Thailand that use HFC-32. Japan has also released air-conditioning units that use HFC-32. Safety assessments being undertaken by groups like AHRI and AREP will help in the production of new standards and regulations to be adopted (JARN 528, Vol. 45, 25 January 2013). As part of the air-conditioning sector plan under its HPMP, China committed to converting at least 18 manufacturing lines for the production of residential air-conditioning equipment with HC technology. The demonstration project for the use of HC-290 in the production of air-conditioning units in China has also shown positive results.

HCFC phase-out in the aerosol, fire extinguisher and solvent sectors

51. The criteria for funding HCFC phase-out in the consumption sector as adopted in decision 60/44 established that the eligibility of ICCs and IOCs for HCFC phase-out projects in the aerosol, fire extinguisher and solvent sectors will be considered on a case-by-case basis. While the Executive Committee decided that the IOCs for the aerosol sector should be determined on the basis of one-year duration (decision 62/9), it has not yet decided on the eligibility of ICCs and IOCs, and whether or not to consider the current cost-effectiveness threshold of US $4.40/metric kg for this sector.

52. The Secretariat notes that in the document UNEP/OzL.Pro/ExCom/72/39 (which updated the criteria as approved by decision 60/44) by mistake the aerosol sector was deleted from the criteria for "HCFC phase-out in the aerosol, fire extinguisher and solvent sectors". In this regard, the aerosol sector has been included in the draft updated criteria in the present document.

Draft updated criteria for funding for stage II of HPMPs

53. The Executive Committee might wish to consider the key elements of the criteria for funding HCFC phase-out in the consumption sector for stage II of HCFC phase-out management plans, with relevant changes introduced as set out below[62].

Cut-off date

(a) Not to consider any projects to convert HCFC-based manufacturing capacity installed after 21 September 2007;

Second-stage conversion

(b) To apply the following principles in regard to second-stage conversion projects ~~for the first stage of HCFC phase-out management plan (HPMP) implementation to achieve the 2013 and 2015 HCFC phase-out compliance targets, to be reviewed by the Executive Committee no earlier than the last Meeting in 2013~~:

(i) Full funding of eligible incremental costs of second-stage conversion projects will be considered in those cases where an Article 5 Party clearly demonstrates in its HPMP that such projects are necessary to comply with the Montreal Protocol HCFC targets up to and including the 35.0 per cent reduction step by 1 January 2020 and/or are the most cost-effective projects measured in ODP tonnes that the Party concerned can undertake in the manufacturing sector in order to comply with these targets;

(ii) Funding for all other second-stage conversion projects not covered under paragraph (b)(i) above will be limited to funding for installation, trials, and training associated with those projects;

~~*Starting points for aggregate reductions in HCFC consumption*~~[63]

~~(c) To establish the starting points for aggregate reductions in HCFC consumption, for those Article 5 countries that submit projects in advance of their assessed baseline, at the time of submission of either the HCFC investment project or the HPMP, whichever is first~~

[62] "Strike-out text" text is no longer relevant for stage II of HPMPs and should be deleted. "Bold text" indicates new text relevant for stage II of HPMPs.

[63] The starting point for aggregate reductions in HCFC consumption is established when stage I of the HPMP of an Article 5 country is approved by the Executive Committee.

~~submitted for the consideration of the Executive Committee;~~

~~(d) To allow Article 5 countries to choose between the most recent reported HCFC consumption under Article 7 of the Montreal Protocol at the time of the submission of the HPMP and/or the investment project, and the average of consumption forecast for 2009 and 2010, in calculating starting points for aggregate reductions in HCFC consumption;~~

~~(e) To adjust the agreed starting points for aggregate reductions in HCFC consumption in cases where calculated HCFC baselines based on reported Article 7 data are different from the calculated starting point based on the average consumption forecast for 2009-2010;~~

~~(f) To include in the starting point for aggregate reduction in HCFC consumption the average amount of HCFC-141b contained in imported polyol systems during the 2007-2009 period which had not been counted as consumption under Article 7.~~

Eligible incremental costs of HCFC phase-out projects

(c) To apply the following principles in regard to eligible incremental costs of HCFC phase-out projects ~~for the first stage of HPMP implementation~~ to achieve the ~~2013 and 2015~~ **2020, 2025 and 2040 (complete phase-out)** HCFC phase-out compliance targets, subject to a review in ~~2013~~ **2018**:

~~(i) When preparing HCFC phase-out projects in the foam, refrigeration and air-conditioning sectors, bilateral and implementing agencies shall use the technical information contained in document UNEP/OzL.Pro/ExCom/55/47 as a guide;~~

