MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

REPORT OF THE TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

SEPTEMBER 2023

VOLUME 7: SUPPLEMENT TO THE MAY 2023 TEAP REPLENISHMENT TASK FORCE REPORT

"ASSESSMENT OF THE FUNDING REQUIREMENT FOR THE REPLENISHMENT OF THE MULTILATERAL FUND FOR THE PERIOD 2024–2026"

UN environment programme

Montreal Protocol on Substances that Deplete the Ozone Layer

United Nations Environment Programme (UNEP)
Technology and Economic Assessment Panel
Replenishment Task Force

September 2023

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The text of this report is composed in Times New Roman.

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Date: September 2023

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UNITED NATIONS ENVIRONMENT PROGRAMME
Ozone Secretariat
P.O. Box 30552
Nairobi, Kenya

This document is also available in portable document format from the UNEP Ozone Secretariat's website:

https://ozone.unep.org/science/assessment/teap

ISBN: 978-9914-733-83-9

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ACRONYMS

A5	Article 5
A7	Article 7
AC	Air conditioning
ACC	Additional capital cost
AOC	Additional operating cost
BAT	Best-available technology
BAU	Business-as-usual
BP	Business Plan
CAP	Compliance Assistance Programme
CE	Cost-effectiveness
ExCom	Executive Committee of the Multilateral Fund
FERM	Fixed-exchange-rate mechanism
EOL	End-of-life management and disposal
GCF	Green Climate Fund
GEF	Global Environment Facility
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HFO	Hydrofluoroolefin
HPMP	HCFC Phase-out Management Plan
HPPMP	HCFC Production Phase-out Management Plan
ICR	Industrial and Commercial Refrigeration
IOC	Incremental operating costs
IS	Institutional Strengthening
KIPs	Kigali HFC Implementation plans
KPPMP	Kigali HFC Production Phase-down Management Plan
LVC	Low-volume consuming
MAC	Mobile Air Conditioning
MEPS	Minimum Energy Performance Standards
MLF	Multilateral Fund
MLFS	Multilateral Fund Secretariat
$MMTCO_2eq$	Million metric tonnes carbon dioxide equivalent
MT	Metric tonnes
MOP	Meeting of the Parties
MYA	Multi-year Agreement
NOU	National Ozone Unit
NPP	National Phase-out Plans
ODP	Ozone depletion potential
ODS	Ozone-depleting substances
OEWG	Open-Ended Working Group
OS	Ozone Secretariat
PMU	Project Management Unit
PUR	Polyurethane
RACHP	Refrigeration Air-conditioning and Heat-pump
RTF	Replenishment Task Force
RMP	Refrigerant Management Plan
RTOC	Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee
TEAP	Technology and Economic Assessment Panel
TOR	Terms of reference
TOC	Technical Options Committee
VLVC	Very low-volume consuming
XPS	Extruded Polystyrene

EXECUTIVE SUMMARY

The replenishment of the Montreal Protocol Multilateral Fund (MLF) for the 2024–2026 triennium represents a significant milestone in assistance to developing countries to comply with the terms of the Montreal Protocol—for the first time, the MLF will provide financing for the incremental costs of not just the phase-out of ozone-depleting substances (ODS) but also the phase-down of hydrofluorocarbons (HFCs).

- For Annex C, Group 1, controlled substances (ozone-depleting hydrochlorofluorocarbons or HCFCs), the compliance target for the 2024–2026 triennium is a 67.5% reduction from baseline by 1 January 2025.
    - For the next two triennia 2027–2029 and 2030–2032, the next HCFC phase-out compliance target is a 97.5% reduction from baseline by 1 January 2030. The annual average of 2.5% is restricted to the servicing of refrigeration and air-conditioning equipment existing during 2030–2040 and subject to review in 2025. Decision XXX/2 referring to Annex I of the MOP30 report[1], adjusted this part of Article 5 (as well as 2F) to include other uses, i.e., the servicing of fire suppression and fire protection equipment existing on 1 January 2030; solvent applications in rocket engine manufacturing; and topical medical aerosol for applications for the specialised treatment of burns.

- For Annex F controlled substances (HFCs), the compliance targets for the 2024–2026 and next two triennia are as follows:
    - Group 1 parties: A 10% reduction from baseline by 1 January 2029 and a 30% reduction from baseline by 1 January 2035.
    - Group 2 parties: For the next two triennia 2027–2029 and 2030–2032, a freeze of production and consumption by 1 January 2028 and a 10% reduction from baseline by 1 January 2032.

Decision XXXIV/2 of the Thirty-fourth Meeting of the Parties (MOP-34) (see Annex 1) provided the terms of reference (TOR) for the work of the Technology and Economic Assessment Panel (TEAP) to prepare a report on the appropriate level of the replenishment of the MLF for the triennium 2024–2026. The parties requested the TEAP to prepare a report for submission to the Thirty-fifth Meeting of the Parties (MOP-35), and to present it to the Open-ended Working Group (OEWG) at its Forty-fifth Meeting (OEWG-45), to enable MOP-35 to take a decision.

The TEAP established a Replenishment Task Force (RTF), with members from TEAP, its Technical Options Committees (TOCs), and other outside experts. In December 2022, RTF members attended the 91st Meeting of the Executive Committee of the MLF (ExCom-91) to conduct informal discussions with ExCom members, and Bilateral and Implementing Agencies (IAs) present at that meeting. RTF members also attended ExCom-92 prior to OEWG-45. RTF members also attended ExCom-92 prior to OEWG-45.

The RTF Report was published by UNEP in May 2023 as volume 3 of the TEAP 2023 Progress Report, entitled "Assessment of the funding requirement for the replenishment of the Multilateral Fund for the period 2024–2026." In that report, the RTF estimated the funding requirements for the 2024–-2026 triennium and future triennia informed by the "Consolidated Business Plan of the Multilateral Fund for 2023–-2025," relevant decisions of the ExCom up to its 91st meeting, information available through the Multilateral Fund Secretariat (MLFS), and information available to the RTF as of 3 April 2023, the cut-off date used by the RTF in order to fix its modelling assumptions and complete its

[1] https://ozone.unep.org/treaties/montreal-protocol/meetings/thirtieth-meeting-parties/decisions/annex-i-adjustments

report drafting and consensus review process in time for submission of its report to OEWG-45. The RTF relied on existing cost guidelines under the MLF and, where these remained under discussion in the ExCom, the RTF noted these limitations in its estimates.

The RTF presented its May 2023 report at OEWG-45 and responded to clarifying questions from parties. Subsequently, the Working Group established a Contact Group to further consider the report. During the discussions, the RTF provided clarification and additional information for the members of the Contact Group. The Contact Group then discussed several topics and agreed on a list of 27 suggestions for additional analysis to be addressed by the RTF in a supplementary report on MLF replenishment for the period 2024–2026.

Approach to Supplementary Report

In the May 2023 Report, the RTF considered a range for the estimated HFC consumption costs based on the following two scenarios for the triennium 2024–2026:

- **Low-end scenario:** Calculated HFC baselines for 104 A5 countries that have ratified the Kigali Amendment as of the 3 April 2023 using a range of cost effectiveness factors; and
- **High-end scenario**: Calculated HFC baselines for all 144 A5 countries, assuming they will be ratifying the Kigali Amendment by 2026, using a range of cost effectiveness factors.

In this report, the RTF updated the high-end scenario (i.e., assuming all parties ratify the Kigali Amendment by 2026) based on decisions from ExCom-92 and revised HFC baseline calculations based on new information through Article 7 (A7) reporting (see Table ES-1 and ES-2). These updates are discussed below.

For the range to its estimated funding for the 2024–2026 triennium, the RTF refers separately to the scenarios requested by parties at OEWG-45 (see Table ES-3), some of which significantly increase or decrease the updated estimated funding. For example, the requested scenario estimating funding for Kigali Implementation Plans (KIPs) where 90% of Group 1 countries and 30% of Group 2 countries request funding in this triennium is estimated to reduce the total funding for the triennium by US$ 124 million. Other requested scenarios, however, are estimated to increase the total funding. Given the many varied scenarios requested by parties, the RTF presents these scenarios without presuming which ones parties may wish to use, combine, or discard. The range of funding for this triennium would then be dependent on these choices.

When developing scenarios, if a different methodology than the one that RTF used in its May 2023 report was required or instructed by the suggestions list from OEWG-45, the results were presented in the specific section where the item was addressed.

Updates to May 2023 RTF report estimated funding for 2024–2026

Based on the above approach, in this report, the RTF provides updates to its May 2023 estimated funding for the 2024–2026 triennium based on ExCom-92 policy decisions and approvals, and A7 data information available to the RTF.

The RTF made the following updates to its May 2023 RTF Report estimated funding for the 2024–2026 triennium based on the following:

- Decision XXXIV/2 (with the same request from Item 4 of the OEWG-45 Contact Group list of suggestions) request to the RTF to adjust funding requirements based on any relevant decisions taken at the ExCom-92 and
- New information available as of 7 August 2023 from A7 reporting by 70 additional parties since the May 2023 RTF Report and revised HFC baseline calculations.

ExCom-92 approvals and new A7 data

Relevant decisions taken at ExCom-92[2], including approval of HCFC and HFC activities for 46 countries, were used by the RTF to update its estimated total funding for the 2024–2026 triennium. The RTF updated the high-end scenario (i.e., assuming all parties ratify the Kigali Amendment by 2026) based on decisions from ExCom-92 and revised HFC baseline calculations based on new information through A7 reporting.

For HCFC activities, the updates:

- Increased the funding for approved HCFC Phase-out Management Plans (HPMPs) from US$ 116.7 to 123.2 million, an increase of US$ 6.5 million;
- Increased the funding for HCFC project preparation costs from US$ 170,000 to 2.8 million, an increase of US$ 2.7 million;
- Reduced the funding for the estimated HPMPs from US$ 205.4 to 195.6 million, a reduction of US$ 9.8 million; and
- Reduced the funding for the HCFC energy efficiency (EE) special funding from US$ 11.1 to 10.2 million, a reduction of US$ 872,335.

For HFC activities, compared with the high-end scenario where all parties are assumed to ratify the Kigali Amendment by 2026, the updates:

- Added funding of US$ 434,420 for one approved KIP;
- Increased the funding for the HFC project preparation from US$ 16.8 to 20.4 million, an increase of US$ 3.6 million;
- Increased the funding for estimated KIPs from US$ 449.4 to 569.6 million, an increase of US$ 120.2 million;
- Reduced the HFC EE funding window from US$ 20 million to 19.97 million, a reduction of US$ 34,000; and
- Added funding of US$ 678,000 for HFC technical assistance.

The largest impact for the HFC updated funding estimates come from the HFC data reported under A7 by an additional 70 parties since the May 2023 RTF Report. The new data increased the total HFC baseline from 1,643 to 1,840 MMTCO_2eq, increasing the required reductions to meet compliance targets with funding covered in the 2024–2026 triennium.

In the absence of final HFC cost guidelines, RTF updated estimated funding based on ExCom-92 approvals and decisions, including the agreed cost-effectiveness value for the servicing sector., and kept the methodology detailed in the May 2023 RTF Report. The RTF made no changes to its previous estimates for institutional strengthening and standard activities, preparation of gender mainstreaming action plans, and end-of-life activities. The RTF updates only adjusted the high-end scenario, assuming all parties ratify the Kigali Amendment by 2026. The RTF made no change to its estimated funding for future triennia (2027–2029 and 2030-–2032).

Summary of updated estimated funding requirements for the 2024–2026 triennium

Following its approach above for the supplementary report, the RTF updated the high-end scenario (i.e., assuming all parties ratify the Kigali Amendment by 2026) based on decisions from ExCom-92 and on revised HFC baseline calculations based on new information through A7 reporting. Tables ES-1 and ES-2 provide this updated high-end of the range for the estimated funding requirement for the replenishment of the MLF in the 2024–2026 triennium of **US$ 1,141 million[3].**

[2] UNEP/OzLPro/ExCom/92/56

[3] Note: figures may not sum due to rounding.

Table ES-1. Estimated funding requirement for the replenishment of the MLF 2024–2026 (US$)

2024–2026 TRIENNIUM	MAY 2023 ESTIMATE [4]	SEPT 2023 UPDATES [5]
SUBTOTAL - HCFC Activities	$ 363,911,000	$ 362,323,000
SUBTOTAL - HFC Activities	$ 519,142,000	$ 643,908,000
SUBTOTAL - EOL/Disposal	$ 13,590,000	$ 13,590,000
SUBTOTAL - IS & Standard Activities	$ 121,581,000	$ 121,581,000
TOTAL	**$ 1,018,224,000**	**$ 1,141,402,000**

Table ES-2. Updated funding requirement for the replenishment of the MLF 2024–2026 (US$)

2024–2026 Triennium Estimated Funding (May 2023)		Sept 2023Updates
HCFC Consumption Sector		
HCFC Approved HPMPs	$ 116,746,000	$ 123,181,000
HCFC Prep Costs	$ 170,000	$ 2,839,000
HCFC Estimated HPMPs (including LVCs/VLVCs)	$ 205,405,000	$ 195,582,000
HCFC Verification	$ 1,766,000	$ 1,766,000
HCFC Energy Efficiency Special Funding	$ 11,092,000	$ 10,220,000
Subtotal – HCFC Consumption Sector	**$ 335,179,000**	**$ 333,588,000**
HCFC Production Sector		
HCFC Production Sector Stage I PRP	$ 148,000	$ 148,000
HCFC Production Sector Stage I HPPMP	$ 5,352,000	$ 5,352,000
HCFC Production Sector Stage II HPPMP	$ 23,232,000	$ 23,232,000
Subtotal – HCFC Production Sector	**$ 28,732,000**	**$ 28,732,000**
SUBTOTAL - HCFC Activities	**$ 363,911,000**	**$ 362,320,000**
HFC Consumption Sector		
HFC Approved KIPs	$ -	$ 434,420
HFC Prep Costs (including gender mainstreaming)	$ 16,802,000	$ 20,369,000
HFC RTF Estimated KIPs	$ 449,415,000	$ 569,643,000
HFC Enabling Activities	$ 1,011,000	$ 1,011,000
HFC Energy Efficiency Funding Window	$ 20,000,000	$ 19,966,000
HFC Technical Assistance	$ -	$ 678,000
Subtotal – HFC Consumption Sector	**$ 487,228,000**	**$ 612,101,420**
HFC Production Sector (Unchanged from May 2023 estimates)		
HFC Production Sector Prep	$ 2,000,000	$ 2,000,000
HFC Production Sector KPPMP RTF Estimated	$ 20,000,000	$ 20,000,000
HFC-23 Mitigation Prep	$ 193,000	$ 193,000
HFC-23 Mitigation Approved	$ 1,721,000	$ 1,614,000 [6]
HFC-23 Emissions Control (per BP formerly Mitigation RTF Estimated)	$ 8,000,000	$ 8,000,000
Subtotal – HFC Production/HFC-23 Sector	**$ 31,914,000**	**$ 31,807,000**
SUBTOTAL - HFC Activities	**$ 519,142,000**	**$ 643,908,000**
IS/Standard Activities/EOL (Unchanged from May 2023 estimates)		
IS	$ 44,500,000	$ 44,500,000
UNEP CAP	$ 36,437,000	$ 36,437,000
UNDP, UNIDO, World Bank Core Unit	$ 18,161,000	$ 18,161,000
MLF Secretariat and ExCom Costs	$ 20,983,000	$ 20,983,000

[4] As of ExCom-91 and information received by TEAP as of 7 April 2023. For HFCs, assuming all parties ratify
[5] As of ExCom-92 and information received by TEAP as of 7 August 2023. For HFCs, assuming all parties ratify
[6] Reducing the Penalty of US $107,000 applied as per decision 92/31(b)(iii) for Argentina

Treasurer		$	1,500,000	$	1,500,000
SUBTOTAL - IS & Standard Activities		**$**	**121,581,000**	**$**	**121,581,000**
Funding Window on EOL/Disposal		$	13,590,000	$	13,590,000
SUBTOTAL – EOL/Disposal		**$**	**13,590,000**	**$**	**13,590,000**
TOTAL		**$**	**1,018,224,000**	**$**	**1,141,402,000**

OEWG-45 Contact Group suggestions and scenarios

In the remainder of this report, the RTF addresses the requests and scenarios, made by the OEWG-45 Contact Group, with updated information up to 7 August 2023. There were 27 items suggested for RTF to consider in its supplementary report, which was a substantial challenge given the wide range and limited timeline. The impacts of the different scenarios varied widely. Table ES-3 provides a summary of the scenarios requested in the OEWG-45 Contact Group list of suggestions and the impact to the updated total estimated funding requirement for the 2024–2026 triennium.

The funding estimates resulting from OEWG-45 requests are only comparable when the same methodology was used. When different methodology was required, RTF presented the updated figure in a separate section of the report where the specific item is discussed. For instance, the analysis on costs for including EE as an incentive payment and estimates of potential support for systemic approaches to EE beyond the pilot window are presented separately as in the Table ES-3 below.

Changes in estimated funding from the application of different scenarios requested at OEWG-45, which required a different methodology from the one used for RTF May 2023 Report, are also indicated in a separate column in Table ES-3. Reductions are shown in numbers in parentheses. Increases are indicated with a plus (+) sign. As mentioned above, when the methodology changed and RTF could not compare funding, information was provided in different report sections as indicated in the table below.

Table ES-3. OEWG-45 Contact Group Suggestions/Scenarios: Potential changes to funding requirement for 2024–2026

Item	Suggestions/Scenarios	Potential change to updated funding requirement 2024–2026 using May 2023 RTF Report methodology* (US$)	Remarks and additional information provided when methodology in parties request at OEWG-45 differed from RTF's	September 2023 RTF Report sections
Overall Suggestions/Methodological Approach				
1	Where the RTF uses cost estimates for specific activities drawn from the MLF business plan include a scenario with a discounting approach as applied by previous replenishment reports. It should reflect that the funding approvals in ExCom were on average found to be lower by 15 to 20% (at present 26% lower) compared to the original cost and expenditures estimated in the business plans;	($ 3.71 million)		3.2
2	Include 2 new scenarios for estimating the funding for the HCFC phase-out and HFC phase-down that are based on the actual consumption (or estimates of such consumption when not reported) to be reduced for countries to meet compliance targets including both the freeze target and the 10% reduction target for the HFC phase-down and	($ 168.5 million)	For both scenarios. Information provided in section uses actual consumption	3.3

	ranges for the respective funding requirements to account for uncertainties;			
ExCom92 Decisions				
3	Adjust the funding estimated for the HCFC phase-out and HFC phase-down by taking into account potential approvals of projects and project preparation requests at the 93rd meeting of the ExCom;		RTF used 2023 Business Plan, BP, figures. Information available not sufficient to adjust updated funding estimates	3.4
4	Adjust all elements of the funding requirements based on any relevant decisions taken at the 92nd meeting of the ExCom;	Adjusted		2.2
5	Include a scenario, wherein some Article 5 parties submit proposals to phase down HFCs in advance of applicable compliance targets in accordance with ExCom decisions 92/44 and 92/37;	+ $4.86 million		5.2
HCFC				
6	When estimating the funding requirement for new HPMPs, identify the sectors that would likely be addressed by these HPMPs, based on remaining HCFC consumption per sector, and apply cost effectiveness factors to calculate funding for these sectors that are based on historical experience under the Multilateral Fund;		The new methodology used following item 6 request (different than methodology used in May 2023 RTF report) resulted in US$ 420.2 million estimated funding (with support costs)	4.2
7	Consider scenario removing the HCFC production phase-out plan for India that is not included in the consolidated BP of ExCom;	($ 5.48 million)		4.3
8	Review the funding requirement for HPMP preparation funding to account for all the countries identified to require new HPMPs in the 2024–2026 triennium;	+$ 2.84 million		4.4
HFC				
9	Develop a scenario estimating funding for KIPs for Group 1 and Group 2 countries which have ratified the Kigali Amendment assuming that 90% of Group I and 30% of Group II countries request funding;	($124 million)		5.3
10	Add scenario for frontloading funding for KIPs during 2024–2026, taking into account the lessons learned from the implementation of HPMPs;	+$ 30.7 million		5.4
11	Reviewing funding requirement for KIPs preparation funding to account for all the countries identified to require KIPs in the 2024–2026 triennium;	+$ 3.56 million		5.5
12	A scenario prioritizing the manufacturing sectors for non-LVCs;		Qualitative assessment	5.6
13	When estimating the funding requirement for KIPs, apply cost effectiveness factors for manufacturing sectors that are based on historical experience under the MLF and/or a technical assessment of the costs to transition to alternatives, taking into	($ 106 million)	RTF used historical experience of economies of scale for manufacturing sectors.	5.7

	account any available information from MLF documents, previous TEAP reports and other sources and ExCom agreed cost guidelines.			
14	Review the funding requirement for the phase-down HFC production and HFC-23 by-product mitigation, based on a technical assessment of the costs, to the extent possible, taking into account the experience with such projects under the MLF and the past funding practice in the production phase-out/down projects;	($10.3 - $11.7 million)		5.8
15	A scenario for funding 10 to 15 individual investment projects;		Examples and costs provided	5.9
16	A scenario to address the challenges for SMEs including safety issues, including in the installation and assembly sectors in implementation of KIPs;		Information provided	5.10
17	Evaluate the potential cost implications of leapfrogging and/or taking early action to phase down HFCs in advance of compliance targets;		Information provided for early action/ see chapter for leapfrogging remark	5.11
Energy efficiency				
18	A scenario for funding 10 to 15 energy efficiency pilot projects;		No change – examples provided	6.2
19	Include a scenario wherein an incentive is provided as part of the funding for KIPs to enhance EE while phasing down HFCs in accordance with ExCom decision 92/38;		Information provided	6.3
20	Consider activities to support SMEs in design and development of energy efficient technology and their implementation;		Included in Item 16	6.4
21	Consider EE related policies and regulations capacity building;		Information provided	6.5
22	Consider additional costs for energy efficient foam products;		Information provided	6.6
23	Consider regional testing centers for monitoring and verification of energy efficiency;		Information provided	6.7
24	Analyse additional costs for including energy efficiency as an incentive for enhancing ambitious HFC-phase down and leapfrogging HFCs in the frame of the HPMPs and KIPs;		Analysis provided	6.8
25	Provide cost estimates of potential support for systemic approaches to EE in KIPS, beyond the pilot window;		Information provided	6.9 (see also 6.2, 6.3, 6.4 6.5, 6.7)
End of Life				
26	Provide estimates of costs of managing reclamation, recycling, and cost-effective destruction of banks, including collection, transport, and disposal activities;		Information provided	7.1
27	Consider a scenario for end-of-life activities considered under ExCom decision 91/66 where only 30 % of countries request funding during this replenishment.	($9.15 million)		7.2

* The symbol “+” indicates increase while parentheses indicate reduction to updated estimated funding for the triennium.

CHAPTER 1 INTRODUCTION

1.1 TERMS OF REFERENCE

Decision XXXIV/2 of the Thirty-fourth Meeting of the Parties (MOP-34) provided the terms of reference for the work of the Technology and Economic Assessment Panel (TEAP) to prepare a report on the appropriate level of the replenishment of the Multilateral Fund (MLF) for the triennium 2024–2026. The parties requested the TEAP to prepare a report for submission to the Thirty-fifth Meeting of the Parties (MOP-35), and to present it to the Open-ended Working Group at its Forty-fifth meeting (OEWG-45), to enable MOP-35 to take a decision. The text of Decision XXXIV/2: "Terms of reference for the study on the 2024–2026 replenishment of the Multilateral Fund for the Implementation of the Montreal Protocol" can be found in Annex 1 of this report.

