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**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))**

**CRITERIA FOR FUNDING HCFC PHASE-OUT IN THE CONSUMPTION SECTOR
ADOPTED BY DECISION 60/44**

1. At the 69th meeting the Secretariat was requested to prepare an information document for the 70th meeting to assist the Executive Committee in reviewing the criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44, including an analysis of the cost-effectiveness of projects approved so far, as well as the division of costs between incremental operating costs and incremental capital costs (decision 69/22(b)). At the same meeting, the Secretariat was also encouraged to consider options to ensure: that the level of funding for the first year of stage II would meet the 20 per cent disbursement threshold, and that subsequent tranches were considered in light of the need for cash and the likelihood of reaching the 20 per cent disbursement threshold (decision 69/24(d)).

2. At the 70th meeting, the Executive Committee considered the document prepared by the Secretariat pursuant to decisions 60/44, 69/22(b) and 69/24(d) and, *inter alia*, requested the Secretariat to include information regarding incremental capital and operating costs incurred under stage I of HCFC phase-out management plans (HPMPs) that would be provided by relevant bilateral and implementing agencies, in a revised document to be submitted to the 71st meeting (decision 70/21 (b) and (c)).

3. The present (revised) document consists of the following parts:

I. Introduction

The mandate given to the Secretariat by the Executive Committee, the sources used to develop the present document

II. Analysis of decision 60/44

An analysis of the implementation of decision 60/44, based on other relevant decisions adopted by the Executive Committee, and on the experience gained through the preparation and approval of HPMPs in Article 5 countries

- Cut-off date
- Second-stage conversion
- Starting points for aggregate reductions in HCFC consumption
- Eligible incremental costs of HCFC phase-out projects
 - HCFC phase-out greater than the 10 per cent reduction required by 2015
 - Cost-effectiveness thresholds
 - Analysis of HCFC phase-out in the foam manufacturing sector
 - Analysis of HCFC phase-out in the refrigeration and air-conditioning manufacturing sector
 - Analysis of HCFC phase-out in the refrigeration servicing sector
 - An analysis of HCFC phase-out in other sectors
 - Impacts on the environment including on the climate

III. A brief analysis of the implementation of the HPMPs

Indicates the amounts of each HCFC funded for phase-out and the remaining consumption eligible to be funded in future stages of the HPMPs

- HPMPs approved for LVC countries
- HPMPs approved for non-LVC countries
- Article 5 countries without an approved HPMP
- HCFC phase-out in the production sector

IV. An overview of HCFC consumption eligible for phase-out in subsequent stages of HPMPs

Includes a preliminary discussion on potential options to ensure that the level of funding

for the first year of stage II of HPMPs will meet the 20 per cent disbursement threshold, and that subsequent tranches will be considered in light of the need for cash and the likelihood of reaching the threshold, based on the experience gained during implementation of the first few tranches of HPMPs.

- HCFC to be phased out in approved HPMPs
- Potential options to ensure that the level of funding meets the 20 per cent disbursement threshold

Observations

- Current status of HPMPs
- Criteria set out in decision 60/44 in the context of stage II of HPMPs
- Incremental cost analysis
- Alternative technologies and their potential use in Article 5 countries
- Flammable alternative technologies

Recommendation

4. The document is supported by the following annexes:

Annex I	An overview on HCFC production and consumption (updated)
Annex II	Relevant decisions on HCFC phase-out in the consumption sector
Annex III	Reference to meeting documents of agreements between relevant governments and the Executive Committee for the phase-out of HCFC in the consumption sector
Annex IV	Report on ODS approved for phase-out in stage I of HPMPs (updated as of the 70 th meeting)
Annex V	Summary of results so far achieved from the approved HCFC demonstration projects

I INTRODUCTION

5. At their 19th meeting (September 2007), the Parties agreed to accelerate the phase-out of HCFCs through an adjustment to the Montreal Protocol¹, and gave a mandate to the Executive Committee to develop funding guidelines to assist Article 5 countries to meet their commitments in accordance with the adjusted schedule (decision XIX/6). At its 53rd meeting (November 2007), the first meeting after the adoption of decision XIX/6 of the Parties, the Executive Committee started intense and complex discussions on policies for phasing out HCFCs in the consumption and production² sectors, which concluded with the adoption of several policies and guidelines to address the mandate given by the Parties.

6. Of particular importance were the criteria for funding HCFC phase-out in the consumption sector in Article 5 countries (decision 60/44) adopted at the 60th meeting (April 2010). The criteria set out in decision 60/44 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

¹ For Article 5 Parties, the accelerated phase-out of production and consumption of HCFCs was agreed on the basis of the following steps: freeze in 2013; 10 per cent reduction by 2015; 35 per cent by 2020; 67.5 per cent by 2025; allowing for servicing an annual average of 2.5 per cent during the period 2030-2040.

² Policy documents on HCFC phase-out in the production sector have been discussed at the 55th (UNEP/OzL.Pro/ExCom/55/45), 56th (UNEP/OzL.Pro/ExCom/56/57), and 57th (UNEP/OzL.Pro/ExCom/57/61) meetings.

conversions³, and eligible incremental costs of HCFC phase-out projects. The decision also explicitly included a review by the Committee of second-stage conversions “no earlier than the last meeting in 2013”, and of eligible incremental costs of HCFC phase-out projects “in 2013”. The Secretariat was planning to submit a document in response to decision 60/44 to the 71st meeting (i.e., the last meeting in 2013). However, at the 69th meeting the Secretariat was requested to prepare an information document for the 70th meeting on this matter.

7. The Secretariat prepared the information document UNEP/OzL.Pro/ExCom/70/52 in response to decisions 60/44, 69/22(b) and 69/24(d). The purpose of the document was to better inform the Executive Committee on the current status of policy development on the one hand, and the implementation of HCFC phase-out based on the criteria set out in decision 60/44, on the other. It drew on an array of sources from the period of five and a half years from the adoption of decision XIX/6 in September 2007 until the conclusion of the 69th meeting in April 2013. These included the numerous policies and guidelines for the phase-out of HCFCs that have been adopted, the funding approvals for the preparation of stand-alone demonstration and investment project proposals, as well as for the preparation of HPMPs in 145 Article 5 countries, and funding approvals for tranches of stage I HPMPs for 138 Article 5 countries. The Secretariat also reviewed historical levels of HCFC consumption reported under Article 7 of the Montreal Protocol as well as through HPMPs⁴, all relevant decisions adopted by the Parties and the Executive Committee since the adoption of decision XIX/6, and the information contained in approved HPMPs.

8. As the criteria set out in decision 60/44 related to funding Article 5 countries for the phase-out of HCFC consumption, the Secretariat considered it relevant to include a brief overview of the consumption of HCFCs in Article 5 countries⁵, taking into consideration the changes introduced to the reported levels of consumption as a result of the preparation of HPMPs⁶, and the fact that HCFC baselines for compliance have already been established for 144 Article 5 countries⁷.

³ Second-stage conversion refers to the conversion of enterprises which have already received financial and/or technical assistance from the Multilateral Fund for converting from CFC-based to HCFC-based technologies.

⁴ Prior to the preparation of HPMPs, the sole source of data on the levels of HCFC consumption and production by Article 5 countries available to the Parties and the Executive Committee was that reported under Article 7 of the Montreal Protocol. However, during the preparation of HPMPs, discrepancies between the levels of consumption obtained from the surveys and those previously reported under Article 7 were found. For example, the Article 7 report issued in 2008 indicated HCFC levels of consumption in 2006 and 2007 of 24,897.6 ODP tonnes and 26,216.0 ODP tonnes, respectively, while the levels in the report issued in 2013 were 33,178.6 ODP tonnes and 37,569.7 ODP tonnes for the same years (see Annex III of the model rolling three-year phase-out plan: 2009-2011 (UNEP/OzL.Pro/ExCom/56/7)). This led a large number of Article 5 countries to submit a request to the Ozone Secretariat to change their previously reported data, also resulting in HCFC baseline revisions for 22 Article 5 countries, in line with decision XV/19.

⁵ Overviews of consumption and production of HCFCs have been included in several documents that have been considered by the Executive Committee: Preliminary discussion paper providing analysis on all relevant cost considerations surrounding the financing of HCFC phase-out (UNEP/OzL.Pro/ExCom/54/54); revised analysis of relevant cost considerations surrounding the financing of HCFC phase-out (UNEP/OzL.Pro/ExCom/55/47); second-stage conversions and determination of cut-off date for installation of HCFC-based manufacturing equipment (UNEP/OzL.Pro/ExCom/57/60, Annex I); updated model rolling three-year phase-out plan: 2010-2012 (UNEP/OzL.Pro/ExCom/59/7); updated model rolling three-year phase-out plan: 2011-2013 (UNEP/OzL.Pro/ExCom/62/7); draft guidelines for funding the preparation of stage II of HCFC phase-out management plans (UNEP/OzL.Pro/ExCom/69/33). An analysis of HCFC consumption and production is also contained in the documents on the status of implementation of delayed projects and prospects of Article 5 countries in achieving compliance with the next control measures of the Montreal Protocol (until the 66th meeting) and status report and compliance (since the 67th meeting) submitted to each meeting.

⁶ The list of all approved HPMPs including the reference to the meeting document when the agreements between the governments concerned and the Executive Committee were approved is contained in Annex III to the present document.

⁷ South Sudan, which ratified the Montreal Protocol on 12 January 2012 and all of its amendments on 1 January 2012, had not yet submitted HCFC consumption data under Article 7.

9. In fulfilling the Executive Committee's request, the Secretariat also considered it relevant to review the criteria in decision 60/44 in light of the Parties' and Executive Committee's decisions adopted in response to the Copenhagen Amendment to the Montreal Protocol⁸, as well as decisions addressing issues identified during the review of the HPMPs for 138 countries approved so far⁹, many of which were adopted subsequent to decision 60/44¹⁰.

10. The Secretariat also extracted information from project proposals that best demonstrate alternative technologies and facilitate the collection of data on incremental capital and operating costs in various applications (decision 54/40)¹¹. The views of implementing agencies on this matter were also taken into account. With regard to the "analysis of the cost-effectiveness of projects approved so far, as well as the division of costs between incremental operating costs and incremental capital costs", the Secretariat prepared a table listing most of the manufacturing enterprises to be converted from HCFC to non-HCFC technologies, which was sent to relevant bilateral and implementing agencies¹². The project data contained in the table, as revised by the bilateral and implementing agencies, was used for the cost-effectiveness analysis. The actual distribution of capital and operating costs at the enterprise level could not be provided in cases where the HPMPs were approved on a sector basis covering a large number of enterprises (e.g., the HPMP for Indonesia covering 21 enterprises manufacturing refrigeration and air-conditioning equipment, or the HPMP for Thailand covering 12 enterprises manufacturing air-conditioning systems).

Discussion of the document at the 70th meeting

11. During the discussion of document UNEP/OzL.Pro/ExCom/70/52¹³, several members said that the guidelines in decision 60/44 and subsequent policy decisions had served well in assisting Article 5 countries to prepare their HPMPs. One member said that there was merit in applying the existing guidelines to stage II, and dealing with any policy or other issues as they arose, in a continuous process of review. That solution would only require some updates of the details in the guidelines with regard to specific dates, and would enable the existing guidelines to meet the needs of individual parties in a timely manner. However, a number of members disagreed with that approach, saying that the guidelines needed to be comprehensively updated on the basis of previous and continuing experience in order to best serve the needs of Article 5 countries as they developed their stage II projects. As a first stage, data should be gathered on the incremental capital and operating costs of completed projects, so that any revision of the guidelines could be based on actual costs, rather than estimated costs. Some members said that, given the comprehensive review set out in the document, there was little scope to update it using additional data, and the limited, case-specific data thus far available could prove to be inadequate for drawing useful lessons for future project formulation. It was stressed that additional information might not provide a basis for making comparisons with the approvals of stage I HPMPs owing to the lack of cross-checking of

⁸ Adopted by the Parties at their 4th meeting in November 1992 (decision IV/4), which, *inter alia* introduced targets for production and consumption of HCFCs in Article 5 countries, namely the freeze in 2016 and the complete phase-out in 2040.

⁹ The HPMP for the Democratic People's Republic of Korea was deferred by the Executive Committee at its 68th meeting, and removed from UNEP and UNIDO business plans at its 69th meeting (decision 69/5(c)(iii)). The HPMP for the Syrian Arab Republic was noted by the Executive Committee at its 68th meeting; the country was encouraged to resubmit it at a future meeting when national conditions had improved (decision 68/38).

¹⁰ These decisions include: prioritization in the phase-out of HCFCs taking into account national circumstances to comply with the 2013 and 2015 control targets; accelerated phase-out of HCFCs beyond the 10 per cent required to be phased out by 2015; and the phase-out of HCFC-141b contained in imported pre-blended polyol systems.

¹¹ As of the 69th meeting, the Executive Committee had approved 16 demonstration projects at a total cost of US \$18,384,172.

¹² Data at the enterprise level was extracted from stand-alone projects approved prior to the 63rd meeting, individual projects included in approved HPMPs (with information at the enterprise level), as well as groups of projects approved under HPMPs (where the data at the enterprise level was extracted from the documents originally submitted by bilateral/implementing agencies).

¹³ Paragraphs 106 to 114 of document UNEP/OzL.Pro/ExCom/70/59.

the data, the possible changes to the configuration of the converted enterprise, and possible upgrades and expansions in the technology, among other factors. Several members opposed any revision to the present guidelines, and asserted their preference for a process whereby the Secretariat compiled the requested data on existing HPMP investment projects as a prerequisite for the formulation of stage II guidelines.

12. Subsequently, the Executive Committee *inter alia* requested relevant bilateral and implementing agencies to submit to the Secretariat, where available, information regarding incremental capital and operating costs incurred under stage I of HPMPs, and the Secretariat to include this information in a revised document to be submitted to the 71st meeting. The Committee also deferred discussion of the criteria for funding HCFC phase-out in the consumption sector for stage II HPMPs to the 72nd meeting of the Executive Committee, with the goal of reaching agreement on such criteria at that meeting (decision 70/21).

13. In line with decision 70/21, the Secretariat has undertaken an analysis of the information on the actual incremental capital and operating costs of completed HCFC phase-out projects included under stage I of HPMPs provided by bilateral and implementing agencies, and has incorporated that analysis into the present document. The Secretariat is very appreciative of the input received from relevant bilateral and implementing agencies during the preparation of the documents submitted to the 70th and 71st meetings.

14. The Secretariat has also updated the information on HCFC baseline for compliance and starting points for aggregate reduction in HCFC consumption based on established HCFC baselines for compliance in Article 5 countries that submitted a tranche request to the 70th meeting¹⁴, and has included a summary of the results on the demonstration project to validate the use of super-critical CO₂ in the manufacture of sprayed polyurethane rigid foam¹⁵.

II AN ANALYSIS OF DECISION 60/44

15. This part of the document presents an analysis of the implementation of decision 60/44, focusing on the following criteria: cut-off date, second-stage conversion, starting points for aggregate reductions in HCFC consumption, and eligible incremental costs of HCFC phase-out projects, including the foam and refrigeration and air-conditioning manufacturing and the refrigeration servicing sectors. The full text of decision 60/44, with the wording for each criterion, is contained in Annex II to the present document.

Cut-off date

16. During the preparation of stand-alone HCFC phase-out investment projects¹⁶ and HPMPs, bilateral and implementing agencies have given due consideration to the date of establishment of manufacturing facilities.

Background

17. Two decisions concerning the cut-off date and its application by the Secretariat when reviewing project proposals are particularly relevant here. The first decision, adopted in July 1995¹⁷, stated that any projects to convert any ODS-based capacity installed after 25 July 1995 would not be considered. The

¹⁴ The Article 5 countries where updated agreements were approved at the 70th meeting based on established HCFC baselines for compliance are: Albania, Benin, Burkina Faso, Cambodia, Chad, Costa Rica, Ecuador, Lebanon, Malawi, Pakistan, Rwanda, Seychelles, Sri Lanka, and Swaziland.

¹⁵ An assessment report on the super-critical CO₂ in the manufacture of sprayed polyurethane rigid foam has been submitted to the 71st meeting (UNEP/OzL.Pro/ExCom/71/6).

¹⁶ All stand-alone HCFC phase-out investment projects that were approved outside of HPMPs were subsequently subsumed in the HPMPs when they were submitted.

¹⁷ Decision 17/7.

second decision, adopted in April 2010, stated that any projects to convert HCFC-based manufacturing capacity installed after 21 September 2007 would not be considered. In both decisions the emphasis is on the installed baseline capacity (i.e., actual production lines, main production equipment items installed) at a precise date decided by the Executive Committee and not only on the date of establishment of the enterprise *per se*.

18. On this basis, the procedure applied by the Secretariat when reviewing projects is to determine the eligibility of the enterprise as a whole, each production line as a whole, and major equipment items installed, with reference to the cut-off date. The following three examples are pertinent:

- (a) At the 62nd meeting, eight stand-alone project proposals for the phase-out of HCFC-141b used as a foam blowing agent were submitted by Egypt¹⁸. One project was for a panel manufacturer founded in 1993, where one of the equipment items (i.e., a panel press) had been installed in 2008. Another project was for an enterprise established in 1991 specialized in spraying and pouring of foam, where four of the nine high pressure dispensers had been purchased in 2008 and 2009. In both cases, the costs associated with the conversion of the equipment added after the cut-off date of 21 September 2007 were considered ineligible;
- (b) The HPMP of Ecuador submitted to the 65th meeting, included one investment project for the phase-out of HCFCs used by a domestic refrigerator manufacturer established in 1972. In 1993 the enterprise received funding for the conversion to CO₂/water blown technology resulting in the complete phase-out of CFC-11. After the conversion had been completed, the enterprise used HCFC-141b as blowing agent instead of CO₂/water blown technology, and in the process installed three foam dispensers, one of them after the cut-off date of 21 September 2007. Funding associated with the conversion of the dispenser established after the cut-off date was not requested, while costs associated with the modification of the production line that had been previously funded for conversion to CO₂/water were considered ineligible. However costs associated with conversion of the other two new lines established before 21 September 2007 were recommended for funding;
- (c) The HPMP of Egypt submitted to the 65th meeting, included one investment project for an enterprise that had previously received funding at the 12th meeting to convert two foam lines that were then in operation to cyclopentane technology. In 2005-2006 the enterprise installed a new line based on HCFC-141b pre-blended polyols. Although the two lines converted to cyclopentane were operational, they were in fact using HCFC-141b due to technical problems. As a result, the enterprise decided to install a new line based on HCFC-141b technology. The cost of the project included in the HPMP related only to the new production line. Although the HCFC consumption associated with the new line was 48.50 mt (5.34 ODP tonnes), it was agreed that once this line has been converted, the total HCFC consumption by the enterprise of 107.50 mt (11.83 ODP tonnes) will be deducted from the starting point.

19. In decision 66/50(b), the Committee decided *inter alia* that conversion of new HCFC foam production lines in second-stage conversion enterprises established after the enterprises had been converted to a non-CFC alternative were entitled to full funding of eligible incremental costs provided that the new lines were established prior to the cut-off date of 21 September 2007, and on the understanding that the cost of replacement or retrofit of any equipment item installed after the cut-off date would not be eligible for funding.

¹⁸ UNEP/OzL.Pro/ExCom/62/30.

20. The issue of the cut-off date also became relevant in cases where stage I of the HPMPs included a proposal for the conversion of a large number of enterprises for which all the detailed information at the enterprise level could not be collected during the preparation of the project. For example, the HPMP for Brazil included the conversion of some 334 foam enterprises through their systems houses, and the project proposal involved confirming which enterprises were in fact eligible in the field, after approval of the project. In this case, the agreement between the Government of Brazil and the Executive Committee included the following clause addressing this issue: “any enterprise to be converted to non-HCFC technology included in the approved HPMP and that would be found to be ineligible under the guidelines of the Multilateral Fund (i.e., due to foreign ownership or establishment post the 21 September 2007 cut-off date), will not receive assistance. This information would be reported to the Executive Committee as part of the Annual Implementation Plan”. The agreements between the Executive Committee and the governments of Bahrain, Dominican Republic, Egypt, India, Kuwait, Mexico, the Philippines, Saudi Arabia, South Africa, Thailand and Turkey include a similar clause.

Secretariat’s comments

21. The Secretariat will continue to determine the eligibility of the enterprise as a whole, each production line as a whole, and major equipment items installed with reference to the cut-off date of 21 September 2007 when reviewing outstanding stage I and stage II HPMPs.

Second-stage conversion

22. Second-stage conversion projects have been included in stage I HPMPs for 18 Article 5 countries.

Background

23. The issue of second-stage conversions was discussed in the document on the information on previous conversions funded by the Multilateral Fund describing the conditions under which agreements were signed with Article 5 countries for the phase-out of CFCs¹⁹. The document informed the Committee that, in light of the principles contained in decision 60/44(b), the Secretariat had reviewed second-stage conversion projects submitted to the 61st and 62nd meetings by Dominican Republic and Morocco²⁰ (as stand-alone projects), and by Indonesia²¹ and the Islamic Republic of Iran²² (as part of stage I of their HPMPs). In the respective project evaluation sheets, the Secretariat provided information related to enterprises that had previously been funded for conversion to HCFC technology, and outlined the reasons given for including them in stage I of the HPMPs. However, at its 62nd meeting the Committee concluded that the analysis presented in the meeting documentation did not fully demonstrate that such projects were necessary to comply with the 35 per cent reduction in HCFC consumption or were the most cost-effective means of meeting these targets, and provided further guidance for the justification of second-stage conversion projects by requesting the submission of additional information (decision 62/16).

24. In subsequent submissions of stage I HPMPs addressing second-stage conversion projects (i.e., Brazil, China (solvent sector plan)²³, Dominican Republic, Egypt, Jordan, Lebanon, Malaysia, Mexico, Viet Nam and Zimbabwe, the Secretariat included more detailed information with regard to this matter. However, as noted by the Committee, the information provided was still not sufficiently detailed to assess whether funding of second-stage conversion projects was necessary to meet compliance targets, or was

¹⁹ UNEP/OzL.Pro/ExCom/66/49.

²⁰ UNEP/OzL.Pro/ExCom/62/41.

²¹ UNEP/OzL.Pro/ExCom/62/35 and Add.1. The HPMP was approved at the 64th meeting.

²² UNEP/OzL.Pro/ExCom/62/36 and Add.1. The HPMP was approved at the 63rd meeting.

²³ UNEP/OzL.Pro/ExCom/65/28.

the most cost-effective means of achieving those targets, particularly in the cases of the HPMPs for Egypt and Malaysia and the solvent sector plan for China²⁴.

25. Following the 65th meeting, the Secretariat prepared a sample justification for second-stage conversion projects (based on the detailed analysis prepared by the Secretariat for the HPMP for Malaysia submitted to the 65th meeting) and forwarded it to relevant bilateral and implementing agencies to be used for submitting second-stage conversion projects in future. Subsequently, the HPMPs for India, Thailand and Turkey which included second-stage conversion projects as a component of stage I, included an analysis in light of decisions 60/44(b) and 62/16.

26. The issue of funding projects based on imported pre-blended polyols containing HCFC-141b²⁵ was addressed at the 61st meeting (July 2010)²⁶. At that time, it was not possible to foreshadow the potential implications of the decision on second-stage conversions, which became relevant at the 65th meeting in the context of the HPMPs for Dominican Republic²⁷ and Zimbabwe²⁸, which included requests for funding of second-stage conversion enterprises to phase out HCFC-141b contained in imported pre-blended polyols²⁹.

27. Consideration of the two aforementioned HPMPs gave rise to two concerns. Firstly, the phase-out of the amount of HCFC-141b contained in imported polyols would not assist the Parties in complying with the Montreal Protocol control targets as that amount is not subject to reporting under Article 7. Secondly, under the HCFC guidelines, second-stage conversion projects were considered for full funding of eligible incremental costs only if they were necessary or were the most cost-effective projects in the manufacturing sector to meet the control targets up to 2020. As phasing out the amount of HCFC-141b contained in imported polyols would not assist the Parties concerned to meet the control targets, those enterprises should only be entitled to funding associated with installation, trials and training. However, after due consideration of the situation prevailing in each country and noting the commitments by the governments to ban imports of HCFC-141b, both in bulk and in imported pre-blended polyols by a specific date, the Committee approved full funding of eligible incremental costs of the projects for both HPMPs.

²⁴ In these three cases, during the meeting concerned, the Secretariat prepared a more detailed analysis of the matter and submitted it to relevant contact groups that had been constituted to review the individual HPMPs. Based on the additional information the Committee approved the two HPMPs and the sector plan.

²⁵ The amount of HCFC-141b contained in imported pre-blended polyols is not reported under Article 7 of the Montreal Protocol, and thus not subject for compliance.

²⁶ During the discussion on the document UNEP/OzL.Pro/ExCom/61/53 the Committee noted “the importance of the matter and the desire to ensure that all eligible enterprises using HCFC-141b in pre-blended polyols could benefit from Multilateral Fund assistance” (paragraph 112 of document UNEP/OzL.Pro/ExCom/61/58), and agreed to establish a contact group to discuss the issue, resulting in the adoption of decision 61/47.

²⁷ A foam sector plan was proposed to completely phase out 177.00 mt (19.47 ODP tonnes) of HCFC-141b contained in imported pre-blended polyols used by 13 foam enterprises, with a commitment by the Government to ban HCFC-141b in bulk as well as amounts contained in pre-blended polyols not later than 1 January 2016. Implementation of the plan would also avoid the emission into the atmosphere of over 126,500 tonnes of CO₂. Two of the enterprises had received assistance from the Fund to convert their CFC-11 production lines to HCFC-141b, and would need to be converted since they relied on the same systems houses supplying polyols to all the foam enterprises

²⁸ A foam sector plan was proposed to phase-out 55.50 mt (6.11 ODP tonnes) of HCFC-141b contained in imported pre-blended polyols used by 5 enterprises manufacturing foam, with a commitment by the Government to ban imports of HCFC-141b in bulk and contained in pre-blended polyols no later than 1 January 2015. Implementation of the plan would also avoid the emission into the atmosphere of approximately 39,700 tonnes of CO₂. Funding of US \$306,713 was approved for three of the enterprises to convert to non-CFC technologies at the 20th meeting (October 1996) of which only US \$34,064 was related to the phase-out of CFC-11.

²⁹ The funding level for foam enterprises would be based on the amount of HCFC-141b contained in imported pre-blended polyol systems to be calculated based on the 2007-2009 average consumption excluding those years in which no production was reported (decision 63/15).

28. In Dominican Republic and Zimbabwe all the HCFC-141b used in foam applications was based on imported pre-blended polyols. However, the situation in Egypt³⁰ and Viet Nam³¹ was more complex, given that HCFC-141b was imported both in bulk by systems houses or large foam enterprises for *in situ* blending (and reported under Article 7), and in pre-blended polyols by systems houses and chemical distributors. As all polyols locally pre-blended or imported were treated the same by the systems houses and chemical distributors, the foam enterprises were unable to discriminate between locally manufactured or imported polyols. Under these circumstances, it was not possible to ascertain whether the HCFC-141b used at each enterprise would contribute to meeting the control targets under the Montreal Protocol. Since then, stage I of HPMPs from other Article 5 countries have included the conversion of foam enterprises where HCFC-141b was imported both in bulk for *in situ* blending, and in pre-blended polyols by systems houses (e.g., Saudi Arabia).

29. Based on the information presented, the Committee decided to consider approving 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 pre-blended polyols, by a specific date to be included within the time-frame of the relevant stage of the HCFC phase-out management plan agreement (decision 66/50(c)).

Secretariat's comments

30. Based on the information available at the Secretariat, it could be expected that second-stage conversion projects will be included in stage I of the HPMP for Tunisia, and in stage II of the HPMPs of no more than 15 countries³². It could also be expected that at the time of submission of stage II of HPMPs, some of second-stage conversion projects would have already been converted to non-HCFC-141b based polyols with their own-resources as these systems would be available in local systems houses³³ or would be closed for various reasons³⁴. Furthermore, when stage II of the HPMPs for the following countries are submitted, the amounts of HCFC-141b exported in pre-blended polyols will be deducted from their respective starting points for aggregate reduction in HCFC consumption: 2.42 ODP tonnes for Chile; 137.83 ODP tonnes for China; 12.30 ODP tonnes for Colombia and 28.60 ODP tonnes for Mexico, in line with decision 68/42(a)³⁵.

³⁰ In 2010, 126.23 ODP tonnes of HCFC-141b were imported for the production of foam while 100.87 ODP tonnes of HCFC-141b were contained in imported polyols (UNEP/OzL.Pro/ExCom/65/32).

³¹ In 2009, 52.60 ODP tonnes were imported for the production of foam while 170.00 ODP tonnes of HCFC-141b were contained in imported polyols (UNEP/OzL.Pro/ExCom/63/55).

³² Stage I of the HPMPs for Dominican Republic, Jordan, Turkey and Zimbabwe included the conversion of all second-stage conversion projects.

³³ Assistance from the Multilateral Fund has been provided to systems houses from Brazil, China, India, Indonesia, the Islamic Republic of Iran, Malaysia, Mexico, Nigeria, Saudi Arabia, South Africa and Thailand. For example, the HPMP for India indicated the expectation that “upon successful completion of the systems house component, many enterprises will choose to convert to one of the customized formulations even before stage II commences, depending on the time frames” (paragraph 60 of document UNEP/OzL.Pro/ExCom/66/38).

³⁴ For example, the HPMP for Indonesia reported that “during the preparation of the foam and refrigeration components of the HPMP, some enterprises that were previously converted to HCFC-141b technology were closed or moved to other countries; others changed their business products and others converted to a final solution on their own. Furthermore, the levels of production have decreased significantly due to the economic crisis.” (paragraph 55 of document UNEP/OzL.Pro/ExCom/63/34).

³⁵ As reported in documents UNEP/OzL.Pro/ExCom/68/46 and Corr.1, HCFC-141b exported in pre-blended polyols by Argentina, Brazil (reported under Article 7 as export), Kuwait, Mexico, Saudi Arabia, South Africa and Syrian Arab Republic, have been deducted from their respective starting points for aggregate reduction in HCFC consumption.

31. The Secretariat will continue reviewing second-stage conversions in light of the existing policies and guidelines for funding the phase-out of ODS (i.e., baseline equipment³⁶, technology upgrade³⁷, end of useful life of manufacturing equipment, export to non-Article 5 countries and foreign ownership); the local circumstances prevailing in the countries concerned; and the additional commitments offered by the Government (such as the issuance of an import ban on HCFC-141b and HCFC-141b contained in imported pre-blended polyols, as the majority of second-stage conversions are related to the foam sector).

Starting points for aggregate reductions in HCFC consumption

32. Of the 145 Article 5 countries eligible to receive assistance from the Multilateral Fund³⁸, 139 have selected a starting point for aggregate reduction in HCFC consumption.

Background

33. An approach for calculating the starting point for aggregate reduction in HCFC consumption was adopted in decision 60/44(d), in advance of the official establishment of the HCFC baseline for compliance. This was done to enable Article 5 countries to submit either individual projects to phase out HCFC or full HPMPs. In calculating the starting point, Article 5 countries were given a choice between their most recent reported HCFC consumption under Article 7 of the Protocol at the time of the submission of the HPMP and/or the first HCFC investment project, or the average of consumption forecast for 2009 and 2010. The Executive Committee also agreed to a one-time adjustment to starting points in those cases where the official HCFC baselines (i.e., based on reported Article 7 data) were different from the calculated starting point, when the country chose the option of the average consumption forecast for 2009 and 2010 (decision 60/44(e)). This adjustment to the baselines and starting points would be made when Article 5 countries submitted a funding request for the second tranche of their HPMPs³⁹.

34. The issue of the amount of HCFC-141b contained in pre-blended polyols imported by 33 Article 5 countries was also relevant for determining the starting point, as that amount was not included in the calculation of the HCFC baseline for compliance. "Given the importance of the matter and the desire to ensure that all eligible enterprises using HCFC-141b in pre-blended polyols could benefit from Multilateral Fund assistance"⁴⁰, the Executive Committee decided, *inter alia*, to include in the starting point the annual amount of HCFC-141b contained in imported polyol systems during the 2007-2009 period (decision 61/47(c)(ii)).

35. The starting point for aggregated reduction in HCFC consumption selected by the 140 Article 5 countries is as follows:

- (a) Seven countries selected the most recently reported consumption (i.e., 2008 or 2009);

³⁶ 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."

³⁷ 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).

³⁸ The Republic of Korea, Singapore and United Arab Emirates, representing countries that have not received assistance from the Multilateral Fund thus far.

³⁹ For the majority of the HPMPs approved, the following text was added in the decision by the Executive Committee "To request the Fund Secretariat, once the baseline data were known, to update Appendix 2-A to the Agreement to include the figures for maximum allowable consumption, and to notify the Executive Committee of the resulting levels of maximum allowable consumption and of any potential related impact on the eligible funding level, with any adjustments needed being made when the next tranche was submitted".