(i) The current cost-effectiveness threshold values used for CFC phase-out projects in paragraph 32 of the final report of the 16th meeting of the Executive Committee (document UNEP/OzL.Pro/ExCom/16/20), to be measured in metric kilograms, **and a cost-effectiveness threshold of US $7.83/metric kilogram for rigid insulation refrigeration foam,** shall be used as guidelines during the development and implementation of the ~~first~~ **second and subsequent** stages of HPMPs;

(ii) **Article 5** countries will have the flexibility to allocate the approved funding from incremental operating costs to incremental capital costs and to allocate up to 20 per cent of the approved funding for incremental capital costs to incremental operating costs, as long as the use of the flexibility does not change the intent of the project. Any reallocation should be reported to the Executive Committee;

(iii) Funding of up to a maximum of 25 per cent above the cost effectiveness threshold will be provided for projects when needed for the introduction of low global warming potential (GWP) alternatives;

HCFC phase-out in the foam sector

(iv) Incremental operating costs for projects in the **polyurethane** foam sector will be considered at US $1.60/metric kilogram for HCFC-141b and **in the extruded polystyrene foam sector** at US $1.40/metric kilogram for **HCFC-142b, HCFC-142b/HCFC-22, or HCFC-22,** consumption to be phased out at the manufacturing enterprise;

(v) For group projects linked to systems houses, incremental operating costs will be calculated on the basis of the total HCFC consumption to be phased out for all downstream foam enterprises;

(vi) The Executive Committee will consider, on a case-by-case basis, funding higher levels of incremental operating costs than indicated in paragraph (f)(iv) above when required for the introduction of low-GWP ~~water-blown~~ technology **other than hydrocarbon-based technologies**;

HCFC phase-out in the refrigeration and air-conditioning manufacturing sector

(vii) Incremental operating costs for projects in the air conditioning sub-sector will be considered at US $6.30/metric kilogram of HCFC consumption to be phased out at the manufacturing enterprise;

(viii) Incremental operating costs for projects in the commercial refrigeration sub-sector will be considered at US $3.80/metric kilogram of HCFC consumption to be phased out at the manufacturing enterprise;

(ix) Consistent with decision 31/45 of the Executive Committee, incremental operating costs will not be considered for enterprises categorized under the refrigeration equipment assembly, installation and charging sub-sector;

HCFC phase-out in the refrigeration servicing sector

(x) Article 5 countries that have total HCFC consumption of up to 360 metric tonnes, **and former low-volume-consuming (LVC) Article 5 countries with HCFC consumption in the refrigeration servicing sector only that was above 360 metric tonnes,** must include in their HPMP, as a minimum:

a. A commitment to meeting, without further requests for funding, at least ~~the freeze in 2013 and the 10 per cent reduction step in 2015, and if the country so decides,~~ the 35 per cent reduction step in 2020, **and if the country so decides, the 67.5 per cent reduction step in 2025 or the complete phase-out of HCFCs ahead of the Montreal Protocol schedule**. This shall include a commitment by the country to restrict imports of HCFC-based equipment if necessary to achieve compliance with the reduction steps and to support relevant phase-out activities;

b. Mandatory reporting, by the time funding tranches for the HPMP are requested, on the implementation of activities undertaken in the refrigeration servicing sector and in the manufacturing sector when applicable, in the previous year, as well as a thorough and comprehensive annual work plan for the implementation of the activities associated with the next tranche;

c. A description of the roles and responsibilities of major stakeholders, as well as the lead implementing agency and the cooperating agencies, where applicable;

(xi) Article 5 countries that have total HCFC consumption of up to 360 metric tonnes will be provided funding consistent with the level of consumption in the refrigeration servicing sector as shown in the table below, on the understanding that project proposals will still need to demonstrate that the funding level is necessary to achieve the ~~2013 and 2015~~ **2020 and 2025** phase-out targets, and if the country so decides, the ~~2020 phase-out targets~~ **complete phase-out of HCFCs**:

~~Consumption (mt)*~~	~~Funding up to 2015 (US$)~~	~~Funding up to 2020 (US$)~~
~~>0 <15~~	~~51,700~~	~~164,500~~
~~15 <40~~	~~66,000~~	~~210,000~~
~~40 <80~~	~~88,000~~	~~280,000~~
~~80 <120~~	~~99,000~~	~~315,000~~
~~120 <160~~	~~104,500~~	~~332,500~~
~~160 <200~~	~~110,000~~	~~350,000~~
~~200 <320~~	~~176,000~~	~~560,000~~
~~320 <360~~	~~198,000~~	~~630,000~~

~~(*) Level of baseline HCFC consumption in the refrigeration servicing sector~~

Consumption (mt)*	**Funding up to 2020 (US$)**	**Funding up to 2025 (US$)**	**Total phase-out (US$)**
>0 <15	**164,500**	**317,250**	**470,000**
15 <40	**210,000**	**405,000**	**600,000**
40 <80	**280,000**	**540,000**	**800,000**
80 <120	**315,000**	**607,500**	**900,000**
120 <160	**332,500**	**641,250**	**950,000**
160 <200	**350,000**	**675,000**	**1,000,000**
200 <320	**560,000**	**1,080,000**	**1,600,000**
320 <360	**630,000**	**1,215,000**	**1,800,000**