1.2 COMPOSITION OF THE TASK FORCE AND ACTIVITIES

The TEAP established a Replenishment Task Force (RTF), with members from TEAP, its Technical Options Committees (TOCs), and other, outside experts. The composition of the RTF is as follows:

Co-chairs:
Suely Carvalho (Brazil, TEAP Senior Expert)
Bella Maranion (USA, TEAP Co-chair)
Shiqiu Zhang (PRC, TEAP Senior Expert)

Members:
Omar Abdelaziz (Egypt, RTOC Co-chair)
Jitendra Bhambure, (India, RTOC member)
Rick Cooke (Canada, MCTOC member)
Gabrielle Dreyfus (USA, RTOC member)
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John Telesford (Grenada, Independent consultant)
Helen Tope (Australia, MCTOC co-chair)
Viraj Vithoontien (Thailand, Independent Consultant[7]
Helen Walter-Terrinoni (USA, FTOC Co-chair)

For this report, the RTF included the following Consulting Experts and appreciates their contributions to its work:
Brian Holuj (USA, UNEP)
Ana Maria Carreno Hoyos (Colombia, RTOC member)
Nihar Shah (India, RTOC member)

TEAP is grateful for the contributions of the members of the RTF to this important work for parties. TEAP also acknowledges in appreciation the invaluable support and assistance provided by the Multilateral Fund Secretariat and the Ozone Secretariat.

[7] Expert member self-recused from participation in the work of RTF for the Supplementary report to avoid potential conflict of interest.

In December 2022, RTF members attended the 91st Meeting of the Executive Committee of the MLF (ExCom-91) to conduct informal discussions with ExCom members, and Bilateral and Implementing Agencies (IAs) present at that meeting. RTF members also attended ExCom-92 prior to OEWG-45.

1.3 MAY 2023 RTF REPORT AND OEWG-45

The Decision XXXIV/2 TEAP RTF Report was published by UNEP in May 2023 as volume 3 of the TEAP 2023 Progress Report, entitled "Assessment of the funding requirement for the replenishment of the Multilateral Fund for the period 2024–2026." In that report, the RTF estimated the funding requirements for the 2024–-2026 triennium and future triennia informed by the "Consolidated Business Plan of the Multilateral Fund for 2023–-2025," relevant decisions of the ExCom up to its 91st meeting, information available through the Multilateral Fund Secretariat (MLFS), and information available to the RTF as of 3 April 2023, the cut-off date used by the RTF in order to fix its modelling assumptions and complete its report drafting and consensus review process in time for submission of its report to OEWG-45. The RTF relied on existing cost guidelines under the MLF and, where these remained under discussion in the ExCom, the RTF noted these limitations in its estimates.

The RTF presented its report at OEWG-45 and responded to clarifying questions from parties. Subsequently, the Working Group established a Contact Group to further consider the report. The Contact Group was co-chaired by Mr. Sergio Merino (Mexico) and Mr. Alain Wilmart (Belgium). The Contact Group held several sessions, which were attended by members of the RTF and by representatives of the MLFS, as resource persons. During the discussions, the members of the Contact Group received clarification and additional information from the RTF. The Contact Group then discussed several topics and agreed on the suggestions for additional analysis to be addressed by the RTF in a supplementary report on MLF replenishment for the period 2024–2026.

The list of categories and suggestions by item number follows below and can also be found in Annex I, section G, of the report of OEWG-45[8]:

Overall suggestions/methodological approach

1. Where the RTF uses cost estimates for specific activities drawn from the MLF business plan include a scenario with a discounting approach as applied by previous replenishment reports. It should reflect that the funding approvals in ExCom were on average found to be lower by 15 to 20% (at present 26% lower) compared to the original cost and expenditures estimated in the business plans;

2. Include two new scenarios for estimating the funding for the hydrochlorofluorocarbon (HCFC) phase-out and hydrofluorocarbon (HFC) phase-down that are based on the actual consumption (or estimates of such consumption when not reported) to be reduced for countries to meet compliance targets including both the freeze target and the 10% reduction target for the HFC phase-down and ranges for the respective funding requirements to account for uncertainties;

3. Adjust the funding estimated for the HCFC phase-out and HFC phase-down by taking into account potential approvals of projects and project preparation requests at the 93rd meeting of the ExCom;

ExCom-92 decisions

4. Adjust all elements of the funding requirements based on any relevant decisions taken at the 92nd meeting of the ExCom;

[8] UNEP/OzL.Pro.WG.1/45/8 at: https://ozone.unep.org/system/files/documents/OEWG-45-8E.pdf

5. Include a scenario, wherein some Article 5 (A5) parties submit proposals to phase down HFCs in advance of applicable compliance targets in accordance with ExCom Decisions 92/44 and 92/37;

HCFC

6. When estimating the funding requirement for new HCFC Phaseout Management Plans (HPMPs), identify the sectors that would likely be addressed by these HPMPs, based on remaining HCFC consumption per sector, and apply cost effectiveness factors to calculate funding for these sectors that are based on historical experience under the MLF;

7. Consider scenario removing the HCFC Production Phaseout Management Plan (HPPMP) for India that is not included in the Consolidated Business Plan (BP) of ExCom;

8. Review the funding requirement for HPMP preparation funding to account for all the countries identified to require new HPMPs in the 2024–2026 triennium;

HFC

9. Develop a scenario estimating funding for Kigali HFC Implementation Plans (KIPs) for Group 1 and Group 2 countries which have ratified the Kigali Amendment assuming that 90% of Group I and 30% of Group II countries request funding;

10. Add scenario for frontloading funding for KIPs during 2024–2026, taking into account the lessons learned from the implementation of HPMPs;

11. Reviewing funding requirement for KIPs preparation funding to account for all the countries identified to require KIPs in the 2024–2026 triennium;

12. A scenario prioritizing the manufacturing sectors for non-low volume consuming countries (LVCs);

13. When estimating the funding requirement for KIPs, apply cost effectiveness (CE) factors for manufacturing sectors that are based on historical experience under the MLF and/or a technical assessment of the costs to transition to alternatives, taking into account any available information from MLF documents, previous TEAP reports and other sources and ExCom agreed cost guidelines.

14. Review the funding requirement for the phase-down of HFC production and HFC-23 by-product mitigation, based on a technical assessment of the costs, to the extent possible, taking into account the experience with such projects under the MLF and the past funding practice in the production phase-out/down projects;

15. A scenario for funding 10 to 15 individual investment projects;

16. A scenario to address the challenges for small- and medium-sized enterprises (SMEs) including safety issues, including in the installation and assembly sectors in implementation of KIPs;

17. Evaluate the potential cost implications of leapfrogging and/or taking early action to phase down HFCs in advance of compliance targets;

Energy efficiency

18. A scenario for funding 10 to 15 energy efficiency (EE) pilot projects;

19. Include a scenario wherein an incentive is provided as part of the funding for KIPs to enhance EE while phasing down HFCs in accordance with ExCom Decision 92/38;

20. Consider activities to support SMEs in design and development of energy efficient technology and their implementation;

21. Consider EE-related policies and regulations capacity building;

22. Consider additional costs for energy-efficient foam products;

23. Consider regional testing centers for monitoring and verification of EE;

24. Analyze additional costs for including EE as an incentive for enhancing ambitious HFC-phase down and leapfrogging HFCs in the frame of the HPMPs and KIPs;

25. Provide cost estimates of potential support for systemic approaches to EE in KIPS, beyond the pilot window;

End of life

26. Provide estimates of costs of managing reclamation, recycling, and cost-effective destruction of banks, including collection, transport, and disposal activities;

27. Consider a scenario for end-of-life (EOL) activities considered under ExCom Decision 91/66 where only 30% of countries request funding during this replenishment."

1.4 APPROACH TO SUPPLEMENTARY REPORT

The replenishment of the MLF for the 2024–2026 triennium represents a significant milestone in assistance to developing countries to comply with the terms of the Montreal Protocol in that the MLF will provide financing for the incremental costs of not just the phase-out of ozone-depleting substances (ODS) but also the phase-down of HFCs.

- For Annex C, Group 1, controlled substances (HCFCs), the compliance target for the 2024–2026 triennium is a 67.5% reduction from baseline by 1 January 2025.
- For the next two triennia 2027–2029 and 2030–2032, the next HCFC phase-out compliance target is a 97.5% reduction from baseline by 1 January 2030. The subsequent annual average of 2.5% is restricted to the servicing of refrigeration and air-conditioning equipment existing during 2030–2040 and will be subject to review in 2025. Decision XXX/2 referring to Annex I of the MOP-30 report[9], adjusted this part of Article 5 (as well as 2F) to include other uses, i.e., the servicing of fire suppression and fire protection equipment existing on 1 January 2030; solvents applications in rocket engine manufacturing; and topical medical aerosol for applications for the specialized treatment of burns.
- For Annex F controlled substances (HFCs), the compliance targets for the 2024–2026 and next two triennia are as follows:
    - Group 1 parties: In the 2024–2026 triennium, a freeze of production and consumption on 1 January 2024 and a 10% reduction from baseline by 1 January 2029; for the next two triennia 2027–2029 and 2030–2032, a 30% reduction from baseline by 1 January 2035.
    - Group 2 parties: For the next two triennia 2027–2029 and 2030–2032, a freeze of production and consumption by 1 January 2028 and a 10% reduction from baseline by 1 January 2032.

In the May 2023 RTF Report, the RTF considered a range for the estimated HFC consumption costs based on the following two scenarios for the triennium 2024–2026:

[9] https://ozone.unep.org/treaties/montreal-protocol/meetings/thirtieth-meeting-parties/decisions/annex-i-adjustments

- **Low-end scenario:** Calculated HFC baselines for 104 A5 countries that have ratified the Kigali Amendment as of the 3 April 2023 using a range of cost effectiveness factors; and
- **High-end scenario**: Calculated HFC baselines for all 144 A5 countries, assuming they will be ratifying the Kigali Amendment by 2026, using a range of cost effectiveness factors.

In this report, the RTF retained the same methodology for estimating funding as in the May 2023 RTF Report. The RTF calculations of the funding requirements are informed by the Adjusted Consolidated BP of the MLF for 2023–2025, relevant policy decisions of the ExCom through its 92nd meeting, and information available through the MLFS and Ozone Secretariat. The RTF relied on existing cost guidelines under the MLF and, where these remained under discussion in the ExCom (i.e., cost guidelines for HFC phase-down activities), the RTF noted these limitations in its estimates. The RTF made no changes from its May 2023 Report to its estimated funding for institutional strengthening and standard activities, preparation of gender mainstreaming activities, and end-of-life activities. The RTF made no changes from its May 2023 Report to its estimated funding for future triennia 2027–2029 and 2030–2032.

In this report, the RTF updated the high-end scenario (i.e., assuming all parties ratify the Kigali Amendment by 2026) based on decisions from ExCom-92 and revised HFC baseline calculations based on new information available as of 7 August 2023 from Article 7 (A7) reporting. These updates are discussed in Chapter 2. In the absence of final HFC cost guidelines, RTF updated estimated funding based on ExCom-92 approvals and decisions taken, including the agreed cost-effectiveness value for servicing sector. That said, and with those changes mentioned, the RTF retained the methodology for estimating funding as detailed in the May 2023 RTF Report. The RTF made no changes to its estimated funding for institutional strengthening and standard activities, preparation of gender mainstreaming action plans, and end-of-life activities. The RTF updates adjusted only the high-end scenario, assuming all parties ratify the Kigali Amendment by 2026. The RTF made no change to its estimated funding for future triennia (2027–2029 and 2030–2032).

For the range to its estimated funding for the 2024–2026 triennium, the RTF refers to the suggestions by parties at OEWG-45 as in above section 1.3, including scenarios some of which significantly increase or decrease the updated estimated funding. For example, the requested scenario estimating funding for KIPs where 90% of Group 1 countries and 30% of Group 2 countries request funding in this triennium is estimated to reduce the total funding for the triennium by US$ 124 million. Other requested scenarios, however, are estimated to increase the total funding. Given the many varied scenarios requested by parties, the RTF presents these scenarios without presuming which ones parties may wish to use, combine, or discard. The range of funding for this triennium would then be dependent on these choices. The suggestions by parties from OEWG-45 are discussed in Chapters 3–7 below.

When developing scenarios, if a methodology, different than the one that RTF used in its May 2023 report, was specified by the item in the suggestions from OEWG-45, the respective results were presented in the chapter where the item was addressed, as they could not be compared.

In this report, the RTF did its best to address the significant number of suggestions, including scenarios, by the OEWG-45 Contact Group to the extent information was available to the RTF as of 7 August 2023, and within the short timeline to prepare this supplementary report for MOP-35.

The chapters of this report are organised as follows:

CHAPTER 2 UPDATE TO RTF MAY-2023 REPORT FOR ESTIMATED FUNDING REQUIREMENT FOR 2024–2026 TRIENNIUM

2.1 INTRODUCTION

This chapter presents updates to the May 2023 RTF Report estimated funding for 2024–2026 based on:

- Decision XXXIV/2 and Item 4 of the OEWG-45 Contact Group list of suggestions, which for both, parties request the RTF to adjust funding requirements based on any relevant decisions taken at ExCom-92 and
- New information available from A7 data reporting as of 7 August 2023 and revised HFC baseline calculations.

2.2 UPDATES BASED ON EXCOM-92 DECISIONS

This section addresses Decision XXXIV/2 and Item 4 of the OEWG-45 Contact Group list of suggestions which both request the RTF to adjust funding requirements based on any relevant decisions taken at ExCom-92.

> ***Decision XXXIV/2, paragraph 2(a): "That, in preparing the report…, the Panel should take into account…[all] control measures and relevant decisions agreed upon by parties to the Montreal Protocol and the Executive Committee of the Multilateral Fund…, and the decisions of the Thirty-Fourth Meeting of the Parties and the Executive Committee at its meetings, up to and including its ninety-second meeting, insofar as those decisions will necessitate expenditures by the Multilateral Fund during the period 2024–2026;"***
>
> ***Item 4: "Adjust all elements of the funding requirements based on any relevant decisions taken at the 92nd meeting of the ExCom;"***

2.2.1 ExCom-92 approvals

Relevant decisions taken at ExCom-92[10], including approval of HCFC and HFC activities for 46 countries, used by the RTF to update its estimated total funding for the 2024–2026 triennium are summarised in Annex 2 of this report.

Based on the decisions from ExCom-92 and new data and information discussed in section 2.3 below, the RTF updated the estimated funding for the 2024–2026 triennium as follows:

- Increased the funding for approved HPMPs from US$ 116.7 to US$ 123.2 million, an increase of US$ 6.5 million;
- Increased the funding for HCFC project preparation costs from US$ 170,000 to US$ 2.84 million, an increase of US$ 2.7 million;
- Reduced the funding for the estimated HPMPs from US$ 205.4 to US$ 195.6 million, a reduction of US$ 9.8 million;
- Reduced the funding for the HCFC energy efficiency special funding from US$ 11.1 to US$ 10.2 million, a reduction of US$ 872,335
- Added funding of US$ 434,420 for approved KIPs;
- Increased the funding for the HFC project preparation from US$ 16.8 to US$ 20.4 million, an increase of US$ 3.6 million;
- Increased the funding for estimated KIPs from US$ 449.4 to US$ 569.6 million, an increase of US$ 120.2 million;

[10] UNEP/OzL.Pro/ExCom/92/56

- Reduced the HFC energy efficiency funding window from US$ 20 million to 19.97 million, a reduction of US$ 34,000;
- Added funding of US$ 678,000 for HFC technical assistance.

Section 2.4 provides a summary of the updated total funding requirement for the triennium 2024–2026 based on the above updates as well as new information discussed in the next section.

2.2.2 ExCom-92 update on funding and cost-effectiveness factors for the refrigeration servicing sector

In addition to the above approvals, the ExCom continued discussions held at previous meeting related to the level and modalities of funding for HFC phase-down in the refrigeration servicing sector[11]. In Decision 92/37[12] (see Annex 3), the ExCom decided that "Article 5 countries that had an average HFC consumption in the servicing sector during the baseline years of up to 360 metric tonnes would be provided funding, as shown in the table below, on the understanding that project proposals would still need to demonstrate that the funding level was necessary to achieve at least the 10 per cent of the Montreal Protocol HFC reduction target."

Table 2-1 summarises the funding level established by Decision 92/37 for LVCs or Bracket E countries according to the RTF methodology. The RTF applied these funding levels for its updated estimate for the 2024–2026 triennium.

Table 2-1 Analysis of the level and modalities of funding for HFC phase-down in the refrigeration servicing sector (ExCom Decision 92/37)

Average HFC consumption in servicing in baseline years (metric tonnes)	Funding for meeting the 10 per cent Montreal Protocol HFC reduction target (US$)*
>0 <15	135,000
15 <40	145,000
40 <80	158,000
80 <120	170,000
120 <160	180,000
160 <200	190,000
200 <300	325,000
300 <360	360,000

*Plus 20 per cent funding for countries committing to reduce consumption by 10 per cent of the average HFC consumption in the baseline years.

2.3 UPDATES BASED ON NEW DATA AND INFORMATION AVAILABLE

This section addresses new information available from A7 data reporting as of 7 August 2023 and revised HFC baseline calculations. Since the May 2023 RTF Report was prepared, 70 additional parties provided HFC consumption data[13] through A7 reporting for 2020, 2021, and/or 2022. Therefore, in order to update the estimated total funding for the 2024–2026 triennium for this report, the RTF revised its HFC baseline calculation.

The RTF methodology for addressing HFC data gaps remains the same as in its May 2023 Report (see section 3.3. and Annex 1 of the May 2023 RTF Report). In summary and since equipment and chemical usage/consumption varies between countries of different sizes and manufacturing capabilities, and to project future consumption and to model the baseline, the RTF allocated each of the 144 A5 parties into "brackets" and estimated projected consumption patterns for HFCs. The

[11] Paragraph 226 of document UNEP/OzL.Pro/ExCom/91/72, "Analysis of the level and modalities of funding for HFC phase-down in the refrigeration servicing sector"
[12] Paragraph 181 of document UNEP/OzL.Pro/ExCom/92/56, "Development of the cost guidelines for the phase-down of HFCs in Article 5 countries" (decision 92/37)
[13] Data submitted as of 7 August 2023 was taken into consideration by RTF.

brackets were based on their baseline HCFC consumption in metric tonnes. The RTF placed countries into five different brackets (A through E), see Table 2-2.

Table 2-2 List of countries per bracket

Bracket (mt HCFCs)	Countries
A: Over 25,000	***Group 1:*** China
B: 10,001 to 25,000	***Group 1:*** Brazil, Mexico, Thailand ***Group 2:*** India, Saudi Arabia
C: 2,001 to 10,000	***Group 1:*** Argentina, Colombia, Egypt, Indonesia, Malaysia, Nigeria, Philippines, South Africa, Turkey, Venezuela (Bolivian Republic of), Viet Nam, Yemen ***Group 2:*** Iran (Islamic Republic of), Kuwait, Pakistan
D: 360 to 2,000*	***Group 1:*** Afghanistan, Algeria, Bangladesh, Cameroon, Chile, Côte d'Ivoire, Democratic People's Republic of Korea, Dominican Republic, Ghana, Guinea, Jordan, Kenya, Lebanon, Libya, Mauritania, Morocco, Panama, Peru, Senegal, Somalia, Sudan, Syrian Arab Republic, Trinidad and Tobago, Tunisia, Uruguay ***Group 2:*** Bahrain, Iraq, Oman, Qatar
E: HCFC LVCs	***Group 1:*** Albania, Angola, Antigua and Barbuda, Armenia, Bahamas, Barbados, Belize, Benin, Bhutan, Bolivia (Plurinational State of), Bosnia and Herzegovina, Botswana, Brunei Darussalam, Burkina Faso, Burundi, Cambodia, Cabo Verde, Central African Republic, Chad, Comoros, Congo, Cook Islands, Costa Rica, Cuba, Democratic Republic of the Congo, Djibouti, Dominica, Ecuador, El Salvador, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Fiji, Gabon, Gambia, Georgia, Grenada, Guatemala, Guinea Bissau, Guyana, Haiti, Honduras, Jamaica, Kiribati, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Marshall Islands, Mauritius, Micronesia (Federated States of), Mongolia, Montenegro, Mozambique, Myanmar, Namibia, Nauru, Nepal, Nicaragua, Niger, Niue, North Macedonia, Palau, Papua New Guinea, Paraguay, Republic of Moldova, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Serbia, Seychelles, Sierra Leone, Solomon Islands, South Sudan, Sri Lanka, Suriname, Timor-Leste, Togo, Tonga, Turkmenistan, Tuvalu, Uganda, United Republic of Tanzania, Vanuatu, Zambia, Zimbabwe

* Note: Benin, Gabon, Niger, and Togo received funding for HPMPs as being LVCs. They are classified in this report under Bracket E. Madagascar had its baseline changed and is an LVC.

For parties where HFC data was available for 2019 and/or 2020 and/or 2021, data gaps were filled by using national Gross Domestic Product (GDP) growth rates[14] for earlier and later time periods. Some parties provided data as part of Country Program (CP) data for the MLF. If CP HFC data and A7 HFC data were available, the A7 HFC data was used because of the differences between the data sets for some parties. The CP HFC data and A7 HFC data were not averaged because the A7 data are the official reported record. It should be noted that CP data are reported in blends, while the A7 data are reported by component, so the RTF converted known blends to components to provide a like-for-like comparison. Many new blend combinations were reported through the CP data.

Table 2-3 shows the updated baseline calculation results by country brackets based on the additional A7 data reported as of 7 August 2023 (see Annex 4). The HFC baseline changed from 1,643 to 1,840 $MMTCO_2e$.

[14]https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD

Table 2-3: HFC and HCFC Component of Formula in HFC Baseline (September 2023 Update)

	% of HCFC Total GWP	HFC Portion of Baseline Calculation	HCFC Portion of Baseline Calculation		Sept 2023 HFC BASELINE (MMTCO2e)	May 2023 HFC BASELINE (MMTCO2e)
			HCFC Baseline	*HCFC Baseline x 65%*		
Bracket A	59.28%	**688**	481	**313**	**1001**	**883**
Bracket B	9.23%	**160**	75	**49**	**208**	**188**
B Group 2	8.62%	**140**	70	**45**	**185**	**150**
Bracket C	11.77%	**144**	96	**62**	**206**	**174**
C Group 2	2.88%	**47**	23	**15**	**62**	**47**
Bracket D	4.53%	**80**	37	**24**	**107**	**109**
D Group 2	1.13%	**18**	9	**6**	**24**	**27**
Bracket E	2.56%	**36**	21	**14**	**47**	**65**
Total All	100.00%	**1312**	812	**528**	**1,840**	**1,643**

2.4 SUMMARY OF UPDATED ESTIMATED FUNDING FOR 2024–2026 TRIENNIUM BASED ON EXCOM-92 DECISIONS AND AVAILABLE INFORMATION AS OF 7 AUGUST 2023

Following its approach above for the supplementary report, the RTF updated the high-end scenario (i.e., assuming all parties ratify the Kigali Amendment by 2026) based on decisions from ExCom-92 and revised HFC baseline calculations based on new information through A7 reporting. Table 2-4 shows this updated high-end of the range for the estimated funding requirement for the replenishment of the MLF in the 2024–2026 triennium of **US$ 1,141 million**[15]**.**

[15] Note: figures may not sum due to rounding.