⁴⁰ Paragraph 112 of the final report of the 61st meeting (UNEP/OzL.Pro/ExCom/61/58).

- (b) One country (Turkey) selected the most recently reported consumption plus HCFC-141b contained in imported pre-blended polyols;
- (c) Ninety-eight countries⁴¹ selected the HCFC baseline for compliance;
- (d) Thirty countries⁴² selected the HCFC baseline for compliance plus HCFC-141b contained in imported pre-blended polyols;
- (e) Four countries selected a calculated starting point taking into account specific circumstances (Argentina, based on the midpoint between the reported HCFC consumption for 2008 and the established baseline, discounting the exported amount of HCFC-141b contained in pre-blended polyols; Bahrain, based on the HCFC baseline for compliance plus HCFC 141b contained in imported pre-blended polyols and excluding HCFCs in stockpiles; Mauritius, excluding HCFCs in stockpiles; and Nepal, based on the official HCFC consumption ceiling set by the country); and
- (f) As of the 69th meeting, adjustments to the starting points due to established HCFC baselines differing from those estimated during the preparation of HPMPs, have been approved by the Executive Committee in line with decision 60/44(e) (i.e., Armenia, China, Colombia, Croatia, Ghana, Guatemala, the Islamic Republic of Iran, Nigeria, Saint Lucia, The former Yugoslav Republic of Macedonia and Venezuela (Bolivarian Republic of)).

36. The total aggregated starting point for aggregate reduction in HCFC consumption by the 144 countries is 33,352.6 ODP tonnes, which is slightly higher than the HCFC baseline for compliance⁴³ of 33,107.9 ODP tonnes.

Secretariat comments

37. The starting points for aggregate reduction in HCFC consumption for the five Article 5 countries that have not yet submitted an HPMP (i.e., Botswana, Libya, Mauritania, South Sudan, and Tunisia), will be based on their established HCFC baselines for compliance, plus any additional amount of HCFC-141b contained in imported pre-blended polyols. This was the case for all HPMPs of Article 5 countries that were approved after their HCFC baselines for compliance were established.

38. For the majority of Article 5 countries, the calculation of the starting points for aggregate reduction in HCFC consumption was based on the levels reported under Article 7 of the Montreal Protocol, plus the average amount of HCFC-141b contained in pre-blended polyols imported during the 2007-2009 period, where applicable. However, not all the HCFC consumption reported under Article 7 would be eligible for funding as it includes amounts used by enterprises with non-Article 5 owned capital, and/or in production lines of manufacturing enterprises established after the cut-off date of 21 September 2007. During the review of subsequent stages of HPMPs, due consideration will be given not to fund the phase out of HCFC consumption ineligible to be funded under the Multilateral Fund.

⁴¹ Including one country (Democratic People's Republic of Korea) which submitted its HPMP to the 68th meeting and was deferred (decision 68/34).

⁴² Including one country (Syrian Arab Republic) which its HPMP was noted by the Executive Committee at its 68th meeting, and the country was encouraged to resubmit it at a future meeting when national conditions had improved (decision 68/38).

⁴³ The HCFC baseline for compliance used in this document is that estimated at the time of the approval of the HPMPs. In several Article 5 countries the estimated baseline is different from that reported under Article 7 of the Montreal Protocol. As decided by the Committee, the Secretariat will update Appendix 2-A ("The targets, and funding") to the respective agreement with the figures for the maximum allowable consumption, when a subsequent tranche request is submitted.

Eligible incremental costs of HCFC phase-out projects

39. The criteria on the eligible incremental costs of HCFC phase-out projects consist of several elements that require a separate analysis. These include: HCFC phase-out greater than the 10 per cent reduction required by 2015; cost-effectiveness; the foam manufacturing sector; the refrigeration and air-conditioning manufacturing sector; and the refrigeration manufacturing sector.

HCFC phase-out greater than the 10 per cent reduction required by 2015

40. The guidelines for the preparation of stage I HPMPs, adopted by the Executive Committee at its 54th meeting (April 2008), were developed to enable Article 5 countries to meet the freeze on HCFC consumption in 2013 and the 10 per cent reduction in 2015 (decision 54/39(b)). However, when considering the HPMPs submitted by Article 5 countries for approval, the Committee noted that several of them proposed HCFC reduction levels greater than the 10 per cent required by 2015. Accordingly, the Executive Committee has adopted several decisions addressing this issue. Specifically:

- (a) Stage I HPMPs, which accelerated the phase-out of HCFC consumption could be considered on a case-by-case basis for low-volume-consuming (LVC) countries that had a strong national level of commitment in place to support accelerated phase-out (decision 60/15);
- (b) HPMPs for Article 5 countries that had a total HCFC consumption of up to 360 mt could be submitted to meet up to the 35 per cent reduction in 2020 if the countries so decided (decision 60/44(f)(xi));
- (c) HPMPs could be submitted for LVC countries which addressed the phase-out of HCFCs ahead of the Montreal Protocol schedule (even up to the complete phase-out of HCFCs) (decision 62/10); and
- (d) HPMPs to assist former LVC countries with HCFC consumption that was above 360 mt in the refrigeration servicing sector only, could be submitted to meet control measures up to 2020 (decision 62/11).

41. As of the 69th meeting (April 2013), the eighty-six LVC countries with approved HPMPs have committed to reducing their HCFC consumption baselines as follows:

- (a) 10 per cent by 2015 for six countries (Angola, Armenia, Guyana, Kyrgyzstan, the Republic of Moldova and Timor-Leste);
- (b) 35 per cent by 2020 for seventy-one countries (Albania, Antigua and Barbuda, Bahamas, Barbados, Belize, Bolivia, Bosnia and Herzegovina, Brunei Darussalam, Burundi, Cape Verde, Central African Republic, Comoros, Congo, Cook Islands, Costa Rica, Cuba, Chad, Djibouti, Dominica, Ecuador, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gambia, Georgia, Grenada, Guatemala, Guinea-Bissau, Haiti, Honduras, Jamaica, Kiribati, Lao People's Democratic Republic, Lesotho, Liberia, Malawi, Mali, Marshall Islands, Micronesia (Federated State of), Mongolia, Montenegro, Mozambique, Myanmar, Nauru, Nepal, Nicaragua, Niue, Palau, Paraguay, Rwanda, Saint Kitts and Nevis, Saint Lucia, Samoa, Sao Tome and Principe, Serbia, Sierra Leone, Solomon Islands, Sri Lanka, Suriname, Swaziland, Tanzania, The Former Yugoslav Republic of Macedonia, Tonga, Turkmenistan, Tuvalu, Uganda, Vanuatu, Zambia and Zimbabwe); and
- (c) Complete phase-out in advance of the Montreal Protocol schedule by nine countries

(Bhutan, Cambodia, Croatia, Maldives, Mauritius, Namibia, Papua New Guinea, Saint Vincent and the Grenadines, and Seychelles).

42. The Executive Committee also noted that stage I of HPMPs for some non-LVC countries were proposing to address more than 10 per cent of the baseline by 2015. In considering this issue at its 63rd meeting (April 2011), the Committee decided to note in the respective decision for each such HPMP that the amount of HCFC consumption to be phased out should assist the country in making progress towards meeting the control measures beyond 2015 accordingly. This was with the understanding that Article 5 countries would still be able to submit stage II proposals when the Executive Committee approved the last tranche of stage I, and that the approach was without prejudice to the tonnage of HCFCs that could be put forward for phase-out in stage II proposals⁴⁴. From the 64th meeting (July 2011), HPMPs that proposed addressing more than 10 per cent of the baseline by 2015 were usually approved with a commitment from the governments concerned to meet specific extended reduction levels in their baselines.

43. The fifty-two non-LVC countries with approved HPMPs have committed to reducing their HCFC consumption baselines as follows:

- (a) 10 per cent by 2015 for seventeen countries (Brazil, Chile, China, Colombia, Democratic Republic of Congo, Dominican Republic, India, Islamic Republic of Iran, Nigeria, Oman, Pakistan, Panama, Peru, Philippines, Uruguay, Venezuela (Bolivarian Republic of) and Viet Nam). Out of these, three countries (Chile; Islamic Republic of Iran and Viet Nam) were approved with the notion that the amount of HCFCs to be phased out should assist them in making progress toward meeting control measures beyond 2015; and
- (b) More than 10 per cent of their consumption baselines by a specific year beyond 2015 for the thirty-five countries, as shown in Table 1.

Table 1. HCFC consumption phase-out commitments by non-LVC countries with an approved HPMP

Former LVC countries			Non-LVC countries		
Article 5 country	% reduction	Target year	Article 5 country	% reduction	Target year
Bahrain	42.0	2020	Afghanistan	35.0	2020
Benin	35.0	2020	Algeria	20.0	2017
Burkina Faso	35.0	2020	Argentina	18.0	2017
Cameroon	20.0	2015	Bangladesh	30.0	2018
Cote d'Ivoire	35.0	2020	Egypt	25.0	2018
Gabon	35.0	2020	Indonesia	20.0	2015
Ghana	35.0	2020	Iraq	14.0	2015
Guinea	35.0	2020	Jordan	20.0	2017
Kenya	21.0	2017	Kuwait	39.0	2018
Madagascar	35.0	2020	Lebanon	18.0	2015
Niger	35.0	2020	Malaysia	15.0	2016
Qatar	20.0	2015	Mexico	30.0	2015
Senegal	35.0	2020	Morocco	20.0	2017
Somalia	35.0	2020	Saudi Arabia	35.0	2020
Togo	35.0	2020	South Africa	35.0	2020
Trinidad and Tobago	35.0	2020	Sudan	30.0	2017
			Thailand	15.0	2018
			Turkey	86.4	2017
			Yemen	15.0	2015

Secretariat's comments

⁴⁴ Paragraphs 73 and 74 of the final report of the 63rd meeting (UNEP/OzL.Pro/ExCom/63/60).

44. Based on the reduction levels on HCFC consumption committed by Article 5 countries in stage I of their HPMPs, it could be expected that the stage II HPMPs of a large number of non-LVC countries will address consumption beyond 35 per cent by 2020. Without pre-empting any decision the Executive Committee might wish to take with regard to the guidelines for stage II HPMP preparation (which included options for phase-out up to the 2020 control target and for total phase-out in accordance with the Montreal Protocol schedule)⁴⁵, the Secretariat will continue reviewing stage II of HPMPs giving due consideration to national priorities and circumstances⁴⁶; the extended commitments by the governments concerned to enact regulations to ban imports of an HCFC once it has been completely phased out⁴⁷; the alternative technologies to be introduced and their impact, particularly on climate; and the cost-effectiveness of the investment phase-out projects⁴⁸, and will be presented for consideration by the Executive Committee on a case-by-case basis.

Cost-effectiveness thresholds

45. For the calculation of the cost-effectiveness⁴⁹ value of any given project proposal, the Secretariat has always reviewed the project based on, *inter alia*, the equipment in the baseline, the number of products manufactured, the amount of ODS and other raw materials used, and the alternative technology selected. Once all technical and cost issues have been satisfactorily addressed and an agreement has been reached between the Secretariat and relevant bilateral/implementing agencies, the cost-effectiveness of the project is calculated by dividing the agreed level of funding by the total amount of ODS to be phased out. In cases where an enterprise is partially owned by non-Article 5 capital, the agreed level of funding is adjusted by proportionally deducting the foreign share ownership of the enterprise⁵⁰. As the total amount of ODS used by the enterprise counts as phase-out (irrespective of the local share ownership), the resulting “adjusted” cost-effectiveness value of the project will be lower (in absolute numbers) than if the enterprise was completely locally owned.

46. In reviewing the HCFC phase-out in investment projects submitted as stand-alone projects or as a component of HPMPs related to the foam and commercial refrigeration manufacturing sectors, the Secretariat used, as a guide, the cost-effectiveness threshold values used for CFC phase-out⁵¹, and the

⁴⁵ At its 66th meeting, the Executive Committee requested the Secretariat, in cooperation with the implementing agencies, to prepare guidelines for stage II HPMP preparation including options for phase-out up to the 2020 control target and for total phase-out in accordance with the Montreal Protocol schedule (decision 66/5(c)). At the 69th meeting, the Committee discussed the draft guidelines (UNEP/OzL.Pro/ExCom/69/33) and decided to continue its deliberations at the 70th meeting (decision 69/22(a)).

⁴⁶ For example, in stage I of the HPMP for Turkey it was reported that the Government was considering accession to the European Union, and decided to phase out HCFC ahead of the Montreal Protocol’s schedule in order to be in line with the European Union policy (paragraph 13 of document UNEP/OzL.Pro/ExCom/68/42).

⁴⁷ For example, in stage I of HPMP for Mexico was stated that the Government “originally proposed to completely phase out the consumption of HCFC-141b during stage 1 of the HPMP; however, considering the significant level of consumption associated with the foam enterprises, the large number of small users in the aerosol sector and the extended uses by technicians for flushing refrigeration equipment, the Government decided to move the deadline for the phase-out of all uses of HCFC-141b to 2018” (paragraph 35 of document UNEP/OzL.Pro/ExCom/64/39).

⁴⁸ For example, the projects included in stage I of the HPMP for Saudi Arabia for the phase-out of HCFC-141b and HCFC-22 used for the production of XPS foam had a cost-effectiveness value of US \$2.14/kg, while the projects for the phase-out of HCFC-141b used for the rigid foam had a cost-effectiveness of US \$3.92/kg (as shown in Table 9 of document UNEP/OzL.Pro/ExCom/68/39).

⁴⁹ In early 1995, cost-effectiveness threshold values were established to prioritize approvals of investment projects, since the level of funding requested in submitted projects was above the level of funding available at that time in the Multilateral Fund. This permitted an equitable distribution of the available funding between the various sectors, ensuring that no sectors were left without financial support (UNEP/OzL.Pro/ExCom/58/47).

⁵⁰ In line with decision on transnational corporations adopted at the 7th meeting (paragraph 88 of document UNEP/OzL.Pro/ExCom/7/30).

⁵¹ The cost-effectiveness threshold values used for CFC phase-out (paragraph 32 of the final report of the 16th meeting, document UNEP/OzL.Pro/ExCom/16/20, shall be used as a guide during the review of stage I of HPMPs

additional cost-effectiveness threshold set in decision 62/13⁵². In none of the projects, were the incremental operating costs above the maximum level allowed under decision 60/44(f)⁵³.

47. Decision 60/44 provides specific criteria on the duration of the period during which incremental operating costs can be claimed in the refrigeration, air-conditioning and foam sectors (which represent most uses of HCFC in the manufacturing sector in Article 5 countries). With regard to the aerosol, fire extinguisher and solvent sectors, the eligibility of incremental costs will be considered on a case-by-case basis (decision 60/44(f)(xvi)). Subsequently, in considering a stand-alone project proposal in the aerosol sector⁵⁴ submitted to the 62nd meeting, the Committee noted that in decision 60/44 the duration of incremental operating costs had been agreed for a one-year period for most of the other sectors, and decided that the incremental operating costs for the aerosol sector should be determined on the basis of a one-year duration (decision 62/9).

48. As CFCs were not used in the air-conditioning manufacturing sector, a cost-effectiveness threshold for this sector has not been established. However, in reviewing HCFC phase-out investment projects submitted under this sector, the Secretariat has been guided by the technical information contained in the document on the revised analysis of relevant cost considerations surrounding the financing of HCFC phase-out⁵⁵ (in line with decision 60/44(f)(i)), and the maximum allowable level of incremental operating costs of US \$6.30/kg (in line with decision 60/44(f)(viii)).

49. Stage I of the HPMPs of several Article 5 countries involve the conversion of only one or a few manufacturing enterprises (e.g., Bangladesh, Costa Rica, El Salvador), while others include conversion of several tens and even hundreds of enterprises (e.g., Brazil, Mexico). While most of the enterprises are locally owned, some enterprises are partially or totally owned by non-Article 5 capital (e.g., from 2 per cent foreign ownership in Swaziland to fully foreign owned in India). Yet, in other cases, HCFC used by some enterprises will be (voluntarily) phased out without assistance from the Fund (e.g., Saudi Arabia, South Africa and Turkey, among others). Accordingly, the total amount of HCFCs to be phased out comprises: the amount funded through the Multilateral Fund, the amount to be phased out voluntarily, and the amount associated with foreign-owned enterprises. This total amount is deducted from the HCFC baselines for compliance, and recorded in the respective agreements between the governments concerned and the Executive Committee.

50. The analysis contained in the present document, is based on the total amount of HCFCs to be phased out in stage I HPMPs as recorded in the respective agreements, since these amounts represent the governments' commitment to the Montreal Protocol. On this basis, the resulting cost-effectiveness values cannot be compared among countries within a given sector. The Secretariat notes that all HCFC phase-out investment project proposals, either submitted as stand-alone projects or covering several enterprises under an umbrella/sector approach, have been recommended for approval below the applicable

(decision 60/44(f)(ii)). Funding of up to a maximum of 25 per cent above the thresholds was provided when low-GWP alternative technologies were introduced (decision 60/44(f)(iv)).

⁵² At the 60th meeting, the Government of Colombia submitted a stand-alone project for the conversion of four domestic refrigeration manufacturing enterprises using HCFCs for the production of polyurethane rigid insulation foam. The project was approved with a cost-effectiveness of US \$12.02/kg, which was below the thresholds of US \$13.76/kg for domestic refrigeration and US \$15.21/kg for commercial refrigeration (UNEP/OzL.Pro/ExCom/60/25). However, at the 62nd meeting, based on the experience gained from the review of similar projects, the Committee established the cost-effectiveness threshold for rigid insulation refrigeration foam at US \$7.83/kg with a maximum of up to 25 per cent above this threshold for low GWP alternatives.

⁵³ Incremental operating costs for the foam sector: US \$1.60/metric kg for HCFC-141b and US \$1.40/metric kg for HCFC-142b. For commercial refrigeration sector: US \$3.80/metric kg.

⁵⁴ The project for the phase-out of 130.7 mt (11.1 ODP tonnes) of HCFC 22 and HCFC 141b use in aerosol products at Silmex (Mexico), submitted by UNIDO, originally requested operating costs calculated over a four-year period (paragraphs 23 to 26 of document UNEP/OzL.Pro/ExCom/62/10).

⁵⁵ UNEP/OzL.Pro/ExCom/55/47.

cost-effectiveness thresholds. This is the case even though, in some instances, the cost-effectiveness values of individual activities within an umbrella project were above the threshold, in line with previous practice.

An analysis of HCFC phase-out in the foam sector

51. The two main foam sub-sectors where HCFCs are used in Article 5 countries are the rigid polyurethane (PU) foam sector, including integral skin applications, where HCFC-141b is used as a blowing agent (and to a lesser extent HCFC-22 as a co-blowing agent), and the extruded polystyrene (XPS) foam sector, where usually a mixture of HCFC-22 and HCFC-142b is used as a blowing agent.

Rigid PU foam

52. Stage I of the HPMPs of 38 Article 5 countries had included projects for the conversion of foam enterprises manufacturing various types of rigid PU foam products⁵⁶. The associated consumption of HCFCs by these enterprises is 3,398.6 ODP tonnes (30,896.3 mt) of HCFC-141b and 26.7 ODP tonnes (485.3 mt) of HCFC-22. The total funding approved for the conversion of these enterprises amounts to US \$174,090,016, resulting in an overall cost effectiveness of US \$5.63/kg, as shown in Table 2.

Table 2. Analysis of HCFC phase-out investment projects in rigid PU foam

Country*	HCFC-141b (ODP t)	Replacement technology	Approved (US \$)	Cost (US \$)		CE (US\$/kg)
				Capital	Operating	
Algeria (1)	2.40	Cyclopentane	215,380	216,045	(665)	9.87
Argentina (1)	18.46	Cyclopentane	838,612	837,210	1,402	5.00
Bangladesh (1)	20.20	Cyclopentane	1,146,074	1,025,750	120,324	6.24
Bosnia and Herzegovina (1)	4.78	Cyclopentane	425,361	363,149	62,212	9.79
Brazil	32.50	Cyclopentane	2,136,135	2,307,610	(171,475)	7.23
Cameroon (9)	15.70	Methyl formate	310,900	310,900		2.18
China (3 demonstration)**	13.60	Cyclopentane HFC-245fa	2,195,412			17.75
China (unknown)***	1,615.00	Cyclopentane	73,000,000			4.97
Colombia (4)****	46.21	Cyclopentane	5,621,483	5,058,456	563,027	9.39
Costa Rica (1)	14.00	Cyclopentane	593,523	593,523		4.66
Croatia (1)	1.76	Water/CO ₂	210,000	210,000		13.13
Cuba (5)	13.35	Cyclopentane	1,187,527	1,187,527		9.78
Dominican Republic (1)	3.70	Cyclopentane	332,775	316,775	16,000	9.89
Dominican Republic (13)	15.77	Methyl formate	663,450	480,700	182,750	4.63
Ecuador (1)	14.96	Cyclopentane	1,331,440	1,198,440	133,000	9.79
Egypt (8)	77.54	Cyclopentane/ methyl formate	3,359,155	3,617,900	(258,745)	4.77
El Salvador (3)	4.94	Cyclopentane/ methyl formate	439,277	424,427	14,850	9.78
Guatemala (1)	1.40	Cyclopentane	109,637	109,637		8.61
India (16)	310.53	Cyclopentane	13,981,990	12,631,330	1,350,660	4.95
Indonesia (26)	33.51	HFC-245fa	2,714,187	2,706,587	7,600	8.91
Indonesia (4)	10.40	Cyclopentane	777,395	708,638	(2,108)	8.26
Islamic Republic of Iran (23)	62.56	Cyclopentane	4,782,642	5,325,750	(543,109)	8.41
Jamaica (1)	3.60	Methyl formate	95,450	57,200	38,250	2.92
Kuwait (2 + SMEs)	36.55	Cyclopentane	738,382			2.22
Lebanon (1)	15.10	Cyclopentane	1,342,209			9.78
Malaysia (13)	94.60	Cyclopentane	7,327,470	6,816,745	510,725	8.52
Mexico (1)*****	38.94	Cyclopentane	2,428,987	2,293,104	135,883	3.68

⁵⁶ For example, insulation foam for domestic refrigerators, panels, insulation for water heaters, block, and integral skin.

Country*	HCFC-141b (ODP t)	Replacement technology	Approved (US \$)	Cost (US \$)		CE (US\$/kg)
				Capital	Operating	
Mexico (3)	22.99	Cyclopentane	2,046,110	1,711,710	334,400	9.79
Morocco (1)	11.00	Cyclopentane	951,740	990,000	(38,260)	9.52
Oman (1)	1.20	Water/CO ₂	79,120	79,120		7.25
Pakistan (5)	71.60	Cyclopentane	4,840,849	4,844,400	(3,552)	7.44
Philippines (13 + 47 SMEs)	43.00	Cyclopentane/CO ₂	2,088,000			5.34
Saudi Arabia (18)	125.10	Pentane	6,882,370	7,642,050	(759,680)	6.05
South Africa (2)	38.90	Cyclopentane	2,498,848	2,498,848		7.07
Sri Lanka (1)	0.45	Cyclopentane	18,860	18,860		4.61
Sudan (4)	11.90	Cyclopentane	1,056,341	1,056,341	(569)	9.76
Swaziland (1)	7.70	Cyclopentane	667,948	667,948		4.77
Thailand (28)	73.96	Cyclopentane	6,111,060			9.09
Thailand (103)	91.40	HFC-245fa	5,383,202			6.48
Trinidad and Tobago (5)	2.50	Methyl formate	173,800	151,900	21,900	7.65
Turkey (sector)	228.63	Cyclopentane	3,631,897	3,050,700	581,197	1.75
Viet Nam (12)	140.10	Cyclopentane	8,876,200	6,837,200	2,039,000	6.97
Zimbabwe (5)	6.10	Cyclopentane	478,818	547,650	(68,832)	8.63
Total	3,398.59		174,090,016	78,894,130	4,266,185	5.63

(*) Number in parenthesis represents the number of enterprises to be converted

(**) Approved as demonstration projects prior to adoption of decision 60/44, on the understanding that the HCFC consumption associated with the projects would be deducted from the consumption eligible for funding.

(***) The actual enterprises that would be converted during stage I of the HPMP for China were not known at the time of submission of the HPMP. Since the approval of the HPMP, several PU foam enterprises have already been selected for conversion⁵⁷.

(****) An additional 9.82 ODP tonnes of HCFC-22 used as a foam blowing agent

(*****) An additional 16.83 ODP tonnes of HCFC-22 used as a foam blowing agent

53. In addition, the HPMPs for Brazil, Egypt, Mexico, Nigeria, Saudi Arabia, and South Africa included projects for adapting locally-owned systems houses for manufacturing non-HCFC-141b pre-blended polyol systems and, through them, converting large numbers of downstream foam enterprises. Through the systems house approach, a total of 902.43 ODP tonnes (8,203.91 mt) of HCFC-141b will be phased out at a total cost of US \$32,793,024 (US \$4.08/kg), as shown in Table 3.

Table 3. Analysis of HCFC-141b phase-out through systems houses

Country	HCFC-141b (ODP t)	Replacement technology	Approved (US \$)	Cost (US \$)		CE (US\$/kg)
				Capital	Operating	
Brazil	136.30	Cyclopentane/ methyl formate	12,339,983	10,726,093	1,613,887	9.96
Egypt	75.74	Methyl formate	3,800,600	2,974,400	826,200	5.52
Mexico	299.79	Methyl formate	11,225,030	7,750,563	3,474,467	4.12
Nigeria	79.50	Methyl formate/ CO ₂	855,603			1.18
Saudi Arabia*	215.90	Pentane	2,324,700	2,324,700	-	1.18
South Africa**	95.20	Methyl formate	2,247,108	1,747,358	499,750	2.60
Total	902.43		32,793,024	25,523,114	6,414,304	4.08

(*) Including 751.73 mt (82.69 ODP tonnes) of HCFC-141b to be phased out without assistance from the Fund.

(**) Including 465.45 mt (51.20 ODP tonnes) of HCFC-141b to be phased out without assistance from the Fund.

54. The cost-effectiveness of foam projects included in approved stage I of HPMPs were influenced by, *inter alia*, the number of enterprises, their size and their levels of HCFC consumption; the alternative

⁵⁷ As reported in document UNEP/OzL.Pro/ExCom/68/24, as of July 2012, a total of 33 enterprises with a total consumption of 8,875.45 mt (976.30 ODP tonnes) of HCFC-141b were selected and requested to submit project proposals to FECO for review. In addition, 30 production lines in 29 room air-conditioning manufacturing enterprises were audited. Of the total funding of US \$38,859,000 approved so far, US \$19,429,500 was to be disbursed by the World Bank to FECO by the end of November or early December 2012.

technology selected; the equipment in the baseline to be modified; and any additional consumption of HCFCs that would be phased out without assistance from the Fund⁵⁸, as explained below.

55. The number of enterprises to be converted varied widely from a relatively small number (less than 15 enterprises for several countries), to several hundred for others⁵⁹. The level of HCFC consumption also varied, from very low levels by several micro-enterprises (below 0.1 mt) to more than 1,000 mt⁶⁰.

56. The main alternative technologies selected by the majority of the foam enterprises were cyclopentane and methyl formate. In addition, HFC-245fa was selected in only two countries: Indonesia (26 enterprises with a total consumption of 33.51 ODP tonnes (304.6 mt) of HCFC-141b) and Thailand (103 enterprises with a total consumption of 91.4 ODP tonnes (830.9 mt) of HCFC-141b). An overview of these technologies is presented below:

- (a) Cyclopentane technology (a technology that was used for the conversion of CFC-11 based foam enterprises) was selected mainly when the insulation property of the foam was an important factor (i.e., insulation for refrigeration equipment) or by enterprises consuming relatively large amounts of HCFC-141b (i.e., typically well above 30 mt) which allowed for covering, partially or in full, installation of safety equipment and systems within the cost-effectiveness threshold. However, given the complexity of the production lines, and the number of foam dispensers and associated equipment (such as pre-mixers and fixtures) in the baseline, the cost-effectiveness values were among the highest (in absolute numbers) and, in some cases, were actually above the threshold value. In those cases, the enterprises must cover the costs above the threshold⁶¹. Depending on the country, the introduction of cyclopentane resulted in operating savings (e.g., Egypt, Indonesia, the Islamic Republic of Iran, Saudi Arabia and Zimbabwe), or operating costs (e.g., Argentina, Bangladesh, Bosnia and Herzegovina, Dominican Republic, India, Malaysia, Mexico and Turkey). In other countries (e.g., Cuba, Costa Rica, Guatemala, Kuwait, Lebanon and Philippines) operating costs were not claimed. The level of incremental operating costs that were claimed by enterprises was always below the maximum allowable level of US \$1.60/kg under decision 60/44(f)(v);
- (b) Methyl formate was selected by large numbers of foam enterprises in several Article 5 countries. Introduction of this technology required a “simple” retrofit of the foam equipment in the baseline (to address potential corrosion issues with the foam dispensers), technical assistance for optimizing the formulations, and incremental operating costs which were requested by the majority of the enterprises (as this

⁵⁸ This includes, for example, ineligible consumption associated with production lines established after the cut-off date or with non-Article 5 foreign owned enterprises that would be phased out in stage I of HPMPs without assistance from the Multilateral Fund. For example, conversion of foreign owned enterprises were included in stage I of the HPMPs of India, Mexico, Turkey among others; while the portion of the costs of the conversions associated with the foreign-ownership were covered by the enterprises, the total HCFC consumption was deducted from the remaining consumption eligible for funding.

⁵⁹ For example, stage I of the HPMPs for Brazil and Mexico will convert 334 and 347 enterprises, respectively, through their systems houses.

⁶⁰ For example, through a systems house, some 53 micro-enterprises with an estimated consumption of 4.4 mt will be converted in Thailand. A few enterprises manufacturing insulation foam for reefers in China have consumption above 1,000 mt.

⁶¹ For example, the project for the conversion of four enterprises in Sudan was agreed at US \$1,456,341. An additional US \$614,319 was provided as counterpart contribution (UNEP/OzL.Pro/ExCom/66/46). In the case of Pakistan, US \$4,840,849 was approved for the conversion of five enterprises manufacturing insulation foam for domestic and commercial refrigerators. Counterpart funding (US \$940,000 including US \$420,000 for technology upgrade) was provided by all enterprises for, *inter alia*, civil works related to underground cyclopentane storage tanks and premix station; piping, support and accessories; ventilating ducts; electric proofing of equipment and systems; and nitrogen supply system (UNEP/OzL.Pro/ExCom/70/39).

technology was only available in a very few Article 5 countries). The cost-effectiveness value of projects where this technology was selected was usually below US \$5.00. In the case of Trinidad and Tobago, the low level of consumption (2.5 ODP tonnes) by five enterprises resulted in a cost-effectiveness of US \$7.65/kg. Funding was approved for systems houses in 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 countries⁶²; and

- (c) HFC-245fa was selected only by some enterprises in Indonesia⁶³ and Thailand⁶⁴. Incremental capital costs were related to retrofit or replacement of baseline equipment, a pre-mixing tank and cooling unit. In both countries, incremental operating costs were limited to the maximum allowable level of US \$1.60/kg (as the price of HFC-245fa was much higher than HCFC-141b). Furthermore, their respective agreements with the Executive Committee included a clause where the countries agreed, taking into account national circumstances related to health and safety: to monitor the availability of substitutes and alternatives that further minimize impacts on the climate; to consider, in the review of regulations standards and incentives adequate provisions that encourage introduction of such alternatives; and to consider the potential for adoption of cost-effective alternatives that minimize the climate impact in the implementation of the HPMP, as appropriate.

57. Additional funding for technical assistance was approved for systems houses 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. 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.

58. Implementation of the projects approved in stage I will result in the complete phase-out of HCFC-141b (both in bulk and in imported polyols) used as a foam blowing agent in the following 19 countries: Armenia, Bosnia and Herzegovina, Cameroon, Croatia, Cuba, Dominican Republic, El Salvador, Guatemala, Jamaica, Kuwait, Oman, Philippines, Saudi Arabia, South Africa, Sri Lanka, Swaziland, Trinidad and Tobago, Turkey and Zimbabwe.

XPS foam projects

59. At the 62nd meeting the Secretariat raised an issue regarding the submission of projects to phase out HCFC-22/HCFC-142b used in the manufacturing of XPS foam by three Article 5 countries⁶⁵, considering that they were not in accordance with the principle of prioritization of HCFCs in decision

⁶² For example, at the time of the submission of the HPMPs for Dominican Republic, El Salvador, Jamaica, and Trinidad and Tobago, it was expected that systems houses in Mexico (that were assisted by the Multilateral Fund) were to supply methyl-formate pre-blended polyols.

⁶³ Extensive consultations with foam experts and the Technical Working Group concluded that HFC-245fa as a co-blowing agent with water was a proven technology without adversely affecting the foam properties and quality (paragraph 62 of document UNEP/OzL.Pro/ExCom/63/34).