(*) Level of HCFC baseline consumption in the refrigeration servicing sector

(xii) Former LVC Article 5 countries with HCFC consumption in the refrigeration servicing sector only that was above 360 metric tonnes will be provided funding for phase-out activities at US $4.50/metric kilogram;

(xiii) Article 5 countries that have total HCFC consumption of up to 360 metric tonnes **and former LVC Article 5 countries with HCFC consumption in the refrigeration servicing sector only that was above 360 metric tonnes** ~~and that receive funding consistent with the above table,~~ will have flexibility in utilizing the resources available to address specific needs that might arise during project implementation to facilitate the smoothest possible phase-out of HCFCs;

(xiv) Article 5 countries that have total HCFC consumption of up to 360 metric tonnes, used in both the manufacturing and refrigeration servicing sectors, could submit HCFC phase-out investment projects in accordance with prevailing policies and decisions of the Multilateral Fund, in addition to funding for addressing HCFC consumption in the servicing sector;

(xv) Article 5 countries that have total HCFC consumption above 360 metric tonnes **used in both the manufacturing and refrigeration servicing sectors** should

first address consumption in the manufacturing sector to meet the reduction steps in ~~2013 and 2015~~ **2020 and 2025**. However, if such countries clearly demonstrate that they require assistance in the refrigeration servicing sector to comply with these targets, funding for these activities ~~such as training,~~ will be calculated at US$4.50/metric kilogram, which will be deducted from their starting point for aggregate reductions in HCFC consumption;

HCFC phase-out in the aerosol, fire extinguisher and solvent sectors

(xvi) The eligibility of incremental capital and operating costs for HCFC phase-out projects in the aerosol, fire extinguisher and solvent sectors will be considered on a case-by-case basis.

Annex I

COMMENTS ON THE CRITERIA FOR FUNDING THE HCFC PHASE-OUT IN THE CONSUMPTION SECTOR FOR STAGE II OF HCFC PHASE-OUT MANAGEMENT PLANS

AUSTRALIA

1. Australia believes that the existing criteria for funding the HCFC consumption phase-out, including decision 60/44 and complementary decisions taken by the Executive Committee are generally adequate and should be applied to subsequent stages of HPMPs with some relatively minor adjustments. We note that the Secretariat has indicated that Stage II and later stages will be easier to undertake, given the large amount of work already undertaken for preparation and implementation of Stage I HPMPs.

2. We note that the thorough analysis prepared by the Secretariat for the 70th and 71st meetings suggests that application of the existing criteria and guidelines has resulted in the approval of stage I HPMPs for almost all Article 5 countries in a cost-effective and equitable manner. Furthermore, progress reports on initial HPMP tranches usually indicate that the funding approved is enabling the implementation of planned activities to reduce HCFCs in line with targets and commitments contained in HPMP Agreements.

3. As indicated in document 72/39, "the Secretariat and all the implementing agencies considered and that criteria and guidelines currently in place could continue to be used when submitting new proposals, on the understanding that they could be further developed as new policy issues arose from their review". In that regard, it should be recognized that the Executive Committee has been able to take into account specific circumstances not foreseen by the criteria through the application of additional guidance when considering projects on a case-by-case basis.

4. While some arguments were made at the 72nd meeting that the criteria should be changed to allow sufficient funding for transition from HCFCs in small enterprises and towards low-global warming potential (GWP) alternatives, Australia believes that the current cost effectiveness thresholds should be adequate in most cases to meet such objectives. In fact, the current cost effectiveness thresholds, taking into account the 25% additional funding for low-GWP alternatives, are higher than the requested costs of conversion under most HPMPs, and significantly higher than the average cost effectiveness of projects in approved HPMPs, as calculated by the Secretariat in document 71/57:

Sector	**CE thresholds**	**CE thresholds with 25% for low-GWP alternatives**	**Average CE of approved HCFC projects**
Foam - Rigid polyurethane	$7.83/kg	$9.79/kg	$5.63/kg
Foam-XPS	$8.22/kg	$10.23/kg	$4.09/kg
Commercial refrigeration	$15.21/kg	$19.01 /kg	$7.50/kg (for both refrigeration and AC)

5. In the case of incremental operating costs (IOCs), it is possible that the IOCs for HCFC-141 b in PU foam ($1.6/kg) and HCFC-22/HCFC-142b in XPS foam ($1.4/kg) may not allow adequate consideration of emerging low-GWP alternatives. For this reason, Australia could support the Secretariat's recommendation to amend paragraph (d)(vi) of the criteria in decision 60/44 to enable consideration, on a case-by-case basis, higher IOCs in the foam sector for new emerging technologies based on unsaturated HFCs.