Table 2-4. RTF updated funding requirement for the replenishment of the MLF 2024–2026 (US$)

2024–2026 Triennium Estimated Funding (May 2023)			Sept 2023 Updates	
HCFC Consumption Sector				
HCFC Approved HPMPs	$	116,746,000	$	123,181,000
HCFC Prep Costs	$	170,000	$	2,839,000
HCFC Estimated HPMPs (including LVCs/VLVCs)	$	205,405,000	$	195,582,000
HCFC Verification	$	1,766,000	$	1,766,000
HCFC Energy Efficiency Special Funding	$	11,092,000	$	10,220,000
Subtotal – HCFC Consumption Sector	**$**	**335,179,000**	**$**	**333,588,000**
HCFC Production Sector				
HCFC Production Sector Stage I PRP	$	148,000	$	148,000
HCFC Production Sector Stage I HPPMP	$	5,352,000	$	5,352,000
HCFC Production Sector Stage II HPPMP	$	23,232,000	$	23,232,000
Subtotal – HCFC Production Sector	**$**	**28,732,000**	**$**	**28,732,000**
SUBTOTAL - HCFC Activities	**$**	**363,911,000**	**$**	**362,320,000**
HFC Consumption Sector				
HFC Approved KIPs	$	-	$	434,420
HFC Prep Costs (including gender mainstreaming)	$	16,802,000	$	20,369,000
HFC RTF Estimated KIPs	$	449,415,000	$	569,643,000
HFC Enabling Activities	$	1,011,000	$	1,011,000
HFC Energy Efficiency Funding Window	$	20,000,000	$	19,966,000
HFC Technical Assistance	$	-	$	678,000
Subtotal – HFC Consumption Sector	**$**	**487,228,000**	**$**	**612,101,420**
HFC Production Sector (Unchanged from May 2023 estimates)				
HFC Production Sector Prep	$	2,000,000	$	2,000,000
HFC Production Sector KPPMP RTF Estimated	$	20,000,000	$	20,000,000
HFC-23 Mitigation Prep	$	193,000	$	193,000
HFC-23 Mitigation Approved	$	1,721,000	$	1,614,000[16]
HFC-23 Emissions Control (per BP formerly Mitigation RTF Estimated)	$	8,000,000	$	8,000,000
Subtotal – HFC Production/HFC-23 Sector	**$**	**31,914,000**	**$**	**31,807,000**
SUBTOTAL - HFC Activities	**$**	**519,142,000**	**$**	**643,908,000**
IS/Standard Activities/EOL (Unchanged from May 2023 estimates)				
IS	$	44,500,000	$	44,500,000
UNEP CAP	$	36,437,000	$	36,437,000
UNDP, UNIDO, World Bank Core Unit	$	18,161,000	$	18,161,000
MLF Secretariat and ExCom Costs	$	20,983,000	$	20,983,000
Treasurer	$	1,500,000	$	1,500,000
SUBTOTAL - IS & Standard Activities	**$**	**121,581,000**	**$**	**121,581,000**
Funding Window on EOL/Disposal	$	13,590,000	$	13,590,000
SUBTOTAL – EOL/Disposal	**$**	**13,590,000**	**$**	**13,590,000**
TOTAL	**$**	**1,018,224,000**	**$**	**1,141,402,000**

[16] Reducing the Penalty of US $107,000 applied as per decision 92/31(b)(iii) for Argentina.

CHAPTER 3 ADDITIONAL INFORMATION AND SCENARIOS: OVERALL SUGGESTIONS/METHODOLOGICAL APPROACH

3.1 INTRODUCTION

This chapter addresses the following OEWG-45 Contact Group items related to overall suggestions and methodological approach:

> ***Item1. "Where the RTF uses cost estimates for specific activities drawn from the MLF business plan include a scenario with a discounting approach as applied by previous replenishment reports. It should reflect that the funding approvals in ExCom were on average found to be lower by 15 to 20% (at present 26% lower) compared to the original cost and expenditures estimated in the business plans";***
>
> ***Item 2. "Include 2 new scenarios for estimating the funding for the HCFC phase-out and HFC phase-down that are based on the actual consumption (or estimates of such consumption when not reported) to be reduced for countries to meet compliance targets including both the freeze target and the 10% reduction target for the HFC phase-down and ranges for the respective funding requirements to account for uncertainties";***
>
> ***Item 3. "Adjust the funding estimated for the HCFC phase-out and HFC phase-down by taking into account potential approvals of projects and project preparation requests at the 93rd meeting of the ExCom";***

For those suggested items above, RTF applied requested scenarios using the RTF model described in the May 2023 RTF Report, adjusted for approvals and decisions taken at ExCom-92, such as HFC cost effectiveness factor for servicing sector, as well as considered new A7 HFC data reported.

3.2 ITEM 1: SCENARIO WITH DISCOUNTING APPROACH

Item 1: "Where the RTF uses cost estimates for specific activities drawn from the MLF business plan include a scenario with a discounting approach as applied by previous replenishment reports."

The MLFS provided to the RTF information in Table 3-1 which provides an analysis of historical approvals as a percentage of the relevant business plan. This reflects that the funding approvals in ExCom were on average found to be lower by 24% compared to the original cost and expenditures estimated in the business plans.

Table 3-1. Historical ExCom approvals as percentage of the business plans[17]

Triennium	Year	Total Business Plan Values (Excluding Secretariat, Treasurer, CAP, Core Unit, IS) (US$)	Approvals (Excluding Secretariat, Treasurer, CAP, Core Unit, IS) (US$)	Approvals as % of Business Plan (Excluding Secretariat, Treasurer, CAP, Core Unit, IS)
2003-2005	2003	212,503,011	155,881,686	73%
	2004	204,103,794	169,517,178	83%
	2005	205,916,333	194,627,144	95%
2006-2008	2006	138,006,337	119,894,678	87%
	2007	148,038,747	116,081,825	78%
	2008	123,598,002	122,728,383	99%
2009-2011	2009	80,870,566	66,237,403	82%

[17] Provided by MLFS.

Triennium	Year	Total Business Plan Values (Excluding Secretariat, Treasurer, CAP, Core Unit, IS) (US$)	Approvals (Excluding Secretariat, Treasurer, CAP, Core Unit, IS) (US$)	Approvals as % of Business Plan (Excluding Secretariat, Treasurer, CAP, Core Unit, IS)
	2010	180,364,456	82,485,680	46%
	2011	225,110,721	208,664,543	93%
2012-2014	2012	131,736,211	98,744,157	75%
	2013	138,999,020	122,992,764	88%
	2014	124,801,957	89,821,064	72%
2015-2017	2015	146,931,066	166,941,225	114%
	2016	147,929,746	110,739,545	75%
	2017	131,640,814	71,629,685	54%
2018-2020	2018	156,529,535	127,691,965	82%
	2019	140,140,562	43,908,689	31%
	2020	125,218,363	70,276,787	56%
2021-2023	2021	125,771,614	73,261,164	58%
	2022	88,273,000	75,194,758	85%
	2023	134,232,228	TBD	TBD

Taking an average annual approval of 76% of estimated costs from the relevant business plan, the RTF applied a 24% discount to cost estimates only for specific activities which RTF has drawn from Table 3, "Adjusted Resource Allocation for the Business Plan for 2023–2025 (US$)" (BP): HFC project preparation, HFC technical assistance, and HFC-23 emissions control. These were the only categories for which the RTF has used the exact figures from the BP.

Table 3-2 summarises the change when this discount is applied. This discount scenario was applied on the funding adjusted by the ExCom-92 approvals, that is, this September 2023 RTF report, and not the figures in the May 2023 RTF report.

This item 1 scenario reduces the total 2024–2026 triennium estimated funding by **US$ 3.7 million**.

Table 3-2. Change in 2024–2026 triennium estimated funding based on Item 1 scenario

Change to 2024–2026 Triennium Estimated Funding (September 2023)		Applied 24% discount
Activities Drawn from BP by RTF		
HFC Consumption/Production Sector		
HFC Prep Costs (including gender mainstreaming)	$ 20,369,000	$ 18,742,000
HFC Technical Assistance	$ 678,000	$ 515,000
HFC-23 Emissions Control	$ 8,000,000	$ 6,080,000
SUBTOTAL	**$ 29,047,000**	**$ 25,337,000**
CHANGE IN ESTIMATED FUNDING BASED ON ITEM 1 SCENARIO		**($ 3,710,000)**

3.3 ITEM 2: SCENARIOS FOR ESTIMATING FUNDING BASED ON ACTUAL/ESTIMATED CONSUMPTION

Item 2: "Include [two] new scenarios for estimating the funding for the HCFC phase-out and HFC phase-down that are based on the actual consumption (or estimates of such consumption when not reported) to be reduced for countries to meet compliance targets including both the freeze target and the 10% reduction target for the HFC phase-down and ranges for the respective funding requirements to account for uncertainties."

For item 2, RTF considered scenarios affecting funding for estimated HPMPs and KIPs in the 2024–2026 triennium as below.

3.3.1 Scenario 1: HCFC phaseout

US$ 191,588,000 including support costs is estimated for countries needing HPMPs to reach the 80.5% compliance target. RTF estimated target for the 2024–2026 triennium is based on CP data (2021 or 2022 if available). RTF assumed all tonnage for the 2024–2026 triennium for non-LVCs is in HCFC-22 using the CE factor for the servicing sector of US$ 4.80/kg[18]. Funding for LVCs is based on Decision 74/50(c)(xii). Annex 5 presents summary of the calculation methodology used, which estimated funding needed for new HPMPs to be US$ 192 million.

3.3.2 Scenario 2: HFC phase-down

It is important to note that RTF didn't use the calculated baseline (which also includes 65% HCFCs) to calculate the estimating funding under this scenario. Item 2 requests RTF to use actual consumption, that is, RTF used the reported or estimated 2022 HFC (actual) consumption to respond to this request.

Therefore, the RTF analysed the average 2020-2022 HFC consumption (reported under A7 or estimated by the RTF using its previous methodology to calculate funding for addressing HFC data gaps[19] for all of the 144 A5 countries). And, based on actual (reported) or estimated consumption data, the RTF estimated the funding needed by Group 1 countries to achieve the 10% reduction target by 1 January 2029 (excludes Group 2).

As result, **US$ 405,155,000** including support costs is estimated for countries needing KIPs to reach the 10% compliance target based on the actual or estimated consumption. Table 3-3 summarises the change when these scenarios are applied.

This item 2 scenarios reduce the updated 2024–2026 triennium estimated funding by **US$ 168.5 million**.

Table 3-3. Change in 2024–2026 triennium estimated funding based on Item 2 scenarios

2024–2026 Triennium Estimated Funding (September 2023)			Item 2 Scenarios	
HCFC Consumption Sector				
HCFC Estimated HPMPs (including LVCs/VLVCs)	$	195,582,000	$	191,588,000
HFC Consumption/ Sector				
HFC RTF Estimated KIPs	$	569,643,000	$	405,155,000
SUBTOTAL	**$**	**765,225,000**	**$**	**596,743,000**
CHANGE IN ESTIMATED FUNDING BASED ON ITEM 2 SCENARIOS				**($ 168,482,000)**

[18] May 2023 RTF Report used an average CE factor based on each country HPMP approvals for stage I and stage II (including average CE factor for China stage II of US$ 1.56/kg).
[19] The methodology is described in the RTF May 2023 report

3.4 ITEM 3: ADJUST FUNDING ESTIMATE BASED ON POTENTIAL APPROVALS AT EXCOM-93

Item 3: "[Adjust] the funding estimated for the HCFC phase-out and HFC phase-down by taking into account potential approvals of projects and project preparation requests at the 93rd meeting of the ExCom."

No information on potential submissions for the ExCom-93 was available to the RTF as of 7 August 2023, which was the cut-off date for new information that the RTF could consider for this report to meet the timeline for submission to MOP-35. Based on the BP total estimated funding for 2023 is US$ 187,244,740, as per Table 3-4. The RTF considered applying 24% difference between approvals and BP estimates and deducting the approvals through ExCom-92 of US$ 29,253,988, which leaves a remaining estimated funding of US$ 146,324,051 for potential approvals at ExCom-93. However, without knowing the specific submissions to ExCom-93, the RTF was unable to adjust its estimated funding for the 2024–2026 triennium as well as future triennia.

Table 3-4: Potential approvals at ExCom-93 using funding for 2023 activities in Business Plan

MLF Business Plan	2023 funding according to endorsed BP*	Applying 24% difference between approvals and BP estimates	Remaining approvals for ExCom-93
HCFC activities			
Approved HPMPs	$ 60,280,861		$ 60,280,861
HPMP PRP – stage II	$ 200,480		$ 200,480
HPMP stage II	$ 2,937,082	$ 2,232,182	$ 2,232,182
HPMP stage II – investment	$ -	$ -	$ -
HPMP PRP – stage III	$ 290,100		$ 290,100
HPMP stage III	$ 14,794,713	$ 11,243,982	$ 11,243,982
HPMP PRP – stage IV	$ 90,000		$ 90,000
HPMP stage IV	$ -	$ -	$ -
HPMP – energy efficiency	$ 3,258,494	$ 2,476,455	$ 2,476,455
HPMP verification	$ 588,600.00		$ 588,600.00
HCFC technical assistance	$ -	$ -	$ -
HCFC activities subtotal	**$ 82,440,330**		**$ 77,402,661**
HFC activities			
Enabling activities for HFC phase-down	$ 53,500		$ 53,500
KIP – PRP	$ 3,945,431		$ 3,945,431
KIPs	$ 27,299,967	$ 20,747,975.	$ 20,747,975
KIPs – investment PRP	$ 129,000		$ 129,000
KIPs – investment	$ 321,000	$ 243,960	$ 243,960
HFC-23 emissions control PRP	$ 43,000		$ 43,000
HFC-23 emissions control	$ -	$ -	$ -
HFC – technical assistance	$ -	$ -	$ -
HFC activities subtotal	**$ 31,791,898**		**$ 25,162,866**
Energy efficiency funding window	**$ 20,000,000**		**$ 19,966,089**
Standard activities			
IS	$ 27,860,444		$ 27,860,444

MLF Business Plan	2023 funding according to endorsed BP*	Applying 24% difference between approvals and BP estimates	Remaining approvals for ExCom-93
CAP	$ 11,445,002		$ 11,445,002
Core unit	$ 5,969,740		$ 5,969,740
Secretariat, Executive Committee, and Monitoring and Evaluation costs minus Canadian counterpart	$ 7,237,326		$ 7,237,326
Treasurer	$ 500,000.00		$ 500,000.00
Standard activities subtotal	**$ 53,012,512**		**$ 53,012,512**
Total	**$ 187,244,740**		$ 175,578,039
ExCom-92 Approvals			$ (29,253,988)
Revised Total			**$ 146,324,051**

* Endorsed BP figures provided by MLFS.

CHAPTER 4 ADDITIONAL INFORMATION AND SCENARIOS: HCFCS

4.1 INTRODUCTION

This chapter addresses the following OEWG-45 Contact Group items related to HCFCs:

> ***Item 6. When estimating the funding requirement for new HPMPs, identify the sectors that would likely be addressed by these HPMPs, based on remaining HCFC consumption per sector, and apply cost effectiveness factors to calculate funding for these sectors that are based on historical experience under the Multilateral Fund;***
>
> ***Item 7. Consider scenario removing the HCFC production phase-out plan for India that is not included in the consolidated BP of ExCom;***
>
> ***Item 8. Review the funding requirement for HPMP preparation funding to account for all the countries identified to require new HPMPs in the 2024–2026 triennium.***

4.2 ITEM 6: IDENTIFY SECTORS LIKELY TO BE ADDRESSED BY NEW HPMPS WHEN ESTIMATING FUNDING AND APPLY MLF CE FACTORS

Item 6: "When estimating the funding requirement for new HCFC Phaseout Management Plans (HPMPs), identify the sectors that would likely be addressed by these HPMPs, based on remaining HCFC consumption per sector, and apply cost effectiveness factors to calculate funding for these sectors that are based on historical experience under the MLF;"

In order to respond to the request above, RTF considered the list of countries with eligible remaining consumption based on approved agreements (between the country and ExCom) in the information table provided by the MLFS which contains data in ODP tons per country/ per chemical, as of ExCom-92. Table 4-1 summarises data used.

Table 4-1: Countries with eligible remaining consumption of HCFCs by sector as of ExCom-92

HCFC/ Potential Sector	Total Remaining Consumption (metric tons) [20]	Countries with eligible remaining consumption of HCFCs
HCFC-22/ Servicing, and RAC manufacturing	124,745	Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Bahrain, Bangladesh, Brazil, Burundi, Cameroon. Central African Republic, China, Comoros, Congo, Cote d'Ivoire, Djibouti, Dominica, Egypt, Equatorial Guinea, Gabon, Guinea, Guinea Bissau, Haiti, Iran, DPRK, Iraq, Jordan, Kuwait, Lebanon, Libya, Mali, Mauritania, Mexico, Morocco, Mozambique, Myanmar, Nigeria, Peru, Philippines, Qatar, Saint Kitts and Nevis, San Tome and Principe, Saudi Arabia, Senegal, Serbia, Somalia, South Sudan, Suriname, Syria, Thailand, Timor Leste, Tunisia, Turkmenistan, Vietnam, and Yemen
HCFC-141b and HCFC-141b contained in polyols/ Foam manufacturing and solvent sector	1,321	Algeria, Bangladesh, Brazil, Libya, Malaysia, Myanmar, Peru, Philippines, Somalia, Thailand, and Yemen

[20] Calculated based on eligible remaining consumption in MLFS list provided to RTF; may include consumption at enterprises that have already been funded for conversion under an approved HPMP but that have not yet completed their conversion as well as consumption at ineligible enterprises; numbers were rounded, so may have rounding differences with totals used in other parts of the report.

HCFC-142b/ RAC servicing, RAC manufacturing, foam manufacturing	7,633	Argentina, Brazil, China, Peru, Serbia, and Yemen.
HCFC-123/ RAC servicing and manufacturing; Fire Suppression,	543	Argentina, Brazil, China, Egypt, Malaysia, Mexico, Philippines, Saudi Arabia, Serbia, Thailand, and Vietnam.
HCFC-124/ RAC; Fire Suppression	495	Argentina, Brazil, China, Mexico, Peru
HCFC-225 and HCFC-225ca and HCFC-225cb/ Solvent	57	China, Malaysia, Thailand

The eligible remaining consumption is covered by Stages III/IV of the HPMP that extend all the way until 2030 eliminating the consumption of HCFCs, except for the service tail.

In order to calculate funding requirements as requested for Item 6, RTF followed the steps below:

- MLFS provided table that reflects the chemical, ODP value and total eligible ODP tons remaining, as of the 92nd ExCom meeting.
- RTF used the remaining consumption eligible for funding per ODP t of HCFC-22, HCFC-141b, HCFC-142b, HCFC-123 and HCFC-124, HCFC-225, HCFC-225ca and HCFC-225cb.
- RTF converted ODP tons into metric tonnes. For non-LVCs, and because there was no information on the proportion of the reported consumption by chemical that was used for manufacturing, RTF worked on some scenarios in order to apply CEs and then calculate estimated funding.
- The Cost Effectiveness values (CE) were applied (based on ExCom 89/10 rev 1 table 1) for HPMPs, to get the funding per chemical/sector. When CE were to be applied on a "case-by-case basis", RTF used, as possible, CE figures based on the experience on demonstration/ stand-alone projects in Tables 2-11 of the same document (ExCom 89/10 rev1). In case more than one sector for same chemical was identified, average CEs were used.
- For LVCs, RTF considered the remaining eligible funding for the Parties in the categories defined in ExCom Decision 74/50 since funding for LVCs is fixed. RTF considered that all LVCs had consumption in the servicing sector only.
- RTF pro-rated the estimated funding for the three years of the triennium 2024–2026, out of 7 years (to 2030).
- Costs of PMU were not applied.

The following sector scenarios were developed to estimate cost:

Scenario 1. HCFC-22

- For LVCs, RTF estimated funding for 24 countries, assuming the total remaining HCFC-22 consumption in servicing sector, is US$ 14 million.
- For 34 non-LVC, RTF assumed that 25% had remaining HCFC-22 consumption in manufacturing sectors (mainly CR and AC), and 75% had consumption in the servicing sector. The total apportioned to the 2024–2026 triennium for non-LVCs only is estimated at US$ 336 million.

- The total (HCFC-22) estimated funding for 2024–2026 is at **US$ 350 million** (Table 4-2) for both LVCs and non-LVCs.

Table 4-2: Sector scenario – HCFC-22

HCFC-22	ODP Value	Metric tons	CE $/kg[21]	Total Phaseout Estimated Funding (million US$)	Estimated Funding 2024–2026* (million US$)
34 Non-LVCs					
75% Servicing	0.055	92,508	4.8	444	190
25% Manufacturing	0.055	30,836	11.0	339	145
Total Non-LVCs		123,344		783	336
24 LVCs					
Servicing	0.055	1,401		14	14
Total LVCs & Non-LVCs		124,745		**797**	**350**

*2024–2026 Funding: For Non-LVCs, RTF considered funding for 3 years (out of 7 years till 2030); for LVCs, considered 100% is in 2024–2026 triennium. For 24 LVCs level of funding applied per country as per ExCom74/50. One non-LVC counted as LVC since it is funded as such (Gabon).

Scenario 2. HCFC-141b and 141b in polyols

- Ten (11) non-LVC countries had remaining eligible consumption in foam manufacturing and solvent sectors.
- RTF assumed 80% of HCFC-141b remaining consumption in the PU foam manufacturing sector. Twenty (20) % was allocated to solvent sector. One LVC with very small consumption not taken in consideration in the scenario.
- The total (HCFC-141b) estimated funding for 2024–2026 is at **US$ 4.5 million** (Table 4-3).

Table 4-3: Sector scenario – HCFC-141b

HCFC-141b	ODP Value	Metric tons	CE $/kg	Total Phaseout Estimated Funding (million US$)	Estimated Funding 2024–2026** (million US$)
10 Non-LVCs					
5 % Solvent	0.11	66	10.13[22]	0.67	0.29
95 % Foam Manufacturing	0.11	1,255	7.83	9.83	4.21
Total		**1,321**		**10.49**	**4.5**

**2024–2026 Funding: For Non-LVCs, RTF considered funding for 3 years (out of 7 years till 2030);

Scenario 3. HCFC-142b

- Six (6) non-LVC countries had remaining consumption of HCFC-142b in sectors that potentially cover foam manufacturing, RAC manufacturing and servicing. RTF did not have information on the sector breakdown of consumption. Therefore, in order to estimate funding RTF assumed all remaining consumption in foam manufacturing sector (XPS). One (1) LVC with very small consumption not included.

[21] UNEP/OzL.Pro/ExCom/89/10/Rev.1. Average CE for AC and CR sectors was used.

[22] RTF used average in "Table 12. Analysis of HCFC phase-out Investment Projects in the Solvent Sector", ExCom Document 89.10 rev1.

- The total (HCFC-142b) RTF estimated funding for the 2024–2026 is at **US$ 26.89** million (Table 4-4).

Table 4-4: Sector scenario – HCFC-142b

HCFC-142b	ODP	Metric tons	CE $/kg	Total Phase-out Estimated Funding (million US$)	Estimated Funding 2024–2026 (million US$)
5 Non-LVC					
Total	0.065	7,633	8.22	62.74	26.89

Scenario 4. HCFC-123

- Ten (11) countries had remaining HCFC-123 consumption. Ten (10) non-LVCs were considered. One LVC with very small consumption not accounted for in the scenario. For lack of information on the sector breakdown RTF assumed **all consumption in servicing** sector.
- The total (HCFC-123) estimated funding for the 2024–2026 triennium is at US$ 1.12 million (Table 4-5).

Table 4-5: Sector scenario – HCFC-123

HCFC-123	ODP	Metric tons	CE $/kg	Total Phase-out Estimated Funding (million US$)	Estimated Funding 2024–2026 (million US$)
10 Non-LVC					
Total	0.02	544	4.8	2.61	1.12

Scenario 5. HCFC-124

- Five (5) countries with remaining HCFC-124 consumption, potentially in RAC/Fire suppression. In the absence of information RTF used CE at US$ 4.8/kg.
- Total estimated cost (HCFC-124) for the 2024–2026 triennium is at US$ 1.02 million (Table 4-6).

Table 4-6: Sector scenario – HCFC-124

HCFC-124	ODP	Metric tons	CE $/kg	Total Phase-out Estimated Funding (million US$)	Estimated Funding 2024–2026 (million US$)
5 Non-LVC					
Total	0.022	495	4.8	2.38	1.02

Scenario 6. HCFC-225/HCFC225ca/cb

- Three (3) countries with remaining consumption in those chemicals are non-LVC countries. Consumption is potentially in solvent applications. RTF applied ODP values for different chemicals when calculating metric tonnes, such as: HCFC-225 (0.07), HCFC-225ca (0.025), HCFC-225cb (0.033).
- Total (HCFC-225, 225ca and 225cb) estimated funding is at US$ 0.25 million.