⁶⁴ For enterprises where it is not possible to use hydrocarbons (i.e. due to small size and/or lack of technical conditions) or water (i.e. insulating requirements), reduced formulations of HFC-245fa would be used considering that it is a proven and non-flammable technology, and that systems houses would be in position to introduce it in the local market in a short period of time (paragraph 45 of document UNEP/OzL.Pro/ExCom/66/47).

⁶⁵ UNEP/OzL.Pro/ExCom/62/10.

59/11⁶⁶. Countries' reasons for submitting XPS foam projects included: the need to phase-out HCFC consumption in all manufacturing sectors simultaneously (China); national regulations banning the use of HCFCs for foam applications by 1 January 2013 (Saudi Arabia and Turkey) and the initiative undertaken by the national industry to start the phase-out process (Turkey). After discussing the issue, the Executive Committee decided to consider XPS foam projects when it was clearly demonstrated that they would be required by national circumstances and priorities to comply with the 2013 and 2015 control measures, and to consider all other XPS foam projects after 2014 (decision 62/12(c)).

60. Stage I of the HPMPs of six Article 5 countries (China, Kuwait, Mongolia, Qatar, Saudi Arabia and Turkey) had included projects for the phase-out of 1,003.4 ODP tonnes (16,803.2 mt) of HCFCs, consisting of 488.6 ODP tonnes (8,884.3 mt) of HCFC-22 and 514.8 ODP tonnes (7,919.0 mt) of HCFC-142b. The total funding approved amounts to US \$68,761,089, resulting in an overall cost effectiveness of US \$4.09/kg, as shown in Table 4.

Table 4. Analysis of HCFC phase-out investment projects in XPS foam

Country	HCFC-22		HCFC-142b		Total HCFCs		Technology*	Approved (US \$)	CE (US\$/kg)
	ODP t	mt	ODP t	mt	ODP t	mt			
China**	6.2	112.7	6.2	95.4	12.4	208.1	CO ₂ /MF	1,973,300	9.48
China	331.2	6,021.6	260.8	4,012.0	592.0	10,033.6	CO ₂ /DME	50,000,000	4.98
Kuwait	46.6	847.5	82.7	1,272.3	129.3	2,119.8	CO ₂ /DME/HFO	7,943,295	3.75
Mongolia	0.5	9.8			0.5	9.8	HFC-152a	130,000	13.24
Qatar	7.4	134.5	12.1	185.4	19.5	319.9	Isobutane	1,510,000	4.72
Saudi Arabia	22.0	400.0	33.0	507.7	55.0	907.7	Isobutane	1,938,901	2.14
Turkey	74.7	1,358.2	120.0	1,846.2	194.7	3,204.3	HFC-152a/DME	5,265,593	1.64
Total	488.6	8,884.3	514.8	7,919.0	1,003.4	16,803.2		68,761,089	4.09

(*) DME (dimethyl ether).

(**) Approved as demonstration project, on the understanding that the HCFC consumption associated with the projects would be deducted from the consumption eligible for funding (MF, methyl formate).

61. From an analysis of the project data summarized in the table above, the following observations are relevant:

- (a) The projects approved in stage I of the HPMPs of Kuwait, Mongolia, Qatar, Saudi Arabia and Turkey will result in the complete conversion of the XPS sector;
- (b) The actual enterprises that would be converted during stage I of the HPMP for China were not known at the time of submission of the HPMP. Since the approval of the HPMP, several XPS enterprises have already been selected for conversion⁶⁷;
- (c) The alternative technologies selected are CO₂/ethanol in China, Kuwait and Turkey (one enterprise); isobutane in Qatar and Saudi Arabia; and HFC-152a⁶⁸ in Mongolia and Turkey⁶⁹ (four enterprises);

⁶⁶ Priority to the submission of projects for HCFC with high-ODP (HCFC-141b), and with ODP lower than HCFC-141b, where national circumstances and priorities required their submission in order to comply with the 2013 and 2015 control measures.

⁶⁷ As reported in document UNEP/OzL.Pro/ExCom/69/23, as of November 2012, 11 XPS foam enterprises with a total consumption of 3,801.8 mt (224.30 ODP tonnes) have signed sub-contracts agreements with the Government of China (FECO) at a value of US \$18,965,620.

⁶⁸ The GWP values of HCFC-22 and HCFC-142b are 1,780 and 2,270 as compared to 124.0 for HFC-152a.

⁶⁹ As reported in document UNEP/OzL.Pro/ExCom/62/52, for the conversion of the XPS foam sector in Turkey," the industries selected HFC-152a/DME as replacement of HCFC-142b/HCFC-22. UNIDO discussed and assessed with the Government of Turkey and the representatives from the enterprises the issue of introducing an HFC-based technology, given that HFCs are among the gases controlled by the Kyoto Protocol and that the Parties to the

- (d) The cost effectiveness of all the projects is below US \$5.00/kg, except for Mongolia where the very low level of HCFC-22 consumption resulted in a cost-effectiveness of US \$13.24/kg;
- (e) The projects in Saudi Arabia⁷⁰ and Turkey⁷¹ include the phase-out of 124.6 ODP tonnes (2,000.0 mt) and 80.5 ODP tonnes (1,320.0 mt) of HCFCs, respectively used by non-eligible enterprises and not covered under the Multilateral Fund, resulting in a cost effectiveness value below US \$3.00/kg. In both cases, the total HCFC consumption was deducted from their remaining eligible HCFC consumption;
- (f) Incremental operating costs were only requested by three countries: Qatar (US \$0.50/kg); Saudi Arabia (US \$0.13/kg); and Turkey (US \$0.37/kg), which in all cases were lower than the US \$1.40/kg under decision 60/44(f)(v); and
- (g) Implementation of the projects approved in stage I will result in the complete phase-out of HCFC-22 and/or HCFC-142b used in the XPS foam sector in the following 5 countries: Kuwait, Mongolia, Qatar, Saudi Arabia and Turkey. Excluding China, it would appear that funding for the conversion of the majority of eligible XPS foam enterprises in Article 5 countries has already been approved.

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

62. Prior to the 62nd meeting, the Executive Committee had approved stand-alone projects for the conversion of air-conditioning equipment in Argentina⁷² and Jordan⁷³. In both cases, justification was provided for prioritizing the phase-out of HCFC-22 over HCFC-141b in the manufacturing sector. At the 62nd meeting, the Secretariat considered it relevant to raise an issue on the submission of projects to phase out HCFC-22 used in the manufacturing of refrigeration and air-conditioning equipment by four Article 5 countries (China, Indonesia, the Islamic Republic of Iran and Nigeria), as they were not in accordance with the principle of prioritization in decision 59/11⁷⁴. The Secretariat pointed out that, during the average life-time of the refrigeration equipment, HCFC-22 would be used continuously for servicing. Therefore, early interventions in reducing the production of HCFC-22-based refrigeration equipment could have an impact on future demand for HCFC-22 for servicing. After discussing the issue, the Executive Committee decided that, when submitting activities to phase out HCFC-22 used in the manufacturing of refrigeration and air-conditioning equipment, the amount of HCFC-22 potentially required through to 2020 for servicing such equipment should be estimated (decision 62/12(a)).

63. Stage I of the HPMPs of 14 Article 5 countries include projects for the conversion of HCFC-22 based refrigeration and/or air-conditioning equipment to alternative technologies. Implementation of these projects will result in the phase-out of 1,400.1 ODP tonnes (24,951.8 mt) of HCFCs (mainly HCFC-22 and to a lesser extent HCFC-141b), at a total cost of US \$187,155,727. The overall cost-effectiveness of the conversion of this sector is US \$7.50/kg (Table 5).

Montreal Protocol are considering including these gases under the Protocol. The stakeholders concluded that HFC-152a/DME was the best available technology; HFC-152a has a very low GWP and zero ODP values”.

⁷⁰ UNEP/OzL.Pro/ExCom/62/46.

⁷¹ UNEP/OzL.Pro/ExCom/62/52.

⁷² UNEP/OzL.Pro/ExCom/61/28.

⁷³ UNEP/OzL.Pro/ExCom/60/31.

⁷⁴ UNEP/OzL.Pro/ExCom/62/10.

Table 5. Analysis of HCFC phase-out investment projects in refrigeration and air-conditioning sectors

Country*	Consumption (ODP t)		Replacement technology**	Cost (US \$)			CE (US\$/kg)
	HCFC-22	HCFC-141b		Approved	Capital	Operating	
Algeria (1)	8.3		HFC-32	1,379,460	433,200	946,260	9.19
Argentina (9)	53.5		HFC-410A	8,435,542	3,161,385	5,274,157	8.68
Armenia (1)	1.4	0.8	R-290	534,353	534,353		16.33
Bahrain (1)	14.0		HFC-32 or R-290	2,064,885	1,262,000	802,885	8.10
Bosnia and Herzegovina (6)	0.8	0.2	HFC-410A HFC-404	247,923	166,108	81,815	15.24
China (3 demonstration)***	30.4		HFC-32, ammonia/R290	9,220,301			16.68
China (industrial commercial)	464.7		HFC-410A/ HFC-32	61,000,000			7.21
China (room air-conditioning)	586.9		HFC-410A/ R-290	75,000,000			7.03
Indonesia (33) (commercial)	9.1	45.4	HFC-32/CO ₂ / ammonia/HC	4,022,649	3,464,450	438,199	8.11
Indonesia (21) (air conditioning)	36.0		HFC-32	4,728,453	2,633,748	2,094,705	7.24
Islamic Republic of Iran (1)	35.4		HFC-410A	3,950,246	594,064	3,356,182	6.14
Jordan (1) (air-conditioning)	17.4		HFC-410A	1,988,850	1,100,550	888,300	6.27
Jordan (1) (air con/commercial)	6.9	1.2	HFC-410A	2,167,033	882,772	1,284,261	15.89
Lebanon (1)	4.9		HFC-410A	920,600	353,600	567,000	10.33
Nigeria	10.6		HFC-410A	550,000	550,000		2.85
Serbia (4)	2.3		R-290	360,130	360,130	0	8.73
Syrian Arab Republic (1)	5.0	7.9	HFC-410A	1,465,361	982,300	483,061	9.01
Thailand (12)	57.0		HFC-32	9,119,941	4,612,410	4,507,531	8.80
Total	1,344.6	55.5		187,155,727	21,091,070	20,724,356	7.50

(*) Number in parenthesis represents the number of enterprises to be converted.

(**) The small amounts of HCFC-141b will be converted to hydrocarbon or methyl formate technologies.

(**) Approved as demonstration projects prior to adoption of decision 60/44, on the understanding that the HCFC consumption associated with the projects would be deducted from the consumption eligible for funding.

64. From an analysis of the project data summarized in the table above, the following observations are relevant:

- (a) The actual enterprises in the commercial, industrial and air-conditioning sub-sectors that would be converted during stage I of the HPMP for China were not known at the time of submission of the HPMP. Since the approval of the HPMP, several enterprises have already been selected for conversion⁷⁵;
- (b) The projects submitted by six countries with more than one enterprise (Argentina, Bosnia and Herzegovina, Indonesia, Nigeria, Serbia and Thailand) cover a large number of

⁷⁵ As reported in document UNEP/OzL.Pro/ExCom/68/24, as of August 2012, a total of 17 enterprises with 20 production lines for unitary air conditioners, multi connected air conditioners, heat pump water heaters, small-sized water chillers, water chillers and freezers and cold storage equipment with an aggregated consumption of more than 6,000 mt of HCFCs were audited. Of the total funding of US \$25,380,000 approved so far, US \$16,000,000 had been disbursed to China (FECO). In addition, 30 production lines in 29 room air-conditioning manufacturing enterprises were audited. Of the total funding of US \$36,430,000 approved so far, US \$18,215,000 had been disbursed to China (FECO).

enterprises with levels of HCFC-22 ranging from 0.17 ODP tonnes (3.0 mt) in Indonesia, to 13.97 ODP tonnes (254.0 mt) in Argentina;

- (c) The alternative technologies selected are: HFC-410A (Argentina, Bosnia and Herzegovina, Jordan⁷⁶, Lebanon, Nigeria and Syrian Arab Republic); HFC-32 (Algeria, Bahrain (or R-290), Indonesia and Thailand); and R-290 (Armenia and Serbia). In the case of China, the technologies selected are HFC-410A and HFC-32 in the industrial, commercial and air-conditioning sub-sectors, and HFC-410A and R-290 in the room air-conditioning sub-sectors⁷⁷;
- (d) The cost-effectiveness of all the projects is below US \$10.50/kg, except for Bosnia and Herzegovina and Armenia where the very low level of HCFC consumption (i.e., 1.0 ODP tonne and 2.0 ODP tonnes of HCFC-22 and HFC-141b, respectively) resulted in a cost-effectiveness of US \$15.24/kg and US \$16.33/kg, respectively; and for Jordan where the project was submitted at the 60th meeting (when the criteria for funding HCFC phase-out in the consumption sector was agreed) and approved as a demonstration project for the phase-out of HCFC-22 and HCFC-141b in the manufacturing of unitary air-conditioning equipment, including operating costs for a two-year period⁷⁸. The cost-effectiveness values of the two projects were slightly above the cost-effectiveness threshold of US \$15.21/kg for the commercial refrigeration sector;
- (e) As expected⁷⁹, incremental operating costs associated with the conversion of HCFC-based manufacturing enterprises in the air-conditioning and the commercial refrigeration sub-sectors are higher than in any other sub-sector. The incremental operating costs varied among the approved projects, ranging from no operating costs requested in one country (Serbia) to 85 per cent of the total project cost (Islamic Republic of Iran). However, in all cases the level of the incremental operating costs were below or equal to the level of US \$6.30/kg in decision 60/44(f)(viii);
- (f) It is expected that the incremental capital costs associated with the HFC-410A technology in the air-conditioning sector (available globally) are lower than those where the HFC-32⁸⁰ technology is used (available only in a few countries, mainly Japan), as the latter is a flammable substance requiring the installation of safety related equipment and

⁷⁶ In approving the project for the conversion of Petra Engineering Industries Co. the Executive Committee noted the commitment of the enterprise to develop, convert manufacturing and actively promote hydrocarbon-based split air conditioners (decision 60/41(e)).

⁷⁷ In its agreement with the Executive Committee, the Government of China agreed to convert at least 18 manufacturing lines for the production of refrigeration and air-conditioning equipment to hydrocarbon technology as part of the refrigeration and air-conditioning sector plan during stage I of the HPMP (Annex X of document UNEP/OzL.Pro/ExCom/67/39).

⁷⁸ In approving the project, the Executive Committee noted that the funding provided under the demonstration project was not indicative of future funding levels for similar conversions (decision 60/41(h)).

⁷⁹ Annex IV of document UNEP/OzL.Pro/ExCom/55/47 includes a detailed analysis on technical and costs issues related to the refrigeration sector. For example, for room and split-ductless air-conditioning systems, incremental capital costs are related to the cost of model redesign, new refrigerant and leak detecting equipment, retooling of the production line, technology transfer, training, commissioning and engineering (and could represent between 10 to 15 per cent of the total incremental costs). Incremental operating costs are related to increased size and cost of the compressor, amount of the refrigerant charge, higher prices of alternative refrigerants, and additional material used (and could represent between 85 to 90 per cent of the total incremental costs). This is also supported by decision 60/44(f) where the levels of incremental operating costs in the foam sector were US \$1.40/kg to US \$1.60/kg, while those for commercial refrigeration and air-conditioning were US \$3.80/kg and US \$6.30/kg, respectively.

⁸⁰ According to the Technical and Economic Assessment Panel report on additional information to alternatives on ODS (in response to decision XXIV/7, the direct cost of HFC-32 is similar to HFC-410A. The lubricant oils and mitigation devices for high discharge temperature of HFC-32 may add some cost.

systems, as shown in the projects approved for Algeria⁸¹ and Thailand⁸²;

- (g) Stage I of the HPMPs for Argentina, Armenia, Bosnia and Herzegovina, Indonesia, Jordan, Lebanon, Nigeria, Serbia and Thailand (except for one eligible enterprise) have addressed the total consumption of HCFCs (mainly HCFC-22) used by eligible enterprises manufacturing refrigeration and air-conditioning equipment.

*An analysis of HCFC phase-out in the refrigeration servicing sector*⁸³

65. ODS are consumed by all Article 5 countries for servicing refrigeration equipment. For a large number of countries, the refrigeration servicing sector is the only one where ODS are used⁸⁴. Accordingly, the Executive Committee has always granted a high priority to the phase-out of ODS in this sector, as demonstrated by the fact that funding for training programmes on good service practices for technicians, and for stand-alone recovery and recycling projects, was approved as early as 1991.

66. With regard to the accelerated phase-out of HCFCs, reduction in the consumption of HCFCs, in particular HCFC-22, used in the refrigeration servicing sector is required to meet the Montreal Protocol compliance targets, particularly in Article 5 countries without HCFC-based manufacturing enterprises. Furthermore, as the consumption of HCFCs used in the manufacturing sector is phased out, the refrigeration servicing sector will be the only HCFC-consuming sector in all countries.

67. The criteria for funding HCFC phase-out in the consumption sector was developed to achieve the 2013 and 2015 phase-out targets; however, the submission of HPMPs to phase out HCFCs in the refrigeration servicing sector to meet the 2020 phase-out target was allowed for LVC countries if they so decided (decision 60/44(f)(xii)). In a separate decision, the Executive Committee agreed that projects that accelerated the phase out of consumption of HCFCs could be considered on a case-by-case basis for LVC countries that had a strong national level of commitment in place to support accelerated phase-out (decision 60/15). As a result, 71 of the 86 LVC countries with an approved HPMP committed to reducing their HCFC consumption baseline by 35 per cent by 2020.

68. At the 61st meeting, three Article 5 countries submitted their HPMPs requesting funding for the complete phase-out of HCFC consumption in 2020 (Bhutan) or 2025 (Nepal and Sri Lanka, both with a five-year service tail)⁸⁵. Further to a discussion, the Committee decided that for HPMPs which addressed phase-out of HCFCs ahead of the Montreal Protocol schedule and had been submitted in line with decision 60/15, the total funding available for achieving 100 per cent phase-out would be extrapolated from the funding available for meeting the 35 per cent reduction in consumption (decision 62/10). Based on the table in subparagraph f(xii) of decision 60/44, the maximum funding levels required to meet the

⁸¹ The project for the conversion of the air-conditioning manufacturing plant as originally submitted in the HPMP was for the conversion to HFC-410A technology. The total capital cost was estimated at US \$332,252. During the discussion stage, the Government and the enterprise agreed to convert to HFC-32 technology. Accordingly, UNIDO redesigned the project to address the flammability of HFC-32. The total revised capital cost was agreed at US \$433,200, plus US \$145,000 as counterpart funding by the enterprise (UNEP/OzL.Pro/ExCom/66/26).

⁸² The incremental capital cost for each conversion increased significantly, due to the conversion towards the use of a flammable refrigerant which required substantial changes (i.e., modifications to the testing laboratory, charging equipment, vacuum pumps and leak detectors; safety equipment for the production and storage sites) (paragraph 11 of document UNEP/OzL.Pro/ExCom/68/41).

⁸³ In response to decision 68/11, the Secretariat prepared a discussion paper outlining key issues and considerations involved in further promoting strategies, approaches and technologies to minimize any adverse climate impacts of HCFC phase-out in the refrigeration servicing sector (UNEP/OzL.Pro/ExCom/70/53). The paper briefly describes the refrigeration servicing sector in Article 5 countries.

⁸⁴ Based on the information from approved HPMPs, about 95 Article 5 countries consume HFCF-22 solely for servicing existing refrigeration and air conditioning equipment, while 50 countries have, in addition, enterprises that use HCFCs in manufacturing.

⁸⁵ UNEP/OzL.Pro/ExCom/62/10.

2025, and 2030 targets (including the 2.5 per cent allowed for servicing between 2030 and 2040) is shown in Table 6. As a result, in stage I of their HPMPs, nine LVC countries committed to completely phasing out their consumption of HCFCs in advance of the Montreal Protocol schedule.

Table 6. Funding levels for the complete phase-out of HCFCs in the servicing sector by LVC countries

Consumption (mt)*	Maximum funding (up to) (US \$)			Total
	2020	2025	2030>**	
>0 <15	164,500	152,750	152,750	470,000
15 <40	210,000	195,000	195,000	600,000
40 <80	280,000	260,000	260,000	800,000
80 <120	315,000	292,500	292,500	900,000
120 <160	332,500	308,750	308,750	950,000
160 <200	350,000	325,000	325,000	1,000,000
200 <320	560,000	520,000	520,000	1,600,000
320 <360	630,000	585,000	585,000	1,800,000

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

(**) Including the 2.5 per cent allowed for servicing between 2030 and 2040.

69. A number HPMPs submitted to the 62nd meeting showed large increases in HCFC consumption, resulting in some countries moving from the LVC category to the non-LVC category (e.g., Burkina Faso, Chad, Gabon, and Togo)⁸⁶. After considering this issue⁸⁷, the Executive Committee decided to allow the submission of stage I of HPMPs to assist former LVC countries with HCFC consumption above 360 mt, in the refrigeration servicing sector only, to meet control measures up to 2020, on the understanding that the level of funding provided would be considered on a case-by-case basis until otherwise decided (decision 62/11). In line with decision 62/11, stage I of the HPMPs of 14 former LVC countries were approved to meet the 35 per cent reduction in their baseline consumption. In all cases, the level of funding was calculated at US \$4.50/kg (in line with decision 60/44(f)(xv)).

70. Also at the 62nd meeting, HPMPs submitted by four non-LVC countries (Colombia, Islamic Republic of Iran, Nigeria and Pakistan) included activities to address HCFC consumption in the servicing sector that were not in accordance with decision 60/44(f)(xv)⁸⁸. The reasons provided for those requests included: the need to reduce HCFC consumption in a sector whose constant growth could offset the amount of HCFCs phased out through investment projects, thus creating a potential risk of non-compliance; the fact that regulations alone would not be sufficient to address growth in the sector; and the need to keep operational the infrastructure established during the phase-out of CFCs. As a result of its deliberations, the Executive Committee requested bilateral and implementing agencies, when submitting activities to phase out HCFC-22 used in the refrigeration servicing sector, to clearly demonstrate how the proposed activities would reduce the growth rate in the servicing sector and contribute to meeting the reduction steps in 2013 and 2015 (decision 62/12(b)).

71. In order to reduce the future demand for HCFC-22, the majority of HPMPs for non-LVC countries with investment activities addressing the manufacturing sector also included activities for the

⁸⁶ The reasons for changes in consumption patterns as explained by the implementing agencies included: an underestimation of prior years' data; the absence of a prior survey, making earlier data unrealistic; the lack of actual customs records, and the possibility that the country was building a stockpile (paragraphs 42 to 45 of document UNEP/OzL.Pro/ExCom/62/10).

⁸⁷ The Executive Committee noted the difficulty of establishing a general rule to address the proposals for countries who were former LVCs but with consumption exceeding 360 mt owing to the uncertainties regarding the levels of consumption and stockpiling in those countries, bearing in mind the need to ensure that sufficient funding was provided to enable them to comply with the 2013 and 2015 control measures (paragraph 48 of document UNEP/OzL.Pro/ExCom/62/62).

⁸⁸ Non-LVC countries should first address consumption in the manufacturing sector to meet the reduction steps in 2013 and 2015.

refrigeration servicing sector, in line with decision 62/12(b)). The HPMPs of three non-LVC countries (i.e., Chile, Venezuela (Bolivarian Republic of), and Yemen), included only activities in the refrigeration servicing sector, as at the time of their submission there were no cost-effective and sustainable technologies to phase out the HCFC used in the manufacturing sector.

72. For the majority of the HPMPs for non-LVC countries that included, in stage I, activities for reducing HCFC consumption in the servicing sector, the level of funding was calculated at US \$4.50/kg. Five Article 5 countries agreed to further reductions of HCFC-22 consumption in the refrigeration servicing sector without assistance from the Multilateral Fund (i.e., Bahrain (30.00 mt (1.65 ODP tonnes)); Kuwait (179.40 mt (19.87 ODP tonnes)); Saudi Arabia (2,638.6 mt (145.12 ODP tonnes)); Turkey (funding calculated at US \$3.14/kg); and Yemen (719.09 mt (39.55 ODP tonnes)).

73. Implementation of activities in the refrigeration and air-conditioning servicing sector included in stage I of HPMPs will result in the complete phase-out of HCFC-141b used as a solvent for flushing refrigeration circuits in the following 25 countries: Algeria, Bahrain, Belize, Bolivia (Plurinational State of), Cameroon, Chile, Colombia, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Kuwait, Mauritius, Mexico, Morocco, Nicaragua, Panama, Peru, Seychelles, Sri Lanka, Uruguay, Yemen and Zimbabwe.

An analysis of HCFC phase-out in other manufacturing sectors

74. Only two HCFC phase-out investment projects in other manufacturing sectors have been included in stage I HPMPs:

- (a) The phase-out of 3.3 ODP tonnes (60.0 mt) of HCFC-22 and 7.8 ODP tonnes (70.9 mt) of HCFC-141b used for the manufacturing of technical aerosol products in Mexico⁸⁹. The total cost of the project amounted to US \$520,916, resulting in a cost effectiveness of US \$3.80/kg (i.e., below the cost effectiveness threshold of US \$4.40/kg). The enterprise selected four different propellants: hydrocarbons, HFC-152a, HFC-134a, a mixture of HFC-365mfc/ HFC-227ea⁹⁰. In line with decision 62/9, incremental operation costs were requested for a one-year period and represented approximately 40 per cent of the total costs; and
- (b) The phase-out solvent sector plan as a component of stage I of the HPMP for China to phase-out of 69.0 ODP tonnes (627.3 mt) of HCFC-141b, at a total cost of US \$5,000,000, with a cost effectiveness of US \$7.97/kg. The technology selected is siloxane (KC-6)⁹¹.

Impacts on the environment including on the climate

75. In its discussions on options for assessing and defining incremental costs for activities to phase out HCFC consumption and production, which began at the 53rd meeting and culminated in the criteria set out in decision 60/44, the Executive Committee was guided by the principles of decision XIX/6. Moreover, in its decision 55/43(h) the Committee requested the Secretariat “to further analyse if an approach of the type outlined in document UNEP/OzL.Pro/ExCom/55/47 (on an analysis of relevant cost considerations surrounding the financing of HCFC phase-out) provided a satisfactory and transparent basis for the prioritization of HCFC phase-out technologies to minimize other impacts on the

⁸⁹ UNEP/OzL.Pro/ExCom/63/42.

⁹⁰ The GWP values of HFC-134a and HFC-365mfc/HFC-227ea are 1,430 and 964, respectively. When the project was reviewed, the Secretariat calculated the climate impact of the conversion resulting in savings of 133,531 tonnes of CO₂ equivalent.

⁹¹ Any organic or inorganic chemical compounds of silicon, oxygen, and usually carbon and hydrogen, based on the structural unit R₂SiO, where R is an alkyl group, usually methyl.

environment, including on the climate as originally envisaged in decision XIX/6⁹². Specifically with regard to paragraph 11(b) of decision XIX/6, “substitutes and alternatives that minimize other impacts on the environment, including on the climate, taking into account GWP, energy use and other relevant factors”, decision 60/44(f)(iv) increases the level of funding up to a maximum of 25 per cent above the cost-effectiveness threshold for projects when needed for the introduction of low-GWP technologies.

76. To assess the direct impact on the climate associated with approved HPMPs solely for the purpose of this document, a simplified calculation has been made, based only on the effect caused by the eventual emission of refrigerants (i.e., a comparison of the GWP values of the HCFCs to be phased out and the alternative substances being introduced), not taking into account energy consumption changes related to the use of alternative foam blowing agents and/or refrigerants. The calculation is made using the phase-out of annual consumption in manufacturing of, mostly, refrigeration and air-conditioning equipment and foam products, as an approximation of future emissions of refrigerants into the atmosphere. The calculation does not quantify whether these emissions take place immediately or in a future year, and does not aggregate the emissions related to multiple years of manufacturing. The calculation is therefore not comparable to annual emissions calculations used in other fora⁹². As shown in Table 7, the 82.114.7 mt (6,812.0 ODP tonnes) of annual HCFC consumption to be phased out in the manufacturing sector are equivalent to approximately 107.0 million tonnes of CO₂-equivalent in emissions, as compared to 27.7 million tonnes of CO₂-equivalent in emissions for the alternatives phased in. As a result, for each year of manufacturing, the substances used after conversion have, when released, an impact on the climate which is lower by 79.4 million tonnes of CO₂-equivalent than the impact of the equivalent amount of HCFC.

Table 7. Simplified calculation of the impact on the climate from HCFC and their replacements for every year of manufacturing

Application*	HCFC	Alternative technology**	HCFC		Emissions (tonnes CO ₂ equivalent)		
			(ODP t)	(mt)	Current	Alternative	Avoided
PU foam	HCFC-141b***	L	4,176.1	37,964.6	27,068,786	531,505	(26,537,281)
		H	124.9	1,135.5	809,644	818,728	9,084
XPS foam	HCFC-142b	L	394.8	6,073.8	13,787,631	72,886	(13,714,745)
		H	120.0	1,846.2	4,190,769	137,354	(4,053,415)
XPS foam	HCFC-22	L	413.4	7,516.4	13,379,127	90,196	(13,288,931)
		H	75.2	1,367.3	2,433,745	101,725	(2,332,020)
Solvent ****	HCFC-141b	L	132.0	1,200.0	855,600	24,000	(831,600)
		H	-	-	-	-	-
RAC	HCFC-22	L	656.4	11,934.5	21,243,491	214,822	(21,028,669)
		H	719.2	13,076.4	23,275,927	25,656,627	2,380,700
Manufacturing	Subtotal		6,812.0	82,114.7	107,044,721	27,647,844	(79,396,877)
Servicing	HCFC-22		1,098.2	19,967	35,541,745		
	HCFC-142b		141.8	2,182	4,953,140		

(*) For PU foam, the amount of the alternative blowing agent is 70 per cent of the amount of HCFC-141b. For XPS foam, the amount of the alternative blowing agent is 60 per cent of the amount of HCFC-22 and HCFC-142b. For refrigeration manufacturing, the amount of alternative refrigerant is 90 per cent of the amount of HCFC-22.

(**) In the context of the present document, alternative technologies “L” include hydrocarbon (blowing agent and refrigerant), and methyl formate, methylal, HFO and water based foam blown agents; and alternative technologies “H” include HFC-245fa for PU foam; HFC-152a for XPS foam; and HFC-32 and HFC-410A for refrigeration manufacturing.

(***) Including 289.7 ODP tonnes (2,633.6 mt) of HCFC-141b contained in imported pre-blended polyols.

(****) Including 59.9 ODP tonnes (544.5 mt) of HCFC-141b used for flushing refrigeration equipment.

⁹² The climate impact of the conversion of the refrigeration and air conditioning manufacturing sector in HPMPs has been calculated in the project documents using the Multilateral Fund Climate Impact Indicator (MCII) developed by the Secretariat; the definitions are similar to the ones used in this document and include in addition to the values mentioned in this document also information on the impact of changes in energy consumption related to the different technologies used before and after conversion.

77. In addition to the HCFCs associated with the manufacturing sector, the annual consumption of 1,098.2 ODP tonnes of HCFC-22 and 141.8 ODP tonnes of HCFC-142b used in the refrigeration servicing sector will also be phased out during the implementation of the approved HPMPs. The technical assistance activities in the servicing sector proposed in the HPMPs, which include the introduction of better containment of refrigerants and leakage control and the enforcement of HCFC import quotas, among other things, will reduce the amounts of CO₂-equivalent tonnes emitted into the atmosphere (each kilogramme of HCFC-22 and HCFC-142b not emitted due to better refrigeration practices results in savings of approximately 1.8 and 2.3 CO₂-equivalent tonnes, respectively). At this time, a more accurate quantitative assessment of impact on the climate cannot be conducted. The impact might be established through an assessment of implementation reports by, *inter alia*, comparing the levels of refrigerants used annually from the beginning of implementation of the HPMP, the reported amounts of refrigerants being recovered and recycled, the number of technicians trained, and the HCFC-22 based equipment being retrofitted.

III BRIEF ANALYSIS OF THE IMPLEMENTATION OF THE HPMPs

78. Thus far the Executive Committee has approved 138 HPMPs, eighty-six for LVC countries and fifty-two for non-LVC countries. A brief analysis of these HPMPs is presented below. Annex IV lists all Article 5 countries with an approved HPMP, indicating *inter alia* their HCFC baseline for compliance, their starting points, the amount of HCFCs approved for phase out and the remaining eligible consumption.