- However, Australia does not think it is useful to specify particular technologies under the guidelines. Taking into account that the current IOCs were determined based on average IOCs of hydrocarbons, Australia suggests replacing the text in paragraph (d)(vi), "*for the introduction of low-GWP water-blown technology or new emerging technologies based*

on unsaturated HFCs" by "*for the introduction of low-GWP technology other than hydrocarbon-based technologies"*.

6. In terms of other revisions and updates to the criteria of decision 60/44, Australia believes that the modifications proposed by the Secretariat in document 72/39 are appropriate and adequate, except for two elements:

(a) Firstly, with respect to paragraph (b) on second-stage conversions, Australia supports retaining the eligibility of second-stage conversions to projects necessary to comply with the 35% reduction step in 2020, instead of the 67.5% reduction step in 2025. The logic of the 2020 date, at the time the criteria were adopted in 2010, was that by 2020, most foaming equipment would reach its end-of-life and need to be replaced anyway. Furthermore, by that time, most foaming machines manufactured and on the market would function with substances other than HCFCs, so that incremental capital costs would essentially be nil by 2020. Although IOCs may remain, Australia still believes that the current guidance represents an adequate compromise between those ExCom members who supported only limited funding for second-stage conversions and those who supported full funding for such conversions.

(b) Secondly, Australia does not believe it is useful to include the new paragraph (c) on accelerated phase-out for non-low volume consuming (non-LVC) countries, as it may be perceived as an encouragement to such countries to submit proposals for accelerated phase-out, when it is uncertain whether sufficient funds will be available to support such efforts. Ideally, it is of course desirable if all countries phased out HCFCs faster than required under the Montreal Protocol, but the priority of the MLF should be to ensure that all Article 5 countries receive assistance to meet their agreed incremental costs of complying with the existing phase-out schedule. Should sufficient funds be available, and compelling cases be made for accelerated phase-out (including the possibility of achieving better cost effectiveness), then the ExCom has the flexibility to consider such proposals anyway. It has already done so on a case-by-case basis for stage I HPMPs in non-LVC countries, without the need for a specific policy on this issue.

CHINA

7. The 72nd meeting of the Executive Committee decided to invite Executive Committee members to submit to the Secretariat, by June 30 2014, any additional information they considered necessary to complete the information already contained in document UNEP/OzL.Pro/ExCom/72/39. As the member of the Executive Committee in 2014, we have the following comments:

(a) According to decision XIX/6, the Parties are encouraged to select alternatives to HCFCs that minimize environmental impacts, in particular impact on climate, as well as meeting other health, safe and economic considerations. The stage I HPMP guideline provides up to a maximum of 25% above the cost effectiveness threshold for introduction of low-GWP alternatives. Currently low-GWP alternatives in many sectors are still not mature. Although there are a few low-GWP alternatives in some sectors, Article 5 countries are still faced with a lot of difficulties and challenges on technology and funding support, and a maximum of 25% above the threshold is not enough for Article 5 countries to introduce low-GWP alternatives. We suggest the Secretariat consider difficulties and challenges of introduction and application of low-GWP alternatives in Article 5 countries and propose an indicative cost for low-GWP alternative technologies based on information from demonstration projects to encourage Article 5 countries to introduce low-GWP alternatives.

(b) To achieve the 2013 freeze and 2015 10% reduction target, stage I HPMP of Article 5 countries mainly focused on large enterprises, whose conversion is relatively cost-effective. However, Article 5 countries have to face with more and more small-and-medium sized enterprises (SMEs) at stage II and beyond. SMEs have weaker technology capability and even limited financial resources compared with those large enterprises; therefore conversion cost for SMEs will be much higher than that of large enterprises, particularly where low-GWP alternatives are introduced. So far as we know all beneficiary enterprises provides counterpart funding for their conversion at stage I as the funding provided by the MLF is not enough. If the funding criteria for stage II HPMP could not provide sufficient financial support to cover actual conversion cost of SMEs, SMEs would not be willing to carry out conversion, which will directly affect achievement of the 35% reduction target of stage II as well as subsequent compliance targets in Article 5 countries. We hope more consideration could be given to the conversion cost of SMEs using low-GWP alternatives in the manufacturing sectors.

(c) For stage II HPMP, the servicing sector will be faced with more difficulties and challenges than Stage I, which is mainly caused by diversity of alternative technologies, such as pressure of low-GWP alternatives, flammability issues etc. At stage II the sector will have to carry out not only routine activities like recovery and recycling but also some additional activities like alternative technology research, dissemination and demonstration of alternative technologies etc. The cost effectiveness threshold for the servicing sector of stage I is not enough compared to the real needs of Article 5 countries and the MLF should provide more support for servicing sector at stage II.