Table 4-7: Sector scenario – HCFC-225/HCFC-225ca/cb

HCFC-225/HCFC-225ca/cb	ODP	Metric tons	CE $/kg	Total Phase-out Estimated Funding (million US$)	Estimated Funding 2024–2026 (million US$)
3 Non-LVC					
Total	various	57	10.13	0.58	0.25

In summary, considering all scenarios, the total estimated funding for the 2024–2026 triennium to cover for the HCFCs eligible remaining consumption for the new HPMPs is **US$ 383.5 million without support costs** and **US$ 420.2 million with support costs.** Numbers may vary due to rounding.

4.3 ITEM 7: SCENARIO REMOVING THE HCFC PRODUCTION PHASEOUT MANAGEMENT PLAN (HPPMP) FOR INDIA

Item 7: "Consider scenario removing the HCFC production phase-out plan for India that is not included in the consolidated BP of ExCom;"

In the May 2023 report, the RTF assumed US$ 128,400 for India's Project Preparation for Stage I of HPPMP, and US$ 5.35 million for India's HPPMP in the period 2024–2026. In response to this item to consider removing India's HPPMP[23], the total funding for the 2024–2026 triennium for HCFC production sector is estimated at **US$ 23.3 million,** as summarised in Table 4-8.

This scenario reduces the updated 2024–2026 triennium estimated funding by **US$ 5.48 million**.

Table 4-8 Change in 2024–2026 triennium estimated funding based on Item 7 scenario removing India HPPMP (US$)

2024–2026 Triennium Estimated Funding: HCFC Production Sector		
	September 2023 Estimate (unchanged from May 2023)	**Item 7 Scenario without India HPPMP (US$)**
HCFC Production Sector Stage I PRP	$ 148,400	$ 20,000
HCFC Production Sector Stage I HPPMP	$ 5,351,600	$ -
HCFC Production Sector Stage II HPPMP	$ 23,232,000	$ 23,232,000
Subtotal – HCFC Production Sector (including support costs)	**$ 28,732,000**	**$ 23,252,000**
CHANGE IN ESTIMATED FUNDING BASED ON ITEM 7 SCENARIO		**($ 5,480,000)**

4.4 ITEM 8: REVIEW OF FUNDING REQUIREMENTS FOR HPMP PREPARATION FUNDING

Item 8: "Review the funding requirement for HPMP preparation funding to account for all the countries identified to require new HPMPs in the 2024–2026 triennium;"

[23] The only HCFC production line in India that was not a swing plant (i.e., HFL) was not economically viable and had closed. UNEP/OzL.Pro/ExCom/86/98*, Report of the Sub-group on the Production Sector.

In consultation with the MLFS, out of 58 countries that need HPMP for total phase-out, only 27 countries require new preparation projects (Table 4-9 below). The remaining 31 countries already have project preparation approved.

Table 4-9: 27 Countries Requiring HPMP Preparation Funds

Country	HCFC	HPMP PRP Required for Total Phase-Out	HPMP PRP Stage II in 2023–2025 Business Plan	HPMP PRP Stage III in 2023–2025 Business Plan	Funding Eligibility for Servicing (Excluding Support Costs) (US$)	Funding Eligibility for Manufacturing (Excluding Support Costs) (US$)
Afghanistan	Non-LVC	Yes			40,000	
Angola	LVC	Yes			40,000	
Bahrain	Non-LVC	Yes			30,000	
Bangladesh	Non-LVC	Yes			60,000	100,000
Cameroon	Non-LVC	Yes			60,000	
Central African Republic (the)	LVC	Yes	Yes		40,000	
China	Non-LVC	Yes			Case by case	
Democratic People's Republic of Korea (the)	Non-LVC	Yes			70,000	
Dominica	LVC	Yes	Yes		30,000	
Egypt	Non-LVC	Yes			70,000	
Iraq	Non-LVC	Yes			60,000	
Kuwait	Non-LVC	Yes		Yes	70,000	
Libya	Non-LVC	Yes			60,000	100,000
Mauritania	Non-LVC	Yes	Yes		30,000	
Morocco	Non-LVC	Yes			60,000	
Nigeria	Non-LVC	Yes			70,000	
Peru	Non-LVC	Yes			60,000	100,000
Qatar	Non-LVC	Yes			60,000	
Saint Kitts and Nevis	LVC	Yes	Yes		30,000	
Senegal	Non-LVC	Yes			40,000	
Serbia	LVC	Yes		Yes	30,000	
South Sudan	LVC	Yes	Yes		30,000	
Thailand	Non-LVC	Yes		Yes	90,000	250,000
Timor-Leste	LVC	Yes		Yes	30,000	
Tunisia	Non-LVC	Yes			60,000	
Turkmenistan	LVC	Yes		Yes	30,000	
Yemen	Non-LVC	Yes			90,000	200,000

The HPMP preparation is calculated at US$ 1.84 million (assuming US$ 500,000 for China) plus preparation for manufacturing sectors of US$ 750,000, totaling US$ 2.59 million, excluding support costs. Considering support costs at an average 9.6%, total is **US$ 2.84 million.**

CHAPTER 5 ADDITIONAL INFORMATION AND SCENARIOS: HFC

5.1 INTRODUCTION

This chapter addresses the following OEWG-45 Contact Group suggested items related to HFCs:

> ***Item 5. Include a scenario, wherein some Article 5 parties submit proposals to phase down HFCs in advance of applicable compliance targets in accordance with ExCom decisions 92/44 and 92/37;***
>
> ***Item 9. Develop a scenario estimating funding for KIPs for Group I and Group II countries which have ratified the Kigali Amendment assuming that 90% of Group I and 30% of Group II countries request funding;***
>
> ***Item 10. Add scenario for frontloading funding for KIPs during 2024–2026, taking into account the lessons learned from the implementation of HPMPs;***
>
> ***Item 11. Reviewing funding requirement for KIPs preparation funding to account for all the countries identified to require KIPs in the 2024–2026 triennium;***
>
> ***Item 12. A scenario prioritizing the manufacturing sectors for non-LVCs;***
>
> ***Item 13. When estimating the funding requirement for KIPs, apply cost effectiveness factors for manufacturing sectors that are based on historical experience under the MLF and/or a technical assessment of the costs to transition to alternatives, taking into account any available information from MLF documents, previous TEAP reports and other sources and ExCom agreed cost guidelines.***
>
> ***Item 14. Review the funding requirement for the phase-down HFC production and HFC-23 by-product mitigation, based on a technical assessment of the costs, to the extent possible, taking into account the experience with such projects under the MLF and the past funding practice in the production phase-out/down projects;***
>
> ***Item 15. A scenario for funding 10 to 15 individual investment projects;***
>
> ***Item 16. A scenario to address the challenges for SMEs including safety issues, including in the installation and assembly sectors in implementation of KIPs;***
>
> ***Item 17. Evaluate the potential cost implications of leapfrogging and/or taking early action to phase down HFCs in advance of compliance targets;***

5.2 ITEM 5: SCENARIO FOR SOME A5 PARTIES TO SUBMIT PROPOSALS IN ADVANCE OF COMPLIANCE TARGETS

Item 5: "Include a scenario, wherein some Article 5 parties submit proposals to phase down HFCs in advance of applicable compliance targets in accordance with ExCom decisions 92/44 and 92/37;"

For item 5, RTF considered scenarios wherein some A5 parties submit proposals to phase down HFCs in advance of applicable targets in accordance with ExCom decisions 92/44 and 92/37 and the estimated KIPs that might be included in the 2024–2026 triennium. RTF only considered Group 1 countries.

The RTF analysed the HFC baseline and average 2020-2022 HFC consumption (reported under A7 or estimated by the RTF using its previous methodology for addressing HFC data gaps) for each country and by country brackets. Based on best available current consumption data, the RTF estimated the amount of room for growth that countries may have before reaching the 10% reduction compliance target at the end of 2028 (meaning by 1 January 2029).

RTF estimated 2028 consumption using a 3% growth rate compounded for 7 years (i.e., 2021-2028), which equals 23% growth. This value, representing 2028 consumption, was compared to an accelerated 2028 compliance target of 80% of the baseline (20% reduction), which advances the phase down by 10%.

RTF assumed that Group 1 countries whose projected 2028 consumption was 50% lower than the accelerated 2028 compliance target of 80% of baseline, or 20% reduction from the baseline, might pursue a KIP in support of advanced phase-down. Fourteen (14) countries fit under this scenario, mainly LVCs (12). Group 2 countries were excluded based on these criteria.

For this scenario, with an estimated shift forward KIP funding from future triennia for these 14 countries, the increase in the 2024–2026 triennium is approximately **US$ 4,861,000**, reducing global HFC consumption by 10MtCO_2eq**.**

During the analysis to determine scenarios where some A5 parties might submit proposals to take early action in advance of compliance targets, RTF also examined priorities parties might select in their KIPs. RTF considered refrigerant transitions in the 2024–2026 triennium, and refrigerant transitions from 2028. Figures 5-1 and 5-2 provide examples of outcomes depending on the timing of the transition for the average Bracket E (LVC) party. The figures highlight some of the differences in outcomes in HFC consumption depending on the timing that replacements start for the servicing sector.[24]

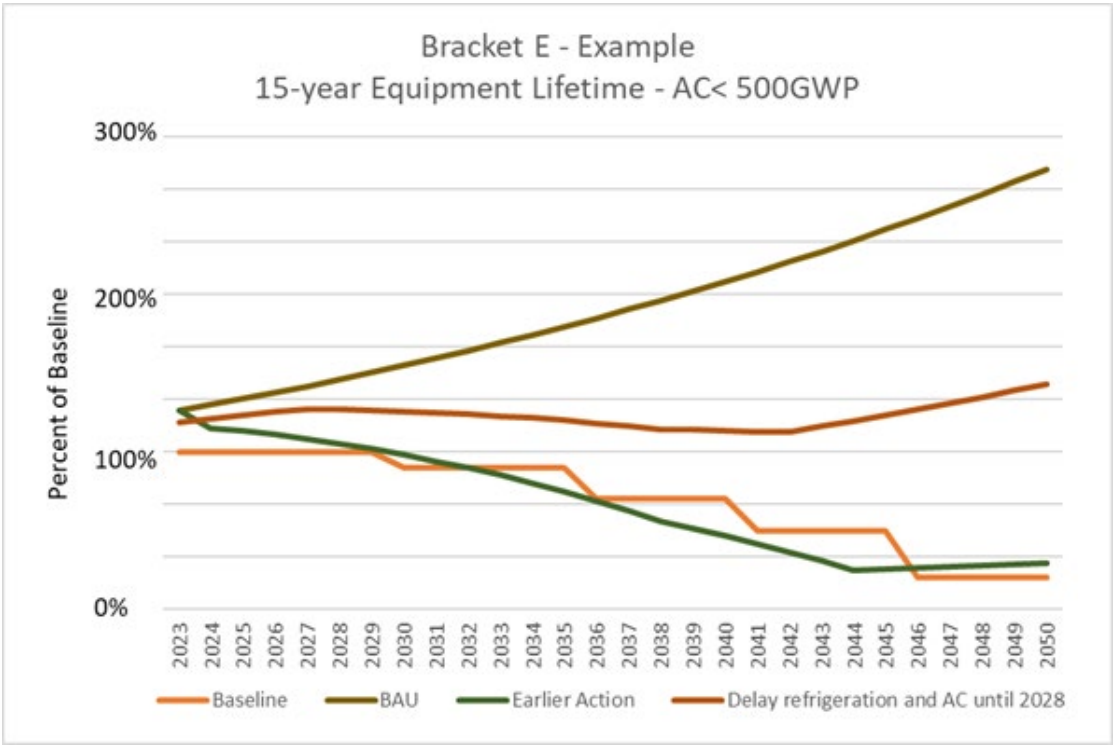
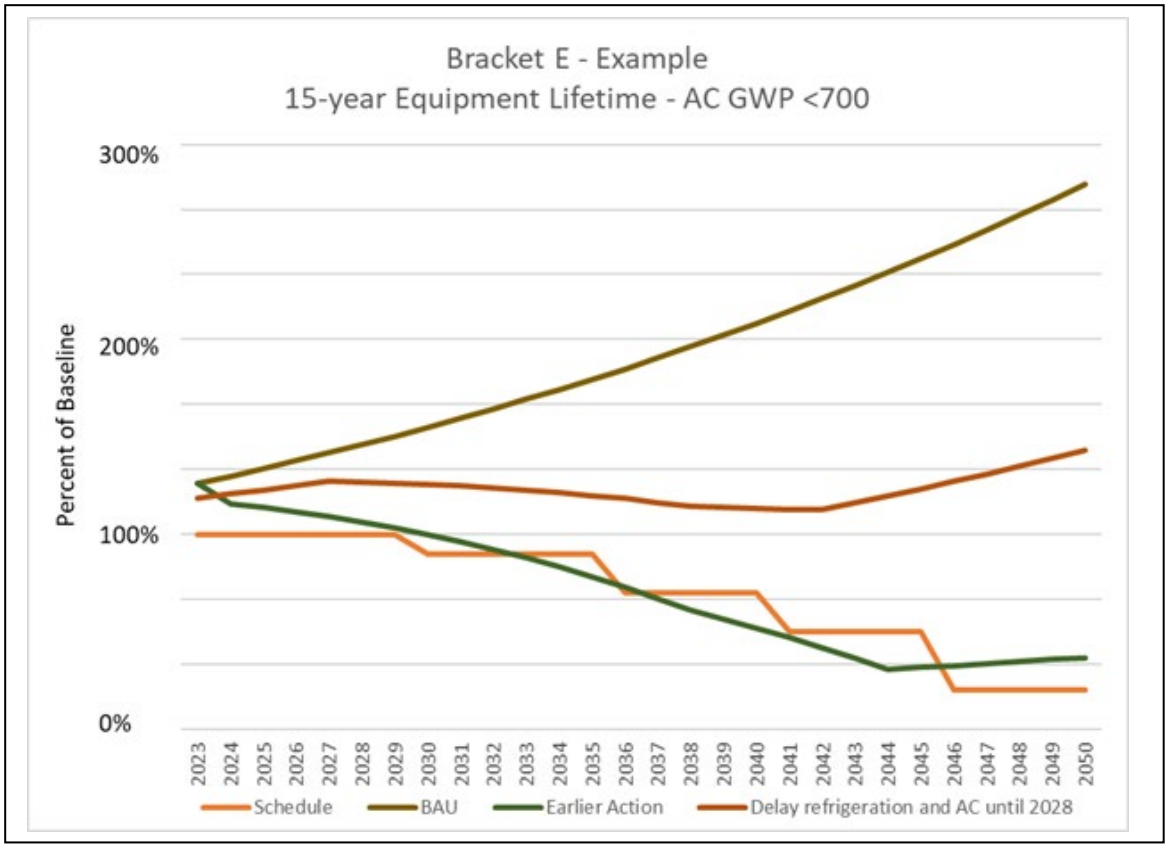


Figure 5-1 Time-dependent Outcomes Equipment Replacement for Bracket E Parties using refrigerant <700 GWP for Air Conditioning

[24] For this average case, a replacement rate for a 15-year lifetime of 7.5% per year was used for mobile and stationary air conditioning and commercial refrigeration to indicate consumption for this and future triennia. Two different refrigerants were assumed to be used as replacements for R-410A, as shown in the graphs below, R-32 and R-454b.



In Figures 5-1 and 5-2, the business as usual (BAU) cases estimate consumption if no action is taken to transition to lower GWP HFC alternatives in any market. The line titled "Delay refrigeration and AC until 2028" is a consumption estimate associated with replacement of higher GWP refrigerants in stationary AC and commercial refrigeration starting in 2028 and spanning 15 years. The "Earlier Action" curves provide an estimate of average consumption if replacements start in 2024 and span 15 years.

HCFC consumption in Bracket E parties is primarily used to service mobile and stationary air conditioning (AC) and refrigeration equipment. This equipment has a natural lifetime of over 20 years, which results in a significant "servicing tail", requiring continuing supply of current refrigerants.

Many of the parties with significant servicing requirements and a baseline that is lower than or close to 2022 consumption may wish to consider incorporating refrigerant conversion in their KIPs. This may be of interest, especially considering the need for preparation to use many lower-GWP, flammable refrigerants. Parties may also wish to consider including equipment replacement projects in KIPs.

5.3 ITEM 9: SCENARIO ASSUMING 90% COUNTRIES IN GROUP 1 AND 30% GROUP 2 REQUEST FUNDING

Item 9: "Develop a scenario estimating funding for Kigali HFC Implementation Plans (KIPs) for Group 1 and Group 2 countries which have ratified the Kigali Amendment assuming that 90% of Group 1 and 30% of Group 2 countries request funding;"

For item 9, RTF assumed 90% of Group 1 estimated funding for KIPs and 30% of Group 2 estimated funding for KIPs which totals US$ 488,493,000, including 9.6% support costs. This is summarised in Table 5-1.

This reduces the updated estimated funding for the 2024–2026 triennium by approximately **US$ 124 million**.

Table 5-1. Change in 2024–2026 triennium estimated funding based on Item 9 scenarios

2024–2026 Triennium Estimated Funding (September 2023)			Item 9 Scenarios	
HFC RTF Estimated KIPs: Group 1 (90% scenario)	$	569,643,000	$	476,896,000
HFC RTF Estimated KIPs: Group 2 (30% scenario)	$	0	$	11,597,000
SUBTOTAL	**$**	**569,643,000**	**$**	**488,493,000**
CHANGE IN ESTIMATED FUNDING BASED ON ITEM 9 SCENARIOS				**($ 123,938,000)**

5.4 ITEM 10: SCENARIO FOR FRONTLOADING FUNDING FOR KIPS

Item 10: "Add scenario for frontloading funding for KIPs during 2024–2026, taking into account the lessons learned from the implementation of HPMPs;"

Informed by the lessons learnt in the implementation of HPMPs, RTF indicated in section 3.5.1 of its May 2023 report that there are challenges related to achieving sustainable financial flow to enable implementation of KIPs activities, specifically in LVCs and VLVC countries. Those may need resources to be frontloaded. OEWG-45 included in the list of suggestions to the RTF Supplementary Report the request to add a scenario for frontloading funding for KIPs.

HPMPs were frontloaded by an average of 15% for stage I, as was shown in the RTF May 2023 report section 3.5.2, to achieve a 10% reduction in consumption. KIP Stage I also covers a 10% reduction step but extends till 2030, a period of seven years. RTF presented that, in general, stage I could cover 28% of the total KIP budget according to the proportion of years to the phase-down. In responding to Item 10, RTF assumed that, based on the challenges faced by LVCs detailed in sections 3.4.1 and 3.4.2 of the RTF May 2023 report, LVCs may need to be frontloaded by 50% in stage I. In order to achieve this 50% frontloading, RTF first estimated funding for KIPs for LVCs as US$ 174,833,000 with support costs and calculated 50%, which amounts to US$ 87,416,000. Assuming that tranche 1 of Stage I would coincide with the 2024–2026 triennium and that tranche 1 is 50% of stage I, frontloading by LVCs is calculated at **US$ 43,708,000.**

This scenario increases the updated estimated funding for the 2024–2026 triennium by **US$ 30,706,000**.

5.5 ITEM 11: REVIEW FUNDING REQUIREMENTS FOR KIPS PREPARATION

Item 11: "Reviewing funding requirement for KIPs preparation funding to account for all the countries identified to require KIPs in the 2024–2026 triennium;"

RTF reviewed funding requirements for KIPs preparation for Stage I, using information by country, provided by the MLFS in Annex 6. Total funding for all countries is US$ 8,565,000. Reducing this by US$ 3,380,000 for countries that already received project preparation in 2023 or are scheduled to submit project preparation request at ExCom-93, leaves US$ 5,185,000 for countries identified to require KIPs in the 2024–2026 triennium. Project preparation funding estimates include preparation for investment projects as well as KIPs preparation. For the 2024–2026 triennium, the estimated funding is **US$ 6,768,000** including support costs.

RTF used the above updated information which increased the estimated funding for "HFC Prep Costs (including gender mainstreaming at US$ 13,590,000)" by **US$ 3,556,000**, so the updated total for this cost element is US$ 20,358,000.

5.6 ITEM 12: SCENARIO PRIORITISING MANUFACTURING SECTORS

Item 12: "A scenario prioritizing the manufacturing sectors for non-LVCs;"

For item 12, RTF considered scenarios wherein A5 parties submitted proposals prioritising different manufacturing sectors for earlier transition considering both compliance for the non-LVC party, preparedness for future transitions, and needs of other parties that may purchase products from the manufacturing non-LVC parties. HFC guidelines for manufacturing sector conversions are still under development, and no manufacturing sector KIPs have been approved yet, so the RTF provides this qualitative assessment.

If non-LVC parties were to prioritise converting non-refrigerant sectors, such as foams and aerosols (excluding metered-dose inhalers or MDIs) there could be a near-term benefit in reducing consumption for the non-LVC party. However, if air conditioning and refrigeration manufacturing sectors were prioritised, this could benefit the non-LVC party by reducing consumption, and for any parties (e.g., LVCs) that receive exported equipment containing low-GWP refrigerants, reducing their demand for refrigerants to service new equipment. For all parties, the challenge of the servicing tail can be mitigated by converting manufacturing sectors to low-GWP refrigerants early in the phasedown with parallel support provided to prepare the servicing sector to safely use the alternatives.

Mobile air conditioning, domestic refrigeration, and some refrigeration systems could potentially be prioritised that use low-GWP substitutes that may be either ASHRAE A1 class refrigerants or small charges of flammable refrigerants. Note that investment for use of flammable refrigerants would likely be required to adhere to best practices (e.g., safety standards, training, building codes).

5.7 ITEM 13: FUNDING REQUIREMENTS FOR KIPS APPLYING CE FACTORS FOR MANUFACTURING SECTORS

Item 13: "When estimating the funding requirement for KIPs, apply cost effectiveness factors for manufacturing sectors that are based on historical experience under the MLF and/or a technical assessment of the costs to transition to alternatives, taking into account any available information from MLF documents, previous TEAP reports and other sources and ExCom agreed cost guidelines."

For this item, the RTF considered the historical **experience of economies of scale** for Brackets A and B countries with manufacturing sectors and the average CE factors for Stage I and Stage II HPMPs. For servicing, RTF used the CE value agreed at ExCom-92. Table 5-2 shows the updated RTF CE factors used following its methodology in the May 2023 RTF Report.

Table 5-2 RTF Cost-effectiveness Values Used for Countries in Brackets A to D (September 2023)

	Servicing ($/kg)	Domestic Ref. ($/kg)	ICR ($/kg)	Stationary AC ($/kg)	MAC ($/kg)	Foam XPS ($/kg)	Foam PUR ($/kg)	Aerosol ($/kg)	Fire Sup. ($/kg)	Solvents ($/kg)
Bracket A	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
Bracket B	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
B Group 2	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
Bracket C	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
C Group 2	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
Bracket D	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
D Group 2	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12

For a scenario, based on historic experience and expert opinion, the RTF applied 25% CE factor adjustment across manufacturing sectors for Brackets A and B countries (except for servicing) to derive an estimated funding for KIPs to be **US$ 463,993,000,** including support costs.

Table 5-3 shows CE values for this scenario based on historical experience for the manufacturing sector only.