HPMPs approved for LVC countries

79. The main activities included in stage I of the HPMPs submitted by LVC countries are related to reducing the consumption of HCFCs used for servicing refrigeration and air-conditioning equipment. While stage I of all of the HPMPs reduced the level of consumption of mainly HCFC-22, several of them also reduced the level of consumption of other HCFCs, mainly HCFC-141b (used for flushing refrigeration circuits), and, to a lesser extent, HCFC-123, HCFC-124 and HCFC-142b (mainly as components of refrigerant blends). Additionally, stage I of the HPMPs of fourteen countries⁹³ also included investment activities for the phase-out of HCFCs used in the manufacturing sector (i.e., HCFC-141b used as a foam blowing agent, either imported in bulk or contained in imported pre-blended polyols).

80. As a result, implementation of the phase-out activities proposed in stage I of the HPMPs approved for the eighty-six LVC countries will result in the phase-out of 41.2 per cent of the aggregated baseline and 77.5 per cent of the amounts of HCFC-141b contained in imported polyols. Table 8 summarizes the amounts to be phased out for each HCFC consumed in the country. The data is presented in three groups according to the phase-out amounts committed to in the HPMPs (i.e., 10 per cent, 35 per cent, and complete phase-out).

Table 8. Amounts of HCFCs to be reduced in stage I of HPMPs for LVC countries (ODP tonnes)

HCFC*	Baseline**	Starting point	Approved	Remaining	% approved
(1)	(2)	(3)	(4)	(5)	(6)
10 per cent reduction by 2015 (6 LVC countries)***					
HCFC-141b	0.8	0.7	-	0.7	0.0
HCFC-142b	0.2	0.2	-	0.2	0.0
HCFC-22	29.5	29.2	3.8	25.4	13.1
HCFC-141b-polyol	-	0.8	0.8	-	100.0

⁹³ Armenia, Bosnia and Herzegovina, Costa Rica, Croatia, Cuba, Ecuador, El Salvador, Fiji, Guatemala, Jamaica, Nicaragua, Sri Lanka, Swaziland and Zimbabwe.

HCFC*	Baseline**	Starting point	Approved	Remaining	% approved
(1)	(2)	(3)	(4)	(5)	(6)
35 per cent reduction by 2020 (71 LVC countries)***					
HCFC-123	0.5	0.5	0.1	0.4	23.1
HCFC-124	0.7	0.7	0.3	0.4	44.3
HCFC-141b	30.6	29.2	22.6	6.6	77.5
HCFC-142b	5.2	5.4	1.9	3.5	35.1
HCFC-22	341.7	336.2	113.3	222.9	33.7
HCFC-141b-polyol	-	77.7	60.1	17.7	77.3
Complete phase-out (9 LVC countries)					
HCFC-141b	0.9	3.5	3.5	-	100.0
HCFC-142b	0.1	0.1	0.1	-	100.0
HCFC-22	44.1	44.2	44.2	-	100.0
Total (85 LVC countries)					
HCFC-123	0.5	0.5	0.1	0.4	23.1
HCFC-124	0.7	0.7	0.3	0.4	44.3
HCFC-141b	32.3	33.5	26.2	7.3	78.2
HCFC-142b	5.5	5.7	2.0	3.7	35.4
HCFC-22	426.3	420.6	161.3	259.3	38.4
HCFC-141b-polyol	-	78.6	60.9	17.7	77.5
Summary grand total					
HCFCs	465.3	461.0	189.9	271.1	41.2
HCFC-141b-polyol	-	78.6	60.9	17.7	77.5

(*) HCFC-141b-polyol, refers to HCFC-141b contained in imported pre-blended polyols and not reported under Article 7 of the Montreal Protocol.

(**) HCFC baseline for compliance as estimated at the time of the approval of the HPMPs.

(***) In a few countries the starting point is slightly higher than the baseline, while in others is lower. Accordingly, the total reduction in HCFC consumption associated with stage I of the HPMP is slightly above/below the 10 or 35 per cent reduction.

(1) HCFCs consumed by LVC countries (reported under Article 7 of the Protocol).

(2) Aggregated HCFC consumption baseline by type of HCFC.

(3) Aggregated starting point for aggregate reductions in HCFC consumption. Starting points for several Article 5 countries would be adjusted based on the established baseline in line with decision 60/44(e).

(4) Amounts of HCFCs approved to be phased out in stage I of HPMPs.

(5) Remaining amounts of HCFCs eligible for funding (i.e., (4) – (3)).

(6) Ratio (in percentage) of the amount of HCFC approved to be phased out (4) and the starting point (3).

HPMPs approved for non-LVC countries

81. The main activities included in stage I of the HPMPs of several non-LVC countries are related to reducing the consumption of HCFCs used in the manufacturing sector, mainly HCFC-141b used as a polyurethane foam blowing agent and, to a lesser extent, HCFC-22 used as a refrigerant in the manufacturing of refrigeration and air-conditioning equipment, and HCFC-22/HCFC-142b used in the production of extruded polystyrene foams.

82. As a result, implementation of the phase-out activities proposed in stage I of the HPMPs approved for the fifty-two non-LVC countries will result in the phase-out of 23.7 per cent of the aggregated baseline and 47.3 per cent of the amounts of HCFC-141b contained in imported polyols. Table 9 summarizes the amounts to be phased out for each HCFC consumed in these countries. Given the much higher level of HCFC consumption by one country (China) compared to all others, the data is presented in two groups: one with aggregated amounts for fifty-one non-LVC countries; and the other with aggregated amounts for China.

Table 9. Amounts of HCFCs to be reduced in stage I of HPMPs for non-LVC countries (ODP tonnes)

HCFC*	Baseline**	Starting point	Approved	Remaining	%approved
(1)	(2)	(3)	(4)	(5)	(6)
51 non-LVC countries (excluding one country, China)					
HCFC-123	21.7	19.6	0.4	19.2	1.9
HCFC-124	22.9	22.3	0.7	21.7	3.0
HCFC-141	1.9	0.9	-	0.9	0.0
HCFC-141b	4,731.9	4,843.6	2,566.4	2,277.2	53.0
HCFC-142b	513.3	526.1	338.0	188.1	64.2
HCFC-21	1.5	0.7	-	0.7	0.0
HCFC-22	8,081.0	8,054.2	1,298.7	6,755.5	16.1
HCFC-225	3.1	1.6	-	1.6	0.0
HCFC-225ca	0.5	0.4	-	0.4	0.0
HCFC-225cb	0.7	0.7	-	0.7	0.0
HCFC-141b Polyol	-	483.5	228.8	254.7	47.3
1 non-LVC country (China)					
HCFC-123	10.6	10.1	-	10.1	0.0
HCFC-124	3.0	3.1	-	3.1	0.0
HCFC-141b	5,941.3	5,885.2	1,698.1	4,187.1	28.9
HCFC-142b	1,473.6	1,470.5	267.0	1,203.6	18.2
HCFC-22	11,839.4	11,495.3	1,480.6	10,014.7	12.9
HCFC-225ca	1.3	1.2	-	1.2	0.0
All 52 non-LVC countries					
HCFC-123	32.3	29.7	0.4	29.4	1.3
HCFC-124	25.9	25.4	0.7	24.7	2.7
HCFC-141	1.9	0.9	-	0.9	0.0
HCFC-141b	10,673.2	10,728.8	4,264.5	6,464.3	39.7
HCFC-142b	1,986.9	1,996.6	604.9	1,391.7	30.3
HCFC-21	1.5	0.7	-	0.7	0.0
HCFC-22	19,920.4	19,549.5	2,779.3	16,770.2	14.2
HCFC-225	3.1	1.6	-	1.6	0.0
HCFC-225ca	1.8	1.6	-	1.6	0.0
HCFC-225cb	0.7	0.7	-	0.7	0.0
HCFC-141b-polyol*	-	483.5	228.8	254.7	47.3
Summary grand total					
51 non-LVC countries	13,378.5	13,470.2	4,204.2	9,266.0	31.2
1 non-LVC country (China)	19,269.2	18,865.4	3,445.6	15,419.8	18.3
All 52 non-LVC countries	32,647.7	32,335.6	7,649.8	24,685.9	23.7
HCFC-141b-polyol*	-	483.5	228.8	254.7	47.3

(*) HCFC-141b-polyol, refers to HCFC-141b contained in imported pre-blended polyols and not reported under Article 7 of the Montreal Protocol.

(**) HCFC baseline for compliance as estimated at the time of the approval of the HPMPs.

(1) HCFCs consumed by non-LVC countries (reported under Article 7 of the Protocol).

(2) Aggregated HCFC consumption baseline by type of HCFC.

(3) Aggregated starting point for aggregate reductions in HCFC consumption. Starting points for several Article 5 countries would be adjusted based on the established baseline in line with decision 60/44(e).

(4) Amounts of HCFCs approved to be phased out in stage I of HPMPs.

(5) Remaining amounts of HCFCs eligible for funding (i.e., (4) – (3)).

(6) Ratio (in percentage) of the amount of HCFC approved to be phased out (4) and the starting point (3).

Article 5 countries without an approved HPMP

83. Of the 145 Article 5 countries that are eligible for receiving assistance to phase out HCFC consumption, seven do not yet have an approved HPMP. Two of these countries are categorized as LVCs, with an aggregated HCFC consumption baseline of 11.0; ODP tonnes; while the remaining five countries

are non-LVCs with an aggregated HCFC consumption baseline of 389.0 ODP tonnes, as shown in Table 10.

Table 10. Article 5 countries without an approved HPMP (ODP tonnes)

Country	Baseline	Starting point	Approved	Remaining	% approved
LVC countries					
Botswana	11.0	11.0		11.0	
South Sudan					
Subtotal (LVC countries)	11.0	11.0		11.0	
Non-LVC countries					
Democratic People's Republic of Korea*	78.0	78.0		78.0	
Libya	114.7	114.7	0	114.7	
Mauritania	20.4	20.4	0	20.4	
Syrian Arab Republic*	135.2	138.3	12.9	125.4	9.3
Tunisia**	40.7	40.7		40.7	
Subtotal (non-LVC countries)	389.0	392.1	12.9	379.2	3.3
Grand total	399.7	403.8	12.9	390.9	3.2

(*) Submitted to the 68th meeting but deferred by the Executive Committee.

(**) Tunisia might import HCFC-141b contained in pre-blended polyols.

HCFC phase-out in the production sector

84. The aggregated HCFC production baseline of the six Article 5 countries that have been receiving assistance from the Multilateral Fund for other ODS⁹⁴ has been established at 32,593.8 ODP tonnes. In order to be in compliance with the Montreal Protocol, the maximum allowable levels of production would be equal to the individual baselines between 1 January 2013 and 31 December 2014 and then be reduced by 10 per cent (i.e., 3,259.4 ODP tonnes) by 1 January 2015⁹⁵. The HCFCs produced by Article 5 countries is presented in Table 4 of Annex I.

85. At its 69th meeting, the Executive Committee approved stage I of the HCFC production sector phase-out management plan (HPPMP) for China to meet the freeze and 10 per cent reduction of HCFC production baseline. The total amount of phase-out to be achieved by the project was based on the verified 2010 ODS production data of: 310,000 mt of HCFC-22, 98,711 mt of HCFC-141b, 33,957 mt of HCFC-142b, 2,819 mt of HCFC-123 and 401 mt of HCFC-124 (decision 69/28).

IV AN OVERVIEW OF HCFC CONSUMPTION ELIGIBLE FOR PHASE-OUT IN SUBSEQUENT STAGES OF HPMPs

HCFC to be phased out in approved HPMPs

86. In summary, implementation of the 138 HPMPs so far approved will result in the total phase out of 8,129.4 ODP tonnes of HCFCs, consisting of 7,839.7 ODP tonnes of HCFCs reported under Article 7 of the Montreal Protocol and 289.7 ODP tonnes of HCFC-141b contained in imported pre-blended polyols. The amounts of HCFCs to be phased out by type of HCFC are shown in Table 11. Given the much higher level of HCFC consumption by one country (China) compared to all others, the data is presented in two groups: one with aggregated amounts for 137 countries; and the other with aggregated amounts for China.

⁹⁴ Excluding the Republic of Korea.

⁹⁵ The Executive Committee is currently considering policy issues related to HCFC phase-out in the production sector, including the funding eligibility of several HCFC 22 production facilities in some Article 5 countries.

Table 11. Total amounts of HCFCs to be phased out in the 138 HPMPs approved so far (ODP tonnes)

HCFC*	Baseline**	Starting point	Approved	Remaining	% approved
(1)	(2)	(3)	(4)	(5)	(6)
All 137 countries					
HCFC-123	22.2	20.1	0.5	19.6	2.5
HCFC-124	23.6	23.0	1.0	22.1	4.3
HCFC-141	1.9	0.9	-	0.9	0.0
HCFC-141b	4,764.2	4,877.1	2,592.6	2,284.5	53.2
HCFC-142b	518.8	531.8	340.0	191.8	63.9
HCFC-21	1.5	0.7	-	0.7	0.0
HCFC-22	8,507.3	8,474.8	1,460.0	7,014.8	17.2
HCFC-225	3.1	1.6	-	1.6	0.0
HCFC-225ca	0.5	0.4	-	0.4	0.0
HCFC-225cb	0.7	0.7	-	0.7	0.0
HCFC-141b-polyol	-	562.0	289.7	272.3	51.6
One country (China)					
HCFC-123	10.6	10.1	-	10.1	0.0
HCFC-124	3.0	3.1	-	3.1	0.0
HCFC-141b	5,941.3	5,885.2	1,698.1	4,187.1	28.9
HCFC-142b	1,473.6	1,470.5	267.0	1,203.6	18.2
HCFC-22	11,839.4	11,495.3	1,480.6	10,014.7	12.9
HCFC-225ca	1.3	1.2	-	1.2	0.0
All 138 countries					
HCFC-123	32.8	30.2	0.5	29.7	1.6
HCFC-124	26.6	26.1	1.0	25.1	3.8
HCFC-141	1.9	0.9	-	0.9	0.0
HCFC-141b	10,705.5	10,762.3	4,290.6	6,471.6	39.9
HCFC-142b	1,992.4	2,002.3	606.9	1,395.4	30.3
HCFC-21	1.5	0.7	-	0.7	0.0
HCFC-22	20,346.7	19,970.1	2,940.6	17,029.5	14.7
HCFC-225	3.1	1.6	-	1.6	0.0
HCFC-225ca	1.8	1.6	-	1.6	0.0
HCFC-225cb	0.7	0.7	-	0.7	0.0
HCFC-141b-polyol	-	562.0	289.7	272.3	51.6
Summary grand total					
All 138 countries	33,113.1	32,796.6	7,839.7	24,956.9	23.9
HCFC-141b-polyol	-	562.0	289.7	272.3	51.6

(*) HCFC-141b-polyol, refers to HCFC-141b contained in imported pre-blended polyols and not reported under Article 7 of the Montreal Protocol.

(**) HCFC baseline for compliance as estimated at the time of the approval of the HPMPs.

(1) HCFCs consumed by Article 5 countries (reported under Article 7 of the Protocol).

(2) Aggregated HCFC consumption baseline by type of HCFC.

(3) Aggregated starting point for aggregate reductions in HCFC consumption. Starting points for several Article 5 countries would be adjusted based on the established baseline in line with decision 60/44(e).

(4) Amounts of HCFCs approved to be phased out in stage I of HPMPs.

(5) Remaining amounts of HCFCs eligible for funding (i.e., (4) – (3)).

(6) Ratio (in percentage) of the amount of HCFC approved to be phased out (4) and the starting point (3).

Potential options to ensure that the level of funding meets the 20 per cent disbursement threshold

87. In its decision 57/15, the Executive Committee requested that submissions for funding requests of tranches of multi-year agreements should not be made where rates of implementation of activities are low and where the rate of disbursement of funding available from the previously approved tranche was less than 20 per cent, even when the ODS levels of consumption under consideration were below the maximum allowable under the Protocol and the Agreement between the Government concerned and the Executive Committee. All the Agreements governing the phase-out of HCFCs contain clauses defining

pre-conditions for the submission of tranches, including one related to the 20 per cent disbursement (in line with decision 57/15).

88. At the 69th meeting, the Secretariat was encouraged to consider options to ensure: that the level of funding for the first year of stage II would meet the 20 per cent disbursement threshold, and that subsequent tranches were considered in light of the need for cash and the likelihood of reaching the threshold (decision 69/24(d)).

89. The main reason for delays in the submission of tranches of approved HPMPs is because the level of disbursement of the funding approved in the previous tranche has been below the 20 per cent specified in the relevant agreements. The reasons for delayed disbursement vary widely. For example, in some cases the delay is due to additional time required for the project documentation between the Government and the relevant bilateral and/or implementing agencies to be signed; in other cases delays relate to discussions between enterprises and agencies on technical and/or cost related issues including the counterpart contributions. In yet other cases, where more than one agency is involved in the implementation of the project, even when one agency's funding is fully disbursed, the combined level of disbursement might still be below the 20 per cent disbursement threshold.

90. During the preparation of this information document, the Secretariat sought the views of the implementing agencies on this issue. Specifically:

- (a) UNIDO indicated that the issue is related to the terms "commitment" (obligations under previous financial system) and disbursement. Both concepts would need to be clearly defined. With the introduction of The International Public Sector Accounting Standards (IPSAS), the definition of disbursement has changed compared to that used over the last 20 years. According to UNIDO, this has serious implications for the timing of the first disbursement and whether the agencies can reach the 20 per cent disbursement within a very short period. In the past, under the United Nations System Accounting Standards (UNSAS) and previous financial systems, the disbursement was equal to transfer of funds or cash outflow from UNIDO's accounts, thus allowing the agencies to meet the 20 per cent disbursement threshold. Now, disbursements are only reflected once the services have been provided which, in many cases, are much later than when funds are released by the agencies. In order to overcome this barrier, UNIDO suggested changing the target of 20 per cent disbursement as follows: either 20 per cent payments/cash outflow (i.e., the definition previously used for disbursement); or 40 per cent of funds implemented as a sum of disbursements and commitments (expenditure); and
- (b) UNEP indicated that the 20 per cent disbursement rate should relate to the tranche specific to each implementing agency. In the case of procurement, this may take longer and will delay implementation of non-investment type activities. UNEP proposed that in a situation where the 20 per cent disbursement was not met, the tranche of the HPMP could be conditionally approved by the Executive Committee, with the understanding that the implementing agency would ensure that 20 per cent was disbursed prior to the additional funds from the next tranche being released to the country. This could be considered on a case-by-case basis.

91. Given the complexity of this matter, in the time available for the preparation of this information document, the Secretariat was unable to undertake detailed discussions with the implementing agencies in order to propose a viable solution which would combine the objectives of simplicity, allow for continued incentives for fast implementation of activities included in the tranches and sensible cash-flow management. The Secretariat also notes that the issue is relevant to stage II of the HPMPs, for which preparation funding is currently under discussion by the Executive Committee. The Secretariat will

continue to discuss the matter with the implementing agencies, and report back to the Executive Committee on the outcomes of the discussion at a later meeting.

OBSERVATIONS

Observations on current status of HPMPs

92. In comparison to stage I, it appears that preparation of stage II and subsequent stages of HPMPs would be easier to undertake⁹⁶ considering that at the time of preparation of stage I HPMPs, there were no guidelines and/or criteria for funding HCFC phase-out. Indeed, there was a high level of uncertainty as the HCFC baselines for compliance were unknown, and no up-to-date and reliable data on HCFC consumption per sector was available. Also, in many cases the ODS licensing system in operation did not extend to control HCFC imports and exports. Furthermore, the availability of mature, cost-effective and energy-efficient alternatives to replace HCFCs in some applications was limited, and the engagement from stakeholders to phase out HCFCs on an accelerated schedule was also limited.

93. Based on the analysis of stage I of the approved HPMPs, the Secretariat observes that all Article 5 countries with an approved HPMP have (or will have soon) in place enforceable national licensing systems for HCFC imports and exports capable of ensuring the countries' compliance with the Montreal Protocol HCFC phase-out, which is a precondition for receiving funding for tranches of the HPMPs. An up-to-date analysis of HCFC consumption and its sector distribution has been carried out based on comprehensive surveys undertaken at the country level. Overarching strategies for reducing HCFC consumption have been prepared and agreed by all stakeholders, based on an extensive consultation process during the preparation of stage I of the HPMPs.

Observations on the criteria set out in decision 60/44 in the context of stage II HPMPs

94. With regard to guidelines for HCFC phase-out in the consumption sector, the Secretariat notes that the criteria for funding HCFC phase-out in the consumption sector as adopted in decision 60/44 and further elaborated with decisions and guidelines subsequently adopted by the Executive Committee, allowed the submission and approval of stage I of HPMPs that will result in over 25 per cent reduction of HCFC consumption from the aggregated baseline in Article 5 countries. These guidelines already address the key elements of developing and funding of HPMPs. Stage II HPMPs could therefore be submitted based on the criteria and guidelines currently in place, which could be further developed as new policy issues arise from their review, as has also been the case in several stage I HPMPs.

95. For Article 5 countries with HCFC consumption in both the servicing and manufacturing sectors, stage II would include activities that build upon those sectors already been addressed in stage I, based on current advances in alternative technologies to HCFCs. It appears that in several Article 5 countries, HCFC consumption associated with small and medium size manufacturing enterprises will be phased out during stage II and, possibly, subsequent stages. Given the overarching strategy, plan of action and phase-out activities included in approved stage I of the HPMPs, it is expected that for approximately 95 Article 5 countries (80 LVC countries and 15 non-LVC countries), stage II would address the remaining HCFC consumption mainly in the refrigeration and air-conditioning servicing sector.

Observations on the incremental cost analysis

96. With regard to the analysis of incremental capital and operating costs contained in the present document, the Secretariat notes that it is based on the costs that were included in the project proposals as submitted in the respective HPMPs and further adjusted during the project review process and/or by the

⁹⁶ Summary extracted from the document on draft guidelines for funding the preparation of stage II of HCFC phase out management plans (UNEP/OzL.Pro/ExCom/69/33).

Executive Committee at the time of approval of the relevant HPMP. The detail of the information provided at the enterprise level varied, as in some cases only one or a few enterprises were to be converted, while in other cases several tens and even hundreds of enterprises were to be converted. In approving the HPMPs, the governments concerned committed to phase out a specific amount of HCFCs used by particular enterprises (except in the case of China).

97. Pursuant to decision 70/21 (b) and (c), additional information on actual costs incurred at the enterprise level was received from 24 foam enterprises, distributed as follows: 12 enterprises manufacturing insulation foam for domestic refrigerators; seven enterprises manufacturing panels (e.g., insulation for cold storage); and five enterprises manufacturing foam for other applications (e.g., containers, freezers, box foam)⁹⁷. The alternative technologies selected by these enterprises were cyclopentane (18 enterprises), water-blown (five enterprises) and CO₂ (one enterprise). Table 12 summarizes the cost-related information of completed HCFC phase-out projects. No information was yet available for other foam applications (i.e., insulation foam for commercial refrigeration, continuous panels, integral skin and spray foam), and other alternative technologies (i.e., pre-blended cyclopentane formulations, methyl formate, and HFC-245fa). Information on incremental operational costs/savings was provided only by one country as these costs have not yet been paid.

Table 12. Cost-related information for completed HCFC phase-out projects

Agency	Country	Sector/subsector	Alternative technology
UNDP	Colombia	Insulation domestic refrigeration (4 enterprises)	Cyclopentane
UNIDO	Morocco	Insulation domestic refrigeration (1 enterprise)	Cyclopentane
UNIDO	Pakistan	Insulation domestic refrigeration (5 enterprises)	Cyclopentane
UNIDO	Philippines	Panel for cold storage (5 enterprises) Spray (1 enterprise) Containers, freezers, cool box (4 enterprises)	Cyclopentane (4) Water blown (5) CO ₂ (1)
UNIDO	Sudan	Insulation domestic refrigeration (2 enterprises) Panels (2 enterprises)	Cyclopentane
Total	5 countries	Insulation domestic refrigeration (12 enterprises) Panels (7 enterprises) Spray (1 enterprise) Containers, freezers, cool box (4 enterprises)	Cyclopentane (18) Water blown (5) CO ₂ (1)

98. In reviewing the information submitted by the implementing agencies, the Secretariat encountered difficulties in determining whether all of the costs incurred were eligible incremental costs as per the approved project proposals⁹⁸. For example, information on the capacities of foam pressure dispensers and safety-related equipment was missing for some enterprises; significant deviations in costs incurred for training and technical assistance were found among enterprises (e.g., while six enterprises satisfactorily completed their conversion with no funds allocated for training, one enterprise (same application and same alternative technology) spent over US \$260,000 over the US \$40,000 approved). Major deviations were also encountered in costs associated with piping and civil works required for the installation of new equipment in few enterprises, while in others these costs were not visible or may have been grouped with other items. In order to overcome these difficulties and provide a meaningful analysis, the Secretariat prepared a format to compare the eligible incremental costs included in the proposals as approved by the Executive Committee to the actual eligible incremental costs incurred by the enterprises as submitted to the implementing agencies.

⁹⁷ Excluding China, stage I of the HPMPs so far approved include the conversion of over 450 enterprises, manufacturing foam for various applications.

⁹⁸ With regard to projects for the conversion of domestic refrigeration foam enterprises cyclopentane, UNDP reported that the costs of new foam dispensers and retrofits thereof have increased by 5 to 10 per cent while costs associated with civil works (especially piping) have also increased.

99. In spite of the efforts and work undertaken by UNDP and UNIDO (the two implementing agencies that submitted cost-related information), the only additional data obtained using the proposed format was the capacity of some equipment items in some of the foam enterprises. Furthermore, both implementing agencies encountered major difficulties in completing the required information for a number of reasons. For example, equipment items are not grouped and described in the same way in the providers' offers and the approved project proposals. Equipment providers can allocate different costs for the same type of equipment. In some cases, during the conversion stage, some foam enterprises decided to install higher capacity equipment as compared to the baseline, and/or other equipment items, and/or make modifications to the plant layout with their own resources (i.e., non-eligible incremental costs). These costs, together with the eligible incremental costs, are included in the same providers' invoices.

100. In addition to the above, the Secretariat notes that the number of enterprises for which actual costs have already been paid is very small as compared to the enterprises currently under conversion, and that yet there is no information on costs incurred by enterprises using other alternative technologies (where it appears that the incremental capital costs are below the cost-effectiveness thresholds). Therefore, the currently available cost-related information does not reflect the actual incremental costs of the polyurethane foam sector as a whole.

101. The cost for determining the actual distribution of capital and operating costs among the enterprises included in stage I of the HPMP will be substantial and will only be known at a future stage of implementation (i.e., several years from now when enterprises in other sub-sectors and using other alternative technologies are completed). Therefore, the Secretariat and the implementing agencies consider that the criteria and guidelines currently in place could continue to be used when submitting new project proposals, on the understanding that they could be further developed as new policy issues arise from their review (e.g., distribution of eligible capital and operating costs when new emerging technologies such as gaseous unsaturated HFCs are selected).

102. Additional considerations provided by the implementing agencies on this issue are presented below:

- (a) UNDP reported that costs of new foam dispensers and retrofits thereof have increased by 5 to 10 per cent while costs associated with civil works (especially piping) have also increased in projects related to the conversion of some foam enterprises to cyclopentane technology (particularly those manufacturing insulation foam for domestic refrigerators);
- (b) UNIDO expressed a view on the possibility of adjusting funding levels in accordance with criteria to be decided at a later stage; an assessment of the costs considering only capital costs; not deducting operating savings when introducing a low-GWP technologies (e.g., hydrocarbon-based); an assessment of historical co-financing by enterprises taking into account the prevailing economic situation at the country level; the special situation of SMEs that will be converted during stage II of HPMPs with higher cost/kilogram of ODS to be phased; consideration of inflation and fluctuations in the exchange rates.

103. The Secretariat also notes that no actual cost-related information is yet available for the conversion of enterprises manufacturing air-conditioning and refrigeration equipment.

Observations on alternative technologies and their potential use in Article 5 countries

104. The main activities included in stage I of the HPMPs for several non-LVC countries consisted of investment projects to reduce the consumption of HCFCs used in the manufacturing sector. These focused largely on the foam sector, where there were some technically acceptable alternatives, with low GWP. Several alternative technologies to replace HCFCs have been (or are being) developed further and, a few of them, have been introduced in several Article 5 markets, supported by demonstration projects funded

by the Multilateral Fund, and the implementation of investment projects included in stage I of the HPMPs.

105. The results of the demonstration projects for alternative technologies to the use of HCFCs⁹⁹, the review of HCFC phase-out investment projects under current implementation, and additional information provided by the implementing agencies, show important developments in the availability of cost-effective and environmentally sound technologies for a larger number of applications where HCFCs are currently used, as briefly described in Annex V to the present document and summarized below:

- (a) Methyl formate as a foam blowing agent has become an alternative technology selected by enterprises in several Article 5 countries. Technical assistance has been provided to systems houses in several Article 5 countries to develop methyl formate-based pre-blended polyol systems that will be supplied to their clients (downstream foam enterprises both locally and abroad);
- (b) The potential use of hydrocarbon-based pre-blended polyols has been assessed through two demonstration projects implemented by UNDP (Egypt) and the World Bank (China). Test results in Egypt confirmed the physical and chemical stability of cyclopentane pre-blended polyol systems for up to six months. In China, hydrocarbon-based pre-blended polyol systems have been developed and commercialized by one systems house and supplied to at least one enterprise manufacturing small refrigerator units. While this technology represents some capital and operating savings (i.e., between US \$100,000 to US \$200,000 or more depending on the enterprise layout and the manufacturing equipment in the baseline), transportation costs are expected to be higher in order to meet safety standards. One systems house in Mexico is in the process of introducing hydrocarbon-based pre-blended polyols where three foam enterprises included in stage I of the HPMP are potential clients;
- (c) The demonstration project on the supercritical CO₂ technology for foam applications is almost completed. While the analysis of incremental capital and operating costs is on-going, it is expected that costs will be higher than those associated with HCFC-141b systems. From the technical point of view, the technology can be used successfully in tropical climates (i.e., Colombia) and at different altitudes;
- (d) The results of the demonstration of HFO-1234ze technology used as co-blowing agent in the manufacture of XPS in Turkey indicate that it 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;
- (e) Although the CO₂ technology as replacement for HCFCs used in the production of XPS foam applications is proven and commercially available, the XPS foam sector plan as a component of stage I of the HPMP for China, in support of the activities implemented at the enterprise level, has included technical assistance activities to, *inter alia*, improve the use and performance of the selected technology. Furthermore, three XPS foam enterprises to be converted to CO₂ technology also manufacture extruders and could become potential suppliers of extruders based on this technology;
- (f) The demonstration projects on HFC-32 and R-290 alternatives technologies to HCFC-22

⁹⁹ Annex V to the present document presents a brief summary of the results so far achieved on the demonstration projects on alternative technologies to HCFCs.

in manufacturing air-conditioning equipment have not been completed. However several Article 5 countries had already selected the HFC-32 technology for enterprises manufacturing air-conditioning equipment. A few others had selected the R-290 technology for enterprises manufacturing refrigeration and room air-conditioning equipment, to be converted during implementation of stage I of their HPMPs;

- (g) Although the demonstration project for conversion from HCFC-22 to ammonia/CO₂ technology in the manufacture of two-stage refrigeration systems for cold storage and freezing applications in China (Yantai Moon Co.) has not yet been finalized, UNDP is of the view that some additional enterprises might be converted during stage II of the HPMP considering that it is a proven and available low-GWP technology and the conversions could be cost-effective and implementable; and
- (h) The demonstration project on low-GWP refrigerants for air-conditioning in high-ambient temperature countries (approved at the 69th meeting) will facilitate the technology transfer and exchange of experiences in this particular sector. The project will, *inter alia*, assess the availability of refrigerants and air-conditioning equipment operating in high-ambient conditions and energy efficiency standards and codes; undertake an economic comparison of alternative technologies; and will identify commercial opportunities for facilitating the transfer of low-GWP technologies. As requested by the Executive Committee, the project will also assess conventional and non-conventional solutions and undertake a special study on district cooling systems using low GWP and/or non-vapour-compression options¹⁰⁰.

106. The Secretariat also notes that, in response to decision XXIV/7, the Technology and Economic Assessment Panel (TEAP) has submitted for consideration by the OEWG at its 33rd meeting (June 2013) a draft report¹⁰¹ which, *inter alia*, describes ODS alternatives that are commercially available, technically proven and environmentally sound, taking into account their efficacy, health, safety and environmental characteristics, cost-effectiveness, and their use including in high ambient temperatures and high urban density cities; identifies barriers and restrictions to the adoption and commercial use of certain environmentally-sound ODS alternatives; and identifies opportunities for the selection of environmentally-sound alternatives in the future. The Secretariat was unable to review and incorporate relevant information from the draft report prepared by TEAP considering the time available between its completion (mid-May 2013) and the finalization of the present document. However, it 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 incremental operating costs, particularly in the foam sector, might limit its introduction for certain applications. The Secretariat will give due consideration to the information contained in the TEAP report during the project review process and will continue following up on the development of emerging technologies to HCFCs.