(d) The cut-off date at stage I HPMP funding criteria is 21 September, 2007, which is the date when the accelerated HCFC phase-out adjustment is approved. However, policies to control HCFC production and consumption in Article 5 countries are usually issued after 21 September, 2007. Currently a number of enterprises established after that date have developed very well, which we think should be incorporated into conversion activities at stage II. We hope that there could be some flexibility in funding production lines established after 21 September, 2007 at stage II.

(e) According to decision XIX/6, the ExCom should give priority to cost-effective projects and programs which focus on phasing-out first those HCFCs with higher ODP taking into account national circumstances. For stage II, most Article 5 countries should phase out an additional 25% of their baseline, and the large amount to be addressed is quite challenging for Article 5 countries. We think the ExCom should give full consideration of specific circumstances of each Article 5 country instead of considering ODP value only.

(f) For the stage I HPMP, incremental operating cost (IOC) is not encouraged to be used for funding enterprises. However, for some specific alternatives, the standard in the stage I HPMP guideline is far from enough to cover the actual IOC and we hope IOC standard at stage II could be increased when some specific alternative technologies are introduced.

(g) According to stage I HPMP guideline, for group projects linked to system houses, incremental operating cost will be calculated on the basis of the total HCFC consumption to be phased out at the manufacturing enterprises. In the foam sector, conversion of system house is an important way to solve HCFC phase-out in small-and-medium sized enterprises at stage II. More considerations should be given to funding system houses at stage II HPMP criteria.

JAPAN

8. We would like to reiterate Japan's position expressed at the previous meetings that the cost guidelines for HPMP stage I should be applied to HPMP stage II with minimum update and we do not support reopening the discussions on the existing guidelines. In the next Executive Committee meeting, we would expect that Executive Committee considers whether the proposed revisions by the Secretariat in document UNEP/OzL.Pro/ExCom/72/39 are appropriate or not.

9. As for the additional information which is necessary to complete the information already contained in document UNEP/OzL.Pro/ExCom/72/39, there is no specific information added from our side, but we think some brief supplementary information or reference to existing documents on the following is useful:

> Regarding the insertion of "new emerging technologies based on unsaturated HFCs" in para 10 (d)(vi), information on the prospects of deployment of the technology in Article 5 countries and its technical and cost related issues to be considered.

THE UNITED STATES OF AMERICA

10. Decision 72/39 invites Executive Committee members to submit to the Secretariat, by 30 June 2014, any additional information they considered necessary to complete the information on criteria for funding HCFC phase-out in the consumption sector for stage II HPMPs already contained in document UNEP/OzL.Pro/ExCom/72/39. Below is additional information the United States would like reflected in a new document to be presented to the Executive Committee at its 73rd meeting per decision 72/39:

(a) Previous experience in the MLF has shown that costs decrease over time as technology develops, experience and know-how increases, and seemingly new technologies become standard technology choices. As noted in UNEP/OzL.Pro/ExCom/54/54: "in case of CFC-phase-out, capital costs, but even more so the costs of items related to IOC (compressors, oils, refrigerants), usually decreased over time, and showed also significant variations in different markets." A footnote in that same document also states that "For example, the price of HCFC-141b dropped from US $5.45/kg in 1993 to US $3.40/kg in 1998, a reduction that is typical of pricing trends once a product is introduced, production is optimised, economies of scale increase and competition becomes established in the marketplace. Enterprises that received funding in 1993 when the price of HCFC-141b was at US $5.45/kg were overcompensated for the incremental operating costs that they actually incurred (UNEP/OzL.Pro/ExCom/36/34)". It would be helpful if the Secretariat provides estimates of the historic experience we have had of costs decreasing over time for different sectors and applications.

(b) The Executive Committee has provided technical assistance for systems houses to a number of Article 5 parties. As noted in that UNEP/OzL.Pro/ExCom/71/57, it is expected that such technical assistance will lead to reduced costs, particularly for SMEs: "through the systems house approach, it is expected that the demand for HCFC-141b, particularly by a large number of small and medium size enterprises (SMEs), will be substantially reduced, and that the overall cost of the conversion will also be reduced, as many enterprises will choose to convert to one of the non-HCFC-based formulations even before stage II commences." It would be useful for the Secretariat to provide some estimates of what level of savings can be expected. For example, UNEP/OzL.Pro/ExCom/66/38 notes that "by providing the technical assistance to systems houses as proposed in stage I, the costs for converting the SMEs can be reduced by up to 50 per cent, and substantial savings can also be realized in the remaining foam enterprises." Further elaboration of the expected savings, particularly for SMEs, would be

welcome because the point of providing resources to systems houses was to ease the transition of SMEs.