Table 5-3 Item 3 Scenario: 25% Adjustment to CE Values for Manufacturing Sectors only

	Servicing ($/kg)	Domestic Ref. ($/kg)	ICR ($/kg)	Stationary AC ($/kg)	MAC ($/kg)	Foam XPS ($/kg)	Foam PUR ($/kg)	Aerosol ($/kg)	Fire Sup. ($/kg)	Solvents ($/kg)
Bracket A	$ 5.10	$ 10.32	$ 10.13	$ 11.63	$ 6.38	$ 6.17	$ 6.75	$ 3.75	$ 3.00	$ 21.84
Bracket B	$ 5.10	$ 10.32	$ 10.13	$ 11.63	$ 6.38	$ 6.17	$ 6.75	$ 3.75	$ 3.00	$ 21.84
B Group 2	$ 5.10	$ 10.32	$ 10.13	$ 11.63	$ 6.38	$ 6.17	$ 6.75	$ 3.75	$ 3.00	$ 21.84
Bracket C	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
C Group 2	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
Bracket D	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12
D Group 2	$ 5.10	$ 13.76	$ 13.51	$ 15.50	$ 8.50	$ 8.22	$ 9.00	$ 5.00	$ 4.00	$ 29.12

This scenario reduces the updated estimated funding for the 2024–2026 triennium by **US$ 105,651,000.**

5.8 ITEM 14: REVIEW THE FUNDING REQUIREMENTS FOR HFC PRODUCTION PHASE-DOWN AND HFC-23 BY-PRODUCT MITIGATION

Item 14: "Review the funding requirement for the phase-down HFC production and HFC-23 by-product mitigation, based on a technical assessment of the costs, to the extent possible, taking into account the experience with such projects under the MLF and the past funding practice in the production phase-out/down projects;"

5.8.1 HFC Production Data Update

According to A7 and CP data (as of July 2023), three parties (China, DPRK and India) produced 766,109.31 MT HFCs in 2021 (excluding HFC-23) [25]. Tables 5-4 and 5-5 provide the details of the chemicals of HFC production for controlled uses, both in MT and in CO_2eq tonnes (3 years), in the three countries.

Table 5-4 2021 HFC Production by Chemicals (MT)*

	China	DPRK	India	Total
HFC-32	239,030.99		9,598.75	**248,629.74**
HFC-41	45.74			**45.74**
HFC-125	172,433.81		4,993.53	**177,427.34**
HFC-134a	200,706.60	357	11,580.59	**212,644.19**
HFC-143a	53,208.68			**53,208.68**
HFC-152a	30,078.07			**30,078.07**
HFC-227ea	30,371.73			**30,371.73**
HFC-236ea	99.9			**99.9**
HFC-236fa	552.36			**552.36**
HFC-245fa	13,051.56			**13,051.56**

[25] RTF notes that A7 data report of one country for 2021 included HFC-23 by-product generated during the production of HCFC-22 as well as HFC-23 that was intentionally produced and captured.

Total	**739,579.44**	**357**	**26,172.87**	**766,109.31**

Note: * from A7 data

Table 5-5 2019-2021 HFC Production in MT and CO_2eq tonnes

HFC Production for controlled uses in MT and CO_2-eq tonnes*						
	2019		**2020**		**2021**	
	MT	**CO_2-eq tonnes**	**MT**	**CO_2-eq tonnes**	**MT**	**CO_2-eq tonnes**
China	N/A	N/A	663,092.74	1,194,073,505	739,579.44	1,410,246,955
DPRK	301	430,430	347	496,210	357	510,510
India		N/A	N/A	N/A	26,172.87	40,516,755
Total	**301**	**430,430**	**663,439.74**	**1,194,569,715**	**766,109.31**	**1,451,274,219**

*CO2-eq tonnes from the website of OS, https://ozone.unep.org/countries/data-table; and MLFs; excluding the HFC-23.

5.8.2 Cost Estimations for HFC Production Sector Phase-down

There will not be guidelines available for HFC production sector phase-down according to UNEP/OzL.Pro/ExCom/92/56: "the Sub-group had agreed not to develop HFC production sector guidelines, but rather that projects to phase down HFC production would be considered on a case-by-case basis, as there were very few Article 5 countries with HFC production" [26].

The "Guide for the Presentation of Tranches of HCFC Production Sector Phase-out Management Plan"[27] states that, "request for funding a tranche should be submitted only when there is a significant level of implementation of activities initiated with previously approved tranches, and where the rate of disbursement of funding from the previously approved tranche has reached 20 per cent", meaning that, tranches of funding can only be provided after previous year reduction targets have been achieved and verified.

Because there is very limited information available for assessing the CE of the HFC production phase-down, RTF draws the experiences from the HCFC production sector phase-out and the HPPMP, and CE values as the references for estimation funding requirements of the HFC production sector.

At ExCom-32, the ExCom reached a decision concerning the timing of project preparation funding approval for the ODS production sector. It was decided that the current procedure of approving project preparation funding after the completion of technical audit should continue to be applied (decision 32/78)[28]. The time required to undertake a technical audit and to then prepare projects in the production sector varies.

Previous RTF reports had assessed the costs of phase out of HCFC production. In its 2014 report[29], US$ 0.8/kg was estimated for China's HCFC production sector and ranged from US$ 1 to US$ 1.5/kg for the HCFC production phase-out in other countries (DPRK and India, for example). In UNEP/OzL.Pro/ExCom/82/68[30] the CE of China's HCFC production phase-out was US$ 0.86/kg. At its 87th meeting, the Executive Committee approved the stage II HPPMP for China at a CE of US$ 0.3/kg[31].

[26] UNEP/OzL.Pro/ExCom/92/56. Report of the Ninety-second Meeting of the Executive Committee
[27] MLF/IACM.2018/2/17 Guide for the Presentation of Tranches of HCFC Production Sector Phase-out Management Plan
[28] UNEP/OzL.Pro/ExCom/32/44/Corr.1. Report of the 32nd Meeting of the Executive Committee and Corrigendum 1.
[29] Supplement to the May 2014 TEAP XX/8 Task Force (Replenishment) Report: "Assessment of the Funding Requirement for the Replenishment of the Multilateral Fund for the Period 2015-2017"
[30]UNEP/OzL.Pro/ExCom/82/68. The cost-effective options for controlling HFC-23 By-Product Emissions
[31] UNEP/OzL.Pro/ExCom/87/58* , Report of the Eighty-seventh Meeting of the Executive Committee.

RTF notes the HFC production phase-out cost at US$ 0.86/kg for China (which accounts for over 96.5% of HFC production), and US$ 1.5/kg for DPRK and India. It is necessary to note here, the cost estimation is directly related to the production capacity and the basis for the calculation of compensation for production closure.

By converting the CE of HFC production in $/kg to CE in $/$CO_2$eq tonnes of HFC production, the RTF derived a CE for China of approximately US$ 0.44/ton of CO_2eq tonnes, and US$ 0.78/ton of CO_2eq tonnes for DPRK and India.

Following the HFC production control schedule, and in line with past practice mentioned above on approving project preparation funding after the completion of technical audit, in this supplementary report, RTF assumes and applies the same approach of HFC consumption phase-down. Group 1 countries (China and DPRK) need to reduce by approximately 6%, and the single country in Group 2 (India) needs to reduce by 2.86% [32]of their baseline production during 2024–2026.

Table 5-6 presents the estimated funding requirement of **US$ 13.7 million** for HFC production during the triennium 2024–2026.

Table 5-6 Total Phase-out Cost Estimation for HFC Production Sector for 2024–2026

2024–2026 Triennium Estimated Funding: HFC Production Sector						
Country	**Baseline of HFC production, CO2eq tonnes**	**Reduction from baseline % GROUP 1 & 2**	**CO_2eq tonnes reduced**	**Cost per kg of HFC production (US$/kg)**	**Cost per CO_2eq tonnes (US$/ton)**	**Cost estimation 2024–2026 (US$)**
China	1,371,610,161	6.00	82,296,610	0.3	0.15	12,344,491
DPRK	510,168	6.00	30,610	1.50	0.78	23,876
India	57,455,146	2.86	1,643,217	1.50	0.78	1,281,709
TOTAL	**1,429,575,475**		**83,970,437**			**13,650,076**

5.8.3 Update of HFC-23 by-product Mitigation based on MLF Experiences and Previous Funding Practices

In its May 2023 report, RTF combined the information on production/generation and emissions of HFC-23. By reviewing the A7 data and CP data by July of 2023, Sep 2023 RTF report further clarified that the amount of HFC-23 emissions reported by those countries in 2021 is: Argentina (33.31 MT), China (1,089.95 MT), India (0.00 MT), DPRK (8.40MT) and Mexico (128.52MT) respectively[33] .

RTF notes that India reported zero emissions of HFC-23 and also reported 607.6 MT production/generation of HFC-23 in 2021. RTF reviewed the ExCom discussion on CE for controlling HFC-23 for Argentina and Mexico, and the HFC-23 funding approved (Table 5-7), as below.

- In ExCom-82[34], responding to Decision 81/68(e), the cost-effective figures for controlling HFC-23 by-product emissions was discussed. By estimating, the overall cost-effectiveness (CE) of closure of CFC production projects and HPPMPs, MLFs assessed the CE for CFC project, (including the additional funding provided for the accelerated phase-out for some of the plans),

[32] Without knowing the audit and verification status, RTF apply the same annual reduction rate for HFC consumption sector

[33] Cited from the Country Programme Data and Prospects for Compliance. UNEP/OzL.Pro/ExCom/91/8 and UNEP/OzL.Pro/ExCom/92/5

[34] UNEP/OzL.Pro/ExCom/82/68. The cost-effective options for controlling HFC-23 By-Product Emissions

ranges from US$ 2.88/kg to US$ 3.86/kg, with an average CE of US$ 3.45/kg; and US$ 0.86/kg is the overall CE for China's HPPMP project, and US$ 0.3/kg for stage II of the HPPMP in China[35]. "The Secretariat compared the cost of HFC-23 by-product emission control through swing plant closure and on-site incineration, using the CE of the previously approved production phase-out projects and the range of IOCs estimated by the independent consultant for a 400 mt/yr and an 800 mt/yr destruction facility (i.e., between US$ 1.80/kg and US$ 4.37/kg)";

- Table 5-7 summaries the analysis for HFC-23 projects approved for Argentina and Mexico.
  a. The overall CE of approved projects is US$ 6.28/kg and US$ 4.19/kg for Argentina and Mexico, respectively;
  b. A maximum amount of incremental operating costs (IOCs), out of the total funding approved was given and would be divided into annual tranches to be provided to the parties concerned upon verification of the quantity of HFC-23 by product destroyed; and the IOC is 22% and 78% of the total funding approved for Argentina and Mexico, respectively;
  c. The IOCs in each annual tranche is calculated by multiplying the number of kilogrammes of HFC-23 destroyed by US$ 1.4/kg and US$ 3.28/kg for Argentina and Mexico respectively
  d. Agency support cost is 7% of the total funding approved.

Table 5-7 The HFC-23 Projects Approved for Argentina and Mexico

	Total HFC-23 addressed (kg)	Total funding approved (US$)	Total Funding CE (US$/kg)	IOC approved (US$)	CE OF IOC US$/kg	% IOC in total cost	Agency support cost approved (US$)	Agency support cost (%)
Argentina	360,378	2,262,630	6.28	502,766	1.40	22.20	158,384	7.00
Mexico	9,669,876	3,833,384	4.19	2,995,047	3.28	78.00	268,337	7.00

Note: based on the information available for the agreements on HFC-23 for Argentina and Mexico

5.8.4 Cost Estimations for HFC-23 by-product Mitigation for 2024–2026 Triennium

US$ 43,000 for project preparation and US$ 8 million for HFC-23 mitigation project in India is included in the Adjusted Consolidated BP of the MLF 2023–2025[36]. In UNEP/OzL.Pro/ExCom/92/55, the representative of India confirmed the Government's intention to submit a project preparation request for HFC-23 to the ExCom-93[37]. RTF was unable to predict if this request would be approved at a future meeting and provides a range of **US$ 0–43,000.** The May 2023 RTF Report also included US$ 8 million for India's HFC-23 emissions control investment project. India has reported zero emissions and 607.6MT production of HFC-23 for 2021, under A7 reporting and CP data. RTF is unable to judge whether and how much of those 607.6 MT HFC-23 generated are eligible for mitigation assistance from the MLF. RTF has assumed that all of the reported 607.6MT is eligible for MLF funding, subject to audit and verification.

Considering the timetable for project preparation and approval, RTF assumes that India's HFC-23 mitigation investment project will be submitted and approved during 2024–2026 and will start to be implemented in 2026. Based on the discussion on CE, and the approvals of Argentina's and Mexico's projects in the previous section (5.8.3), RTF estimates the cost for India's HFC-23 mitigation within the range of US$ 4.19/kg to US$ 6.28/kg. The funding requirement for India's HFC-23 is estimated at **US$ 2.7- 4.1 million** (including agency support costs) for the triennium 2024–2026 (Table 5-8).

Table 5-8 Cost Estimation for India's HFC-23 Emission Mitigation Investment Project (US$)

	CE=US$ 4.19/kg	**CE=US$ 6.28/kg**

[35] UNEP/OzL.Pro/ExCom/87/58. Report of Eighty-seventh Meeting of the Executive Committee.
[36] UNEP/OzL.Pro/ExCom/91/22 and UNEP/OzL.Pro/ExCom/92/11
[37] UNEP/OzL.Pro/ExCom/92/55. Report of the Sub-Group on the Production Sector

Cost of HFC-23 investment project (2026)	2,545,844.00	3,815,728.00
Agency Support Cost 7%	178,209.08	267,100.96
Subtotal - HFC-23 mitigation investment project for India	**2,724,053.08**	**4,082,828.96**

5.8.5 Total Funding Requirements for HFC Production Sector Phase-Down and HFC-23 Mitigation for the Period 2024–2026

The total funding required for the phase-down of HFC production and HFC-23 mitigation is estimated at a range of **US$ 20.1–21.5million** for the 2024–2026 triennium. This estimation is summarised in Table 5-9.

This scenario reduces the total 2024–2026 triennium estimated funding by **US$ 10.3-11.7million**.

Table 5-9 Estimated Funding Requirements for HFC Production Sector Phase-down and HFC-23 Mitigation for the Triennium 2024–2026 (US$)

	September 2023 US$	Estimation of Scenario of Item 14 US$	Potential change by Item 14 to updated funding requirement 2024–2026 US$
HFC Production Sector Prep	2,000,000	2,000,000	0
HFC Production Sector KPPMP	20,000,000	13,650,076	(6,349,924)
HFC-23 Mitigation Prep	193,000	150,000–193,000	(43,000–0)
HFC-23 Mitigation Approved (Argentina and Mexico)	1,613,571	1,613,571	0
RTF estimated HFC-23 investment project (India)	8,000,000	2,724,053–4,082,828	(5,275,947–3,917,171)
Subtotal – HFC Production and HFC-23 Sector	**31,806,571**	**20,137,700 –21,539,475**	**(11,668,871–10,267,095)**

5.9 ITEM 15: SCENARIO FOR FUNDING 10-15 INDIVIDUAL INVESTMENT PROJECTS

Item 15: "A scenario for funding 10-15 individual investment projects;"

Parties requested RTF to provide a scenario for 10-15 investment projects. Using the same framework in addressing Item 18 (see Section 6.2 on EE pilot projects), RTF looked at the same sectors to respond to this request without computing energy efficiency additional costs and excluding servicing sector.

1. Residential and Commercial AC and HP Sector

Residential and commercial AC and heat pump (HP) sector conversions from HFCs to HC-290 (propane) while maintaining EE; assuming units up to 7 kW capacity with need for coordination and costs associated with supply chain, manufacturing, and service with a conversion project duration of 1 to 2 years.

a) Large enterprises

Large enterprises of AC and HPs typically produce 200,000 units per year or more and have in-house testing capabilities. A typical project will incur US$ 1,500,000 for production line conversion, factory safety upgrades, and product development team which include mechanical design, simulation, fluid dynamics and analysis, electrical and electronics, testing for performance, reliability and safety; as

well as additional external testing involved for certification needs. Additional series conversion cost would be significantly reduced by the learning curve – at least by 25%. Furthermore, the in-house testing laboratory would need to be upgraded to ensure its compatible with flammable refrigerants (up to US$ 750,000) including any additional updates for ISO 17025 conformity. Typical manufacturing and training for safe operation and maintenance of units with flammable refrigerants would cost up to US$ 400,000 depending on the technology of choice and the buy-versus-make decision. As such, the total additional capital cost investment range from US$ 1,500,000 to US$ 2,650,000 + incremental cost for large enterprises to cover the cost of components used to operate with flammable refrigerants.

b) SME

SME in the AC and HP sector typically produce 75,000 units per year or less and rely on third party laboratory testing capabilities. They typically rely on third party technologies and have minimal product development costs – however additional incremental cost for energy efficiency would be higher than that for large enterprises. A typical project will incur US$ 750,000 for production line conversion, factory safety upgrades, and the product development team which include external consultants, production engineer; as well as additional external testing involved for certification needs. Additional series conversion cost would be significantly reduced by the learning curve – at least by 25%. Third party laboratory testing would add approximately US$ 150,000 for set-up and testing (assumes two rounds of 10 tests for 3 SKU at US$ 750 each). Typical manufacturing and training for EE enhancement would cost up to US$ 400,000 depending on the technology of choice and the buy-versus-make decision. As such, the total additional capital cost investment range from US$ 800,000 to US$ 1,200,000 + incremental cost for SMEs targeting the use of enhanced EE low GWP AC and HPs.

2. Domestic Refrigeration and/or SCCR

In this example, we consider domestic refrigeration and/or self-contained commercial refrigeration (SCCR) sector conversion to A3 refrigerants while maintaining EE. Abdelaziz et al. 2020, showed that the ICC varies based on the size of the production line (varies from US$ 400,000 to US$ 2,000,000) while the IOC is typically marginal since the there is no added cost of refrigerant and the compressors for alternative low GWP refrigerants are within the same cost of baseline compressors.

3. Distributed Commercial Refrigeration with Remote Condensing Units

In this example, we consider pilot projects for distributed systems and condensing units in the form of technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP systems to improve their energy efficiency during construction, retrofit, commissioning, or recommissioning. The primary costs involve consultants providing technical assistance to upgrade capacity to develop higher EE systems and install them properly to maximise EE performance, including in some cases costs related to installation start-up engineer. While economies of scale may be possible for non-LVC where consultants can be engaged for multiple projects, there is assumed to be less opportunity for economies of scale in LVC countries.

Table 5-10 summarises the potential individual investment projects. This scenario for item 15 is estimated at **US$ 21 million for 14 projects as per examples given.**

Table 5-10 Potential Individual Investment Projects

Sector	Cost per project (excluding project preparation and support costs)	Total Cost, US$
1. Residential and commercial AC and HP sector conversions from HFCs (assumes conversion to A3)	Up to 2 large ACHP enterprises with project cost of up to US$ 3,500,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support. Up to 2 small and medium ACHP enterprises with project cost of less than US$ 2,000,000 including additional capital and operating cost for product development and operating cost.	11.0 million (Up to 4 projects)
2.1. Domestic refrigeration and/or stand-alone commercial refrigeration sector (assumes conversion to A3)	Up to 2 large enterprises with project cost of up to US$ 2,000,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support.	7.0 million (Up to 4 projects)
2.2 Stand-alone commercial refrigeration sector	Up to 2 SME and large enterprises with project cost of up to US$ 1,500,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support.	
3.1 [racks -- distributed systems and condensing units] Technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP	~US$ 50K per country for policy & awareness ~US$ 45-150K for study tours ~US$ 200-800K (for non-LVC with multiple enterprises) for consultants to provide technical assistance to upgrade capacity to develop higher EE systems and install properly	2.0 million (4 regional projects)
3.2 [industrial refrigeration] Technical assistance for assembly and installation of large industrial refrigeration and/or ACHP	Training costs related to maintaining EE, e.g., ~US$ 50K per country for policy & awareness ~US$ 50-150K for study tours	1.0 million (2 regional projects)
TOTAL		**21 million (14 projects)**

5.10 ITEM 16: ADDRESSING CHALLENGES FOR SMES

Item 16: "A scenario to address the challenges for SMEs including safety issues, including in the installation and assembly sectors in implementation of KIPs;"

5.10.1 History of support for SMEs

In the early stages of the Montreal Protocol, Parties realized that industrialised countries would have to assist those that are not. SMEs in Article 5 countries, in particular, would require more assistance "to make the transition to non-ODS technologies avoiding severe economic and social dislocations. [And,] because of their smaller-scale, SME ODS phaseout investment projects will usually not be as cost-effective as for larger companies. On the other hand, this very same SME feature provides greater flexibility and adaptability for SMEs to switch to new technologies and to respond to the requirements of their clients."

- Document UNEP/OzL.Pro/ExCom/19/54 (12 April 1996) defined SMEs, addressed their challenges, and recommended higher cost effectiveness thresholds to meet those challenges.
- Document UNEP/OzL.Pro/ExCom/20/61 (16 September 1996) recommended that small operators in LVCs should be grouped and financed under special allocation for the LVCs.

- Document UNEP/OzL.Pro/ExCom/22/69 (27 April 1997) estimated the size of the population of SMEs on a sector, sub-sector basis and the impact of approved projects disaggregated by size of industry
- Document UNEP/OzL.Pro/ExCom/92/45 and in line with decision 91/64(b), provides information to assist the Executive Committee in defining "small and medium-sized enterprises" in the commercial air-conditioning manufacturing and commercial refrigeration manufacturing sectors. The Executive Committee has not yet come to consensus on such a definition.

5.10.2 Assembly and Installation subsector

The local assembly and installation subsector is not exactly manufacturing, nor exactly servicing. Main highlights for the RAC sector which is the focus of RTF.

- Addressing this subsector could facilitate the introduction of low-GWP technologies and promote safe and appropriate installation practices to optimize energy-efficient operation of the systems
- There is limited information available
- Assembly enterprises design and/or select, assemble, and install prefabricated components in the commercial or industrial refrigeration applications or in AC systems and charge them with refrigerant
- The assembler/installer normally influences the customer choice of refrigerant used
- Assemblers have no production lines found at manufacturers plants
- Enterprises need to invest in tools, equipment, product development capabilities, and training of personnel

At its 31st meeting (July 2000), the Executive Committee defined the assembly, installation and charging subsector and agreed on guidelines for the calculation of incremental costs (decision 31/45). Additional guidance was agreed at the 62nd meeting (decision 62/14). Since then, activities in this subsector have been approved in the context of umbrella projects or phase-out plans where the specific conditions of the enterprises assembling the equipment were not known in detail[38].

Document UNEP/OzL.PRO/ExCom/92/49 (27 April 2023) on the local installation and assembly subsector defines enterprises in this subsector as generally locally owned and predominantly small and medium-sized, designing and installing cold stores and single cabinets with remote condensing units, but can also include large enterprises with in-house design departments that design and install complete supermarket systems with machine rooms, multiple display racks and online monitoring. The support to convert local assembly and installation enterprises to low-GWP alternatives would include technical assistance, capacity building, and training of staff in the design of systems using alternative technologies and in the handling of alternative refrigerants that are flammable, toxic and under high pressure.

The document mentioned defines the main challenges faced by these enterprises as a) lack of standards for RAC equipment and components based on refrigerants that are flammable, toxic or under high pressure; b) wider availability and lower cost of RAC equipment and components based on high-GWP HFCs; c) the lack of regulations or policies to incentivize the uptake of low-GWP technologies or disincentivize the use of high-GWP technologies; and d) the hesitancy of customers to use flammable or toxic refrigerants due to safety concerns. Additionally, there are:

- Difficulties in identifying enterprises in the sector;

[38] UNEP/OzL.Pro/ExCom/82/64

- Difficulties in obtaining the enterprises' commitment to only use low-GWP technologies;
- Limited technical capacity to handle new low-GWP technologies; and
- Limited ability to influence supply chains to secure the components necessary for low-GWP technologies.

The paper concludes that addressing this subsector could facilitate the introduction of low-GWP technologies during HFC phase-down and promote safe and appropriate installation practices to optimize energy-efficient operation of the systems. Support to this subsector would depend on the characteristics and needs of the involved enterprises, and would mainly include technical assistance, capacity building, provision of tools and training to staff to design, install and handle systems using alternative technologies.