Observations on flammable alternative technologies

107. With regard to the selection of alternative technologies, the Secretariat notes that most of the low-GWP alternatives to HCFCs used in the manufacturing of foam products or refrigeration and air-conditioning equipment are flammable.

108. In reviewing the project proposals submitted to the 62nd meeting¹⁰², the Secretariat noted that hydrocarbon-based technologies were the preferred choice of most enterprises, irrespective of the size of

¹⁰⁰ Decision 69/16.

¹⁰¹ Decision XXIV/7 Task Force Report. Additional Information to Alternatives on ODS (Draft Report). Report of the Technology and Economic Assessment Panel. May 2013. Volume 2.

¹⁰² UNEP/OzL.Pro/ExCom/62/10.

the enterprise. At the interagency coordination meeting held in early 2010, and during the project review process (mid 2010), the Secretariat expressed concern regarding the selection of a flammable alternative technology. While hydrocarbon-based foam blowing technology is very well established, widely used throughout the world, and cost-effective in the long term, its flammability must be given due consideration when it is selected, especially by SMEs. The Secretariat also noted that, with eligible funding determined by the cost-effectiveness threshold (i.e., US \$9.79/kg for rigid foam using a low-GWP alternative), introducing a flammable technology in enterprises with low levels of HCFC consumption would result in additional counterpart contributions reaching, in some cases, from 75 to more than 90 per cent of the total cost. Therefore, due consideration must be given to all internal and external factors specific to each enterprise to allow for the introduction of a flammable process. Given the limited time available to meet the 2013 and 2015 control measures, and in order to avoid any delay in project implementation, the Secretariat proposed to bilateral and implementing agencies to include in project proposals the minimum amount of information for each enterprise that has selected a flammable alternative technology, including local and/or national regulations and standards governing the use of flammable substances; the feasibility for enterprises operating in their current location post-conversion, and assurances that they will be able to install the equipment required for the conversion within the project implementation timeframe; information on the economic sustainability and ability of the enterprise to safely introduce and operate a flammable technology; and assurances that the counterpart contributions are in place, in cases where counterpart contributions are needed to ensure implementation.

109. With regard to the refrigeration and air conditioning manufacturing sector, the Secretariat notes that low-GWP technologies are facing challenges in their penetration of local markets, despite that for several applications technically sound technologies are available. These challenges are mainly due to insufficient know-how in the design, manufacturing and marketing the refrigeration and air-conditioning equipment augmented by limitations in servicing the equipment, insufficient availability of components (e.g., compressors), and lack of regulations, codes and standards allowing the operation of such technologies in most Article 5 countries.

110. With regard to the refrigeration servicing sector, the Secretariat notes¹⁰³ that in several Article 5 countries HC-290 is being used for retrofitting, operating and/or filling new HCFC-22-based 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 has major concerns regarding the safe use of hydrocarbon-based refrigerants in systems designed for non-flammable ones, where policies and regulations allowing their use appear not to be in place; where the technical capacity for properly servicing and maintaining hydrocarbon-based equipment is limited with associated risks to technicians and end-users. The Secretariat is of the view that it is meaningful that Article 5 countries take immediate steps to adopt standards on storage, installation, operation, maintenance and disposal of equipment using flammable refrigerants to ensure safe introduction of flammable low-GWP alternatives. Furthermore, during implementation of HPMPs priority should be given to training to technicians on safe handling of hydrocarbon technologies and developing codes and standards on their proper use.

RECOMMENDATION

111. The Executive Committee may wish to take note of the document on the criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44 contained in document UNEP/OzL.Pro/ExCom/71/57.

¹⁰³ This issue is further analyzed in the discussion paper on minimizing adverse climate impact of HCFC phase-out in the refrigeration servicing sector (UNEP/OzL.Pro/ExCom/70/53).

ANNEX I

AN OVERVIEW ON HCFC PRODUCTION AND CONSUMPTION

1. HCFCs were in use as early as 1936, when HCFC-22 was commercialized as a refrigerant. Production and consumption levels of HCFCs were substantially increased as a result of new applications, particularly in the air conditioning sector, as well as under the Montreal Protocol, given that several countries selected these substances as interim replacements of CFCs and other controlled substances.
2. The reduction trend in the production and consumption of HCFCs by non-Article 5 countries has been offset by a growth in both production and consumption in Article 5 countries, as shown in Table 1¹.

Table 1. Global production and consumption of HCFCs reported under Article 7 (ODP tonnes)(*)

Party	2005	2006	2007	2008	2009	2010	2011	2012	Baseline
Production									
Article 5	21,803.1	27,722.1	32,003.0	30,451.6	34,715.8	37,147.3	37,164.2	36,981.3	35,935.1
Non-Article 5	10,278.1	9,843.9	10,102.1	10,782.1	6,474.3	3,999.6	4,023.0	2,629.5	36,868.1
Total	34,086.2	39,572.0	44,112.1	43,241.7	43,199.1	43,156.9	43,198.3	41,622.9	72,803.2
% for A5	64.0%	70.1%	72.5%	70.4%	80.4%	86.1%	86.0%	88.8%	49.4%
Consumption									
Article 5	20,548.6	27,003.3	30,953.8	28,633.3	32,207.8	33,769.4	35,033.9	37,003.3	32,988.9
Non-Article 5	11,862.8	9,451.7	10,539.7	10,417.5	5,796.5	4,513.8	3,593.6	2,717.3	41,178.6
Total	32,411.4	36,455.0	41,493.5	39,050.8	38,004.3	38,283.2	38,627.5	39,720.6	74,167.5
% for A5	63.4%	74.1%	74.6%	73.3%	84.7%	88.2%	90.7%	93.2%	44.5%

(*) Article 7 data reported as of 7 October 2013.

HCFC consumption in Article 5 countries

3. Based on data reported under Article 7 of the Montreal Protocol by all Article 5 countries that have received assistance from the Multilateral Fund², the aggregated HCFC consumption baseline has been established at 502,491 mt (33,250 ODP tonnes), as shown in Table 2. Out of the eight different HCFCs consumed by Article 5 countries, HCFC-141b, HCFC-142b and HCFC-22 accounted for more than 99 per cent of total consumption. Measured in ODP tonnes, consumption of HCFC-22 represented 61.5 per cent of the aggregated consumption baseline, while HCFC-141b and HCFC-142b represented 32.3 and 6.0 per cent respectively. Additionally, 33 Article 5 countries imported 5,109.1 mt (562.0 ODP tonnes) of HCFC-141b contained in pre-blended polyols³, an amount not reported under Article 7 of the Montreal Protocol.

Table 2. HCFC consumption by substance in Article 5 countries* (Article 7 data)

HCFC	2009	2010	2011	2012	Baseline	% total baseline
Metric tonnes						
HCFC-123	1,538.9	1,697.3	1,850.1	2,217.3	1,618.1	0.32
HCFC-124	767.1	554.2	457.9	262.0	660.7	0.13

¹ This category includes the HCFC consumption and production of the Republic of Korea, Singapore and United Arab Emirates, representing countries that have not received assistance from the Multilateral Fund thus far. At its 66th meeting, the Committee deferred the request of the United Arab Emirates for assistance for phasing out HCFC from the Fund to a future meeting to allow more time for discussion with the country (decision 66/5(a)(vi)).

² Excluding HCFC consumption and production of the Republic of Korea, Singapore and United Arab Emirates. The HCFC baseline for South Sudan has not yet been established as the country has not reported consumption for 2009 and/or 2010.

³ Calculated as the average amount of HCFC-141b contained in pre-blended polyols imported during the 2007-2009 period, in line with decision 61/47(c)(ii).

HCFC	2009	2010	2011	2012	Baseline	% total baseline
HCFC-141	-	26.8	80.0	-	13.4	0.00
HCFC-141b	94,419.0	101,000.8	111,505.6	102,621.3	97,709.9	19.45
HCFC-142b	31,331.3	30,252.3	28,123.8	18,501.2	30,791.8	6.13
HCFC-21	37.2	-	3.1	2.3	18.6	0.00
HCFC-22	358,182.4	384,954.0	366,261.1	390,540.7	371,568.2	73.95
HCFC-225	35.6	10.0	19.7	63.8	22.8	0.00
HCFC-225ca	57.9	74.8	73.4	27.0	66.4	0.01
HCFC-225cb	19.3	23.1	16.7	33.0	21.2	0.00
Total (mt)	486,388.8	518,593.2	508,391.3	514,268.6	502,491.0	100.00
ODP tonnes						
HCFC-123	30.8	33.9	37.0	44.3	32.4	0.10
HCFC-124	30.7	22.2	18.3	10.5	26.4	0.08
HCFC-141	-	1.9	5.6	-	0.9	0.00
HCFC-141b	10,386.1	11,110.1	12,265.6	11,288.3	10,748.1	32.32
HCFC-142b	2,036.5	1,966.4	1,828.0	1,202.6	2,001.5	6.02
HCFC-21	1.5	-	0.1	0.1	0.7	0.00
HCFC-22	19,700.0	21,172.5	20,144.4	21,479.7	20,436.2	61.46
HCFC-225	2.5	0.7	1.4	4.5	1.6	0.00
HCFC-225ca	1.4	1.9	1.8	0.7	1.7	0.00
HCFC-225cb	0.6	0.8	0.6	1.1	0.7	0.00
Total (ODP tonnes)	32,190.2	34,310.3	34,302.8	34,031.8	33,250.2	100.00

(*) Excluding consumption by the Republic of Korea, Singapore and United Arab Emirates. (Article 7 data reported as of 7 October 2013).

4. Eighty-seven Article 5 countries have an HCFC consumption baseline below 360 mt, 24 other countries have a baseline between 360 and 1,000 mt, while 33 countries have a baseline above 1,000 mt tonnes. Measured in metric tonnes, the HCFC consumption baseline of one country (China) represents over 58 per cent of the aggregated baseline of all Article 5 countries (measured in mt), while the aggregated consumption baseline of the 10 largest consuming countries (Argentina, Brazil, China, India, Kuwait, Malaysia, Mexico, Saudi Arabia, Thailand and Turkey) represents nearly 83 per cent of the aggregated baseline of all Article 5 countries.

5. HCFC-22 is consumed by all Article 5 countries, while only 68 and 48 countries have reported consumption of HCFC-141b⁴ and HCFC-142b respectively in 2009 and/or 2010 (i.e., baseline years). Table 3 presents the number of countries according to their baseline consumption for the three main HCFCs.

Table 3. Number of countries by level of consumption of their baseline for specific HCFCs (ODP tonnes)

HCFC	<10	>10 and <50	>50 <100	>100 <1,000	>1,000	Total
HCFC-141b	36	12	4	15	1	68
HCFC-142b	39	4	2	2	1	48
HCFC-22*	73	38	12	19	2	144

(*) One country (South Sudan) does not yet have an established HCFC baseline.

⁴ The amount of HCFC-141b contained in imported pre-blended polyols is not included as this amount is usually not reported under Article 7 of the Montreal Protocol.

HCFC production in Article 5 countries

6. The aggregated HCFC production baseline covering the six Article 5 countries producing HCFCs (Argentina, China, the Democratic People's Republic of Korea, India, Mexico, and Venezuela (Bolivarian Republic of)), has been established at 494,081 mt (32,594 ODP tonnes)⁵. HCFC-22 is produced by all six countries, while HCFC-123, HCFC-124, HCFC-141b and HCFC-142b are produced by only one country (China). Production of HCFC-22 by one country (China) represents 82.9 per cent of the total HCFC-22 production by the six Article 5 countries. Table 4 shows the amounts of HCFCs produced by Article 5 countries and by type of HCFC produced.

Table 4. HCFC production by six Article 5 countries* (Article 7 data)

Country	HCFC	2008	2009	2010	2011	Baseline
Metric tonnes						
Argentina	HCFC-22	3,914.1	4,251.0	4,018.2	4,190.0	4,082.6
China	HCFC-22	298,559.4	311,356.8	326,691.8	364,547.3	304,958.1
China	HCFC-123	2,238.1	2,819.2	3,082.8	1,687.2	2,528.6
China	HCFC-124	473.9	401.0	232.6	221.3	437.5
China	HCFC-141b	91,879.9	98,857.1	111,922.3	117,131.3	95,368.5
China	HCFC-142b	24,889.7	30,449.2	27,073.8	22,159.3	27,669.5
Democratic People's Republic of Korea	HCFC-22	504.0	498.0	480.0	521.0	501.0
India	HCFC-22	46,584.5	40,668.9	27,344.9	28,461.9	43,626.7
Mexico	HCFC-22	12,725.0	12,618.8	11,812.7	5,424.0	12,671.9
Venezuela (Bolivarian Republic of)	HCFC-22	2,306.9	2,166.9	2,442.6	2,914.1	2,236.9
Total (mt)		484,075.6	504,086.9	515,101.6	547,257.2	494,081.2
ODP tonnes						
Argentina	HCFC-22	215.3	233.8	221.0	230.5	224.5
China	HCFC-22	16,420.8	17,124.6	17,968.1	20,050.1	16,772.7
China	HCFC-123	44.8	56.4	61.7	33.7	50.6
China	HCFC-124	10.4	8.8	5.1	4.9	9.6
China	HCFC-141b	10,106.8	10,874.3	12,311.5	12,884.4	10,490.5
China	HCFC-142b	1,617.8	1,979.2	1,759.8	1,440.4	1,798.5
Democratic People's Republic of Korea	HCFC-22	27.7	27.4	26.4	28.7	27.6
India	HCFC-22	2,562.1	2,236.8	1,504.0	1,565.4	2,399.5
Mexico	HCFC-22	699.9	694.0	649.7	298.3	697.0
Venezuela (Bolivarian Republic of)	HCFC-22	126.9	119.2	134.3	160.3	123.0
Total (ODP tonnes)		31,832.5	33,354.5	34,641.5	36,696.6	32,593.5

(*) Excluding production by the Republic of Korea. (Article 7 data reported as of 5 May 2013).

7. The two main HCFCs produced by Article 5 countries are: HCFC-22 representing 62.1 per cent of total production measured in ODP tonnes, and HCFC-141b representing 32.2 per cent of the total production. The combined production of HCFC-123, HCFC-124 and HCFC-142b represents 5.7 per cent of the total HCFC production as shown in Table 5.

Table 5. HCFC production by substance in Article 5 countries* (Article 7 data)

HCFC	Metric tonnes		ODP tonnes	
	Baseline	% of total	Baseline	% of total
HCFC-123	2,528.6	0.5%	50.6	0.2%

⁵ Excluding the Republic of Korea.

HCFC	Metric tonnes		ODP tonnes	
	Baseline	% of total	Baseline	% of total
HCFC-124	437.5	0.1%	9.6	0.0%
HCFC-141b	95,368.5	19.3%	10,490.5	32.2%
HCFC-142b	27,669.5	5.6%	1,798.5	5.5%
HCFC-22	368,077.2	74.5%	20,244.2	62.1%
Total	494,081.2	100.0%	32,593.5	100.0%

(*) Excluding HCFC production by the Republic of Korea.

ANNEX II

RELEVANT DECISIONS ON HCFC PHASE-OUT IN THE CONSUMPTION SECTOR

1. This Annex contains all relevant decisions associated with the phase-out of HCFCs in the consumption sector adopted by the Parties to the Montreal Protocol and the Executive Committee, and is organized in the following three parts:

- I Policies on HCFCs prior to decision XIX/6
- II Policies on HCFCs in response to decision XIX/6
- III Policies addressing issues identified during the review of HPMPs

2. To facilitate the Executive Committee's review, the text of decisions adopted in response to decision XIX/6 have been included in this Annex, as these decisions are related to the phase-out of HCFCs in accordance with the adjusted schedule. The sources for all other decisions prior to and including decision XIX/6 contained in this document, are included.

Introduction

3. In accordance with the procedure set out in paragraph 4 of Article 9 of the Vienna Convention for the Protection of the Ozone Layer, the Parties to the Montreal Protocol adopted at their 4th meeting (November 1992), the Copenhagen Amendment to the Montreal Protocol¹, which *inter alia* introduced targets for production and consumption of HCFCs (decision IV/4).

I Policies on HCFCs prior to decision XIX/6

4. Although HCFCs control targets for Article 5 Parties were the freeze in 2016 and the complete phase-out in 2040, specific decisions addressing the phase-out of these ODS have been taken by the Parties since their 5th meeting (November 1993) and by the Executive Committee since its 12th meeting (March 1994)².

5. One of the underlying principles of the Executive Committee governing the phase-out of ODS has been the presumption against the use of HCFCs as alternative chemicals, which influenced the preparation, approval and implementation of investment projects for phasing out CFCs (mainly CFC-11 used as a foam blowing agent), recognizing that HCFCs were transitional substances for which beneficiary enterprises assumed funding for subsequent (second-stage) phase-out by themselves. A summary of the key elements of relevant decisions on HCFCs adopted by the Executive Committee, together with projects that were approved for replacing CFCs with HCFCs, is presented in Table 1³.

¹ Annex III of document UNEP/OzL.Pro.4/15.

² The decisions on HCFCs adopted by the Parties up to their 19th meeting (September 2007) and the Executive Committee up to the 54th meeting (April 2008) in chronological order could be found in Annex I of document UNEP/OzL.Pro/ExCom/55/47.

³ A description of the decisions listed in Table 1 is provided in Annex I to document UNEP/OzL.Pro/ExCom/66/49.

Table 1. Decisions regarding conversion to transitional HCFC technology

Meetings	No. of projects	CFCs (ODP t)	Summary of relevant decisions by the Executive Committee
(1)	(2)	(3)	(4)
Up to 12 th	36	1,544	<ul style="list-style-type: none"> Proposals should only be submitted for specific sectors and where no non-HCFC alternatives were available (12th meeting)
13 th to 15 th	41	1,957	<ul style="list-style-type: none"> Agencies should note the presumption against HCFC; Justification required for the selection of HCFC; Requirement for the estimated costs of a second conversion (15th meeting)
16 th to 20 th	119	5,236	<ul style="list-style-type: none"> Full explanation for the selection of HCFC required; Need for enterprises to have agreed to bear the cost of a second conversion to non-HCFC technology (decisions 19/2 and 20/48)
21 st to 23 rd	135	6,087	<ul style="list-style-type: none"> Project evaluation sheets should contain information on the conversion technology, reasons for selection of HCFC, and estimated length of time that the enterprise intends to use transitional HCFC technology (decision 23/20)
24 th to 26 th	83	2,359	<ul style="list-style-type: none"> Full information provided in the project proposal should be included in the project evaluation sheet (decision 26/26)
27 th	26	619	<ul style="list-style-type: none"> Mandatory letter from the Government indicating it had reviewed the projects and its commitments under Article 2F, and had determined that the use of HCFC for the projects was justified, and that it understood that no funding would be available for second conversion (decision 27/13)
28 th to 34 th	301	9,487	<ul style="list-style-type: none"> Letters from governments concerned explaining the reasons for the choice of HCFC-141b in projects (as per decisions 23/20 and 27/13) should be included in the meeting documentation (decision 34/51)
35 th to 36 th	62	1,891	<ul style="list-style-type: none"> Agencies to provide data concerning import restrictions into non Article 5 countries; Letters to be sent to ozone units recalling that HCFC projects will be excluded from funding in the future (decision 36/56)
37 th to 38 th	16	968	<ul style="list-style-type: none"> The Government had endorsed the choice of technology and was informed that no additional funding could be requested for second conversion (decision 38/38)
38 th to 54 th	28	3,465	<ul style="list-style-type: none"> Last project approved for conversion to HCFC technology at the 54th meeting (i.e., 6th tranche of a sector phase-out plan)
Total	847	33,613	

Analysis of Multilateral Fund projects converted to HCFC-based technologies

6. For the preparation of the document on revised analysis of relevant cost considerations surrounding the financing of HCFC phase-out⁴, the Secretariat reviewed 657 stand-alone foam projects for the conversion from CFC-11 to HCFC-141b technology in 38 Article 5 countries, and 454 stand-alone projects for the conversion of CFC-11 to HCFC-141b and from CFC-12 to alternative refrigerants used in the manufacturing of domestic and commercial refrigeration equipment. This analysis⁵ showed that HCFC-141b-based systems met the needs of both small scale and medium scale enterprises⁶ as they were technically mature and commercially available, provided the most acceptable insulation value and energy efficiency, and the lowest investment and operating costs vis-à-vis other options. No major changes in the

⁴ UNEP/OzL.Pro/ExCom/55/47.

⁵ Annexes III and IV of document UNEP/OzL.Pro/ExCom/55/47.

⁶ Nearly 70 per cent of all the rigid foam enterprises were small and medium scale producers. Only 20 per cent of the enterprises had CFC consumption over 60 ODP tonnes where the cyclopentane could have been introduced cost-effectively.

baseline equipment in the production line were needed. Accordingly, the use of HCFC-141b accounted for approximately 75 per cent of all CFCs phased out in rigid foam applications. However, the introduction of cyclopentane-based technology was feasible in enterprises manufacturing refrigeration equipment, even with CFC-11 consumption below 20 ODP tonnes/year, as the projects were funded under the refrigeration manufacturing cost-effectiveness thresholds (i.e., US \$13.76/kg for domestic refrigeration and US \$15.21/kg for commercial refrigeration), rather than under the rigid foam threshold (US \$7.83/kg). Accordingly, the use of HCFC-141b accounted for less than 37 per cent of all CFCs phased out in rigid insulation foam for refrigeration equipment.

7. In addition to the projects in the refrigeration manufacturing sector, the Committee also approved 43 projects for the conversion of enterprises manufacturing CFC-12-based compressors. The refrigerants introduced were HCF-134a in 21 enterprises; HCFC-22 in 19 enterprises; and isobutane and ammonia in two and one enterprise, respectively⁷.

8. On subsequent review and analysis of investment projects approved up until the 54th meeting (April 2008), the Secretariat concluded that, during project preparation, implementing agencies duly informed governments and enterprises of the presumption against the choice of HCFCs, and that decisions on HCFCs were applied during the project preparation and submission process. On this basis, enterprises were able to select the most viable alternative technologies and provide full justification for selecting HCFC technology. Since May 1996, enterprises were also informed that no funding would be available from the Fund for the conversion from HCFC to a non-ODS technology⁸.

II Policies on HCFCs in response to decision XIX/6

9. In accordance with paragraph 9 of Article 2 of the Montreal Protocol, the Parties agreed at their 19th meeting (September 2007) to accelerate the phase-out of production and consumption of HCFCs, by way of an adjustment (decision XIX/6)⁹.

10. Immediately after the adoption of decision XIX/6, the Executive Committee started intense discussions on policies for the phase-out of HCFCs in the consumption and production sectors, considered substantive policy documents¹⁰, and adopted relevant decisions to address the mandate given by the Parties, as summarized below.

Options for assessing and defining incremental costs for HCFC phase-out activities

11. At its 53rd meeting (October 2007), the Executive Committee considered a discussion paper on options for assessing and defining eligible incremental costs for HCFC consumption and production phase-out activities¹¹. The paper addressed issues pertaining to HCFCs, *inter alia*: the legal prerequisite for assessing funding; the applicability of the existing policies and guidelines of the Fund; and the

⁷ In the case of China, 24 enterprises were converted on a sector plan (with an associated amount of CFC-12 for phase-out), on the understanding that the Government would not seek any assistance from the Multilateral Fund for the conversion of commercial refrigeration manufacturing enterprises.

⁸ Paragraph 6 of document UNEP/OzL.Pro/ExCom/66/49.

⁹ For Article 5 Parties, the accelerated phase-out of production and consumption of HCFCs was agreed on the basis of the following steps: freeze in 2013; 10 per cent reduction by 2015; 35 per cent by 2020; 67.5 per cent by 2025; and phase-out.

¹⁰ Policy documents on HCFC phase-out of the production sector have been discussed at the 55th (UNEP/OzL.Pro/ExCom/55/45), 56th (UNEP/OzL.Pro/ExCom/56/57), 57th (UNEP/OzL.Pro/ExCom/57/61) meetings.

¹¹ UNEP/OzL.Pro/ExCom/53/60.

development of surveys and phase-out management plans for HCFCs. The paper also discussed issues relating to funding priority and cost-effectiveness thresholds, the cut-off date for installation of HCFC-based manufacturing equipment and second stage-conversions, as well as the HCFC production sector.

12. Although the Executive Committee felt that it might take several meetings to reach agreement on all the policy issues involved, it was able to adopt specific decisions on the legal preconditions for assessing funding for HCFC phase-out, the applicability of existing guidelines and criteria for phasing out ODS, and the use of existing institutions and capacities in Article 5 countries. The Secretariat was requested to propose draft guidelines for the preparation of HCFC phase-out management plans (HPMPs), and to prepare a discussion document providing analysis on cost considerations surrounding the financing of HCFC phase-out (decision 53/37).

Guidelines for preparation and implementation of HCFC phase-out management plans

13. In response to decision 53/37, draft guidelines for the preparation and implementation of HCFC phase-out management plans (HPMP)¹² were considered at the 54th meeting (April 2008). The guidelines, as adopted by the Executive Committee, were to be used by Article 5 countries for the development of an overarching HCFC phase-out strategy allowing, in stage I, reductions to meet the freeze in HCFC consumption in 2013 and the 10 per cent reduction in baseline consumption in 2015, while at the same time allowing countries to propose subsequent stages to manage their HCFC phase-out (decision 54/39). In the context of HPMPs, Article 5 countries were classified in two broad categories: one for countries with consumption only in the servicing sector and another for countries with consumption also in the manufacturing sector.

Cost considerations surrounding the financing of HCFC phase-out

14. The discussion paper analysing relevant cost considerations surrounding the financing of HCFC phase-out¹³ was considered for the first time at the 54th meeting. Further to a discussion of the paper in plenary and in a contact group established by the Chair, the Executive Committee decided to consider a revised version of the paper which would take into account comments that were to be submitted by Executive Committee members (decision 54/40).

15. In response to decision 54/40, the Executive Committee considered at its 55th meeting (July 2008) a revised discussion paper¹⁴ and, further to a discussion, decided (decision 55/43):

- (a) To take note of the discussion paper providing an analysis of relevant cost considerations surrounding the financing of HCFC phase-out contained in document UNEP/OzL.Pro/ExCom/55/47;
- (b) To invite bilateral and implementing agencies to prepare and submit project proposals to the Secretariat for those HCFC uses addressed in paragraphs (c), (d), (e) and (f) below so that the Executive Committee could choose those projects that best demonstrated alternative technologies and facilitated the collection of accurate data on incremental capital cost and incremental operating costs or savings, as well as other data relevant to the application of the technologies, on the understanding that the quantity of HCFC to be phased out under those projects needed to be deducted from the starting point for

¹² UNEP/OzL.Pro/ExCom/54/53.

¹³ UNEP/OzL.Pro/ExCom/54/54, Corr.1 and Add.1.

¹⁴ UNEP/OzL.Pro/ExCom/55/47.

sustained aggregate reductions in eligible consumption as set by the HCFC phase-out management plan (HPMP);

- (c) To note the limited introduction of several of the HCFC alternative technologies available to date in Article 5 countries, the need to validate them and optimize their use in the light of the local conditions prevailing in Article 5 countries, and the wide variation in costs of replacement equipment and raw materials and, accordingly:
 - (i) To request the Secretariat to gather technical information related to HCFC phase-out in the aerosols, fire extinguishers and solvents sectors on an on-going basis, to review any project in those sectors when submitted and to refer it, as appropriate, for individual consideration by the Executive Committee;
 - (ii) To consider deferring to its first meeting in 2010 any decision it might wish to take on policies for the calculation of incremental operating costs or savings from HCFC conversion projects, as well as the establishment of cost-effectiveness thresholds, in order to benefit from the experience gained through review of HCFC phase-out projects as stand-alone projects and/or as components of HPMPs prior to that meeting;
- (d) To agree that the technical information contained in document UNEP/OzL.Pro/ExCom/55/47, was sufficient to enable preparation, review and submission on a case-by-case basis of a number of stand-alone projects for HCFC phase-out in the foam, refrigeration and air conditioning sectors;
- (e) To invite bilateral and implementing agencies, as a matter of urgency, to prepare and submit a limited number of time-specific project proposals involving interested systems houses and/or chemical suppliers for the development, optimization and validation of chemical systems for use with non-HCFC blowing agents on the following basis:
 - (i) As part of the projects, following the development and validation process, the collaborating systems houses would provide technology transfer and training to a selected number of downstream foam enterprises to complete the phase-out of HCFCs in those enterprises;
 - (ii) Agencies would collect and report accurate project cost data as well as other data relevant to the application of the technologies;
 - (iii) In order to be of benefit for the preparation and implementation of the HPMPs, as well as any stand-alone projects, these specific projects would be completed within a period not exceeding 18 months and a progress report on each of the two implementation phases as outlined in paragraphs (i) and (ii) above, would be made available to the Executive Committee;
 - (iv) Bilateral and implementing agencies and relevant collaborating systems houses were encouraged to address the technological issues surrounding preparation and distribution of premixed polyols containing hydrocarbon blowing agents;
- (f) To invite 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-global warming potential (GWP) technologies to identify all the steps required and to assess their associated costs;

- (g) To continue its deliberations on policy relating to second-stage conversions and determination of the cut-off date for installation of HCFC-based manufacturing equipment, after which incremental costs for the conversion of such equipment would not be eligible for funding, with a view to concluding its considerations prior to submission of stand-alone projects;
- (h) To further analyse if an approach of the type outlined in document UNEP/OzL.Pro/ExCom/55/47 provided a satisfactory and transparent basis for the prioritization of HCFC phase-out technologies to minimize other impacts on the environment, including on the climate as originally envisaged in decision XIX/6 of the nineteenth meeting of the Parties, and to request the Secretariat to continue with its evaluation in order to report in a more detailed fashion at a subsequent Executive Committee Meeting;
- (i) To request the Secretariat to approach other institutions with the objective of identifying individual, regional or multilateral funding mechanisms that might be suitable and compatible as sources for timely co-financing to top up Multilateral Fund ozone funding in order to achieve additional climate benefits and to provide a further report to a future Meeting; and
- (j) To consider, at a future meeting, issues relating to whether or not to retire, prematurely, functioning equipment once the 2013 and 2015 compliance targets had been addressed.

Funding levels for preparation of HCFC investment and associated activities

16. At its 56th meeting (November 2008), the Executive Committee considered a document on the cost structure for determining funding levels for preparation of HCFC investment and associated activities¹⁵, describing a funding structure for the preparation of demonstration and investment activities on the basis of five defined manufacturing sectors. Further to discussions on this matter that took place in an open-ended contact group established by the Chair, the Executive Committee decided (decision 56/16):

- (a) To note document UNEP/OzL.Pro/ExCom/56/13 regarding a cost structure for determining funding levels for preparation of HCFC investment and associated activities (decision 55/13(d));
- (b) To define the elements of a cost structure for funding the preparation of an overall HCFC phase-out management plan (HPMP) in line with decision 54/39 and comprising several components as follows:
 - (i) Assistance for policy and legislation, e.g. to develop new or extend existing legislation regarding HCFC, products containing HCFCs, quotas, and licences;
 - (ii) Survey of HCFC use and analysis of data;
 - (iii) Development and finalization of the HPMP including its stage one to address the

¹⁵ UNEP/OzL.Pro/ExCom/56/13.