(c) We note that UNEP/OzL.Pro/ExCom/71/57 includes information on conversions in SMEs. For example, Table 2 includes information on conversions in Kuwait, and the Philippines. The cost effectiveness of those projects varied between US $2.22/kg and US $5.34/kg, and those conversions were to low-GWP alternatives. So already in Stage I, we have examples of highly cost-effective transitions for SMEs that should only get easier as we look toward Stage II proposals.

(d) We want to emphasize the importance of collecting actual incurred, eligible incremental costs and the difficulty of reliably collecting that data. We recall the "difficulties the Secretariat encountered in determining whether all the costs incurred were eligible incremental costs as per the approved project proposals, and that the agencies also had difficulties in providing the required information." (para 6, document 72/29). The Secretariat should be careful to cross check the data to ensure its validity and distinguish between eligible incremental costs and other costs, such as possible changes to the configuration of the converted enterprise, and possible upgrades and expansions in the technology.

(e) We want to emphasize that it would NOT be appropriate to include the costs of demonstration projects when determining average costs of conversions. Demonstration projects, as their name suggests, serve a particular purpose: to demonstrate a new technology. The Executive Committee approves such projects on a case-by-case basis because, among other issues, the costs of those projects will vary on a number of factors. Those projects will have additional costs that will not be incurred in "regular" conversion projects, for example in taking on challenges inherent in new technology, as well as in conducting the project itself in a way that goes well beyond normal project requirements by including, for example, additional testing, optimization, or prototyping of new equipment. As a general matter, demonstrations should cost significantly more to implement than a conversion project of the same technology, and therefore they should generally not be used as a basis for cost comparison of simple conversion projects.

11. We note that per decision 70/21(e), Article 5 Parties can continue to submit and implement stage II projects with the existing guidelines. Should the Secretariat include draft revised criteria for funding in its new document, as it did in document 72/39, we suggest that no changes beyond those proposed in that document be made. Moreover, we suggest the following changes be made so as to reduce the number of unnecessary changes:

(a) Do not make the changes suggested in paragraph (b)(i) regarding to second-stage conversions.

(b) Do not make the changes suggested in (d)(xiii).

(c) Do not add paragraph (c).

URUGUAY

Introduction

12. In relation to the guidelines of HCFC consumption for the stage II, it is considered that they should necessarily take into account the experiences of implementing projects in stage I. This means, analyzing the different difficulties encountered by the countries during the implementation of the

activities, their own situation in relation to the availability of alternatives, the funding provided (US $/kg) in each sector, and the difficulty in the introduction of new technologies.

13. In particular, through the activities implemented in stage I, we can draw some considerations:

In service and maintenance sector

14. In this subsector we must consider that the alternatives to HCFCs available in our region are notoriously more expensive than HCFCs (especially R-22), which can be purchased for about U$S 5/Kg or less, while the cost of the cheaper alternative is almost double. Beside this, the management of these alternatives is more complex than the R-22 (zeotropic mixtures, flammability, etc.).

15. At the same time, and taking into account the recommendations of the Secretary of the Executive Committee, it should strengthen the security issue, especially when working with training in the use of new equipment using flammable refrigerant is needed, and more even for the case that a country chooses "drop-in or retrofitting" activities in using this technology. This issue should been considered when analyzing others naturals and definitive alternatives like ammonia, CO_2 in cold facilities.

16. Another important issue to be taken into account is the fact that the equipment which uses alternatives refrigerants has increasingly technology, which must be added to the training topics such as inverter technology, refrigerant variable volume of, electronics controls in cooling and air conditioning, etc.

17. Regarding to flushing sub-sector, in stage I of the HPMP is not in sight any (chemical) alternative to replace in fact the R-141b, and those which comprehensive information has been obtained, were found to be significantly more expensive. In the case of the use of equipment that recycle the R-141b (and others), the cost of each one is also very high (approximately US $1,200 in the destination country). This makes it impractical for most technicians, and if we are thinking of an incentive plan, the costs are quite high. Therefore, it is estimated that the costs of future activities for the elimination of R-141b in stage II, would also significantly more elevated.

Observations

18. Regarding the key consideration to minimize adverse climate impacts in the servicing sector from decision 72/41, it becomes necessary to review the cost-effectiveness threshold for this sector. Especially having in mind that for most A5 countries the refrigeration servicing sector will be the largest or the single consumer of HCFC turning it in a crucial issue for the second phase of HPMP for A5 countries, and also considering that consumption reduction schedules have already begun and the first conversion projects in the sectors of manufacturing are finishing[64].