ExCom Decision 92/39:

- Article 5 countries invited, through the bilateral and implementing agencies, to provide to the Secretariat, on a voluntary basis, by 20 September 2023, information on the local installation and assembly subsector;
- To consider projects in the local installation and assembly subsector in the context of KIPs on a case-by-case basis

5.10.3 Technical Assistance for SMEs to support adoption of EE technologies

Decision 91/65 item 244e under "Technical assistance for small and medium-sized enterprises (SMEs) in manufacturing and assembly/installation" mentions that projects involving technical assistance for SMEs to support the adoption of energy-efficient technologies and alternatives while phasing down HFCs would be considered on a case-by-case basis, provided that such technical assistance projects assisted beneficiaries in maintaining and/or enhancing energy efficiency while phasing down HFCs.

5.10.4 Challenges

The challenges faced by SMEs are, inter alia,

- Most have no R&D facilities. Access to technology is required; however, the degree of technology absorption is limited at the small enterprises and average at the medium enterprises;
- Cost of R&D is the same irrespective of the size of the enterprise;
- Most have no testing facilities;
- It is hard to get co-financing in general but more specifically for SMEs in LVCs which leads to incomplete implementation of projects. Case-in-point are incentive programmes to SMEs to encourage the early replacement of old, leaky equipment with ODS or high-GWP refrigerants where end user co-financing is a requirement. SMEs don't have enough technical and financial background to proactively influence the end users.
- Other challenges are, a) preparing the right documentation, b) insufficient audits to ensure sustainability of activities, c) problems with additional investments needed during implementation, d) their need for a quick disbursement, e) their low eligibility for funding due to their small consumption, and f) difficulty of disposal of old equipment.
- Factors that affect SMEs are, a) level of customs duty on imported equipment vs. components, providing higher duties on finished products help SMEs, b) Higher MEPS impose a hardship on SMEs to comply because of design limitations, c) market size, the larger the market, the more space for SMEs to grow.
- Areas to address, a) R&D, b) testing and labs, c) isolation of electrical components, d) explosion proofing, and d) storage.

- There is also a need to address financial flow issues as not enough funds are available upfront; for example, LVCs are estimated to need up to about 50% front loading in the first tranche as learned from the experience of the HPMPs.

5.10.5 Sectors and subsectors where SMEs operate

The sectors and subsectors where SMEs operate vary according to the size of the manufacturing and servicing sectors in the country. RTF tried to categorize these areas by country brackets, as defined in RTF May 2023 report, from A to D for the countries with manufacturing sectors, and E, no manufacturing, as follows:

Bracket A: China

RTF has consulted with researchers and sector experts to get information, their experiences, and best estimates regarding the distribution of SMEs in various sectors in China.

- Domestic refrigeration is dominated by large manufacturers. The top five companies in household refrigerators, household freezers, and electric water heaters manufacturing have a market share of over 70%. There are approximately over 200 large-scale enterprises (with revenue of over 20 million RMB) in the household refrigerator and freezer sub-sectors, and close to 100 such enterprises in the electric water heater sub-sector.
- The heat pump water heater sub-sector is primarily composed of SME enterprises. The overall estimate suggests that there are several hundred companies operating in this sub-sector.
- Refrigeration sector, according to the revised sector plan of 2020, the number of enterprises in the commercial and industrial refrigeration sectors exceed 1,000. It is estimated that there are about 100-200 large enterprises consuming more than 50 tonnes of refrigerants each and some of these individual companies (groups) consume several thousand tonnes of refrigerants. Most enterprises in the sector are classified as small and medium-sized enterprises (in the sector plan, enterprises consuming less than 50 tonnes are considered small and medium-sized enterprises).
- The room air conditioner sector is dominated by large enterprises.
- The foam sector has numerous subsectors, and industry associations conservatively estimate that there are about 5,000 small and medium-sized enterprises. HFCs are mainly used in the spraying and home appliances sectors, with an estimated total of 200-300 SMEs. Among them, the spraying subsector has a relatively higher number of SMEs, and their usage may not be small (probably more than 20 tons). However, these enterprises often suffer from poor management practices.
- The XPS foam sector uses relatively less HFCs. According to the revised HPMP sector plan in 2020, there are approximately 300 companies in this sector. However, the number of companies in the sector might have decreased in recent years due to the impact of the pandemic, and the specific count of small and medium-sized enterprises is not known.
- According to sector research conducted in 2015, there are estimated to be over 400 enterprises in the solvent sector that consume HCFCs. Among them, based on a study on the disposable medical equipment sub-sector in 2019, there are approximately 193 companies, including 38 companies that have already implemented phase out projects. The remaining 150 companies consume around 430 tons of HCFCs, with more than 50 companies having an annual consumption of less than 1 ton[39].

- Aerosol sector, there may be SMEs consuming HFCs in the aerosol sector in China; however, these were not identified by RTF research.

[39] Data and information gathered from the interview with the experts and researchers, based on their field studies at various sectors.

Bracket B

The countries in this bracket have varying degrees of SME involvement in the different sectors. India, for example, has a ministry for micro, small, and medium enterprises (MSME) which defines the different categories by their annual turnover. The SMEs are involved in the sectors shown in the table below where SMEs are mostly involved in commercial refrigeration and commercial AC:

Table 5-11 Involvement of SMEs in manufacturing of equipment and components in India

Subsector	Large enterprises	Medium enterprises	Small enterprises
Products			
VRF	Y		
Chiller Centrifugal	Y		
Chiller Screw	Y		
Chiller Scroll	Y	Y	Y
Ducted	Y	Y	
Room AC	Y	Y	
Commercial Refrigeration	Y	Y	Y
Domestic Refrigerators	Y		
Components			
Compressors	Y		
Refrigerant controls	Y		
Valves	Y	Y	Y
Motors	Y	Y	Y
Drives	Y	Y	

Bracket C & D: large manufacturers are active in residential and large commercial air conditioning and refrigeration. SMEs are the vast majority of manufacturers of commercial refrigeration in bracket D and a good percentage of Bracket C.

Bracket E, LVCs, have no manufacturing; however, SMEs dominate the assembly and installation subsector.

5.10.6 Approach and modelling

There is not enough data on the extent of SME involvement in the different sectors to build a reliable model for the additional financing need to address their technical development. Document UNEP/OzL.PRO/ExCom/92/49 confirms that hardly any data is available regarding the level of HCFCs or HFCs used in the local assembly, installation, and first charge of new refrigeration and air-conditioning (RAC) systems across Article 5 countries. On the other hand, SMEs in local manufacturing can be identified based on the definition of their level of production which is still under discussion.

RTF has adopted an approach for estimating the additional funding needed by SMEs in both the manufacturing sector and the assembly and installation subsector.

5.10.7 Manufacturing sector

RTF focused on the commercial refrigeration manufacturing sector and assumed a range for the share of SMEs of the total consumption that is the same for all brackets, then calculated the cost based on the agreed upon cost effectiveness (CE) and compared it to the cost at levels that the RTF estimates are needed for SMEs as per table 5-12 below:

Table 5-12: Estimation of additional funding needs of SMEs in the manufacturing sector[40]

Lower range 20%						
Bracket	**a= Comm Ref consumption in mt**	**% by SMEs (b)**	**SME consumption in mt (a)*(b) = (c)**	**Costing at Standard CE. (d)=(c)*CE $15.21**	**US$ at 40% more (e)=(d)*1.40**	**Additional (f)=(d)-(e) in US$**
A	68,861	20%	13,772	209,475,162	293,265,227	83,790,065
B	17,507	20%	3,501	53,256,294	74,558,812	21,302,518
C	6,135	20%	1,227	18,662,670	26,127,738	7,465,068
D	1,215	20%	243	3,696,030	5,174,442	1,478,412
E: LVCs have no manufacturing and were not considered						
Total	**93,718**		**18,744**	**285,090,156**	**399,126,218**	**114,036,062**

Upper range: 40%						
Bracket	**a= Comm Ref consumption in mt**	**% by SMEs (b)**	**SME consumption in mt (a)*(b) = (c)**	**Costing at Standard CE (d)=(c)*CE $15.21**	**USD at 40% more (e)=(d)*1.40**	**Additional (f)=(d)-(e) in US$**
A	68,861	40%	27,544	418,950,324	586,530,454	167,580,130
B	17,507	40%	7,003	106,512,588	149,117,623	42,605,035
C	6,135	40%	2,454	37,325,340	52,255,476	14,930,136
D	1,215	40%	486	7,392,060	10,348,884	2,956,824
E: LVCs have no manufacturing and were not considered						
Total	**93,718**	**-**	**37,487**	**570,180,312**	**798,252,437**	**228,072,125**

In the table above

(a) is the consumption of the commercial refrigeration subsector in metric tonnes as calculated by the RTF in its May report;
(b) is an estimation by the RTF of the percentage of that subsector that is covered by SMEs. RTF considered a range from 20 to 40% and calculated for the lower and upper ends of the range. RTF considered the range to apply to all brackets as it was not possible to collect data by sector with close enough accuracy.
(c) Is the consumption by SMEs for the subsector in metric tonnes by multiplying (a) times (b);
(d) Is the cost in US$ considering a cost effectiveness of US$ 15.21/kg which was agreed by ExCom 92;
(e) The 40% extra for SMEs is the upper end of the additional financing that is being considered by the ExCom. The total for SMEs at that CE level is between **US$ 114 million and US$ 228 million**.

The subsector consumption of 93,718 MT is equivalent to ~US$ 1.425B in funding, The additional funding needed for SMEs is an additional 8 to 16% for the subsector.

5.10.8 Assembly and Installation subsector

Similarly, RTF estimated a range of the percentage of the total service consumption that is used for local assembly and installation and compared the cost at standard service CE to the estimated CE that RTF determined is needed by the subsector as per tables below:

[40] SMEs in the manufacturing sector are assumed to be addressed in KIP stage I

Table 5-13 Estimation of additional funding needs in the assembly and installation subsector (US$)

Lower range 10%						
Country Bracket	**(a)= Service consumption in mt**	**% for Installation (b)**	**Installation consumption. (c) = (a)*(b)**	**Installation at std CE. (d)=(c)*CE $5.1**	**Additional CE +50% (e)**	**Additional costing in US$ (f)=(d)*(e)**
A	98,031	10%	9,803	49,995,810	74,993,715	24,997,905
B	63,053	10%	6,305	32,157,030	48,235,545	16,078,515
C	54,574	10%	5,457	27,832,740	41,749,110	13,916,370
D	35,972	10%	3,597	18,345,720	27,518,580	9,172,860
LVCs	13,916	10%	1,392	7,097,160	10,645,740	3,548,580
Total	**265,546**		**26,555**	**135,428,460**	**203,142,690**	**67,714,230**
Upper range 30%						
Bracket	**(a)= Service consumption in mt**	**% for Installation (b)**	**Installation consumption. (c) = (a)*(b)**	**Installation at std CE. (d)=(c)*CE $5.1**	**Additional CE +50% (e)**	**Additional costing US$ (f)=(d)*(e)**
A	98,031	30%	29,409	149,987,430	224,981,145	74,993,715
B	63,053	30%	18,916	96,471,090	144,706,635	48,235,545
C	54,574	30%	16,372	83,498,220	125,247,330	41,749,110
D	35,972	30%	10,792	55,037,160	82,555,740	27,518,580
LVCs	13,916	30%	4,175	21,291,480	31,937,220	10,645,740
Total	**265,546**		**79,664**	**406,285,380**	**609,428,070**	**203,142,690**

The tables for the assembly and installation subsector of the servicing sector were calculated in the same manner as for manufacturing:

a) is the total service consumption
b) is the range of that consumption that is handled by SMEs for installation and assembly considered between 10 and 30%. RTF assumed a larger range since it could not get data on I&A sector size.
c) is the consumption in metric tonnes of the I&A subsector
d) is the funding for the A&I subsector at standard CE of US$ 5.1/kg
e) is the additional funding for the I&A subsectors assuming a 50% increase in funding. The 50% increase assumption is based on the premise that assemblers would need to be at half the CE of the manufacturing sector, considered here at US$ 15.2/kg and hence a CE of US$ 7.6/kg.
f) the additional funding needed by the I&A subsector is between US$ 67–223 million. This is estimated to be 5-16% of the servicing sector funding.

5.11 ITEM 17: EVALUATING THE POTENTIAL COST IMPLICATIONS OF LEAPFROGGING AND/OR EARLY ACTION

Item 17: "Evaluate the potential cost implications of leapfrogging and/or taking early action to phase-down HFCs in advance of compliance targets"

Leapfrogging

RTF considered that there is insufficient data available to evaluate cost implications, challenges and benefits of leapfrogging from high-GWP HFCs to low-GWP alternatives. Nevertheless, the TEAP

September 2022: Decision XXVIII/2 TEAP Working Group Report - Information on Alternatives to HFCs (Volume 5) and 2022 TEAP Progress Report provides qualitative information on alternatives, its accessibility and availability for each sector that could help to evaluate options and potential transitions to low GWP alternatives and its expected timeframe. With more data and as more KIPs are approved and implemented, costs implications can be estimated.

Early Action

RTF also considered scenarios where some A5 parties submit proposals to take early action in advance of compliance targets, as responded to in Item 5 (see section 5.2) per the criteria described in that summary. In Item 5, parties requested that the RTF include a scenario, where parties submit proposals to phase down HFCs in advance of applicable compliance targets.

For both Items 5 and 17, the RTF analysed the HFC baseline and average 2020-2022 HFC consumption (reported under A7 or estimated by the RTF using its previous methodology for addressing HFC data gaps) for each country and by country brackets. Based on best available current consumption data, the RTF estimated the amount of room for growth that countries may have before reaching the 10% reduction compliance target at the end of 2028.

RTF estimated 2028 consumption using a 3% growth rate compounded for 7 years (i.e., 2021-2028), which equals 23% growth. This value, representing 2028 consumption, was compared to an accelerated 2028 compliance target of 80% of the baseline (20% reduction), which advances the phase down by 10%.

RTF included parties with projected 2028 consumption that was 50% lower than the accelerated 2028 compliance target of 80% of baseline or 20% reduction from the baseline. Fourteen (14) countries might fit under this scenario, mostly LVCs (12) that might pursue a KIP in support of advance phase-down. Fourteen (14) countries fit under this scenario, mainly LVCs (12).

For this scenario, with an estimated shift in KIP funding from future triennia for these 14 countries, the increase in the 2024–2026 triennium is approximately **US$ 4,861,000**, reducing global HFC consumption by 10MtCO_2eq**.**

CHAPTER 6 ADDITIONAL INFORMATION AND SCENARIOS: ENERGY EFICIENCY (EE)

6.1 INTRODUCTION

This chapter addresses the following OEWG-45 Contact Group requests related to energy efficiency:

Item 18. A scenario for funding 10 to 15 energy efficiency pilot projects;

Item 19. Include a scenario wherein an incentive is provided as part of the funding for KIPs to enhance EE while phasing down HFCs in accordance with ExCom decision 92/38;

Item 20. Consider activities to support SMEs in design and development of energy efficient technology and their implementation;

Item 21. Consider EE related policies and regulations capacity building;

Item 22. Consider additional costs for energy efficient foam products;

Item 23. Consider regional testing centers for monitoring and verification of energy efficiency;

Item 24. Analyze additional costs for including energy efficiency as an incentive for enhancing ambitious HFC-phase down and leapfrogging HFCs in the frame of the HPMPs and KIPs;

Item 25. Provide cost estimates of potential support for systemic approaches to EE in KIPS, beyond the pilot window.

6.2 ITEM 18: SCENARIO FOR FUNDING EE PILOT PROJECTS

Item 18: "A scenario for funding 10 to 15 energy efficiency pilot projects;"

Decision 91/65[41] established a "funding window for pilot projects in the amount of US$ 20 million with the possibility of augmenting that funding window at a future meeting to maintain and/or enhance EE in the context of HFC phase-down as specified in decision XXVIII/2, following the criteria identified in subparagraph(b)".

The May 2023 RTF Report included US$ 20 million in the funding requirements for the 2024–2026 triennium, without considering possible augmentation. Table 6.1 summarises figures not exceeding a total of US$ 20 million. In response to Item 18, this section discusses the following examples of energy efficiency pilot projects[42] to fit the approved funding window and their estimated funding of total US$ 20 million.

Sectors selected (same for Item 15, except for servicing and MEPS activities) are:

1. Residential and Commercial AC and HP Sector

Residential and commercial AC and HP sector conversions from HFCs to an A3 alternative (i.e., HC-290) while considering EE enhancement using variable speed compressor technology; assuming units up to 7 kW capacity with need for coordination and costs associated with supply chain, manufacturing, and service with a conversion project duration of 1 to 2 years.

a) Large enterprises

Large enterprises of AC and HPs typically produce 200k units per year or more and have in-house testing capabilities. A typically project will incur US$ 400,000 for the product development team

[41] UNEP/OzL.Pro/ExCom/91/72

[42] Projects for low-GWP technologies like HC, CO_2 or equivalent

which include mechanical design, simulation, fluid dynamics and analysis, electrical and electronics, testing for performance, reliability and safety; as well as additional external testing involved for certification needs. Additional series conversion cost would be significantly reduced by the learning curve – at least by 25%. Furthermore, the in-house testing laboratory would need to be upgraded to ensure its compatible with ISO 16358 (up to US$ 600,000) including any additional updates to the ISO 17025. Typical manufacturing and training for EE enhancement would cost up to US$ 400,000 depending on the technology of choice and the buy-versus-make decision. As such, the total additional capital cost investment range from US$ 400,000 to US$ 1,400,000 + incremental cost for large enterprises targeting the use of enhanced EE low GWP AC and HPs.

b) SME in the AC and HP sector

SME in the AC and HP sector typically produce 75k units per year or less and rely on third party laboratory testing capabilities. They typically rely on third party technologies and have minimal product development costs – however additional incremental cost for energy efficiency would be higher than that for large enterprises. A typical project will incur US$ 150,000 for the product development team which include external consultants, production engineer; as well as additional external testing involved for certification needs. Additional series conversion cost would be significantly reduced by the learning curve – at least by 25%. Third party laboratory testing would add approximately US$ 150,000 for set-up and testing (assumes two rounds of 10 tests for 3 SKU at US$ 750 each). Typical manufacturing and training for EE enhancement would cost up to US$ 400,000 depending on the technology of choice and the buy-versus-make decision. As such, the total additional capital cost investment range from US$ 300,000 to US$7 00,000 + incremental cost for SMEs targeting the use of enhanced EE low GWP AC and HPs.

2. Domestic Refrigeration and/or SCCR

In this example, we consider domestic refrigeration and/or self-contained commercial refrigeration (SCCR) sector conversion to A3 refrigerants while improving EE by 10%. India's market experience shows that the R&D cost for this conversion would typically be around 75% that of example 1 above (i.e., ranging from US$ 300,000 to US$ 1,050,000 for large enterprises and US$ 225,000 to US$ 525,000 for SMEs). Abdelaziz et al. 2020, showed that the additional capital cost for EE can be similar to or higher than the ICC; however, the additional incremental cost for EE depends greatly on the target energy efficiency; for 10% efficiency improvement; it may be less than typical IOC.

3. Distributed Commercial Refrigeration with Remote Condensing Units

Pilot projects for distributed systems and condensing units in the form of technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP systems can improve their energy efficiency during construction, retrofit, commissioning, or recommissioning. The primary costs involve consultants providing technical assistance to upgrade capacity to develop higher EE systems and install them properly to maximise EE performance, including in some cases costs related to installation start-up engineer. While economies of scale may be possible for non-LVCs where consultants can be engaged for multiple projects, there is assumed to be less opportunity for economies of scale in LVC countries.

4. Service Sector

Actions help in maintaining EE and stop or delay the efficiency degradation that is almost inevitable due to the wear and tear over the life of equipment. Example of actions include eliminating refrigerant leaks through smart monitoring of the refrigerant charge and checking operations and controller settings as suggested in document UNEP/OzL.Pro/ExCom/87/7. Such actions help in reducing consumption through leakage reduction which contributes to compliance under the MP, as well as ensuring that energy consumption does not increase dramatically over the life of the

equipment/systems as systems have to work harder when leaks reduce refrigerant charge. These actions can take place throughout the lifetime of the equipment[43]

Components of a servicing sector project could include:

- Demonstrate smart monitoring US$ 10,000 per demonstration (technology upgrades + capacity building and reporting)
- Demonstrate performance improvement and proper sizing and maintenance of variable speed drive systems US$ 75,000 per demonstration (components, fees for expert installer and trainer, installations, training, and monitoring for one year + capacity building and reporting)
- Retro-commissioning building HVAC US$ 100,000 per building (training, energy audit, implementation)

5. Minimum Energy Performance Standards (MEPS)

See section 6.5. Note that additional market analysis and technology assessment for MEPS customization adds costs, for example countries with domestic AC manufacturing may wish to customize temperature bins used for assessing energy efficiency performance in standards based on ISO 16358. Countries seeking continuous improvement (e.g., ratcheting India example) may require recurring costs.

[43] Proper assembly and installation of equipment plays a prominent role in maintaining EE and reducing factors that lead to EE degradation.

Table 6-1 Summary of energy efficiency pilot projects to fit US$ 20 million funding window

Pilot project sector	Cost per project (excluding support costs)	Total cost to fit US$ 20M funding window
1. Residential and commercial AC and HP sector conversions from HFCs that enhance EE by 5-10% (assumes conversion to A3)	Up to 3 large ACHP enterprises with project cost of up to $2,000,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support. Up to 6 small and medium ACHP enterprises with project cost of less than $1,000,000 including additional capital and operating cost for product development and operating cost.	$9.0 M (5 projects)
2.1. Domestic refrigeration and/or stand-alone commercial refrigeration sector conversions from HFCs that enhance EE by 5–10% (assumes conversion to A3)	Up to 2 large enterprises with project cost of up to $1,500,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support.	$5.0 M-5 (3 projects)
2.2 Stand-alone commercial refrigeration sector conversions from HFCs that enhance EE by 5–10%	Up to 2 SME and large enterprises with project cost of up to $1,000,000 including additional capital and operating cost for product development, factory upgrades, and operating cost support.	
3.1 [racks -- distributed systems and condensing units] Technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP	~$50k per country for policy & awareness ~$45k-150k for study tours ~$200-800k (for non-LVC with multiple enterprises) for consultants to provide technical assistance to upgrade capacity to develop higher EE systems and install properly	$2.0 M (3 regional projects)
3.2 [industrial refrigeration] Technical assistance for assembly and installation of large industrial refrigeration and/or ACHP	Training costs related to maintaining EE, e.g., ~$50k per country for policy & awareness ~$50k-150k for study tours	$1.0 M (2 regional)
4. Servicing sector	Technology demonstrations $10,000 - $75,000 per demo retro-commission pilot $100,000+	$1.0 M (2 regional projects)
5. MEPS, labels and supporting framework for implementation capacity	~$535k development per country (importing, assumes enabling legislation is in place) [align with U4E/trading partner] Market assessment: ~$70,000+ MEPS and labelling analyses, design and vetting: ~$200,000+ (with additional complexity/cost in case of domestic manufacturing/assembly) Communications and awareness raising: ~$90,000+ Market monitoring, verification and enforcement (MVE) protocols, software and training: ~$175,000+ Collection, Recycling, and Disposal: $170,000+	$2.0 M (2 projects)

Pilot Project Example 1 (Residential and commercial AC and HP sector conversions from HFCs that enhance EE) considers two cases: a large enterprise producing on the order of 200k units per year with in-house laboratory testing capabilities, and a small enterprise (based on Indian sector) producing under 75k units per year reliant on third party laboratory testing capabilities. this scenario considers conversion from HFC to HC 290 in the residential sector for units up to 2.0 refrigerant tons

capacity and would involve research and development (R&D), as well as coordination and costs associated with supply chain, manufacturing, and service. End-to-end project timelines expected of one to 2 years.