2013 and 2015 control measures, the latter being akin to a terminal phase-out management plan (TPMP) or a refrigeration service sector plan;

- (iv) Development of investment activities for the HCFC-consuming manufacturing sectors for stage one of an HPMP, if such activities were necessary;
- (c) To provide funding for elements (b)(i) to (iii) above as specified in the table below, based on the countries' HCFC consumption for 2007, while applying decision 55/13(a), (b) and (c):

Group according to consumption pattern	Funding for above components (b)(i) to (iii) (US \$)
Countries with zero consumption of HCFC	30,000
Countries with consumption only of HCFC-22, or consumption below 6 ODP tonnes/year	85,000
Countries with medium consumption, between 6 ODP tonnes/year and 100 ODP tonnes/year	150,000
Countries with consumption higher than 100 ODP tonnes/year	195,000

- (d) To limit the maximum funding provided for the element (b)(iv) of the HPMP for any country with a manufacturing sector using HCFCs as per the following table based on the countries' HCFC consumption for 2007, on the understanding that those limits represented maximum amounts and requests for project preparation would have to justify the level of funding up to that amount, and on the understanding that preparation costs for demonstration projects according to decision 55/43 paragraphs (b) to (f) were not taken into account when calculating that level of funding;

Consumption limit (ODP tonnes)	Investment preparation limit (US \$)
Up to 100	100,000
101 to 300	200,000
301 to 500	250,000
501 to 1,000	300,000
1,001 and above	400,000

- (e) To define five manufacturing sub-sectors as follows: air-to-air air conditioning systems; refrigeration (including all refrigeration, heat pumps and air conditioning sub-sectors except air-to-air air conditioning systems); polyurethane foam; extruded polyurethane (XPS) foam; and solvent uses in manufacturing;
- (f) To provide funding for the element (b)(iv) of the HPMP for countries with manufacturing capacity up to a maximum specified below, to be determined by the total number of enterprises to be converted under HPMP stage one in the relevant sub-sector as defined under paragraph (e) above, excluding those enterprises with demonstration projects that might be chosen by the Executive Committee according to decision 55/43, paragraphs (b) to (f):
 - (i) One enterprise to be converted in a manufacturing sector: US \$30,000;
 - (ii) Two enterprises to be converted in a manufacturing sector: US \$60,000;

- (iii) Three to 14 enterprises to be converted in a manufacturing sector: US \$80,000;
- (iv) Fifteen or more enterprises to be converted in a manufacturing sector: US \$150,000;
- (g) That in the case where Parties wish to submit requests for preparation of sub-sector plans in the approved sectors, the total funding available for all sub-sector plans in each sector should not exceed US \$150,000;
- (h) Not to apply the provisions in subparagraphs (c), (e) and (f) above to China;
- (i) To request that for demonstration projects, according to decision 55/43 paragraphs (b) to (f), the request for preparation funds should include specification of country, sector, brief description of the project, approximate ODP tonnes phase-out to be achieved, the enterprise(s) to be addressed, if relevant, and the date when they began operation, reference to the relevant sub-paragraph of decision 55/43, and a description of compelling reasons as to why the Executive Committee should choose this project as described in decision 55/43 (b). Funding could be provided up to the following levels:
 - (i) Stand-alone demonstration projects (55/43) in a manufacturing sector, per project: US \$30,000;
 - (ii) Umbrella demonstration projects (55/43) with three to 14 beneficiaries in one manufacturing sector, per umbrella project: US \$80,000;
 - (iii) Projects addressing 15 or more beneficiaries could not receive preparation funding for demonstration projects related to decision 55/43; and
- (j) To request the Secretariat to apply this cost structure when assessing the eligibility for funding of the different elements of the HPMP preparation, and to propose adjustments to the structure, in particular with regard to investment and associated activities, to the Executive Committee when necessary.

17. Based on the above guidelines, the Executive Committee approved funding for the preparation of HPMPs in all 145 eligible Article 5 countries. It should be noted that at the 66th meeting the Secretariat in cooperation with the implementing agencies were requested to prepare guidelines for stage II of HPMPs including options for phase-out up to the 2020 control target and for total phase-out in accordance with the Montreal Protocol (decision 66/5(c)). The guidelines for stage II of HPMPs were discussed by the Executive Committee at its 69th meeting¹⁶ (April 2013). As the Committee was unable to conclude its deliberations, it agreed to continue the discussion at the 70th meeting (July 2013).

Criteria for funding HCFC phase-out in the consumption sector

18. The Executive Committee continued its deliberations on policy relating to determination of the cut-off date for installation of HCFC-based manufacturing equipment; starting point for aggregate reductions in HCFC consumption; second-stage conversions; and eligible incremental costs of HCFC phase-out projects, based on documents submitted between the 56th and 60th meetings, listed in Table 2.

¹⁶ UNEP/OzL.Pro/ExCom/69/33.

Table 2. Policy documents on outstanding issues surrounding the financing of HCFC phase out

Meeting (date)	Document title (number)	Decision
56 (November 2006)	Issues related to relevant cost considerations surrounding the financing of HCFC phase out (decision 55/43(g)) (UNEP/OzL.Pro/ExCom/56/58)	56/65
57 (March-April 2009)	Second-stage conversions and determination of cut-off date for installation of HCFC-based manufacturing equipment (UNEP/OzL.Pro/ExCom/57/60)	57/34
58 (July 2009)	Analysis of new approaches on second-stage conversions, determination of cut-off date and other outstanding HCFC policy issues (decision 57/34) (UNEP/OzL.Pro/ExCom/58/47)	
59 (November 2009)	Analysis of new approaches on second-stage conversions, determination of cut-off date and other outstanding HCFC policy issues (UNEP/OzL.Pro/ExCom/59/52)	59/46
60 (April 2010)	Outstanding HCFC issues: cut-off date, level of incremental operating costs, funding provided to the servicing sector, and incremental capital costs (decision 59/46) (UNEP/OzL.Pro/ExCom/60/46)	60/44

19. At its 60th meeting, following an arduous process that had begun over a year previously, the Executive Committee agreed on the following criteria for funding HCFC phase-out in the consumption sector in Article 5 countries:

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 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

- (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

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;

Eligible incremental costs of HCFC phase-out projects

- (f) 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 HCFC phase-out compliance targets, subject to a review in 2013:
 - (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;
 - (ii) 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 kilogrammes, shall be used as guidelines during the development and implementation of the first stage of HPMPs;
 - (iii) That 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;
 - (iv) 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

- (v) Incremental operating costs for projects in the foam sector will be considered at US \$1.60/metric kg for HCFC-141b and US \$1.40/metric kg for HCFC-142b consumption to be phased out at the manufacturing enterprise;
- (vi) 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;
- (vii) The Executive Committee will consider, on a case-by-case basis, funding higher

levels of incremental operating costs than indicated in paragraph (f)(v) above when required for the introduction of low-GWP water-blown technology;

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

- (viii) Incremental operating costs for projects in the air conditioning sub-sector will be considered at US \$6.30/metric kg of HCFC consumption to be phased out at the manufacturing enterprise;
- (ix) Incremental operating costs for projects in the commercial refrigeration sub-sector will be considered at US \$3.80/metric kg of HCFC consumption to be phased out at the manufacturing enterprise;
- (x) 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

- (xi) Article 5 countries that have total HCFC consumption of up to 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. 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 following 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;
- (xii) 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 phase-out targets, and if the country so decides, the 2020 phase-out targets:

Consumption (mt)*	Funding up to 2015 (US\$)	Funding up to 2020 (US\$)
>0 <15	51,700	164,500
15 <40	66,000	210,000

Consumption (mt)*	Funding up to 2015 (US\$)	Funding up to 2020 (US\$)
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

- (xiii) Article 5 countries that have total HCFC consumption of up to 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 should first address consumption in the manufacturing sector to meet the reduction steps in 2013 and 2015. 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 kg, 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.

20. At its 69th meeting, in the context of a discussion on draft guidelines for funding the preparation of stage II of HPMPs, the Executive Committee, *inter alia*, requested the Secretariat to prepare an information document for the 70th meeting to assist the Executive Committee in reviewing the criteria for funding HCFC phase-out in the consumption sector adopted by decision 60/44, including an analysis of the cost effectiveness of projects approved so far, as well as the division of costs between incremental operating costs and incremental capital costs (decision 69/22 (b)). At the same meeting, in the context of a discussion on fund transfers and information on any interest accrued on funds held by China for stage I of its HPMP and historical implementation modalities of the Multilateral Fund, the Committee, *inter alia*, encouraged the Secretariat to consider in the context of the information document options to ensure that: the level of funding for the first year of stage II would meet the 20 per cent disbursement threshold; and subsequent tranches were considered in light of the need for cash and the likelihood of reaching the disbursement threshold (decision 69/24(d)).

III Policies addressing issues identified during the review of HPMPs

21. Funding has been allocated to the 145 eligible Article 5 countries¹⁷ for the preparation of their HPMPs. To date, the Executive Committee has approved funding for implementation of stage I of HPMPs for 138 countries¹⁸. Several policy issues were identified during the project review process of these HPMPs, and addressed by the Executive Committee through the adoption of specific decisions as summarized below.

Prioritization in the phase-out of HCFCs

22. The issue of prioritization in the phase-out of HCFCs taking into account national circumstances and priorities in order to comply with the 2013 and 2015 control targets has been considered by the Executive Committee. At its 59th meeting, the Committee decided (decision 59/11):

- (a) To request bilateral and implementing agencies to submit, as a priority, HCFC-141b phase-out projects to enable compliance with the reductions in consumption for the years 2013 and 2015, in accordance with decision XIX/6, paragraph 11(a), of the nineteenth meeting of the Parties; and
- (b) To consider HCFC consumption phase-out projects for HCFCs with ODP lower than HCFC-141b, where national circumstances and priorities required their submission, in order to comply with the 2013 and 2015 control measures.

23. Subsequently, at its 62nd meeting (November-December 2010) the Executive Committee decided (decision 62/12):

- (a) To request bilateral and implementing agencies, when submitting activities to phase out HCFC-22 used in the manufacture of refrigeration and air conditioning equipment, to estimate the total future amount of HCFC-22 that could potentially be required until 2020 for servicing such equipment;
- (b) To request bilateral and implementing agencies, when submitting activities to phase out HCFC-22 used in the refrigeration servicing sector, to clearly demonstrate how the proposed activities would reduce the growth rate in the servicing sector and contribute to meeting the reduction steps in 2013 and 2015; and
- (c) To consider projects for the phase-out of HCFC-22/HCFC-142b used for the manufacture of extruded polystyrene (XPS) foam when it was clearly demonstrated that they would be required by national circumstances and priorities to comply with the 2013 and 2015 control measures, and to consider all other XPS foam projects after 2014.

¹⁷ Excluding Republic of Korea, Singapore and United Arab Emirates that were reclassified as operating under paragraph 1 of Article 5, and have agreed or were urged not to seek assistance from the Multilateral Fund pursuant to decision VI/5(e).

¹⁸ The HPMP for the Democratic People's Republic of Korea was deferred by the Executive Committee at its 68th meeting and removed from UNEP and UNIDO business plans at its 69th meeting (decision 69/5(d)(iii)). The HPMP for the Syrian Arab Republic was noted by the Executive Committee at its 68th meeting; the country was encouraged to resubmit it at a future meeting when national conditions had improved (decision 68/38).

Cost-effectiveness threshold

24. At its 60th meeting, the Committee decided that projects for the phase-out of HCFCs used by domestic refrigeration enterprises should be considered under the foam sector as rigid insulation refrigeration foam, and that the cost-effectiveness threshold for that sub-sector should be considered at a future meeting, once sufficient information had been gathered from the review of phase-out projects (decision 60/13).

25. Based on the information gathered from projects for the phase-out of HCFCs used by domestic refrigeration enterprises submitted by several Article 5 countries¹⁹, the Executive Committee decided to set the cost-effectiveness threshold for rigid insulation refrigeration foam at US \$7.83/kg with a maximum of up to 25 per cent above this threshold for low GWP alternatives (decision 62/13).

Accelerated phase-out of HCFCs

26. The issue of HPMPs that proposed levels of HCFC phase-out greater than the 10 per cent required to be phased out by 2015 was considered by the Executive Committee at its 60th and 62nd meetings, which resulted in the adoption of the following decisions:

- (a) That projects which accelerated the phase-out of consumption of HCFCs could be considered on a case-by-case basis for low-volume-consuming countries that had a strong national level of commitment in place to support accelerated phase-out (decision 60/15);
- (b) That for HCFC phase-out management plans which addressed phase-out of HCFCs ahead of the Montreal Protocol schedule and had been submitted in line with decision 60/15, the total funding available for achieving 100 per cent phase-out would be extrapolated from that available for meeting the 35 per cent reduction in consumption as prescribed in the table in subparagraph f(xii) of decision 60/44 (decision 62/10); and
- (c) To allow the submission of stage I of the HCFC phase-out management plans to assist former low-volume-consuming countries with HCFC consumption in the refrigeration servicing sector only, that was above 360 metric tonnes, to meet control measures up to 2020 on the understanding that the level of funding provided would be considered on a case-by-case basis until otherwise decided (decision 62/11).

Guidance on the justification for second-stage conversion

27. At its 62nd meeting, the Executive Committee raised a concern regarding the information included in HPMPs to justify second-stage conversion projects as required by decision 60/44. Accordingly, the Committee decided that project proposals that included requests for second-stage conversions should provide the following information: the proportion of HCFCs consumed by enterprises that received assistance under the Multilateral Fund for CFC phase-out, as a percentage of (i) total HCFC consumption; (ii) total HCFC consumption in the manufacturing sector; and (iii) total consumption of HCFC-141b in the foam sector; and the estimated cost-effectiveness value, in ODP and metric tonnes, of the proposed second-stage conversion projects as compared with the estimated cost-effectiveness of phasing out HCFC consumption in other manufacturing enterprises in all sectors (decision 62/16).

¹⁹ Algeria, Bangladesh, China, Egypt, Indonesia, the Islamic Republic of Iran, Morocco, Philippines, Sri Lanka and Sudan.

HCFC-141b contained in imported pre-blended polyol systems

28. Two project proposals were submitted to the 59th meeting to phase out HCFC-141b contained in imported pre-blended polyols for foam²⁰. In both cases, the amount of HCFC-141b to be phased out was not recorded as consumption as per the Montreal Protocol's definition. When consulted, the Ozone Secretariat had indicated that it was not possible to determine whether Parties included pre-blended polyols in their reported Article 7 data. It was further noted that the issue of not reporting HCFC-141b contained in pre-blended polyols was likely to occur in a number of Article 5 countries. Following a discussion, the Executive Committee *inter alia* requested the Fund Secretariat, in consultation with the Ozone Secretariat, to prepare a paper outlining the implications for Article 5 Parties and the Multilateral Fund associated with the import and export of HCFC-based pre-blended polyols (decision 59/12).

29. In response to decision 59/12, the Executive Committee considered at its 61st meeting (July 2010) a paper on the consumption arising from HCFC-141b contained in pre-blended foam chemicals (polyols)²¹. Given the importance of the matter and the desire to ensure that all eligible enterprises using HCFC-141b in pre-blended polyols could benefit from Multilateral Fund assistance, the Executive Committee decided (decision 61/47):

- (a) To take note of document UNEP/OzL.Pro/ExCom/61/53 on consumption arising from HCFC-141b contained in pre-blended foam chemicals (polyols) (decisions 59/12 and 60/50);
- (b) To confirm that the phase-out of HCFC-141b contained in pre-blended polyol systems that were imported and/or manufactured domestically, and counted as consumption under Article 7, was eligible for assistance according to existing guidelines;
- (c) With regard to the import of HCFC-141b contained in pre-blended polyols, which had not been counted as consumption under Article 7, to request Article 5 countries that wished to seek assistance for the phase-out of such imports:
 - (i) To include in the overarching strategy for their HCFC phase-out management plans (HPMPs) an indicative list of all the foam enterprises established prior to 21 September 2007 that used imported polyol systems, including the amount of HCFC-141b contained therein;
 - (ii) To include in the starting point for aggregate reduction in HCFC consumption the annual amount of HCFC-141b contained in imported polyol systems during the 2007-2009 period;
 - (iii) Also to include in their HPMPs a sector plan for the complete phase-out of the use of HCFC-141b in imported pre-blended polyol systems, covering the cost and funding schedule, taking into account that the share of imported polyol within the HPMP might need support under a schedule beyond 2015, and on the understanding that quantities of HCFC-141b in imported pre-blended polyol systems that had not been included in the overarching strategy for the HPMP would not be eligible for funding;

²⁰ A mixture of several chemicals with HCFC-141b that was blended centrally and then distributed to different sites, as compared to other cases where the blending with HCFC-141b would occur only on site.

²¹ UNEP/OzL.Pro/ExCom/61/53.

- (iv) To include in the sector plan a commitment from the country to put in place, by the time the last foam manufacturing plant had been converted to a non-HCFC technology, regulations or policies banning the import and or the use of HCFC-141b pre-blended polyol systems;
- (d) That Article 5 Parties with eligible enterprises manufacturing HCFC-141b pre-blended polyol systems would be provided with assistance calculated on the basis of consumption of HCFC-141b sold domestically, on the understanding that the full consumption of HCFC-141b by those enterprises manufacturing pre-blended polyol systems would be deducted from the starting point.

30. At their 22nd meeting²² (November 2010) the Parties noted with appreciation the cooperative manner in which the members of the Executive Committee addressed the issue of HCFCs in pre-blended polyols through decision 61/47 by agreeing on a framework on eligible incremental costs for Article 5 parties in their transition away from the use of these polyols, and affirmed that this issue had been addressed to the satisfaction of the parties (decision XXII/9).

31. At its 63rd meeting (April 2011), the Executive Committee decided (decision 63/15) that Article 5 countries with HCFC consumption reported under Article 7 solely in the refrigeration servicing sector and with foam enterprises relying exclusively on imported HCFC-141b pre-blended polyol systems not reported as consumption could, on an exceptional and case-by-case basis, and consistent with decision 61/47, submit a funding request for the conversion of those enterprises during the implementation of stage I of the HCFC phase-out management plan (HPMP), on the understanding that:

- (a) There were no systems houses in the country concerned, and funding for the conversion of any of the foam enterprises was not requested but fully described in the submission of stage I of the HPMP;
- (b) All foam enterprises and the annual amount of HCFC-141b contained in imported pre-blended polyol, to be calculated based on the 2007-2009 average consumption excluding those years in which no production was reported, would be included therein;
- (c) The eligibility of the foam enterprises would be determined at the time of the submission of the project, and the funding level would be based on the amount of HCFC-141b contained in imported pre-blended polyol systems as defined under subparagraph (b) above; and
- (d) The project proposal would completely phase out the use of HCFC-141b in imported pre-blended polyol systems and would include a commitment from the country to put in place, by the time the last foam manufacturing plant had been converted to a non-HCFC technology, regulations or policies banning the import and/or the use of HCFC-141b pre-blended polyol systems.

32. At the 65th meeting (November 2011), in the context of a discussion on the issue of providing information on second-stage conversions in relevant project documents, it was noted that there were instances in which countries were seeking funding for second-stage conversions to phase out HCFC-141b-based pre-blended polyols not reported under Article 7. Under the HCFC guidelines, second-stage conversions were eligible for funding only if they were necessary or were the most cost-effective projects

²² UNEP/OzL.Pro.22/9.

to meet the targets under the Montreal Protocol, based on consumption reported under Article 7. Following a discussion, the Executive Committee *inter alia*, requested the Secretariat to prepare a document on options for a tracking system to correlate, by country, the amounts of HCFC 141b-based pre-blended polyols exported by systems houses with the amounts used by foam enterprises in importing Article 5 countries that had been approved for phase-out, which could be updated on a periodic basis (decision 65/12(b)).

33. In response to decision 65/12(b), the Secretariat submitted to the 66th meeting (April 2012) a document on options for a tracking system²³, which could be updated on a periodic basis, and which would correlate, by country, the amounts of HCFC-141b-based pre-blended polyols exported by systems houses on the one hand, with the amounts used by foam enterprises in importing Article 5 countries on the other. Following a discussion, the Executive Committee, *inter alia*, requested the Secretariat to update the document based on best available data on the amount of HCFC-141b in pre-blended polyols exported in 2009 and 2010 in Chile, China and Colombia, and to report back to the 68th meeting (decision 66/51). Based on the document submitted to the 68th meeting (December 2012) pursuant to decision 66/51²⁴, the Executive Committee decided (decision 68/42):

- (a) When stage II of the countries' HPMPs were submitted, to deduct the following amounts of HCFC-141b exported in pre-blended polyols from the starting point for aggregate reduction in HCFC consumption: 2.42 ODP tonnes for Chile; 137.83 ODP tonnes for China; 12.30 ODP tonnes for Colombia and 28.60 ODP tonnes for Mexico; and
- (b) To encourage relevant Article 5 countries to consider establishing a national system for recording the amounts of HCFC-141b contained in pre-blended polyols imported and/or exported (where applicable) to support the ban on imports of pure HCFC-141b, as well as that contained in pre-blended polyols, to be issued once all the foam enterprises had been converted, and to facilitate monitoring of these enterprises to sustain the phase-out of HCFC-141b.

Minimizing any adverse climate impacts of HCFC phase-out in the refrigeration servicing sector

34. At its 66th meeting, the Executive Committee considered the issue of maximizing the climate benefits from the phase-out of HCFCs in the refrigeration servicing sector. During the discussion, it was noted *inter alia* the importance to ensure that the phase-out of HCFCs in the refrigeration servicing sector had no negative impact on the climate. While some activities in this sector, (e.g., training of technicians) could have a beneficial impact on the climate, other activities (retrofitting of existing HCFC-based refrigeration/ air-conditioning equipment) could have a detrimental impact depending on the effect on the climate of the alternatives being used. It was also pointed out that where low global warming potential (GWP) alternatives were available at competitive prices countries should give priority to their use.

35. Discussions on this issue continued at the 67th and 68th meetings (July 2012 and December 2012, respectively) without reaching a conclusion. Therefore, the Executive Committee requested the Secretariat, in consultation with the bilateral and implementing agencies, to prepare a discussion paper for the 70th meeting outlining key issues and considerations involved in further promoting strategies, approaches and technologies to minimize any adverse climate impacts of HCFC phase-out in the refrigeration servicing sector in the context of decision XIX/6 (decision 68/11).

²³ UNEP/OzL.Pro/ExCom/66/54.

²⁴ Options for a tracking system for HCFC-141b-based pre-blended polyols exported by systems houses and used by foam enterprises in importing Article 5 countries (UNEP/OzL.Pro/ExCom/68/46).

36. At the 70th meeting, the Executive Committee considered a discussion paper on minimizing adverse climate impact of HCFC phase-out in the refrigeration servicing sector, prepared by the Secretariat pursuant to decision 68/11. As the Committee was unable to reach an agreement, it agreed to defer consideration of the discussion paper to the 71st meeting²⁵.

²⁵ UNEP/OzL.Pro/ExCom/71/56.

ANNEX III

MEETING DOCUMENTS OF AGREEMENTS BETWEEN RELEVANT GOVERNMENTS AND THE EXECUTIVE COMMITTEE FOR THE PHASE OF HCFC IN THE CONSUMPTION SECTOR

Country	Originally approved*		Revised**	
	Document No.	Annex No.	Document No.	Annex No.
Afghanistan	63/60	XXXIV		
Albania	64/53	VII	70/59	IX
Algeria	66/54	XXIII		
Angola	65/60	VIII		
Antigua and Barbuda	66/54, Corr.1	XV		
Argentina	66/54	XXIV	66/54	XI
Armenia	62/62	VII		
Bahamas	65/60	IX		
Bahrain	68/53	XIX		
Bangladesh	65/60	XXI		
Barbados	69/40	XIII		
Belize	62/62	VIII		
Benin	63/60	XII	70/59	X
Bhutan	63/60	XXVI		
Bolivia	64/53	VIII	68/53	II
Bosnia and Herzegovina	66/54	XVI		
Botswana				
Brazil	64/53	XXI		
Brunei Darussalam	66/54	XVII		
Burkina Faso	62/62	XV	70/59	XI
Burundi	65/60	X		
Cambodia	61/30	XII	70/59	XII
Cameroon	64/53	XXII		
Cape Verde	64/53	IX		
Central African Republic	64/53	X		
Chad	62/62	XVI	70/59	XIII
Chile	63/60	XXXV		
China	64/53, 65/60	XXVII, XXII	66/54, 67/39	VII, X
Colombia	62/62	XX	66/54	XII
Comoros	64/53	XI		
Congo	63/60	XIII		
Congo (Democratic Republic)	63/60	XXXVI		
Cook Islands	63/60	XXI		
Costa Rica	64/53	XII	70/59	XIV
Cote d'Ivoire	66/54	XXV		
Croatia	61/33	XIII	66/54	XIII
Cuba	65/60	XI		
Democratic People's Republic of Korea				
Djibouti	66/54	XVIII		
Dominica (The)	62/62	IX		
Dominican Republic	65/60	XXIII		
Ecuador	65/60	XII	70/59	XV
Egypt	65/60	XXIV		
El Salvador	65/60	XIII		
Equatorial Guinea	65/60	XIV		
Eritrea	67/39	XIII		

Country	Originally approved*		Revised**	
	Document No.	Annex No.	Document No.	Annex No.
Ethiopia	68/53	XV		
Fiji	65/60	XV		
Gabon	62/62	XVII		
Gambia	65/60	XVI		
Georgia	63/60	XIV		
Ghana	61/39	XIV	67/39	XI
Grenada	62/62	X		
Guatemala	64/53	XIII	68/53	XII
Guinea	66/54	XXVI		
Guinea-Bissau	65/60	XVII		
Guyana	63/60	XV		
Haiti	68/53	XVI		
Honduras	63/60	XVI		
India	66/54	XXVII		
Indonesia	64/53	XXIII		
Iraq	65/60	XXV		
Islamic Republic of Iran	63/60	XXXVII	68/53	XIII
Jamaica	64/53	XIV		
Jordan	65/60/Rev.1	XXVI		
Kenya	66/54	XXVIII		
Kiribati	63/60	XXI		
Kuwait	66/54	XXIX		
Kyrgyzstan	63/60	XVII		
Lao People's Democratic Republic	63/60	XXXI		
Lebanon	64/53	XXIV	70/59	XVI
Lesotho	64/53	XV		
Liberia	63/60	XVIII		
Libya				
Madagascar	62/62	XI		
Malawi	62/62	XII	70/59	XVII
Malaysia	65/60	XXVII		
Maldives	60/33	VII	69/40	X
Mali	63/60	XIX		
Marshall Islands	63/60	XXI		
Mauritania				
Mauritius	63/60	XXVII		
Mexico	64/53	XXV		
Micronesia (Federated State of)	63/60	XXI		
Mongolia	63/60	XXXII		
Montenegro	63/60	XX		
Morocco	65/60	XXVIII		
Mozambique	66/54	XIX		
Myanmar	68/53	XVII		
Namibia	63/60	XXVIII		
Nauru	63/60	XXI		
Nepal (***)	66/54	XX		
Nicaragua	66/54	XXI		
Niger	66/54	XXII		
Nigeria	62/62	XXI	66/54	XIV
Niue	63/60	XXI		
Oman	65/60	XXIX		
Pakistan	62/62	XXII	70/59	XVIII

Country	Originally approved*		Revised**	
	Document No.	Annex No.	Document No.	Annex No.
Palau	63/60	XXI		
Panama	65/60	XXX		
Papua New Guinea	63/60	XXIX		
Paraguay	63/60	XXII		
Peru	68/53	XX		
Philippines	68/53	XXI		
Qatar	65/60	XXXI		
Republic of Moldova	63/60	XXIII		
Rwanda	64/53	XVI	70/59	XIX
Saint Kitts and Nevis	64/53	XVII		
Saint Lucia	64/53	XVIII	68/53	XIV
Saint Vincent and the Grenadines	64/53	XIX		
Samoa	63/60	XXI		
Sao Tome and Principe	63/60	XXIV		
Saudi Arabia	68/53	XXII		
Senegal	65/60	XXXII		
Serbia	62/62	XIII		
Seychelles	63/60	XXX	70/59	XXIII
Sierra Leone	65/60	XVIII		
Solomon Islands	63/60	XXI		
Somalia	67/39	XIV		
South Africa	67/39	XVI		
South Sudan				
Sri Lanka	62/62	XIX	70/59	XX
Sudan	66/54	XXX		
Suriname	65/60	XIX		
Swaziland	63/60	XXXIII	70/59	XXI
Syria				
Tanzania	67/39	XV		
Thailand	68/53	XXIII		
The former Yugoslav Republic of Macedonia	60/40	VIII	67/39	XII
Timor Leste	63/60	XXV	69/40	XI
Togo	62/62	XVIII		
Tonga	63/60	XXI		
Trinidad and Tobago	64/53	XXVI		
Tunisia				
Turkey	68/53	XXIV		
Turkmenistan	62/62	XIV		
Tuvalu	63/60	XXI		
Uganda	68/53	XVIII		
Uruguay	65/60	XXXIII		
Vanuatu	63/60	XXI		
Venezuela (Bolivarian Republic of)	63/60	XXXVIII	67/39	VIII
Viet Nam	63/60	XXXIX		
Yemen	68/53	XXV		
Zambia	64/53	XX		
Zimbabwe	65/60	XX		

(*) As approved at the time of the submission of the HPMP, when the HCFC baseline for compliance was not yet established for the majority of Article 5 countries.

(**) Updated based on the established HCFC baseline for compliance.

(***) The HPMP was approved at the 62nd meeting (UNEP/OzL.Pro/ExCom/62/42).

Report on ODS approved for phase-out in stage I of HPMPs (as of the 70th meeting)

Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Afghanistan					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	23.60	23.55	8.20	15.35	34.82%
<i>Total for Afghanistan</i>	<i>23.60</i>	<i>23.55</i>	<i>8.20</i>	<i>15.35</i>	<i>34.82%</i>
Albania					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-124	0.01	0.01	0.01	0.00	100.00%
HCFC-142b	0.29	0.29	0.29	0.00	100.00%
HCFC-22	5.62	5.62	1.80	3.82	32.03%
<i>Total for Albania</i>	<i>5.93</i>	<i>5.92</i>	<i>2.10</i>	<i>3.82</i>	<i>35.47%</i>
Algeria					
<i>HPMP approved at ExCom 66 to reduce 20% of baseline by 2017</i>					
HCFC-141b	5.70	5.70	3.97	1.73	69.65%
HCFC-141bPolyol	0.00	5.36	0.00	5.36	0.00%
HCFC-22	24.50	24.50	10.51	13.99	42.90%
<i>Total for Algeria</i>	<i>30.20</i>	<i>35.56</i>	<i>14.48</i>	<i>21.08</i>	<i>40.72%</i>
Angola					
<i>HPMP approved at ExCom 65 to reduce 10% of baseline by 2015</i>					
HCFC-22	16.00	15.95	1.59	14.36	9.97%
<i>Total for Angola</i>	<i>16.00</i>	<i>15.95</i>	<i>1.59</i>	<i>14.36</i>	<i>9.97%</i>
Antigua and Barbuda					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.30	0.30	0.03	0.27	10.00%
<i>Total for Antigua and Barbuda</i>	<i>0.30</i>	<i>0.30</i>	<i>0.03</i>	<i>0.27</i>	<i>10.00%</i>
Argentina					
<i>HPMP approved at ExCom 66 to reduce 18% of baseline by 2017</i>					
HCFC-123	1.50	1.57	0.00	1.57	0.00%
HCFC-124	1.10	0.83	0.00	0.83	0.00%
HCFC-141b	113.40	94.57	23.96	70.61	25.34%
HCFC-142b	17.40	14.34	0.00	14.34	0.00%
HCFC-22	267.30	266.20	59.57	206.63	22.38%
<i>Total for Argentina</i>	<i>400.70</i>	<i>377.51</i>	<i>83.53</i>	<i>293.98</i>	<i>22.13%</i>
Armenia					
<i>HPMP approved at ExCom 62 to reduce 10% of baseline by 2015</i>					
HCFC-141bPolyol	0.00	0.83	0.83	0.00	100.00%
HCFC-22	7.00	7.00	1.40	5.60	20.00%
<i>Total for Armenia</i>	<i>7.00</i>	<i>7.83</i>	<i>2.23</i>	<i>5.60</i>	<i>28.48%</i>
Bahamas					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	4.80	4.81	1.68	3.13	34.93%
<i>Total for Bahamas</i>	<i>4.80</i>	<i>4.81</i>	<i>1.68</i>	<i>3.13</i>	<i>34.93%</i>
Bahrain					
<i>HPMP approved at ExCom 68 to reduce 42% of baseline by 2020</i>					
HCFC-141b	0.50	0.44	0.44	0.00	100.00%
HCFC-141bPolyol	0.00	10.11	0.00	10.11	0.00%
HCFC-22	51.50	51.46	22.77	28.69	44.25%
<i>Total for Bahrain</i>	<i>52.00</i>	<i>62.01</i>	<i>23.21</i>	<i>38.80</i>	<i>37.43%</i>