In the foam sector

19. There are three critical points to take into account for the funding guidelines in the second HPMP stage:

[64] One proposal in that sense is a minimal funding for all countries operating under A5 and required to remove a maximum of 20 metric tons to achieve targets beyond the 35% reduction from HCFC baseline. If all other countries range beyond 20 metric tons, funding should be calculated with a minimum of US$ 6.00 / kg metric. Additionally, for projects of HCFC consumption elimination with strategies to reduce the adverse climate impacts in the servicing sector funding shall be provided up to 30% above the previous threshold. Finally countries should have flexibility in the use of the available resources to address specific needs that might arise during project implementation.

(a) Eliminate the ceiling limit of 1.60 dollars per kg for the Incremental Operating Costs (IOC) in the PU foam sector (Decision 60/44). The reasons are as follows:

20. The vast majority of developing countries will address in the second stage the conversion of small and medium enterprises (SMEs). The large enterprises, found in applications such as domestic refrigeration and continuous panels, were or are being converted in the first stage.

21. Typical characteristics of the SMEs in the foam sector found in applications such as commercial refrigeration, discontinuous panels, pipe insulation and spray, are their reliability on local system houses, their very limited technical capacity, and their poor safety standards. The introduction of flammable options to replace HCFC-141b (hydrocarbons, methylal, methyl formate) in this SME sector necessarily involves a safety risk. As illustration: in the developed countries (US, Europe, Japan) flammable products are not used for spray because of safety. The blowing agents used in SMEs in the developed world are carbon dioxide (all water blown systems) and saturated HFCs (HFC-245fa, HFC-365mfc/ HFC-227ea).

22. In consequence the low-GWP options that we have for SMEs in developing countries are carbon dioxide (all water blown foam) and the unsaturated HFCs, also called HFOs. All these three alternatives (water, HFOs and saturated HFCs) have a major drawback, the high unitary cost (US$ per kg of blowing agent) that significantly raises the incremental operating costs. In the same file a graph illustrates the influence of the polyol and isocyanate costs on the IOC for all water blown systems. If the polyol and iso cost is US $4.00/kg, situation that is not unusual in SMEs, the IOC goes up from US $3.89/kg to US $6.06/S$/kg of HCFC-141b. Opposite to the large enterprises SMEs do not have the purchase power to negotiate low costs of polyol and iso.

(b) Increase the threshold values of the cost effectiveness factors. The reasons:

23. The current values were defined in the 16th meeting, held in March 1995. 19 years ago. The value of US $9.79/kg for PU rigid foam would correspond today to US $13.72/kg according to the GDP deflator and to US $15.29/kg using the CPI deflator. The inflation is obviously reflected in the current price of the polyurethane equipment.

24. As it was mentioned before the second stage conversion in most of the developing countries will be concentrated on SMEs. They are affected by the detrimental economy of scale for the new options implementation and this difference should be considered in the definition of the cost effectiveness factors.

25. The table in the attached file shows the cost of chemicals in one square meter of a sandwich panel for the different options. The cost for cyclopentane (preferred option of the large enterprises) is US $12.80/m^2 meanwhile the cost for CO_2 and unsaturated HFCs (non flammable options for SMEs) are US $13.86/m^2 and US $15.66/m^2 respectively.

(c) A third crucial point is to allow second conversions until 2025

26. First, do not limit the second-stage conversions, considering the compliance targets of the countries and its cost-effectiveness, but also considering other factors such as the difficulty of selecting only some companies within an industry, which could distort local market conditions affecting the competitiveness.

27. Also because companies that have eliminated the CFCs consumption and have converted to of HCFC technology, they have committed to achieve full HCFCs elimination without the assistance of Multilateral Fund, within initial phase-out schedule until 2040. Subsequently Decision XIX/6 related to accelerated phase-out of HCFC was based on the understanding that all companies that received funding for HCFC technology conversion would be eligible for second-stage conversion projects.

(d) Accelerated phase-out of HCFCs

28. It is not appropriate to propose a fixed progress for all A5 countries, given that countries progress according to local realities. A fixed progress would not solve the challenges pending in the elimination of HCFC consumption and previous experiences have shown that progress depends on the country's own circumstances and suitable technology selection.

(e) HCFC phase-out in the refrigeration and air-conditioning manufacturing sector[65]

29. Remove all constraints on the existing guidelines and allow funding for projects under the refrigeration equipment assembly, installation and charging sub-sector taking into account that assembly tasks, initial loading and startup of new refrigeration equipment have important impacts on the progress of reducing the consumption of HCFCs (especially favoring the election of a new technology) and that initial refrigerant charge range between 20 and 60% of the HCFC consumption (from the refrigeration servicing sector perspective).

Others considerations

30. Very few low GWP technologies are mature nowadays and HFC technologies are currently the cheapest alternative option at least in the RAC sector, and there are major concerns in many markets on the introduction of new technologies. Nevertheless ExCom is pushing for low-GWP and is reluctant to approve HFC alternatives.