Case 1 (Large enterprise, 200k units per year, with in-house test lab capacity):

- R & D and Supply Chain [US$ 400,000 for combined refrigerant conversion and EE improvement; separate EE and conversion would double the cost]: A team of 8 engineers comprising Mechanical design, Simulation, fluid dynamics and Analysis, Electrical and Electronics, testing for performance, reliability and safety, external testing will be involved. There will be a project leader leading the team. Estimate includes all costs as expenses towards salaries, running of labs, external testing, samples of components, external consultants, specialist in flame proof designs, building prototypes. This cost will be 75 % for any additional series.
- In-house laboratory testing capacity case [US$ 0-600,000]: accreditation and potential upgrades to ISO 17025 for part-load testing.
- Manufacturing and Training [US$ 400,000] for EE enhancement (about 20% of US$ 750,000 for conversion-related costs, including refrigerant storage set-up, assembly line modifications, charging equipment, production test set-up for flammable refrigerant, with about 30% of investment for recurring costs in terms of depreciation, interest and licence fees for renewal of regulatory requirements of flame proof licences; plus extensive training requirements for workers, line engineers.).
- Sales and Service [US$ 200,000 one-time cost; most relevant to refrigerant conversion]: Extensive training to sale and service dealers and dealer technicians.

Case 2 (Small enterprise, <75k units per year, using third party test lab):

- Third party laboratory testing would add approximately US$ 150,000 for set-up and testing (assumes two rounds of 10 tests for 3 SKU at US$ 750 each).

Pilot Project Example 2.1 Domestic refrigeration and/or stand-alone commercial refrigeration sector (assumes conversion to A3)

Domestic refrigeration equipment is generally produced at mass scale by larger enterprises. The cost of R & D will be 75% of Room AC, other costs will be the same. Assumes about 10% EE improvement.

These estimates are based on India setup and will vary from country to country.

Pilot Project Example 2.2 Stand-alone commercial refrigeration sector (assumes conversion to A3)

Commercial stand-alone chest freezer/coolers manufacturing sector includes many small enterprises with production as low as 25k units.

Pilot Project Example 3.1 [racks -- distributed systems and condensing units] Technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP

We consider all enterprises in this sector to be small and medium enterprises that both designs and installs equipment. Primary costs involve consultants to provide technical assistance to upgrade capacity to develop higher EE systems and install properly to maximise EE performance, including in some cases costs related to installation start-up engineer.

While economies of scale may be possible for non-LVC where consultants can be engaged for multiple projects, there is assumed to be less opportunity for economies of scale in LVC countries.

Pilot Project Example 3.2 [industrial refrigeration] Technical assistance for assembly and installation of large commercial and industrial refrigeration and/or ACHP

For industrial refrigeration, projects for technical assistance for Assembly and Installation of large industrial refrigeration and/or ACHP are suggested, covering for training, policy and awareness of EE at US$ 50,000 per country plus US$ 50,000–100,000 per country for study tours. At a total of US$ 1 million per region.

Pilot Project Example 4 Servicing sector

Servicing actions help in maintaining EE and stop or delay the efficiency degradation that is almost inevitable due to the wear and tear over the life of equipment. Example of actions include eliminating refrigerant leaks through smart monitoring of the refrigerant charge and checking operations and controller settings as suggested in document 87/7. Such actions help in reducing consumption through leakage reduction which contributes to compliance under the MP, as well as ensuring that energy consumption does not increase dramatically over the life of the equipment/systems as systems have to work harder when leaks reduce refrigerant charge. These servicing actions can take place throughout the lifetime of equipment. Proper assembly and installation of new equipment, including charging with the correct refrigerant charge, plays a prominent role in maintaining EE and reducing factors that lead to EE degradation.

Components of a servicing sector project could include:

- Demonstrate smart monitoring at US$ 10,000 per demonstration (technology upgrades + capacity building and reporting)
- Demonstrate performance improvement and proper sizing and maintenance of variable speed drive systems US$ 75,000 per demonstration (components, fees for expert installer and trainer, installations, training, and monitoring for one year + capacity building and reporting)
- Retro-commissioning[44] building HVAC at US$ 100,000 per building (training, energy audit, implementation)

Pilot Project Example 5 MEPS

See section 6.5. Note that additional market analysis and technology assessment for MEPS customization adds costs, for example countries with domestic AC manufacturing may wish to customize temperature bins used for assessing energy efficiency performance in standards based on ISO 16358. Countries seeking continuous improvement (e.g., ratcheting India example) may require recurring costs.

6.3 ITEM 19: SCENARIO PROVIDING AN INCENTIVE FOR KIPS FUNDING TO ENHANCE EE

Item 19: "Include a scenario wherein an incentive is provided as part of the funding for KIPs to enhance EE while phasing down HFCs in accordance with ExCom decision 92/38;"

Decision 92/38 includes request to develop information including:

i. Any additional activities to maintain and/or enhance energy efficiency while phasing down HFCs beyond those listed in paragraph (b)(i) of decision 91/65;

[44] "Retro-commissioning is a systematic process applied to existing buildings that have never been commissioned to ensure that their systems can be operated and maintained according to the owner's needs." ENERGY STAR Building Manual https://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH5_RetroComm.pdf

ii. Information on additional costs and savings while implementing activities, including those identified in subparagraph (b)(i) above, taking into account the payback associated with use of energy-efficient equipment and other benefits to the consumer;

We have selected three sectors identified as priority sectors in decision 91/65 for which data are available for scenario development (domestic refrigerators, self-contained commercial refrigeration equipment, and mini-split room air conditioner units). Baseline unit characteristics and energy performance were taken as roughly representative of present conditions in markets for A5 parties based on analysis conducted by implementing agencies. Additional capital and per unit production costs were assessed based on technical support documents developed for the US Department of Energy, U4E, UNIDO and LBNL analysis. Energy efficiency improvement percentages, factory upgrade costs, and factory sizes were considered at various levels to estimate a range in potential costs. Energy efficiency improvement percentages were selected to capture least lifecycle cost (criterion used by the European Commission as part of the Ecodesign Directive to consider payback while accounting for product lifetime), that is the energy efficiency level that gives the minimum ownership cost over the average life of a product taking into consideration the electricity savings over the lifetime of the equipment and estimated possible increase in retail price resulting from the higher energy efficiency performance. While domestic and commercial refrigeration equipment can be assumed to operate 24/7, the operating hours for air conditioning equipment depends on the local climate conditions. To estimate least lifecycle cost efficiency level, we use 1817 hours per ISO standard 16358-1 (2013). In warmer climates with higher hours of usage, the energy savings would be greater, allowing for higher levels of efficiency under least lifecycle cost (assuming same electricity price), and we consider a case of 3630 hours of usage for a higher end estimate of potential energy savings. We assume 15 years of production for each factory and 15-year operating lifetime for all three product types when calculating lifetime energy savings per dollar invested in enhanced energy efficiency.

Taking into consideration the priority sectors in decision 91/65, we have developed Table 6-2 to summarize a funding scenario using an efficiency improvement incentive-linked approach while phasing down HFCs in the residential refrigeration, self-contained commercial refrigeration, and residential air conditioning sectors. Table 6-2 uses indicative levels of potential incentive support levels. For each product type, levels of efficiency are indexed to a reference minimum level: 2.80 CSPF[45] in the case of split AC indexed to level 1.0, and higher efficiency in this case set at 4.4 CSPF and indexed to level 10. From these values, a support percentage is calculated as a function of the factory's starting efficiency level, with decreasing levels of support for higher starting efficiency levels, such that resources are focused on those enterprises with the greatest need for capacity building and access to knowledge for designing and integrating lower-cost components into their products to improve from minimum to medium and better energy performance. See Annex 7 for more details. As noted in section 6.2 and 6.4 the types of resources needed include enhanced R&D and access to laboratory testing facilities as part of factory upgrades (additional capital costs) and additional product manufacturing costs (additional operational costs).

[45] Cooling Seasonal Performance Factor (CSPF) - CSPF ratings measure annual energy consumption and efficiency. A higher CSPF rating reflects a more energy efficient air conditioning unit. The CSPF takes into account different seasonal periods and temperature fluctuations at different cooling loads. These include situations where the unit is on standby or operating at partial load, such as when inverter technology is involved. This results in a more accurate and realistic indication of energy efficiency over an entire cooling season.

Table 6-2 Summary of MLF support for energy efficiency upgrades for three types of refrigeration and AC equipment (Bolded cases are those treated in detail in Wei and Shah 2023[46])

Product	EE improvement	Incentive	Range [1]	Units/Lines
Split AC	**23% (CSPF 3.4 to 4.4)**	19%	$6-220M [2]	25 million units 82 lines @
	30% (CSPF 3.1 to 4.4) [2]	43%	$14-582M [2]	300k units/line
Domestic Refrigerators	**16% savings in annual kWh**	18%	$17-130M	21 million units 112 lines @ 188k
	21% savings	47%	$44-340M	units/line
Self-contained commercial refrigeration equipment	**20% savings in annual kWh**	22%	$9-34M	2.2 million units 56 lines @
	23% savings	47%	$19-72M	39k units/line

[1] Lower number in the range is for factory upgrades only (additional capital costs); high number in range includes factory upgrade cost and two years of support for higher additional manufacturing production costs (additional operating costs).
[2] The 23% and 30% EE improvement cases assume that all factories are starting at CSPF 3.4 or 4.4, respectively. If half of the factories start at 3.4 and half at 3.1, each of the ranges would be reduced by 50%.

Figure 6-1 below represents a schematic illustration of an efficiency improvement-linked incentive approach. Panel A illustrates a simplified version of the prevalent situation where enterprises have different capabilities to produce equipment with energy efficiency, many countries have no or low MEPS and, as a result, the market is dominated by inefficient equipment. Panel B illustrates how an efficiency improvement-linked incentive approach would focus resources on those enterprises with the greatest need for capacity building and access to knowledge for designing and integrating lower-cost components into their products to improve from minimum to medium and better energy performance. Specifically, the overall capacity of an enterprise based on the energy performance of its portfolio of products is considered in this approach. Such an approach would enable adoption of MEPS and address a key barrier to access to higher energy efficient equipment in manufacturing and importing countries (TEAP EEWG 2023[47]).

[46] Wei M. and Shah N., *Costs and benefits of improving cooling equipment efficiency during the refrigerant transition under the Montreal Protocol including novel improvement-linked incentive approach*, Lawrence Berkeley National Laboratory, Berkeley, CA USA (2023), https://eta-publications.lbl.gov/publications/costs-and-benefits-improving-cooling

[47] For reference, language from EEWG report page 78: "A key feature of the incentive index is that it focuses resources on those enterprises with the greatest need for capacity building and access to knowledge for designing and integrating lower-cost components into their products to improve from minimum to medium and better energy performance. Specifically, the overall capacity of an enterprise based on the energy performance of its portfolio of products is considered in this approach. Previous TEAP EETF reports have identified MEPS as a major enabling policy for access to higher EE equipment. However, in manufacturing countries, the ability of small and medium domestic enterprises to access the capital, capacity and knowledge to improve the EE of their products can act as a limitation on the MEPS level for that country. When MEPS levels are low, there is no disincentive for higher capacity manufacturers to continue producing and exporting inefficient RACHP equipment into that market. The adage "a rising tide raises all boats" applies here, as "raising the floor" on manufacturing EE capacity would address a key barrier to access to higher energy efficient equipment in manufacturing and importing countries."

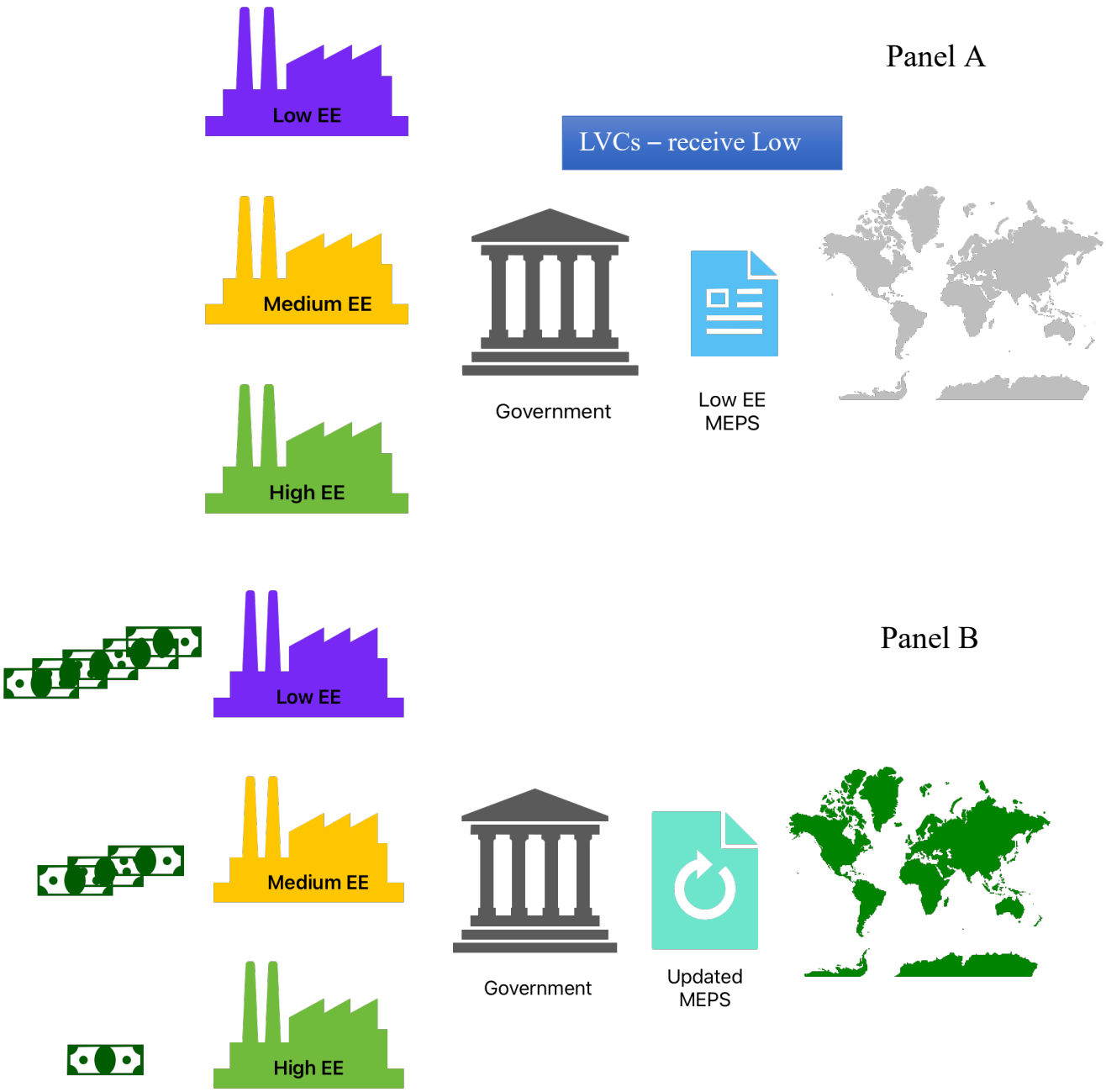


Figure 6-1 Schematic Illustration: Efficiency Improvement-Linked Incentive Approach

6.4 ITEM 20: ACTIVITIES TO SUPPORT SMES IN EE DESIGN AND DEVELOPMENT

Item 20: "Consider activities to support SMEs in design and development of energy efficient technology and their implementation;"

SMEs in refrigeration, air conditioning, and heat pump sector require ongoing capacity building related to energy efficiency for design and development. The 2023 EEWG report identified in Chapter 9.4 the challenge faced by SMEs in particular regarding higher costs when trying to access essential energy efficient components because they do not have the know-how, or volumes needed for economy of scale. Manufacturers are faced with the option to buy from OEMs, or to make the required components themselves, including those for both refrigerant conversion and EE upgrades. This decision depends greatly on the company size and experience, production volumes and the business strategy related to capital recovery period. One approach to support building SME capacity for EE is

through an EE improvement incentive-linked approach as described in section 6.3 that focuses resources on those enterprises with the greatest need for capacity building and access to knowledge for designing and integrating lower-cost components into their products to improve from minimum to medium and better energy performance.

A complementary approach that would allow continued knowledge and capacity building can be achieved through the establishment of regional centres of excellence related to energy efficiency or extending the capacity of current regional centres of excellence to include energy efficiency related activities. In the case of an established centre of excellence, the cost of adding the energy efficiency capacity building component would focus on adding training module for high efficiency RACHP equipment, including variable speed compressor technology, design software, and testing laboratories. This can result in a varying cost depending on the regional requirements.

In the case of establishing a new energy efficiency regional centre of excellence, the centre should aim at providing support for product development, testing, certification, and training. Table 6-3 provides the different component costs for the setting up of the SMEs energy-efficient technology design and development. The selection of the components of the regional activities to support the SMEs for product development vary greatly by region and market.

Table 6-3 Activity/component additional costs for SME EE technology design and development (US$)

Activity/component	Adding EE to a new regional centre of excellence, US$	Adding EE to an existing regional centre of excellence, US$
Equipment modelling tools (software and hardware)	$25,000	$25,000
Training of trainer for product development process	$35,000	$35,000
Regional EE consultant	$50,000/year	$50,000 /year
Regional supply chain consultant	$25,000/year	$25,000/year
High RACHP training module with variable speed compressor	$50,000	$60,000
Testing Laboratory – RAC	$1,000,000**	$1,200,000**
Testing Laboratory – Refrigeration	$600,000**	$720,000**

** see section 3.4.5 for more details.

6.5 ITEM 21: EE RELATED POLICIES AND REGULATIONS

Item 21: "Consider EE-related policies and regulations capacity building;"

An integrated set of interventions are necessary to accelerate the transition toward more energy-efficient and climate-friendly appliances, foams, and equipment. Minimum Energy Performance Standards (MEPS) are the proven cornerstone of market transformation. MEPS are often complemented with labels which help consumers make more informed purchasing decisions based on the energy use of products evaluated under standard test conditions and can include additional information such as refrigerant. Market monitoring, verification, and enforcement (MVE) is essential to track progress and ensure compliance. Finance schemes, incentives and other voluntary and government-led measures help catalyse uptake of the highest performance products and offset first-cost barriers to adoption. And at the end of useful product life, care must be taken for proper collection, recycling, treatment of refrigerants and hazardous materials (as applicable), and disposal.

International standards and best practices in programme design and implementation have emerged from decades of experience, enabling replicable pathways for cost-effective energy savings, mitigation of direct- and indirect-greenhouse gas emissions, heating and cooling load reduction, enhanced electric grid stability, energy security, and expanded access to essential services as regular energy efficiency improvements are unleashed. However, results vary widely, and desired impacts are elusive when

investment in building and maintaining needed capacity, skills, and awareness is inadequate. Some common elements apply across market transformation programmes, such as the need for enabling legislation authorizing regulatory activity. However, complex differences arise when going from one covered product to another (i.e., lighting relative to electric motors, air conditioners, etc.), including how testing is conducted.

The following examples suggest illustrative budgets (not including overhead fees) from recent market transformation projects by UNEP's United for Efficiency (U4E) and other similar initiatives addressing household refrigerating appliances or air conditioners in small developing or emerging economy markets with little to no prior experience or infrastructure for addressing these products. Such complex, multi-year undertakings entail a combination of in-kind staff time from local officials and stakeholders complemented by international expert advisors and local consultants. Significant differences exist across markets depending on many factors. These examples generally represent minimum budgets and must be refined with proper study of local circumstances.

Current minimum initial investments (note: follow-on funds for maintaining such interventions are needed over time) across the following integrated set of interventions for a single product may include:

- Market assessment: ~US$ 70,000+ for gathering and reviewing available "top-down" data from official sources (i.e., typically these are insufficiently granular) and manufacturers and vendors (business sensitive information requiring data protection and ability to mask findings to avoid adverse impacts), as well as a representative "bottom-up" sample via visits to physical stores and review of online sites for those with much of the market share. High quality data is essential for setting sound policies. Complement quantitative information with qualitative insights and anecdotes on market trends, for example to better understand the pervasiveness of imports of used products and so-called black market (unofficial) product sales and the needs and challenges faced by market actors. The assessment should address a sample across several key cities and several typical rural settings (where such products are common) which are representative.
- MEPS and labelling analyses, design and vetting: ~US$ 200,000+ for utilizing market assessment findings to conduct techno-economic analyses and generate recommendations for product scope, energy performance thresholds, refrigerant requirements (upper limit on global warming potential, ozone depletion potential, etc.) and labelling design, while definitions, test procedures and other aspects should reference international standards and best practice guidelines and with a harmonized regional approach to the extent practicable. Review recommendations in multiple consultative sessions with stakeholders from government, the private sector and civil society to gather input and refine original proposals.
- MVE protocols and implementation framework: ~US$ 175,000+ to define roles and responsibilities of key actors (assuming enabling legislation exists), adapt available software and toolkit for a product registration system, prepare necessary documentation templates, and conduct thorough training prior to policies and programmes coming into effect addressing new products as well as used products which may be entering the market. A laboratory to test product performance requires equipment and infrastructure which when installed and commissioned within an existing building can cost a further ~US$ 360,000+, not including ongoing staffing, maintenance, recalibration and other operational costs over time which is prohibitive without a sufficient throughput of products to justify the capital and operational investment in many individual markets. It is recommended in such situations to coordinate across multiple markets in a region for the use of a single test laboratory.
- Communications and awareness raising: ~US$ 90,000+ for an introductory outreach campaign with materials with fit-for-market (translated into local languages and cultural dynamics) which educate likely consumers and businesses on the importance and benefits of energy efficiency and refrigerant transition, how this is being undertaken locally, and their roles and responsibilities. Leveraging existing Montreal Protocol-related campaigns, public service announcements, marketing efforts by companies, social media and other existing channels help to promote the contents cost-effectively at scale, while kick-off events with prominent

officials and influencers help convey underpin the importance of this work and care taken at the highest levels to ensure its success.

- Financing, incentives and other voluntary schemes: ~US$ 450,000+ for designing a market-based mechanism for several major cities and financial institutions and competing vendors, including development of legal agreements, criteria tied to the top-level of the energy label, capacity building, reporting systems, outreach and capacity building, etc. Another option is to train officials on sustainable public procurement and update government procurement protocols followed-by technical assistance on a sample procurement (e.g., refrigerators for a public housing project) to put the concept into practice.
- Collection, Recycling, and Disposal: US$ 170,000+ for designing and executing a basic pilot in a major city for a modest pilot programme whereby a local recycling facility partners with participating appliance vendors on a swap-out programme with a rebate offered to customers who turn-in a working appliance at the end of useful life toward the purchase of an energy-efficient, climate-friendly new product from the upper tier of the labelling programme. The value of recyclable content helps offset programme costs, while addressing insulating foams, refrigerants, and toxic materials are non-recoverable costs, though carbon markets can be leveraged in some circumstances. As with test laboratories, regional approaches may be best for cost-effectively addressing specialized aspects of recycling or treatment of refrigerants, lubricants, etc.
- Building codes and standard mandates, insulation performance standards, labelling mandates, and other policies establish requirements to reduce heating and cooling loads in both commercial and residential buildings, and for refrigeration. Investment in decarbonization and infrastructure. For example, standards and codes can incorporate foam thermal performance standards, such as EN 13164 for XPS products or the China National Standard GB/T 20974 for rigid phenolic foam for thermal insulation. Appliance and building performance standards also offer a mechanism for ensuring that efficiency levels are maintained in new foam formulations.

6.6 ITEM 22: ADDITIONAL COSTS FOR EE FOAM PRODUCTS

Item 22: "Consider additional costs for energy-efficient foam products;"

Foam insulation used in the cold chain and buildings represent an important contribution to reducing heating and cooling loads and energy consumption. Combining the use of state-of-the-art foams and newer more efficient HVAC systems, higher comfort and better temperature control can be achieved while lowering energy consumption for buildings, logistics process, cold storages, and food conservation in both A5 and non-A5 parties.

Minimum thermal standards for insulation and building energy performance standards can ensure that insulation is optimised throughout the foam blowing agent transition while reducing the need for additional electricity generation. When mandated, foam and appliance manufacturers must provide the same performance in the finished product, as they select new FBAs. In addition, necessary foam performance is influenced by local market conditions and unique manufacturing conditions.