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Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Bangladesh					
<i>HPMP approved at ExCom 65 to reduce 30% of baseline by 2018</i>					
HCFC-123	0.30	0.21	0.21	0.00	100.00%
HCFC-124	0.10	0.07	0.07	0.00	100.00%
HCFC-141b	21.30	21.23	20.20	1.03	95.15%
HCFC-142b	5.72	5.72	0.57	5.15	9.97%
HCFC-22	45.50	45.42	3.48	41.94	7.66%
<i>Total for Bangladesh</i>	<i>72.92</i>	<i>72.65</i>	<i>24.53</i>	<i>48.12</i>	<i>33.76%</i>
Barbados					
<i>HPMP approved at ExCom 69 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.10	0.10	0.00	0.10	0.00%
HCFC-22	3.60	3.60	1.29	2.31	35.83%
<i>Total for Barbados</i>	<i>3.70</i>	<i>3.70</i>	<i>1.29</i>	<i>2.41</i>	<i>34.86%</i>
Belize					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-141b	0.20	0.12	0.04	0.08	33.33%
HCFC-22	2.70	2.68	0.99	1.69	36.94%
<i>Total for Belize</i>	<i>2.90</i>	<i>2.80</i>	<i>1.03</i>	<i>1.77</i>	<i>36.79%</i>
Benin					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	23.80	23.80	8.33	15.47	35.00%
<i>Total for Benin</i>	<i>23.80</i>	<i>23.80</i>	<i>8.33</i>	<i>15.47</i>	<i>35.00%</i>
Bhutan					
<i>HPMP approved at ExCom 63 to reduce 100% of baseline by 2030</i>					
HCFC-22	0.30	0.30	0.30	0.00	100.00%
<i>Total for Bhutan</i>	<i>0.30</i>	<i>0.30</i>	<i>0.30</i>	<i>0.00</i>	<i>100.00%</i>
Bolivia					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-124	0.04	0.10	0.10	0.00	100.00%
HCFC-141b	1.00	1.00	1.00	0.00	100.00%
HCFC-141bPolyol	0.00	0.60	0.00	0.60	0.00%
HCFC-142b	0.20	0.17	0.00	0.17	0.00%
HCFC-22	4.90	3.68	0.60	3.08	16.30%
<i>Total for Bolivia</i>	<i>6.14</i>	<i>5.55</i>	<i>1.70</i>	<i>3.85</i>	<i>30.63%</i>
Bosnia and Herzegovina					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-141b	3.00	1.50	1.50	0.00	100.00%
HCFC-141bPolyol	0.00	3.47	3.47	0.00	100.00%
HCFC-22	3.20	3.20	1.61	1.59	50.31%
<i>Total for Bosnia and Herzegovina</i>	<i>6.20</i>	<i>8.17</i>	<i>6.58</i>	<i>1.59</i>	<i>80.54%</i>
Botswana					
<i>HPMP not yet approved</i>					
HCFC-141b	0.01	0.01	0.00	0.01	0.00%
HCFC-22	11.00	11.00	0.00	11.00	0.00%
<i>Total for Botswana</i>	<i>11.01</i>	<i>11.01</i>	<i>0.00</i>	<i>11.01</i>	<i>0.00%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Brazil					
<i>HPMP approved at ExCom 64 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.30	0.30	0.00	0.30	0.00%
HCFC-124	7.80	7.73	0.00	7.73	0.00%
HCFC-141b	521.60	521.54	168.80	352.74	32.37%
HCFC-142b	5.60	5.61	0.00	5.61	0.00%
HCFC-22	792.10	792.05	51.50	740.55	6.50%
<i>Total for Brazil</i>	<i>1,327.40</i>	<i>1,327.23</i>	<i>220.30</i>	<i>1,106.93</i>	<i>16.60%</i>
Brunei Darussalam					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	6.10	6.10	2.14	3.96	35.08%
<i>Total for Brunei Darussalam</i>	<i>6.10</i>	<i>6.10</i>	<i>2.14</i>	<i>3.96</i>	<i>35.08%</i>
Burkina Faso					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	28.90	28.90	10.11	18.79	34.98%
<i>Total for Burkina Faso</i>	<i>28.90</i>	<i>28.90</i>	<i>10.11</i>	<i>18.79</i>	<i>34.98%</i>
Burundi					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	7.20	7.15	2.50	4.65	34.97%
<i>Total for Burundi</i>	<i>7.20</i>	<i>7.15</i>	<i>2.50</i>	<i>4.65</i>	<i>34.97%</i>
Cambodia					
<i>HPMP approved at ExCom 61 to reduce 100% of baseline by 2030</i>					
HCFC-22	15.00	15.00	15.00	0.00	100.00%
<i>Total for Cambodia</i>	<i>15.00</i>	<i>15.00</i>	<i>15.00</i>	<i>0.00</i>	<i>100.00%</i>
Cameroon					
<i>HPMP approved at ExCom 64 to reduce 20% of baseline by 2015</i>					
HCFC-141b	22.10	15.70	15.70	0.00	100.00%
HCFC-22	66.80	66.76	9.70	57.06	14.53%
<i>Total for Cameroon</i>	<i>88.90</i>	<i>82.46</i>	<i>25.40</i>	<i>57.06</i>	<i>30.80%</i>
Cape Verde					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.10	0.25	0.09	0.16	36.00%
<i>Total for Cape Verde</i>	<i>1.10</i>	<i>0.25</i>	<i>0.09</i>	<i>0.16</i>	<i>36.00%</i>
Central African Republic					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	12.00	11.99	4.20	7.79	35.03%
<i>Total for Central African Republic</i>	<i>12.00</i>	<i>11.99</i>	<i>4.20</i>	<i>7.79</i>	<i>35.03%</i>
Chad					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	16.10	16.10	5.63	10.47	34.97%
<i>Total for Chad</i>	<i>16.10</i>	<i>16.10</i>	<i>5.63</i>	<i>10.47</i>	<i>34.97%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Chile					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-123		0.03	0.00	0.03	0.00%
HCFC-124		0.01	0.00	0.01	0.00%
HCFC-141b	39.30	39.29	3.02	36.27	7.69%
HCFC-142b	0.70	0.63	0.00	0.63	0.00%
HCFC-22	47.30	47.26	18.98	28.28	40.16%
HCFC-225	0.60	0.29	0.00	0.29	0.00%
<i>Total for Chile</i>	<i>87.90</i>	<i>87.51</i>	<i>22.00</i>	<i>65.51</i>	<i>25.14%</i>
China					
<i>HPMP approved at ExCom 64 to reduce 10% of baseline by 2015</i>					
HCFC-123	10.60	10.13	0.00	10.13	0.00%
HCFC-124	3.00	3.07	0.00	3.07	0.00%
HCFC-141b	5,941.30	5,885.18	1,698.05	4,187.13	28.85%
HCFC-142b	1,473.60	1,470.53	266.95	1,203.58	18.15%
HCFC-22	11,839.40	11,495.31	1,480.60	10,014.71	12.88%
HCFC-225ca	1.30	1.22	0.00	1.22	0.00%
<i>Total for China</i>	<i>19,269.20</i>	<i>18,865.44</i>	<i>3,445.60</i>	<i>15,419.84</i>	<i>18.26%</i>
Colombia					
<i>HPMP approved at ExCom 62 to reduce 10% of baseline by 2015</i>					
HCFC-123	2.20	2.20	0.00	2.20	0.00%
HCFC-124	0.10	0.04	0.00	0.04	0.00%
HCFC-141b	151.80	151.70	53.92	97.78	35.54%
HCFC-142b	0.50	0.50	0.00	0.50	0.00%
HCFC-22	71.10	71.10	24.99	46.11	35.15%
<i>Total for Colombia</i>	<i>225.70</i>	<i>225.54</i>	<i>78.91</i>	<i>146.63</i>	<i>34.99%</i>
Comoros					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.14	0.05	0.09	35.71%
<i>Total for Comoros</i>	<i>0.10</i>	<i>0.14</i>	<i>0.05</i>	<i>0.09</i>	<i>35.71%</i>
Congo					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	8.90	8.85	3.55	5.30	40.11%
<i>Total for Congo</i>	<i>8.90</i>	<i>8.85</i>	<i>3.55</i>	<i>5.30</i>	<i>40.11%</i>
Congo, DR					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-22	47.80	58.00	5.80	52.20	10.00%
<i>Total for Congo, DR</i>	<i>47.80</i>	<i>58.00</i>	<i>5.80</i>	<i>52.20</i>	<i>10.00%</i>
Cook Islands					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.04	0.02	0.02	50.00%
<i>Total for Cook Islands</i>	<i>0.10</i>	<i>0.04</i>	<i>0.02</i>	<i>0.02</i>	<i>50.00%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Costa Rica					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-123		0.01	0.01	0.00	100.00%
HCFC-124	0.10	0.09	0.09	0.00	100.00%
HCFC-141b	3.60	3.58	1.43	2.15	39.94%
HCFC-141bPolyol	0.00	18.11	14.00	4.11	77.31%
HCFC-142b	0.40	0.40	0.40	0.00	100.00%
HCFC-22	10.00	10.00	3.00	7.00	30.00%
<i>Total for Costa Rica</i>	<i>14.10</i>	<i>32.19</i>	<i>18.93</i>	<i>13.26</i>	<i>58.80%</i>
Cote d'Ivoire					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	63.80	63.80	22.33	41.47	35.00%
<i>Total for Cote d'Ivoire</i>	<i>63.80</i>	<i>63.80</i>	<i>22.33</i>	<i>41.47</i>	<i>35.00%</i>
Croatia					
<i>HPMP approved at ExCom 61 to reduce 100% of baseline by 2030</i>					
HCFC-141b	(0.20)	3.10	3.10	0.00	100.00%
HCFC-142b	0.10	0.10	0.10	0.00	100.00%
HCFC-22	4.00	4.30	4.30	0.00	100.00%
<i>Total for Croatia</i>	<i>3.90</i>	<i>7.50</i>	<i>7.50</i>	<i>0.00</i>	<i>100.00%</i>
Cuba					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-124		0.01	0.00	0.01	0.00%
HCFC-141b	2.60	2.60	2.60	0.00	100.00%
HCFC-141bPolyol	0.00	13.35	13.35	0.00	100.00%
HCFC-142b		0.02	0.00	0.02	0.00%
HCFC-22	14.30	14.25	3.31	10.94	23.23%
<i>Total for Cuba</i>	<i>16.90</i>	<i>30.23</i>	<i>19.26</i>	<i>10.97</i>	<i>63.71%</i>
Djibouti					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.70	0.70	0.24	0.46	34.29%
<i>Total for Djibouti</i>	<i>0.70</i>	<i>0.70</i>	<i>0.24</i>	<i>0.46</i>	<i>34.29%</i>
Dominica					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.40	0.40	0.08	0.32	20.00%
<i>Total for Dominica</i>	<i>0.40</i>	<i>0.40</i>	<i>0.08</i>	<i>0.32</i>	<i>20.00%</i>
Dominican Republic					
<i>HPMP approved at ExCom 65 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.20	0.19	0.00	0.19	0.00%
HCFC-141b	1.20	0.60	0.60	0.00	100.00%
HCFC-141bPolyol	0.00	19.51	19.51	0.00	100.00%
HCFC-22	50.40	50.41	7.03	43.38	13.95%
<i>Total for Dominican Republic</i>	<i>51.80</i>	<i>70.71</i>	<i>27.14</i>	<i>43.57</i>	<i>38.38%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Ecuador					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.18	0.18	0.00	0.18	0.00%
HCFC-141b	0.86	0.86	0.86	0.00	100.00%
HCFC-141bPolyol	0.00	20.67	14.96	5.71	72.38%
HCFC-142b	1.20	1.20	0.00	1.20	0.00%
HCFC-22	21.02	21.02	7.36	13.66	35.01%
<i>Total for Ecuador</i>	<i>23.27</i>	<i>43.93</i>	<i>23.18</i>	<i>20.75</i>	<i>52.77%</i>
Egypt					
<i>HPMP approved at ExCom 65 to reduce 25% of baseline by 2018</i>					
HCFC-123	0.10	0.11	0.00	0.11	0.00%
HCFC-124	0.00	0.00	0.00	0.00	
HCFC-141b	129.60	129.61	95.69	33.92	73.83%
HCFC-141bPolyol	0.00	98.34	72.18	26.16	73.40%
HCFC-142b	16.40	16.36	0.00	16.36	0.00%
HCFC-22	240.20	240.19	6.13	234.06	2.55%
<i>Total for Egypt</i>	<i>386.30</i>	<i>484.61</i>	<i>174.00</i>	<i>310.61</i>	<i>35.91%</i>
El Salvador					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.10	0.05	0.05	0.00	100.00%
HCFC-124	0.10	0.11	0.11	0.00	100.00%
HCFC-141b	3.40	3.34	1.05	2.29	31.44%
HCFC-141bPolyol	0.00	4.94	4.94	0.00	100.00%
HCFC-142b		0.03	0.03	0.00	100.00%
HCFC-22	8.20	8.15	2.85	5.30	34.97%
<i>Total for El Salvador</i>	<i>11.80</i>	<i>16.62</i>	<i>9.03</i>	<i>7.59</i>	<i>54.33%</i>
Equatorial Guinea					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	6.29	6.29	2.20	4.09	34.98%
<i>Total for Equatorial Guinea</i>	<i>6.29</i>	<i>6.29</i>	<i>2.20</i>	<i>4.09</i>	<i>34.98%</i>
Eritrea					
<i>HPMP approved at ExCom 67 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.10	0.03	0.07	30.00%
<i>Total for Eritrea</i>	<i>0.10</i>	<i>0.10</i>	<i>0.03</i>	<i>0.07</i>	<i>30.00%</i>
Ethiopia					
<i>HPMP approved at ExCom 68 to reduce 35% of baseline by 2020</i>					
HCFC-22	5.50	5.50	1.92	3.58	34.91%
<i>Total for Ethiopia</i>	<i>5.50</i>	<i>5.50</i>	<i>1.92</i>	<i>3.58</i>	<i>34.91%</i>
Fiji					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.04	0.04	0.04	0.00	100.00%
HCFC-22	8.40	8.37	2.90	5.47	34.65%
<i>Total for Fiji</i>	<i>8.44</i>	<i>8.41</i>	<i>2.94</i>	<i>5.47</i>	<i>34.96%</i>
Gabon					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	30.20	29.74	10.40	19.34	34.97%
<i>Total for Gabon</i>	<i>30.20</i>	<i>29.74</i>	<i>10.40</i>	<i>19.34</i>	<i>34.97%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Gambia					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.90	0.92	0.32	0.60	34.78%
<i>Total for Gambia</i>	<i>0.90</i>	<i>0.92</i>	<i>0.32</i>	<i>0.60</i>	<i>34.78%</i>
Georgia					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.70	0.72	0.72	0.00	100.00%
HCFC-22	4.60	4.57	1.61	2.96	35.23%
<i>Total for Georgia</i>	<i>5.30</i>	<i>5.29</i>	<i>2.33</i>	<i>2.96</i>	<i>44.05%</i>
Ghana					
<i>HPMP approved at ExCom 61 to reduce 35% of baseline by 2020</i>					
HCFC-142b	14.70	14.70	5.35	9.35	36.39%
HCFC-22	42.60	42.60	14.70	27.90	34.51%
<i>Total for Ghana</i>	<i>57.30</i>	<i>57.30</i>	<i>20.05</i>	<i>37.25</i>	<i>34.99%</i>
Grenada					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.80	0.83	0.30	0.53	36.14%
<i>Total for Grenada</i>	<i>0.80</i>	<i>0.83</i>	<i>0.30</i>	<i>0.53</i>	<i>36.14%</i>
Guatemala					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-124	0.20	0.20	0.00	0.20	0.00%
HCFC-141b	1.10	1.10	1.10	0.00	100.00%
HCFC-141bPolyol	0.00	1.40	1.40	0.00	100.00%
HCFC-142b	0.10	0.10	0.00	0.10	0.00%
HCFC-22	6.90	6.90	1.80	5.10	26.09%
<i>Total for Guatemala</i>	<i>8.30</i>	<i>9.70</i>	<i>4.30</i>	<i>5.40</i>	<i>44.33%</i>
Guinea					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	22.60	22.60	7.91	14.69	35.00%
<i>Total for Guinea</i>	<i>22.60</i>	<i>22.60</i>	<i>7.91</i>	<i>14.69</i>	<i>35.00%</i>
Guinea-Bissau					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.43	1.43	0.50	0.93	34.97%
<i>Total for Guinea-Bissau</i>	<i>1.43</i>	<i>1.43</i>	<i>0.50</i>	<i>0.93</i>	<i>34.97%</i>
Guyana					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-22	1.80	1.64	0.10	1.54	6.10%
<i>Total for Guyana</i>	<i>1.80</i>	<i>1.64</i>	<i>0.10</i>	<i>1.54</i>	<i>6.10%</i>
Haiti					
<i>HPMP approved at ExCom 68 to reduce 35% of baseline by 2020</i>					
HCFC-22	3.60	3.60	1.26	2.34	35.00%
<i>Total for Haiti</i>	<i>3.60</i>	<i>3.60</i>	<i>1.26</i>	<i>2.34</i>	<i>35.00%</i>
Honduras					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-141b	1.90	1.90	0.67	1.23	35.26%
HCFC-141bPolyol	0.00	0.80	0.00	0.80	0.00%
HCFC-22	18.00	18.01	6.30	11.71	34.98%
<i>Total for Honduras</i>	<i>19.90</i>	<i>20.71</i>	<i>6.97</i>	<i>13.74</i>	<i>33.66%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
India					
<i>HPMP approved at ExCom 66 to reduce 10% of baseline by 2015</i>					
HCFC-123	3.60	3.50	0.00	3.50	0.00%
HCFC-124	13.50	13.50	0.00	13.50	0.00%
HCFC-141b	865.50	865.50	310.53	554.97	35.88%
HCFC-141bPolyol	0.00	83.05	0.00	83.05	0.00%
HCFC-142b	123.70	123.70	0.00	123.70	0.00%
HCFC-22	602.00	602.00	31.24	570.76	5.19%
<i>Total for India</i>	<i>1,608.30</i>	<i>1,691.25</i>	<i>341.77</i>	<i>1,349.48</i>	<i>20.21%</i>
Indonesia					
<i>HPMP approved at ExCom 64 to reduce 20% of baseline by 2015</i>					
HCFC-123	3.90	3.85	0.00	3.85	0.00%
HCFC-141b	132.70	132.65	89.90	42.75	67.77%
HCFC-22	267.40	267.40	45.10	222.30	16.87%
HCFC-225		0.03	0.00	0.03	0.00%
<i>Total for Indonesia</i>	<i>404.00</i>	<i>403.93</i>	<i>135.00</i>	<i>268.93</i>	<i>33.42%</i>
Iran					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-141b	216.90	216.83	62.70	154.13	28.92%
HCFC-22	163.60	163.60	38.60	125.00	23.59%
<i>Total for Iran</i>	<i>380.50</i>	<i>380.43</i>	<i>101.30</i>	<i>279.13</i>	<i>26.63%</i>
Iraq					
<i>HPMP approved at ExCom 65 to reduce 14% of baseline by 2015</i>					
HCFC-22	108.30	108.38	14.98	93.40	13.82%
<i>Total for Iraq</i>	<i>108.30</i>	<i>108.38</i>	<i>14.98</i>	<i>93.40</i>	<i>13.82%</i>
Jamaica					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-141b	3.60	3.63	3.63	0.00	100.00%
HCFC-22	12.70	12.68	4.50	8.18	35.49%
<i>Total for Jamaica</i>	<i>16.30</i>	<i>16.31</i>	<i>8.13</i>	<i>8.18</i>	<i>49.85%</i>
Jordan					
<i>HPMP approved at ExCom 65 to reduce 20% of baseline by 2017</i>					
HCFC-141b	28.80	28.29	1.18	27.11	4.17%
HCFC-141bPolyol	0.00	11.31	0.00	11.31	0.00%
HCFC-22	54.20	54.19	24.32	29.87	44.88%
<i>Total for Jordan</i>	<i>83.00</i>	<i>93.79</i>	<i>25.50</i>	<i>68.29</i>	<i>27.19%</i>
Kenya					
<i>HPMP approved at ExCom 66 to reduce 21% of baseline by 2017</i>					
HCFC-22	52.20	52.20	11.00	41.20	21.07%
<i>Total for Kenya</i>	<i>52.20</i>	<i>52.20</i>	<i>11.00</i>	<i>41.20</i>	<i>21.07%</i>
Kiribati					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.05	0.03	0.02	60.00%
<i>Total for Kiribati</i>	<i>0.10</i>	<i>0.05</i>	<i>0.03</i>	<i>0.02</i>	<i>60.00%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Korea, DPR					
<i>HPMP not yet approved</i>					
HCFC-141b	16.00	16.00	0.00	16.00	0.00%
HCFC-22	62.00	62.00	0.00	62.00	0.00%
<i>Total for Korea, DPR</i>	<i>78.00</i>	<i>78.00</i>	<i>0.00</i>	<i>78.00</i>	<i>0.00%</i>
Kuwait					
<i>HPMP approved at ExCom 66 to reduce 39% of baseline by 2018</i>					
HCFC-123	0.30	0.30	0.00	0.30	0.00%
HCFC-141b	75.20	75.20	75.20	0.00	100.00%
HCFC-141bPolyol	0.00	10.64	0.00	10.64	0.00%
HCFC-142b	82.70	82.70	82.70	0.00	100.00%
HCFC-22	260.50	260.50	81.25	179.25	31.19%
<i>Total for Kuwait</i>	<i>418.70</i>	<i>429.34</i>	<i>239.15</i>	<i>190.19</i>	<i>55.70%</i>
Kyrgyzstan					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-141b	0.80	0.73	0.00	0.73	0.00%
HCFC-142b	0.20	0.17	0.00	0.17	0.00%
HCFC-22	3.20	3.16	0.44	2.72	13.92%
<i>Total for Kyrgyzstan</i>	<i>4.20</i>	<i>4.06</i>	<i>0.44</i>	<i>3.62</i>	<i>10.84%</i>
Lao, PDR					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-141bPolyol	0.00	3.24	0.00	3.24	0.00%
HCFC-22	2.30	1.84	0.62	1.22	33.70%
<i>Total for Lao, PDR</i>	<i>2.30</i>	<i>5.08</i>	<i>0.62</i>	<i>4.46</i>	<i>12.20%</i>
Lebanon					
<i>HPMP approved at ExCom 64 to reduce 18% of baseline by 2015</i>					
HCFC-123	0.05	0.05	0.00	0.05	0.00%
HCFC-141b	37.53	37.53	15.10	22.43	40.23%
HCFC-22	35.95	35.95	4.90	31.05	13.63%
<i>Total for Lebanon</i>	<i>73.52</i>	<i>73.53</i>	<i>20.00</i>	<i>53.53</i>	<i>27.20%</i>
Lesotho					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	3.50	3.90	1.40	2.50	35.90%
<i>Total for Lesotho</i>	<i>3.50</i>	<i>3.90</i>	<i>1.40</i>	<i>2.50</i>	<i>35.90%</i>
Liberia					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	5.30	5.25	1.93	3.32	36.76%
<i>Total for Liberia</i>	<i>5.30</i>	<i>5.25</i>	<i>1.93</i>	<i>3.32</i>	<i>36.76%</i>
Libya					
<i>HPMP not yet approved</i>					
HCFC-141b	30.20	30.20	0.00	30.20	0.00%
HCFC-22	84.50	84.50	0.00	84.50	0.00%
<i>Total for Libya</i>	<i>114.70</i>	<i>114.70</i>	<i>0.00</i>	<i>114.70</i>	<i>0.00%</i>
Macedonia, FYR					
<i>HPMP approved at ExCom 60 to reduce 35% of baseline by 2020</i>					
HCFC-141bPolyol		1.55	1.55	0.00	100.00%
HCFC-22	1.80	1.80	0.63	1.17	35.00%
<i>Total for Macedonia, FYR</i>	<i>1.80</i>	<i>3.35</i>	<i>2.18</i>	<i>1.17</i>	<i>65.07%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Madagascar					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	24.90	17.10	6.00	11.10	35.09%
<i>Total for Madagascar</i>	<i>24.90</i>	<i>17.10</i>	<i>6.00</i>	<i>11.10</i>	<i>35.09%</i>
Malawi					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	10.80	10.80	3.78	7.02	35.00%
<i>Total for Malawi</i>	<i>10.80</i>	<i>10.80</i>	<i>3.78</i>	<i>7.02</i>	<i>35.00%</i>
Malaysia					
<i>HPMP approved at ExCom 65 to reduce 15% of baseline by 2016</i>					
HCFC-123	1.20	1.13	0.00	1.13	0.00%
HCFC-141	1.90	0.94	0.00	0.94	0.00%
HCFC-141b	162.60	162.54	94.60	67.94	58.20%
HCFC-142b	0.80	0.79	0.00	0.79	0.00%
HCFC-21	1.50	0.74	0.00	0.74	0.00%
HCFC-22	349.60	349.54	8.42	341.12	2.41%
HCFC-225	0.10	0.08	0.00	0.08	0.00%
<i>Total for Malaysia</i>	<i>517.70</i>	<i>515.76</i>	<i>103.02</i>	<i>412.74</i>	<i>19.97%</i>
Maldives					
<i>HPMP approved at ExCom 60 to reduce 100% of baseline by 2030</i>					
HCFC-141b	0.70	0.00	0.00	0.00	
HCFC-22	3.90	3.70	3.70	0.00	100.00%
<i>Total for Maldives</i>	<i>4.60</i>	<i>3.70</i>	<i>3.70</i>	<i>0.00</i>	<i>100.00%</i>
Mali					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	15.00	14.97	5.20	9.77	34.74%
<i>Total for Mali</i>	<i>15.00</i>	<i>14.97</i>	<i>5.20</i>	<i>9.77</i>	<i>34.74%</i>
Marshall Islands					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.20	0.11	0.08	0.03	72.73%
<i>Total for Marshall Islands</i>	<i>0.20</i>	<i>0.11</i>	<i>0.08</i>	<i>0.03</i>	<i>72.73%</i>
Mauritania					
<i>HPMP not yet approved</i>					
HCFC-22	20.40	20.40	0.00	20.40	0.00%
<i>Total for Mauritania</i>	<i>20.40</i>	<i>20.40</i>	<i>0.00</i>	<i>20.40</i>	<i>0.00%</i>
Mauritius					
<i>HPMP approved at ExCom 63 to reduce 100% of baseline by 2030</i>					
HCFC-141b	0.10	0.14	0.14	0.00	100.00%
HCFC-22	7.90	7.88	7.88	0.00	100.00%
<i>Total for Mauritius</i>	<i>8.00</i>	<i>8.02</i>	<i>8.02</i>	<i>0.00</i>	<i>100.00%</i>
Mexico					
<i>HPMP approved at ExCom 64 to reduce 30% of baseline by 2015</i>					
HCFC-123	1.50	0.30	0.00	0.30	0.00%
HCFC-124	0.20	0.10	0.00	0.10	0.00%
HCFC-141b	673.70	820.60	392.50	428.10	47.83%
HCFC-142b	5.80	1.00	0.00	1.00	0.00%
HCFC-22	467.80	392.80	24.80	368.00	6.31%
<i>Total for Mexico</i>	<i>1,149.00</i>	<i>1,214.80</i>	<i>417.30</i>	<i>797.50</i>	<i>34.35%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Micronesia					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.20	0.14	0.04	0.10	28.57%
<i>Total for Micronesia</i>	<i>0.20</i>	<i>0.14</i>	<i>0.04</i>	<i>0.10</i>	<i>28.57%</i>
Moldova, Rep					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-22	1.00	0.94	0.23	0.71	24.47%
<i>Total for Moldova, Rep</i>	<i>1.00</i>	<i>0.94</i>	<i>0.23</i>	<i>0.71</i>	<i>24.47%</i>
Mongolia					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.40	1.30	1.00	0.30	76.92%
<i>Total for Mongolia</i>	<i>1.40</i>	<i>1.30</i>	<i>1.00</i>	<i>0.30</i>	<i>76.92%</i>
Montenegro					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.80	0.90	0.33	0.57	36.67%
<i>Total for Montenegro</i>	<i>0.80</i>	<i>0.90</i>	<i>0.33</i>	<i>0.57</i>	<i>36.67%</i>
Morocco					
<i>HPMP approved at ExCom 65 to reduce 20% of baseline by 2017</i>					
HCFC-141b	20.90	22.10	14.20	7.90	64.25%
HCFC-22	38.80	45.90	2.57	43.33	5.60%
<i>Total for Morocco</i>	<i>59.70</i>	<i>68.00</i>	<i>16.77</i>	<i>51.23</i>	<i>24.66%</i>
Mozambique					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	6.50	6.50	2.27	4.23	34.92%
<i>Total for Mozambique</i>	<i>6.50</i>	<i>6.50</i>	<i>2.27</i>	<i>4.23</i>	<i>34.92%</i>
Myanmar					
<i>HPMP approved at ExCom 68 to reduce 35% of baseline by 2020</i>					
HCFC-141b	0.10	0.04	0.00	0.04	0.00%
HCFC-141bPolyol	0.00	1.83	0.00	1.83	0.00%
HCFC-22	4.30	4.26	1.50	2.76	35.21%
<i>Total for Myanmar</i>	<i>4.40</i>	<i>6.13</i>	<i>1.50</i>	<i>4.63</i>	<i>24.47%</i>
Namibia					
<i>HPMP approved at ExCom 63 to reduce 100% of baseline by 2030</i>					
HCFC-141b	0.30	0.26	0.26	0.00	100.00%
HCFC-22	8.10	8.10	8.10	0.00	100.00%
<i>Total for Namibia</i>	<i>8.40</i>	<i>8.36</i>	<i>8.36</i>	<i>0.00</i>	<i>100.00%</i>
Nauru					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22		0.01	0.02	(0.01)	200.00%
<i>Total for Nauru</i>		<i>0.01</i>	<i>0.02</i>	<i>(0.01)</i>	<i>200.00%</i>
Nepal					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.10	1.27	0.64	0.63	50.39%
<i>Total for Nepal</i>	<i>1.10</i>	<i>1.27</i>	<i>0.64</i>	<i>0.63</i>	<i>50.39%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Nicaragua					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-123		0.01	0.00	0.01	0.00%
HCFC-124	0.10	0.03	0.00	0.03	0.00%
HCFC-141b	0.60	0.60	0.60	0.00	100.00%
HCFC-141bPolyol	0.00	0.31	0.31	0.00	100.00%
HCFC-22	6.10	6.10	1.78	4.32	29.18%
<i>Total for Nicaragua</i>	<i>6.80</i>	<i>7.05</i>	<i>2.69</i>	<i>4.36</i>	<i>38.16%</i>
Niger					
<i>HPMP approved at ExCom 66 to reduce 35% of baseline by 2020</i>					
HCFC-22	16.00	16.00	5.60	10.40	35.00%
<i>Total for Niger</i>	<i>16.00</i>	<i>16.00</i>	<i>5.60</i>	<i>10.40</i>	<i>35.00%</i>
Nigeria					
<i>HPMP approved at ExCom 62 to reduce 10% of baseline by 2015</i>					
HCFC-141b	149.70	149.60	79.50	70.10	53.14%
HCFC-22	248.60	248.50	10.60	237.90	4.27%
<i>Total for Nigeria</i>	<i>398.30</i>	<i>398.10</i>	<i>90.10</i>	<i>308.00</i>	<i>22.63%</i>
Niue					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22		0.02	0.01	0.01	50.00%
<i>Total for Niue</i>		<i>0.02</i>	<i>0.01</i>	<i>0.01</i>	<i>50.00%</i>
Oman					
<i>HPMP approved at ExCom 65 to reduce 10% of baseline by 2015</i>					
HCFC-141b	1.10	1.12	1.11	0.01	99.11%
HCFC-141bPolyol	0.00	1.11	1.10	0.01	99.10%
HCFC-142b	0.80	0.78	0.79	(0.01)	101.28%
HCFC-22	29.60	29.57	3.79	25.78	12.82%
<i>Total for Oman</i>	<i>31.50</i>	<i>32.58</i>	<i>6.79</i>	<i>25.79</i>	<i>20.84%</i>
Pakistan					
<i>HPMP approved at ExCom 62 to reduce 10% of baseline by 2015</i>					
HCFC-141b	138.50	138.50	71.70	66.80	51.77%
HCFC-22	108.90	108.90	7.40	101.50	6.80%
<i>Total for Pakistan</i>	<i>247.40</i>	<i>247.40</i>	<i>79.10</i>	<i>168.30</i>	<i>31.97%</i>
Palau					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.20	0.15	0.06	0.09	40.00%
<i>Total for Palau</i>	<i>0.20</i>	<i>0.15</i>	<i>0.06</i>	<i>0.09</i>	<i>40.00%</i>
Panama					
<i>HPMP approved at ExCom 65 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.10	0.05	0.00	0.05	0.00%
HCFC-124		0.01	0.00	0.01	0.00%
HCFC-141b	2.30	2.30	2.30	0.00	100.00%
HCFC-141bPolyol	0.00	2.50	0.00	2.50	0.00%
HCFC-142b	0.20	0.18	0.00	0.18	0.00%
HCFC-22	22.30	22.24	2.48	19.76	11.15%
<i>Total for Panama</i>	<i>24.90</i>	<i>27.28</i>	<i>4.78</i>	<i>22.50</i>	<i>17.52%</i>

Report on ODS approved for phase-out in stage I of HPMPs (as of the 70th meeting)

Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Papua New Guinea					
<i>HPMP approved at ExCom 63 to reduce 100% of baseline by 2030</i>					
HCFC-142b		0.02	0.02	0.00	100.00%
HCFC-22	3.20	3.21	3.21	0.00	100.00%
<i>Total for Papua New Guinea</i>	<i>3.20</i>	<i>3.23</i>	<i>3.23</i>	<i>0.00</i>	<i>100.00%</i>
Paraguay					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.18	0.20	0.00	0.20	0.00%
HCFC-124	0.16	0.15	0.00	0.15	0.00%
HCFC-141b	0.06	0.05	0.00	0.05	0.00%
HCFC-141bPolyol	0.00	1.36	0.00	1.36	0.00%
HCFC-142b	1.33	1.60	0.26	1.34	16.25%
HCFC-22	16.28	15.95	5.32	10.63	33.35%
<i>Total for Paraguay</i>	<i>18.01</i>	<i>19.31</i>	<i>5.58</i>	<i>13.73</i>	<i>28.90%</i>
Peru					
<i>HPMP approved at ExCom 68 to reduce 10% of baseline by 2015</i>					
HCFC-124	0.06	0.06	0.00	0.06	0.00%
HCFC-141b	1.79	1.79	1.79	0.00	100.00%
HCFC-141bPolyol	0.00	0.00	0.00	0.00	
HCFC-142b	1.18	1.18	0.00	1.18	0.00%
HCFC-22	23.85	23.85	1.95	21.90	8.18%
<i>Total for Peru</i>	<i>26.88</i>	<i>26.88</i>	<i>3.74</i>	<i>23.14</i>	<i>13.91%</i>
Philippines					
<i>HPMP approved at ExCom 68 to reduce 10% of baseline by 2015</i>					
HCFC-123	2.20	1.70	0.00	1.70	0.00%
HCFC-141b	63.40	51.85	43.00	8.85	82.93%
HCFC-22	142.90	109.32	2.00	107.32	1.83%
<i>Total for Philippines</i>	<i>208.50</i>	<i>162.87</i>	<i>45.00</i>	<i>117.87</i>	<i>27.63%</i>
Qatar					
<i>HPMP approved at ExCom 65 to reduce 20% of baseline by 2015</i>					
HCFC-141b	0.60	0.57	0.00	0.57	0.00%
HCFC-142b	12.70	12.05	12.05	0.00	100.00%
HCFC-22	73.50	73.45	45.81	27.64	62.37%
<i>Total for Qatar</i>	<i>86.80</i>	<i>86.07</i>	<i>57.86</i>	<i>28.21</i>	<i>67.22%</i>
Rwanda					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.06	0.06	0.06	0.00	100.00%
HCFC-141b	0.16	0.16	0.16	0.00	100.00%
HCFC-142b	0.13	0.13	0.13	0.00	100.00%
HCFC-22	3.75	3.75	1.09	2.66	29.07%
<i>Total for Rwanda</i>	<i>4.10</i>	<i>4.10</i>	<i>1.44</i>	<i>2.66</i>	<i>35.12%</i>
Saint Kitts and Nevis					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.50	0.49	0.18	0.31	36.73%
<i>Total for Saint Kitts and Nevis</i>	<i>0.50</i>	<i>0.49</i>	<i>0.18</i>	<i>0.31</i>	<i>36.73%</i>

Report on ODS approved for phase-out in stage I of HPMPs (as of the 70th meeting)

Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Saint Lucia					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.20	0.20	0.07	0.13	35.00%
<i>Total for Saint Lucia</i>	<i>0.20</i>	<i>0.20</i>	<i>0.07</i>	<i>0.13</i>	<i>35.00%</i>
Saint Vincent and the Grenadine					
<i>HPMP approved at ExCom 64 to reduce 100% of baseline by 2025</i>					
HCFC-22	0.30	0.28	0.28	0.00	100.00%
<i>Total for Saint Vincent and the Gre</i>	<i>0.30</i>	<i>0.28</i>	<i>0.28</i>	<i>0.00</i>	<i>100.00%</i>
Samoa					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.30	0.25	0.07	0.18	28.00%
<i>Total for Samoa</i>	<i>0.30</i>	<i>0.25</i>	<i>0.07</i>	<i>0.18</i>	<i>28.00%</i>
Sao Tome and Principe					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	2.20	0.15	0.05	0.10	33.33%
<i>Total for Sao Tome and Principe</i>	<i>2.20</i>	<i>0.15</i>	<i>0.05</i>	<i>0.10</i>	<i>33.33%</i>
Saudi Arabia					
<i>HPMP approved at ExCom 68 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.20	0.19	0.00	0.19	0.00%
HCFC-141b	341.00	341.00	341.00	0.00	100.00%
HCFC-142b	115.90	115.86	115.86	0.00	100.00%
HCFC-22	1,011.60	1,011.64	246.43	765.21	24.36%
<i>Total for Saudi Arabia</i>	<i>1,468.70</i>	<i>1,468.69</i>	<i>703.29</i>	<i>765.40</i>	<i>47.89%</i>
Senegal					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	36.20	36.15	12.65	23.50	34.99%
<i>Total for Senegal</i>	<i>36.20</i>	<i>36.15</i>	<i>12.65</i>	<i>23.50</i>	<i>34.99%</i>
Serbia					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.60	0.59	0.00	0.59	0.00%
HCFC-22	7.80	7.76	3.30	4.46	42.53%
<i>Total for Serbia</i>	<i>8.40</i>	<i>8.35</i>	<i>3.30</i>	<i>5.05</i>	<i>39.52%</i>
Seychelles					
<i>HPMP approved at ExCom 63 to reduce 100% of baseline by 2030</i>					
HCFC-141b	0.00	0.02	0.02	0.00	100.00%
HCFC-22	1.40	1.40	1.40	0.00	100.00%
<i>Total for Seychelles</i>	<i>1.40</i>	<i>1.42</i>	<i>1.42</i>	<i>0.00</i>	<i>100.00%</i>
Sierra Leone					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.70	1.67	0.58	1.09	34.73%
<i>Total for Sierra Leone</i>	<i>1.70</i>	<i>1.67</i>	<i>0.58</i>	<i>1.09</i>	<i>34.73%</i>
Solomon Islands					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	2.00	1.91	0.67	1.24	35.08%
<i>Total for Solomon Islands</i>	<i>2.00</i>	<i>1.91</i>	<i>0.67</i>	<i>1.24</i>	<i>35.08%</i>

Report on ODS approved for phase-out in stage I of HPMPs (as of the 70th meeting)

Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Somalia					
<i>HPMP approved at ExCom 67 to reduce 35% of baseline by 2020</i>					
HCFC-141bPolyol	0.00	1.68	0.00	1.68	0.00%
HCFC-22	21.90	5.30	1.85	3.45	34.91%
Total for Somalia	21.90	6.98	1.85	5.13	26.50%
South Africa					
<i>HPMP approved at ExCom 67 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.30	0.30	0.00	0.30	0.00%
HCFC-124	(0.70)	(0.70)	0.00	(0.70)	
HCFC-141b	160.10	160.00	160.00	0.00	100.00%
HCFC-142b	(0.80)	(0.80)	0.00	(0.80)	
HCFC-22	210.90	210.90	16.72	194.18	7.93%
Total for South Africa	369.80	369.70	176.72	192.98	47.80%
South Sudan					
<i>HPMP not yet approved</i>					
HCFC-22		0.00	0.00	0.00	
Total for South Sudan		0.00	0.00	0.00	
Sri Lanka					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-141b	1.90	2.22	1.90	0.32	85.59%
HCFC-22	12.00	11.87	2.86	9.01	24.09%
Total for Sri Lanka	13.90	14.09	4.76	9.33	33.78%
Sudan					
<i>HPMP approved at ExCom 66 to reduce 30% of baseline by 2017</i>					
HCFC-141b	40.70	39.10	11.90	27.20	30.43%
HCFC-22	12.10	11.60	4.28	7.32	36.90%
Total for Sudan	52.80	50.70	16.18	34.52	31.91%
Suriname					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.10	0.04	0.04	0.00	100.00%
HCFC-22	2.00	1.94	0.65	1.29	33.51%
Total for Suriname	2.10	1.98	0.69	1.29	34.85%
Swaziland					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-141b	5.55	5.55	5.55	0.00	100.00%
HCFC-22	1.72	1.72	0.59	1.13	34.30%
Total for Swaziland	7.28	7.27	6.14	1.13	84.46%
Syria					
<i>HPMP not yet approved</i>					
HCFC-141b	67.80	67.71	7.90	59.81	11.67%
HCFC-141bPolyol	0.00	3.25	0.00	3.25	0.00%
HCFC-142b	6.90	6.82	0.00	6.82	0.00%
HCFC-22	60.50	60.50	5.00	55.50	8.26%
Total for Syria	135.20	138.28	12.90	125.38	9.33%
Tanzania					
<i>HPMP approved at ExCom 67 to reduce 35% of baseline by 2020</i>					
HCFC-22	1.70	1.69	0.59	1.10	34.91%
Total for Tanzania	1.70	1.69	0.59	1.10	34.91%

Report on ODS approved for phase-out in stage I of HPMPs (as of the 70th meeting)

Annex IV

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Thailand					
<i>HPMP approved at ExCom 68 to reduce 15% of baseline by 2018</i>					
HCFC-123	3.20	3.20	0.00	3.20	0.00%
HCFC-124	0.10	0.08	0.00	0.08	0.00%
HCFC-141b	205.30	205.25	151.68	53.57	73.90%
HCFC-141bPolyol	0.00	15.68	15.19	0.49	96.88%
HCFC-142b	0.20	0.12	0.00	0.12	0.00%
HCFC-22	716.60	716.57	67.86	648.71	9.47%
HCFC-225	2.40	1.20	0.00	1.20	0.00%
HCFC-225ca	0.50	0.42	0.00	0.42	0.00%
HCFC-225cb	0.70	0.68	0.00	0.68	0.00%
<i>Total for Thailand</i>	<i>929.00</i>	<i>943.20</i>	<i>234.73</i>	<i>708.47</i>	<i>24.89%</i>
Timor Leste					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-22	0.50	0.50	0.05	0.45	10.00%
<i>Total for Timor Leste</i>	<i>0.50</i>	<i>0.50</i>	<i>0.05</i>	<i>0.45</i>	<i>10.00%</i>
Togo					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	20.00	20.57	7.00	13.57	34.03%
<i>Total for Togo</i>	<i>20.00</i>	<i>20.57</i>	<i>7.00</i>	<i>13.57</i>	<i>34.03%</i>
Tonga					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.07	0.03	0.04	42.86%
<i>Total for Tonga</i>	<i>0.10</i>	<i>0.07</i>	<i>0.03</i>	<i>0.04</i>	<i>42.86%</i>
Trinidad and Tobago					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-123	0.30	0.13	0.13	0.00	100.00%
HCFC-124	0.50	0.52	0.52	0.00	100.00%
HCFC-141b	2.30	2.26	2.26	0.00	100.00%
HCFC-22	43.10	43.06	14.75	28.31	34.25%
<i>Total for Trinidad and Tobago</i>	<i>46.20</i>	<i>45.97</i>	<i>17.66</i>	<i>28.31</i>	<i>38.42%</i>
Tunisia					
<i>HPMP not yet approved</i>					
HCFC-141b	1.60	1.60	0.00	1.60	0.00%
HCFC-142b	0.10	0.10	0.00	0.10	0.00%
HCFC-22	39.00	39.00	0.00	39.00	0.00%
<i>Total for Tunisia</i>	<i>40.70</i>	<i>40.70</i>	<i>0.00</i>	<i>40.70</i>	<i>0.00%</i>
Turkey					
<i>HPMP approved at ExCom 68 to reduce 86.4% of baseline by 2017</i>					
HCFC-123	0.00	0.02	0.00	0.02	0.00%
HCFC-141b	193.10	197.10	197.10	0.00	100.00%
HCFC-141bPolyol	0.00	31.53	31.53	0.00	100.00%
HCFC-142b	94.70	116.40	120.00	(3.60)	103.09%
HCFC-22	205.32	296.30	159.24	137.06	53.74%
<i>Total for Turkey</i>	<i>493.12</i>	<i>641.35</i>	<i>507.87</i>	<i>133.48</i>	<i>79.19%</i>

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HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Turkmenistan					
<i>HPMP approved at ExCom 62 to reduce 35% of baseline by 2020</i>					
HCFC-22	6.80	6.81	2.55	4.26	37.44%
<i>Total for Turkmenistan</i>	<i>6.80</i>	<i>6.81</i>	<i>2.55</i>	<i>4.26</i>	<i>37.44%</i>
Tuvalu					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.10	0.09	0.03	0.06	33.33%
<i>Total for Tuvalu</i>	<i>0.10</i>	<i>0.09</i>	<i>0.03</i>	<i>0.06</i>	<i>33.33%</i>
Uganda					
<i>HPMP approved at ExCom 68 to reduce 35% of baseline by 2020</i>					
HCFC-22	0.20	0.20	0.07	0.13	35.00%
<i>Total for Uganda</i>	<i>0.20</i>	<i>0.20</i>	<i>0.07</i>	<i>0.13</i>	<i>35.00%</i>
Uruguay					
<i>HPMP approved at ExCom 65 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.00	0.04	0.04	0.00	100.00%
HCFC-124	0.10	0.09	0.09	0.00	100.00%
HCFC-141b	1.50	1.49	1.08	0.41	72.48%
HCFC-141bPolyol	0.00	5.33	0.00	5.33	0.00%
HCFC-142b	0.70	0.63	0.63	0.00	100.00%
HCFC-22	21.10	21.08	2.34	18.74	11.10%
<i>Total for Uruguay</i>	<i>23.40</i>	<i>28.66</i>	<i>4.18</i>	<i>24.48</i>	<i>14.58%</i>
Vanuatu					
<i>HPMP approved at ExCom 63 to reduce 35% of baseline by 2020</i>					
HCFC-142b	0.00	0.01	0.00	0.01	0.00%
HCFC-22	0.30	0.26	0.10	0.16	38.46%
<i>Total for Vanuatu</i>	<i>0.30</i>	<i>0.27</i>	<i>0.10</i>	<i>0.17</i>	<i>37.04%</i>
Venezuela					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.07	0.07	0.00	0.07	0.00%
HCFC-141b	39.60	39.56	0.00	39.56	0.00%
HCFC-141bPolyol	0.00	1.91	0.00	1.91	0.00%
HCFC-142b	5.70	5.68	0.00	5.68	0.00%
HCFC-22	161.60	161.63	23.16	138.47	14.33%
<i>Total for Venezuela</i>	<i>206.97</i>	<i>208.85</i>	<i>23.16</i>	<i>185.69</i>	<i>11.09%</i>
Vietnam					
<i>HPMP approved at ExCom 63 to reduce 10% of baseline by 2015</i>					
HCFC-123	0.20	0.16	0.00	0.16	0.00%
HCFC-141b	53.90	53.90	50.80	3.10	94.25%
HCFC-141bPolyol	0.00	164.60	89.30	75.30	54.25%
HCFC-22	167.20	167.15	0.00	167.15	0.00%
<i>Total for Vietnam</i>	<i>221.30</i>	<i>385.81</i>	<i>140.10</i>	<i>245.71</i>	<i>36.31%</i>
Yemen					
<i>HPMP approved at ExCom 68 to reduce 15% of baseline by 2015</i>					
HCFC-141b	1.10	1.10	1.10	0.00	100.00%
HCFC-141bPolyol	0.00	17.55	0.00	17.55	0.00%
HCFC-142b	1.00	1.00	0.00	1.00	0.00%
HCFC-22	156.10	156.10	62.18	93.92	39.83%
<i>Total for Yemen</i>	<i>158.20</i>	<i>175.75</i>	<i>63.28</i>	<i>112.47</i>	<i>36.01%</i>

HCFC	Baseline	Starting Point	Approved	Remaining	%Approved
Zambia					
<i>HPMP approved at ExCom 64 to reduce 35% of baseline by 2020</i>					
HCFC-22	5.00	4.95	1.70	3.25	34.34%
<i>Total for Zambia</i>	<i>5.00</i>	<i>4.95</i>	<i>1.70</i>	<i>3.25</i>	<i>34.34%</i>
Zimbabwe					
<i>HPMP approved at ExCom 65 to reduce 35% of baseline by 2020</i>					
HCFC-141b	0.95	0.95	0.55	0.40	57.89%
HCFC-141bPolyol	0.00	6.11	6.11	0.00	100.00%
HCFC-22	16.90	16.90	4.85	12.05	28.70%
<i>Total for Zimbabwe</i>	<i>17.85</i>	<i>23.96</i>	<i>11.51</i>	<i>12.45</i>	<i>48.04%</i>
Grand total	33,113.06	33,358.63	8,129.41	25,229.22	24.37%

ANNEX V

SUMMARY OF RESULTS SO FAR ACHIEVED FROM THE APPROVED HCFC DEMONSTRATION PROJECTS

1. In line with decision 55/43 (on submission of a limited number of projects that could best demonstrate alternative technologies to the use of HCFCs), the Executive Committee approved the following projects:

- (a) Pilot project for validation of methyl formate (MF) as a blowing agent in the manufacture of polyurethane foam (UNDP) (BRA/FOA/56/DEM/285);
- (b) Pilot project for validation of MF in microcellular polyurethane applications (UNDP) (MEX/FOA/56/DEM/141);
- (c) Pilot project to validate methylal as blowing agent in the manufacture of polyurethane foams (UNDP) (BRA/FOA/58/DEM/292);
- (d) Demonstration project to validate the use of super-critical CO₂ in the manufacture of sprayed polyurethane rigid foam (Japan) (COL/FOA/60/DEM/75);
- (e) Validation/demonstration of low-cost options for the use of hydrocarbons as foaming agent in the manufacture of polyurethane foams (UNDP) (EGY/FOA/58/DEM/100);
- (f) Conversion demonstration from HCFC-141b-based to cyclopentane-based pre-blended polyol in the manufacture of rigid polyurethane foam at Guangdong Wanhua Rongwei Polyurethane Co. Ltd (World Bank) (CPR/FOA/59/DEM/491);
- (g) Conversion of the foam part of Jiangsu Huaiyin Huihuang Solar Co. Ltd. from HCFC-141b to cyclopentane (World Bank) (CPR/FOA/59/DEM/492);
- (h) Validation of the use of HFO-1234ze as blowing agent in the manufacture of extruded polystyrene foam boardstock (UNDP) (TUR/FOA/60/DEM/96);
- (i) Demonstration project for conversion from HCFC-22/HCFC-142b technology to CO₂ with MF co-blowing technology in the manufacture of extruded polystyrene foam at Feininger (Nanjing) Energy Saving Technology Co. Ltd. (UNDP) (CPR/FOA/64/DEM/507);
- (j) 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) (CPR/REF/60/DEM/499);
- (k) Demonstration project for conversion from HCFC-22 technology to HFC-32 technology in the manufacture of commercial air-source chillers/heat pumps at Tsinghua Tong Fang Artificial Environment Co. Ltd. (UNDP) (CPR/REF/60/DEM/498);
- (l) Demonstration sub-project for conversion of room air-conditioning compressor manufacturing from HCFC-22 to propane at Guangdong Meizhi Co. (UNIDO) (CPR/REF/61/DEM/502);

- (m) Demonstration sub-project for conversion from HCFC-22 to propane at Midea Room Air-conditioning Manufacturing Company (UNIDO) (CPR/REF/61/DEM/503);
- (n) Promoting low-global warming potential refrigerants for air-conditioning sectors in high-ambient temperature countries in West Asia (UNEP, UNIDO) (ASP/REF/69/DEM/56, ASP/REF/69/DEM/57); and
- (o) Demonstration project for conversion from HCFC-141b based technology to iso-paraffin and siloxane (KC-6) technology for cleaning in the manufacture of medical devices at Zhejiang Kindly Medical Devices Co. Ltd. (UNDP) (CPR/SOL/64/DEM/511)

2. Several of the demonstration projects in the foam sector have been completed and comprehensive reports have been submitted to the Executive Committee. Other projects are under current implementation with final results expected soon.

3. Considering that several of the technologies included in the demonstration projects have already been selected in several Article 5 countries for replacing HCFCs used in the manufacturing sectors, and others could be introduced during the remainder of implementation of stage I or futures stages of the HPMPs, this annex includes a brief description of the results of the demonstration projects that have been completed.

Methyl formate¹ as a rigid polyurethane (PU) foam blowing agent

4. The use of methyl formate (MF)-based systems has been evaluated at Purcom Quimica² (Brazil) and Quimiuretanos Zadro³ (Mexico) with the objective of assessing their performance compared to HCFC-141b-based systems, and establishing the feasibility of its use in Multilateral Fund projects.

5. Analysis of assessment outcomes led to the following conclusions:

- (a) The use of MF as an alternative blowing agent to HCFC-141b in PU foam applications can be considered in flexible/integral skin foam applications and in a number of rigid foam applications. For certain rigid foam applications, mainly domestic appliances, the technology cannot be recommended at this stage because the density required for this application cannot be reached by MF at the current level of technology (i.e., further optimization of the technology is required). Other applications of the technology should be analyzed on a case-by case-basis and might require further optimization;
- (b) To minimize safety risks for downstream users, such projects should preferably be implemented through their system suppliers as fully formulated systems; and
- (c) Project designers should ensure that: chemical compatibility is verified; minimum packed density is observed; health, safety and environmental recommendations are incorporated; and implications related to acidity are taken into account.

6. The peer review concluded that many of the apparent shortfalls in MF's performance are very likely to be addressed by formulation optimisation. However, in the present case so far, this optimisation

¹ UNEP/OzL.Pro/ExCom/62/9.

² At the time the project was approved by the Committee, Purcom was the only Article 5 licensee of the technology; for that reason, it was selected to implement the pilot project.

³ To assess the use of MF for shoe sole systems.

process has not been led by the global polyurethane systems houses, as was the case with earlier blowing agents. The peer review also highlighted the following areas that require further consideration: information on experience and MF usage per application (sub-sector); combustibility safety during foam processing and of the end product/foam in some cases; data on spray and shoe-soling elastomer applications; further and longer-term dimensional stability test data, particularly for rigid insulating foams; and longer-term thermal conductivity testing.

7. Several successful trials with methyl formate and methylal have been undertaken at the systems house level in Egypt, Mexico and Brazil, in spray foam applications in Egypt and Jamaica, and for insulation in water heaters in Egypt. Information at the foam enterprises level will be available towards the end of 2013, when methyl formate pre-blended polyol systems will be supplied to them. UNDP also noted that highly qualified technical assistance is needed in conducting trials with methyl formate as formulations need to be optimized. Therefore, costs associated with trials will remain until formulations are optimized for the various foam applications where methyl formate might be used.

Methylal as a rigid PU foam blowing agent

8. UNDP formulated a number of pilot projects to investigate the safe use of methylal to replace HCFC-141b in polyurethane (PU) foam applications. The use of methylal-based systems has been evaluated at Arinos Química, Ltd. (Brazil), with the objective of assessing its performance compared with HCFC-141b-based systems in order to establish whether the technology is feasible for use in Multilateral Fund projects. Sixteen PU foam applications using HCFC-141b as a blowing agent were evaluated for their potential to convert to methylal⁴.

9. The results of the assessment indicated that methylal is better suited for integral skin and flexible foam applications. Taking into consideration that the comparison is being made between optimized HCFC-141b-based systems and recently developed methylal-based systems, the results for rigid (insulation) foam applications showed a penalty in insulation value of up to 10 per cent. Therefore, the use and further optimization of methylal systems in those applications should be evaluated individually by enterprises.

10. The technical reviewer concluded that “the use of methylal as a replacement for HCFC-141b systems in polyurethane foam manufacturing in Article 5 countries appears to be a feasible solution that meets the objectives of a cost-effective, zero-ODP, low-GWP replacement technology. Final foam properties are comparable to HCFC-141b-based foams”. The technical reviewer further recommended that the report should, *inter alia*, define the parameters of the test results to provide guidance about whether the density results are predictive of actual operating conditions; provide an estimate of the incremental operating costs based on the results obtained; continue with the long-term stability studies of foam properties, particularly dimensional stability; and include monitoring equipment as an integral component of each project to assure operational and personnel safety.

Super-critical CO₂ technology in the manufacture of sprayed foam

11. UNDP submitted to the 71st meeting an assessment report of the super-critical CO₂ technology in the manufacture of sprayed foam⁵: The performance of this technology, which has been used in Japan since 2004, was evaluated in Espumlatex, the largest locally-owned system house in Colombia. The supercritical CO₂ technology was assessed versus the HCFC-141b technology, in two different

⁴ UNEP/OzL.Pro/ExCom/66/17.

⁵ UNEP/OzL.Pro/ExCom/71/6.

environmental conditions, namely at sea level (Barranquilla) and at an altitude of 2,600 m (Bogota). To check processability of the foam, field in-door applications were done in industrial warehouses in both cities; and to determine the physical properties, test foam sprayed samples were prepared and analysed following ASTM⁶ and JIS⁷ standards in Achilles Corporation (the owner of the supercritical CO₂ patented technology and Espumlatex laboratories. In addition few samples (polyisocyanurate (PIR) and rigid polyurethane (PUR)) were made for E-84⁸ fire performance testing at QAI laboratories in the United States.

12. Analysis of assessment outcomes led to the following conclusions:

- (a) Supercritical CO₂ technology is non-flammable, and does not incur any incremental industrial hygiene and safety hazard. Under tropical weather conditions and various levels of altitude over sea level, the technology showed a similar processability to HCFC-141b-based systems currently used. Polyol and isocyanate components of both technologies were stable during the six months of project duration;
- (b) In terms of physical properties of PU foam, the supercritical CO₂ technology showed: higher thermal conductivity but better aging (the difference in lambda value between the two technologies decreased with time); similar aging behaviour in compressive strength (values kept stable with time; similar dimensional stability performance at temperatures below 20 °C; improved dimensional stability at 60 °C and 96 per cent relative humidity; similar adhesion strength to galvanised steel);
- (c) In terms of physical properties of PIR foam, the supercritical CO₂ technology showed: higher thermal conductivity but better aging; similar aging behaviour in compressive strength; similar dimensional stability performance at temperatures below 20 °C; similar dimensional stability at 60 °C and 96 per cent relative humidity in absolute values, however, while the supercritical CO₂ technology experienced a negative change in volume the HCFC-141b formulation had a positive one; and lower adhesion strength to galvanised steel;
- (d) According to fire performance test ASTM E84-12c, run on just one sample per formulation, both the PU and PIR foams based on supercritical CO₂ technologies would be classified as class A and B respectively by the National Fire Protection Association (NFPA);
- (e) The cost of the required retrofit of a typical spray machine to apply the supercritical CO₂ range between US \$9,800 to US \$13,700 for PU foam and from US \$11,800 to US \$15,700 for PIR foam; and
- (f) The supercritical CO₂ technology is a patented technology owned by Achilles Corporation, and is based on proprietary polyol and isocyanate formulations. The free on board (FOB) price of supercritical CO₂ system is US \$7.00/kg in Japan. The interested enterprises should come to an agreement with Achilles on technology fees.

⁶ ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development and delivery of international voluntary consensus standards.

⁷ The Japanese Industrial Standards (JIS) specifies the standards used for industrial activities in Japan.

⁸ ASTM E84 is the standard test method for surface burning characteristics of building materials

Hydrocarbon-based pre-blended polyol systems

13. UNDP submitted to the 66th meeting a technical report on low-cost options for the use of hydrocarbons in the manufacture of polyurethane foam⁹: During project implementation, UNDP identified options for cost reduction in pre-blending at the supplier level, which would avoid the need for a pre-blender plus ancillary equipment (e.g., storage tanks, piping); direct injection of hydrocarbons, which also removes the need for pre-blender systems; and the introduction of more recently developed hydrocarbon blends which would allow for lower foam densities.

14. The equipment selected was a three-module high-pressure dispenser capable of processing fully formulated systems, with direct injection of flammable as well as non-flammable blowing agents. In the trials it functioned well for HCFC systems (baseline), pre-blended systems and direct injection. In particular, the dispenser offered: excellent repeatability; acceptable three-stream blending (future adjustments may improve the performance); and high efficiency in blowing-agent containment, leading to lower foam densities.

15. Test results showed that: physical and chemical stability of cyclopentane systems under standard conditions for up to six months is confirmed; cost savings of around US \$100,000 can be expected, as no pre-blender system is needed; although there are no savings in the cost of equipment for direct injection, the compact design could result in savings in layout and storage; operating savings of between 6 and 8 per cent (or 10 per cent with direct injection) can be expected as compared to HCFC-141b systems (however, transportation costs may increase); and a slightly higher k-factor¹⁰ (between 5 to 8 per cent) and lower reactivity show that the mixer head impingement has suffered from the introduction of a third stream.

16. The technical reviewer concluded that the study has verified the acceptable physical properties of rigid foam products for commercial refrigeration, discontinuous panels and water heater applications using pre-blended hydrocarbon-based systems as well as direct metering of hydrocarbons. The study has also verified the stability of cyclopentane pre-blended systems for a 5-month period; studies are continuing to verify a minimum 6-month shelf life. It has also shown that n-pentane systems are not suitable for pre-blending due to instability (phase separation) of the blended product.

17. The study did not adequately verify the continued safety of operations of the new systems and equipment. Additional studies should be conducted to generate data clearly establishing that the three-component blending operation meets safety requirements, particularly for flammability, during the processing of both pre-blended systems and direct-metered hydrocarbons. Further information should be provided regarding the safety requirements for ventilation and monitoring during transportation and storage of the pre-blended polyol systems, including projected costs. An analysis of the projected costs for the conversion to these pre-blended/direct injection systems should be developed to establish the approximate usage level that will benefit from this technology refinement.

18. Based on preliminary cost analysis by UNDP, savings of approximately US \$100,000 could be expected when using these systems, as no pre-mixing equipment and ancillary equipment will be required at the enterprise; although there are no savings in the cost of foam dispensers for direct injection, the compact design could result in savings in layout and storage. Operating savings of between 6 and 8 per cent (or 10 per cent with direct injection) can be expected as compared to HCFC-141b systems; however, transportation costs may increase.

⁹ UNEP/OzL.Pro/ExCom/66/17.

¹⁰ The thermal conductivity for a unit thickness of material.

19. The World Bank also implemented a demonstration for cyclopentane based pre-blended polyol in the manufacture of rigid polyurethane foam. The objective of the project is to demonstrate the feasibility of pre-blending polyol with cyclopentane, supplying the pre-blended polyol to foam producers and testing the approach in four foam producing enterprises¹¹. The assessment of technical feasibility of the conversion to cyclopentane is considered particularly in terms of the compatibility of cyclopentane with polyether. The test on the stability of 16 representative grades of dry pre-mixed formulated polyols undertaken by the Jiangsu Research Institute of Product Quality Supervision and Inspection found that the majority of the polyols have good stability and good compatibility with cyclopentane. These results indicated that the domestic polyether suppliers have solved the compatibility issue of cyclopentane and polyether. Another critical component under evaluation is the flammability of the mixture, as it sets the requirements for transportation, storage and use within a company. Flash-point tests to assess the safety hazard of the 16 samples of pre-mixed formulated polyols with cyclopentane have demonstrated that the formulated polyols are categorized as class II flammable liquids; they can be transported over short and medium distances provided they meet the requirements of the specific transport regulations for dangerous goods.

20. As reported by the World Bank, delivering hydrocarbon pre-blended polyols in drums as compared to cyclopentane delivered in bulk results in 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.

HFO-1234ze used for XPS foams

21. UNDP submitted to the 67th meeting a technical report on HFO-1234ze as a blowing agent in the manufacture of extruded polystyrene foam boardstock¹². UNDP conducted a series of trials with different formulations of HFO-1234ze and dimethyl ether (DME), which is an extremely flammable gas. Based on the validation data collected so far, HFO-1234ze technology is believed to have good prospects for replacing the use of HCFCs and/or HFCs in XPS applications while providing acceptable thermal insulation and structural properties. However, to make such a product commercially acceptable, some optimization of density and surface will be required. The trials also showed that there is the potential to reduce flammability of the HFO-1234ze/DME blend and to improve thermal insulation performance by reducing the amount of DME. This would however require further trials.

R-290 used as a refrigerant in air-conditioning systems

22. Although the demonstration project on R-290 alternative technology to HCFC-22 in manufacturing air-conditioning equipment has not been completed, UNIDO reported that the introduction of hydrocarbons, in particular R-290, in room air-conditioning systems will strongly influence the development of the markets. Although the introduction of the technology is already feasible as demonstrated through projects under implementation, the analysis of incremental capital and operating costs, penetration in local markets, at present, is difficult to assess. Furthermore, codes and standards to allow the placing on the market of R-290-based equipment has been established very recently (beginning of May 2013). A comprehensive consideration requires more time to collect robust data to have a profound analysis of on-going developments in the market.

¹¹ UNEP/OzL.Pro/ExCom/63/15

¹² UNEP/OzL.Pro/ExCom/67/6.

Low-GWP refrigerants for air-conditioning in high-ambient temperature countries

23. The objective of the project (implemented by UNEP and UNIDO) is to facilitate the technology transfer and exchange of experiences regarding low-GWP alternatives for the air-conditioning sector in high-ambient temperature countries. It will gather inputs from the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) to identify and evaluate promising alternative refrigerants for major product categories through the Alternative Refrigerants Evaluation Programme AREP). The project will assess commercially available refrigerants and air-conditioning equipment in terms of suitability to operate under high-ambient conditions; assess relevant energy efficiency standards and codes; undertake an economic comparison of alternative technologies taking into consideration perspectives of manufacturing sectors, consulting sectors and operating/clients sectors; and will identify commercial opportunities and associated fiscal implications for facilitating the transfer of low-GWP technologies including commercial and trade barriers, patents and relevant intellectual property rights.