31. The duration of the IOC should be increased significantly, since 1 year is not enough to introduce the new alternatives to the market and the price of the units with new alternatives will be much higher for several years. For this reason, if the ExCom wants to push further low-GWP alternatives, **IOC should be increased to 4 years** as it was the case in the early phases of the MP. The **additional of 25% C/E for low-GWP alternatives should also be increased**. If such measures are not taken and the ExCom continues to disapprove HFC projects, countries won't be ready to go for low-GWP and at the end, due to the reduced quotas in the next 5-10 years, manufacturers in Article 5 countries would have to convert on their own to HFCs due to market forces without MLF funding, or they may be forced to non-compliance. Projects being implemented in Stage I have demonstrated that conversion of the foam part of commercial refrigeration enterprises using cyclopentane have been around 40% over the CE + 25%.

32. So if the ExCom wants Article 5 countries to adopt low-GWP alternatives leapfrogging the use of HFCs, there should be **significant incentives** to convince manufacturers to make this step. It would also be important to request **additional funding for the phase-out of HCFC in SMEs** in Stage II and future.

33. At this time, the use of methyl formate or methylal is not supported for rigid PU insulating foam applications, particularly because of its long-term performance on thermal conductivity or dimensional stability, and questions regarding corrosion of equipment. In addition, methyl formate is flammable. Methyl formate is, however, considered to be proven only for use in integral skin PU foams for transport and furniture applications.

Conclusions

34. Therefore these considerations make it necessary a review of the guidelines of the stage I, since the difficulty in the introduction of new technologies. (It is good to remember that the word "available" means: "economically and technically available").

[65]ExCom 70/52. Annex II. Relevant decisions on HCFC phase-out in the consumption sector. 19. HCFC phase-out in the refrigeration and air-conditioning manufacturing sector65 (item x)

35. In the other hand, one of the main consequences of the above considerations is the increased in the complexity and the costs in all the activities, especially in the training of technicians.

	141b	**C-pentane**	**Water**	**Methyl Formate**	**HFC-365mfc/HFC-227ea blend**	**HFC-245fa**	**1233zd(E) 50 % reduced**	**1233zd(E) 60% reduced**	**1336 mzzm(Z) 50% reduced**	**1336 mzzm(Z) 60% reduced**
Molecular Weight	117.0	70.1		60.0	149.4	134.0	130.5	130.5	164.0	164.0
Cost of blowing agents, (USD/kg)	2.6	2.6	0.0	3.0	14.0	12.0	17.0	17.0	17.0	17.0
Cost of Polyol (USD/kg)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Cost of MDI (USD/kg)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Polyol	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Blowing agent	22.0	13.2	0.0	11.3	19.7	17.6	12.3	9.8	15.4	12.3
MDI	134.2	124.5	160.0	122.4	131.6	129.4	123.5	120.8	127.0	123.6
Subtotal	256.2	237.7	260.0	233.7	251.3	247.0	235.8	230.6	242.4	235.9
Total foam cost (USD/kg)	2.97	2.98	3.00	3.00	3.86	3.64	3.73	3.60	3.89	3.73
BA per kg foam (%)	0.09	0.06	0.00	0.05	0.08	0.07	0.05	0.04	0.06	0.05
Applied density kg/m3	42.00	43.00	46.20	46.20	42.00	42.00	42.00	42.00	42.00	42.00
Total foam cost per m3 (USD/m3 of foam)	124.56	128.05	138.60	138.60	162.16	152.99	156.60	151.03	163.41	156.75
BA per m3 (kg/m3)	3.61	2.38	0.00	2.23	3.29	3.00	2.19	1.79	2.67	2.20
Incremental Operating Cost, IOC, USD/kg HCFC-141b		**0.97**	**3.89**	**3.89**	**10.43**	**7.88**	**8.88**	**7.34**	**10.77**	**8.92**
Polyol cost/kg of foam	1.17	1.26	1.15	1.28	1.19	1.21	1.27	1.30	1.24	1.27
BA cost/kg of foam	0.22	0.14	0.00	0.14	1.10	0.86	0.88	0.72	1.08	0.89
MDI cost/kg of foam	1.57	1.57	1.85	1.57	1.57	1.57	1.57	1.57	1.57	1.57
Weight per m2 for 100 mm thick panel, kg	4.2	4.3	4.62	4.62	4.2	4.2	4.2	4.2	4.2	4.2
Cost of chemicals per m2 (USD)	**12.46**	**12.80**	**13.86**	**13.86**	**16.22**	**15.30**	**15.66**	**15.10**	**16.34**	**15.67**
Difference versus 141b system per m2/usd	0.00	0.35	1.40	1.40	3.76	2.84	3.20	2.65	3.88	3.22