Insulated appliance design often balances energy efficiency and cost by examining the impact of both by multiple components, such as compressors, doors on refrigeration cabinets, and foam insulation. MEPS and energy labelling requirements have been instrumental in maintaining or increasing energy efficiency of these integrated systems during past transitions to foam blowing agents with higher thermal conductivity, e.g., the transition from CFC-11 to HCFC-141b. Optimizing foam formulations for efficiency and cost for next generation FBAs may require changes to other components (e.g., catalysts and surfactants) designed to address stability of systems to maintain shelf-life, especially in high temperatures), so the simple replacement of foam blowing agents (FBAs) may not be possible for some end-uses with limited foam thickness (e.g., high efficiency appliances). For large companies that manufacture polyurethane (PU) foams in one location, flammable foam blowing agents would require the same investment for safety equipment as required to safely use flammable refrigerants. For end-

uses that will allow for thicker construction foams (e.g., agricultural foams on roofs, spray foams in walls), thicker water-blown foams might be used, if they can be applied with cure times between layers without additional costs and achieve the same results (see Annex 8).

For PU foams where the highest efficiency is needed and the foam is currently incorporated at maximum thickness (e.g., high efficiency domestic and commercial appliances), the current cost to maintain thermal performance can be as high as US$ 30-70/kg FBA depending on the alternative selected.

Extruded polystyrene foams have similar outcomes, except that water is not a viable alternative, ranging from the capital cost for use of flammable FBAs to US$ 30-40/kg FBA higher than for currently used FBAs for foams with advanced thermal performance.

It should be noted that few countries require that commercial appliances have been optimized for efficiency, balancing the trade-offs for the contribution of different energy -saving strategies (e.g., doors on cabinets, more efficient compressors, higher performing foams), so manufacturers may select lower cost options than foam optimization.

6.7 ITEM 23: REGIONAL TESTING CENTRES

Item 23: "Consider regional testing centres for monitoring and verification of energy efficiency;"

In response to item 23, the RTF provides the following considerations for parties:

Testing needs. Product testing is an integral part of energy efficiency programs. Testing helps guarantee the quality and efficacy of products and provides the evidence needed to demonstrate compliance with national or regional policies. Test results are used to check products' performance claims before they enter the market, and to verify performance claims for suspicious products found on the market during market surveillance checks.
Access to national or regional testing centres will support effective implementation of product efficiency policies, help prevent delays in adopting regional policies, strengthen enforcement, and protect markets from inefficient and low-quality products.

National vs regional approach for testing. Establishing a test laboratory for a regulated product requires a large upfront investment and ongoing funding for its operation. If there is little demand for product testing for market surveillance purposes, the underutilization of a facility may hinder other policy enforcement efforts, as the funds needed for laboratory upkeep and maintenance may be diverted from other activities.
The use of regional laboratories is a viable alternative, especially in regions that are harmonizing energy efficiency standards and where a regional association already exists. Furthermore, using regional resources to support regional policy implementation such as a regional product registration system (PRS) for managing product registration and sharing market surveillance intelligence and test results can reduce the number of tests required to verify product compliance with policies in each member state.

Products should always be tested at an accredited laboratory or a laboratory that is seeking accreditation, which ensures that the laboratory is competent to provide consistent, accurate, and reliable test results.

Testing costs. Prices to test cooling products can vary greatly depending on different factors such as product type, test method, and the region. The price to test products at an accredited laboratory is higher than in a non-accredited laboratory. According to a SEAD Initiative study[48], indicative prices to test room air conditioners (AC) at an accredited laboratory range from 350 USD to 11,101 USD, and

[48] SEAD Global Appliance Testing Costs Catalogue. https://www.clasp.ngo/research/all/sead-global-appliance-testing-costs-catalogue/

to test refrigerator between 480 USD and 3,000 USD.[49] The Table 6-4 below shows the variation in testing prices for different regions, which are impacted by factors including complexity of test requirements, product characteristics and design features, compressor type, and laboratory ownership.

Table 6-4. Regional Variation in testing prices for AC and refrigeration products (US$)

Equipment	MENA		Africa		Asia		LAC		Other Regions	
	Low	High	Low	High	Low	High	Low	High	Low	High
AC	$1,040	$8,057	NA		$350	$6,825	$450	$3,360	$4,733	$11,101
Refrigeration	$480	$2,939	NA		$885	$2,500	$930	$3,000	$1,770	$2,360

Regional testing centres. If there are established regional testing centres to support regionally harmonized policy implementation, testing can be outsourced to these centres. This is especially key when countries in the region commit to using these regionally funded centres supported by other collaboration platforms (e.g., in ECOWAS, two regional testing centres are being considered to support the regional policy implementation for cooling appliances). Alternatively, governments looking to invest in testing capacity may also contribute to and provide co-funding to set up accredited and high-quality regional testing centres, rather than investing in a smaller and potentially unaccredited in-country test laboratory.

Costs of Building and Maintaining a Laboratory. Setting up a laboratory is an involved and complicated process requiring knowledge of equipment, its installation and procurement process. Professional expertise and assistance are recommended to ensure that the correct equipment is purchased, that it is correctly installed, and that quality training is provided for the staff.
The laboratory establishment costs include:

- Construction of the facility such as erecting a laboratory building or renovating the existing laboratories to accommodate a new laboratory.
- Procurement of specialized equipment for testing a specific product. The import duties should be considered as these may be steep for the equipment made overseas.
- Building human capacity requires investment of resources and time to train the technicians to operate the laboratory, maintain the equipment, test the products and produce reliable test reports.

The main costs associated with the operating the laboratory are:

- Ongoing operation and maintenance of the laboratory and equipment including rent, utilities, replacement and calibration of the equipment.
- Retention and on-going training of technical staff.
- Laboratory re-accreditation – an accreditation requires renewal after it expired, usually every four years.

A SEAD Initiative study found that the cost of setting up an air conditioner or refrigerator test laboratory can exceed 600,000 USD. The costs of building and operating a test laboratory are relatively consistent across the regions. Greater variation among the regions may be found for the costs to retain staff and space, such as lease or rent[1].

Technology	Capital Costs (USD)		Operational Costs (USD)
	Low	High	
ACs	$363,000	$665,000	$12,000 + Staff & Space
Refrigerators	$265,000	$617,000	$4,000 + Staff & Space

CLASP developed a **Test Laboratory Financial Evaluation Tool** to help policy makers and other stakeholders assess the financial viability of a planned test laboratory to support MEPS and labelling policies for products and appliances. The Tool allows users to calculate the costs of building and

[49] These are 2019 prices.

operating a laboratory and forecast its revenue for 5 product groups, including air conditioners and domestic refrigeration. Users can also choose to enter their own cost data. The Tool displays the costs and revenues in U.S. dollars and the local currencies of ECOWAS Member States as the Tool was initially developed for the policymakers in ECOWAS region. The tool can be downloaded here[50] along with a guide that provides instruction on establishing sustainable testing practices for ensuring product compliance with energy efficiency programs. Parties may wish to consider incorporating testing of foam insulation performance in testing centres, as well.

Regional testing needs and recommendations

Economic Community of West African States (ECOWAS)

- Market size (2022): 0.92 million ACs and 1.86 million refrigerators
- Nigeria and Ghana, among others, have national AC and refrigerators policies.
- **Focus on increasing capacity of existing testing laboratories**. Three room air conditioner and two refrigerator testing laboratories are currently in operation or under-construction in Ghana, Nigeria and Cape Verde. Ghana opened the test labs for ACs and refrigerators in 2021. Nigeria also has test labs for both products, but information on its operation is not available. The region would benefit from further investment and expansion of laboratory capacity, especially if the regional harmonization process is finalized.

East African Community (EAC)

- Market size (2022): 0.11 M ACs and 0.38 M refrigerators
- Harmonization of AC and refrigerator policies under way under the EELA program with support from U4E and East African Centre of Excellence for Renewable Energy and Efficiency (EACREE). The MEPS are yet to be adopted at a regional level. Kenya, Uganda and Rwanda have individually implemented national policies for cooling appliances.[51]
- There is no information available on the cooling testing capacity both in-country and at a regional level.

Southern African Development Community (SADC)

- Market size (2022): 0.28 million ACs and 1.94 million refrigerators
- Harmonization of AC and refrigerator policies under the EELA program with support from U4E and SADC Centre of Excellence for Renewable Energy and Efficiency (SACREE) has been successfully implemented. The regional cooling MEPS have been formally adopted by the SADCSTAN with acceptance from all member states. South Africa and Mauritius had MEPS for refrigerators and ACs and South Africa is in the process of amending the MEPS to reflect the new regional MEPS.
- Mauritius and South Africa have national test labs for refrigerators.

Association of South East Asian Nations (ASEAN)

- Market size (2022): 10.48 million ACs and 12.93 million refrigerators
- ASEAN has harmonized MEPS for ACs through the ASEAN SHINE 2020 targets at CSPF 3.08 Wh/Wh for all fixed- and variable-speed ACs below 3.52 kW. Most ASEAN countries have adopted these harmonized MEPS. U4E is helping with a phase-step approach for updating regional MEPS, with targets of CSPF 3.7 Wh/Wh by 2023 and CSPF 6.09 Wh/Wh (China inverter MEPS) by 2025.[52] As of 2021, there is interest to

[50] https://www.clasp.ngo/research/all/guide-to-building-sustainable-testing-capacity-in-ecowas/

[51] Adoption of the regional MEPS at EAC level would require all member states to nationalize the MEPS in 6 months.

[52] https://united4efficiency.org/u4e-ace-asean-member-states-workshop-takes-forward-recommendations-for-updating-room-air-conditioner-meps-in-the-region/

expand regional harmonized MEPS (and roadmap) to refrigerators, among other products.[53]

- As of 2018, there were 14 test labs for ACs and 18 for domestic refrigerators across the region, and only the Philippines, Thailand, and Vietnam had established national testing facilities. Indonesia has established MEPS for ACs since then, and it now has six AC testing labs appointed by Ministry of Energy and Mineral Resources (MEMR) - 2 facilities are government owned, 2 facilities owned by manufactures and other 2 facilities are private testing labs - providing testing and quality assurance services. The ASEAN Centre for Energy (ACE) is developing a regional mutual recognition arrangement for energy efficiency performance testing of ACs and other products for member states.[54] Thus, the region has some testing capacity, but would likely benefit from an expansion of capacity.

Caribbean Community (CARICOM) and Central American Integration System (SICA)

- Market size (2022): 0.84 million ACs and 1.97 million refrigerators
- Harmonization of AC and refrigerator policies under consideration.
- There is a CARICOM regional testing centre at the Bureau of Standards Jamaica, with the ability to test up to 15 refrigerators at a time and one air conditioner. The centre has electricity voltage and frequency controls that allow it to test according to the power configurations in other countries in the region, as Jamaica's 50Hz and 110V power configuration is unique in the region.

6.8 ITEM 24: ANALYSIS OF ADDITIONAL COSTS FOR EE AS INCENTIVE FOR LEAPFROGGING

Item 24: "Analyze additional costs for including EE as an incentive for enhancing ambitious HFC-phasedown and leapfrogging HFCs in the frame of the HPMPs and KIPs;"

The RTF took guidance based on ExCom Decision 60/44 para 198[55] where a funding of up to a maximum of 25 per cent above the cost effectiveness threshold (see Annex 9) will be provided for projects when needed for the introduction of EE technologies. This fulfilled part of the obligation under Decision XIX/6(11) to "minimize other impacts on the environment, including on the climate, taking into account global warming potential" but did not address the mandate to minimize "energy use," which is also explicitly mentioned in Decision XIX/6(11).

Leapfrogging in HPMPs

According to Chapter 4 Item 6, of this report, RTF used the assumptions for sector distribution of remaining eligible consumption, to estimate funding in manufacturing where leapfrogging opportunities were clear to RTF, such as:

- For the 34 non-LVCs with remaining HCFC-22 eligible consumption, 25% is assumed to be in the manufacturing sectors (mainly CR and AC), and 75% is in the servicing sector.
- For the AC and commercial refrigeration manufacturing sectors, RTF used an average CE of US$ 11/kg for the 30,836 MT of HCFC-22 in those sectors which gives an estimated cost for the total phaseout till 2030 of US$ 339 million. The total estimated funding for the triennium 2024–2026 when using the methodology in item 6, would be US$ 145 million.
- For 10 non-LVCs with remaining HCFC-141b consumption is foam manufacturing and solvent sectors, and as explained in Item 6 of Chapter 4, RTF assumed 95% in foam manufacturing at a CE of US$ 7.83/kg. The estimated funding to phaseout till 2030 the

[53] https://united4efficiency.org/wp-content/uploads/2021/04/ASEAN-workshop_EE-market-transformation_presentation.pdf

[54] https://www.clasp.ngo/wp-content/uploads/2021/01/2019-eceee-Summer-Study-Assessing-testing-capacity-in-ECOWAS-and-ASEAN-regions-to-support-SL-programs-for-cooling-appliances.pdf

[55] http://www.multilateralfund.org/sites/60/Document%20Library2/1/6054.pdf

remaining 1,255 metric tonnes of HCFC-141b is US$ 9.83 million and, according to RTF methodology in item 6, the 2024–2026 triennium funding needs would be US$ 4.21 million.

For leapfrogging high GWP HFCs in HPMPs, an incentive of up to a maximum 25% is applied as mentioned above which translates into an estimated additional **US$ 41 million** for the 2024–2026 triennium.

Table 6-5 provides a summary for the estimated consumption and funding requirement for the sectors with most of the eligible remaining consumption for the HPMPs.

Table 6-5. Estimated additional funding for including EE as an incentive for enhancing ambitious HFC-phasedown and leapfrogging HFCs

Controlled Substance/ Manufacturing sector	2024–2026 Estimated Funding (Million US$)
HCFC-22, Commercial Refrigeration and AC	145
HCFC-141b, foam manufacturing	4.21
Total funding without EE	**149**
Applying 25% for including EE as incentive	41
Total funding with EE	**186**

Leapfrogging in KIPs

In order to provide an estimate for the additional costs for EE as incentive for leapfrogging when implementing KIPs, the RTF considered the incentive linked approach presented in TEAP EEWG 2023 report, as shown in Table 6-6 below for split ACs, as example. An analysis by Wei and Shah in 2023 suggests that moving from Cooling Seasonal Performance Factor (CSPF)[56] of 3.4 to 4.4 would result in additional capital cost of US$ 400,000 per manufacturing line and US$ 23 of additional operating cost of per unit converted. Moving from CSPF 3.4 to CSPF 4.4 would be in the 30% range shown in Table 6-6.

For moving from 2.8 to 4.5 CSPF which is covering the lowest EE, the RTF expects that the additional capital cost of US$1,700,000 and additional operating cost would be US$ 93 per unit. Assuming a typical production line with a 200,000 unit per year and each consuming 2kg. The EE full cost would be US$ 20,300,000. The maximum additional costs for EE as incentive for leapfrogging is US$ 33.83/kg.

[56] CSPF ratings measure annual energy consumption and efficiency. A higher CSPF rating reflects a more energy efficient air conditioning unit. The CSPF takes into account different seasonal periods and temperature fluctuations at different cooling loads. These include situations where the unit is on standby or operating at partial load, such as when inverter technology is involved. This results in a more accurate and realistic indication of energy efficiency over an entire cooling season.

Table 6-6. EE Incentive Linked Cost and Assumed Market Distribution

EE improvement brackets	Example	Incentive Ratio	Market Distribution	Additional costs for EE as incentive while leapfrogging ($/kg)
More than 60%	Moving from a CSPF = 2.8 to 4.5	100%	5%	*33.83*
50 - 60%	Moving from a CSPF = 2.9 to 4.5 Or CSPF = 2.8 to 4.34	70%	10%	*23.70*
40 – 50 %	Moving from a CSPF = 3.1 to 4.5 Or CSPF = 2.8 to 4.06	50%	25%	*16.92*
30 – 40%	Moving from a CSPF = 3.3 to 4.5 Or CSPF = 2.8 to 3.8	30%	35%	*10.15*
20 – 30%	Moving from a CSPF = 3.6 to 4.5 Or CSPF = 2.8 to 3.5	15%	25%	*5.07*
Average additional costs for EE as incentive while leapfrogging, $/kg				13.11

6.9 ITEM 25: COST ESTIMATES OF POTENTIAL SUPPORT FOR SYSTEMIC APPROACHES

Item 25: "Provide cost estimates of potential supporting for systemic approaches to EE in KIPs, beyond the pilot window;"

Supporting systemic approaches to integrating energy efficiency into the HFC transition through enhancing capacity and enabling policies could be addressed through incorporation of additional EE costs in KIPs accounting for the appropriate combination of the "four legs of the stool": 1) manufacturing capability; 2) enabling policy & regulatory capacity, 3) testing capacity, monitoring, verification, and enforcement capacity, and 4) technician capacity.

Each of these components is described in the preceding sections as outlined in Table 6-7 (and in preceding TEAP EETF and EEWG reports). Note that the cost estimates in the sub-sections are not for a single consistent case but range from pilots to sectors to national policies and regional testing centres.

Table 6-7: Chapter Location and Sections on Systemic Approach

	Discussed in Chapter /Section
Manufacturing capability	6.2 (pilots), 6.3 and 6.8 (incentive), 6.4 (SME)
Enabling policy & regulatory capacity	6.5
Testing and MVE capacity	6.7
Servicing technician capacity	

A related concept is “systems thinking” in the context of energy efficiency and energy consumption and lifecycle emissions of the cold chain system or buildings as a system (e.g., envelope, equipment, integration, grid). Several case studies of this type of systems approaches were presented in Chapter 2 of the EEWG report[57], however, without cost estimates.

[57] https://ozone.unep.org/system/files/documents/TEAP-May2023-Progress-Report-Supplementary.pdf. "Supplement to the TEAP 2023 Progress Report: Decision XXXIV/3 Energy Efficiency Working Group Report"

CHAPTER 7 ADDITIONAL INFORMATION AND SCENARIOS: END OF LIFE (EOL)

7.1 INTRODUCTION

This section addresses the following items from the OEWG-45 Contact Group suggestions related to end-of-life (EOL) management of controlled substances:

> ***Item 26. Provide estimates of costs of managing reclamation, recycling, and cost-effective destruction of banks, including collection, transport, and disposal activities;***
>
> ***Item 27. Consider a scenario for end-of-life activities considered under ExCom decision 91/66 where only 30 % of countries request funding during this replenishment.***

7.2 ITEM 26: COST ESTIMATES

Item 26: "Provide estimates of costs of managing reclamation, recycling, and cost-effective destruction of banks, including collection, transport, and disposal activities;"

Providing estimates of costs of related activities

The conceptual scoping framework that could apply to funding in future triennium, for implementation of EOL management plans that are developed in the current triennium under Decision 91/66, might be applied across three categories of A5 countries that could potentially implement EOL ODS/HFC Management Plans. These three categories are differentiated by the scale involved (geographically and potential EOL waste volume generated) and the present country capacity that would initially exist in terms of institutional development/regulatory governance, servicing infrastructure, status of/access to supporting financial mechanism, and access to qualified chemical/hazardous waste management services/infrastructure.

1) *Larger industrialised countries with national chemical waste management capacity*— This category would apply to a relatively few industrialised countries with large, identified inventories of equipment containing banks of controlled substances, from which major quantities of EOL ODS/HFCs would become accessible continuously at EOL for management. These countries would be characterised by:

    - Well established commercial refrigeration servicing sector with effective refrigerant recovery, recycling and potentially reclaim treatment capability that covers all or most servicing requirements;
    - A regulatory framework covering the handling and management of EOL ODS/HFCs, such as emission controls, mandatory technician certification and servicing operator licensing requirements, major equipment registration/record keeping and regulations governing EOL ODS/HFC waste streams;
    - Implementation of national fiscal/financial mechanisms that provide incentives to recover and retain unwanted EOL ODS/HFCs;
    - A national commercial chemical/hazardous waste management sector and facilities to destroy halogenated chemical wastes; and
    - Implementation of overall circular economy-oriented policies that could address management of dilute EOL ODS/HFCs waste streams, such as foams.

2) *Countries with mature refrigeration servicing operations and potential access to regional chemical waste management capacity or co-disposal in qualified industrial processes*— This would a principally apply to medium-sized, industrialising countries with significant identified

inventories of equipment containing controlled substances, which could become accessible at EOL for management with targeted effort. These countries would be characterised by:

- An established commercial refrigeration sector with relatively advanced state of development in terms of refrigerant recovery, recycling, and potentially reclaim treatment capability, that handles most refrigeration servicing requirements but also retains less organised, informal servicing elements;
- A commitment to, or implementation of, a regulatory framework covering the handling and management of EOL ODS/HFCs such as emission controls, mandatory technician certification and servicing operator licensing requirements, and regulations governing EOL ODS/HFC waste streams;
- Commitments to implement national fiscal/financial mechanisms that provide incentives to recover and retain unwanted EOL ODS/HFCs;
- Developing national commercial chemical/hazardous waste management sector and potential to qualify facilities to destroy halogenated chemical wastes; and
- Limited or absent overall circular economy-oriented policies that could address management of dilute EOL ODS/HFCs waste streams, such as foams.

3) *Servicing only countries including LVCs*— This would principally apply to small- to medium-sized countries with more limited identified inventories of equipment containing controlled substances and associated predicably accessible EOL ODS/HFC. These countries would be characterised by:

   - A basic organised commercial refrigeration servicing sector, with developing but not fully developed, recovery, recycling, and reuse capability, that manages some but not all servicing requirements which otherwise may be handled by participation of less organised, informal servicing elements;
   - Limited regulatory framework covering the handling and management of EOL ODS/HFCs;
   - No plans to implement national fiscal/financial mechanisms that provide incentives to recover and retain unwanted EOL ODS/HFCs;
   - No national commercial chemical/hazardous waste management sector or facilities to destroy halogenated chemical wastes; and
   - No overall circular economy-oriented policies that could address management of dilute EOL ODS/HFCs waste streams, such as foams.

The underlying assumption for all three categories of country is that MLF funding for EOL management would primarily focus in the near-term on building physical capacity. This capacity would start at the source, to capture and secure EOL ODS/HFC before release, and work back through existing commercial refrigerant servicing, chemicals distribution, and waste management systems available in the country. Activities would involve capture of EOL ODS/HFCs at source and integration into the commercial operation of these sectors back to central points in the country, such as regional servicing workshops/operating bases, chemicals distribution operations, and/or licensed commercial waste management service providers. At these central points, unwanted collected material would be evaluated for their appropriate disposition (i.e., treatment for reuse or destruction), and secure storage to accumulate quantities of EOL ODS/HFC to allow economic higher-level treatment for reuse or destruction.

Table 7-1 below provides a more detailed scoping framework and indicative costs, where applicable, for the three categories of country and specific components and elements that might be considered in estimating the potential costs that could apply in a future triennium.

In general, the source-based components will be common across the country categories, defined to a greater or lesser degree by the quantities of accessible EOL ODS/HFCs that can be predicably anticipated to be captured for management, the existing level of infrastructure and capacity in the commercial refrigeration servicing and waste management sectors, and the maturity of supporting regulatory frameworks and sustaining financial mechanisms.

MLF support for destruction activities, within a country or through export, is assumed to be limited to:

- National capacity to support the development of associated business arrangements and administration required for the transactions between parties involved, including transborder transactions, and
- Identification and qualification/demonstration of environmentally sound and economically sustainable destruction options.

It is generally assumed that undertaking destruction of sustainable quantities of EOL ODS/HFC would be supported by other market-based financing mechanisms, including extended producer responsibility and carbon finance mechanisms. With respect to the latter, a key role that MLF could play is supporting A5 countries. This support could be particularly for those countries currently with the least capacity to participate in an evolving sustainable global EOL management system. The ideal system would be based on the equitable distribution throughout the system of the revenues generated, extending back to the national level commercial refrigeration servicing and waste managers.

Table 7-1 Scoping framework and indicative costs for EOL ODS/HFC management for 2027–2029 triennium

Process step/Cost factor	Large, industrialized countries with national chemical waste mgt. capabilities	Countries with mature servicing operations and potential access to regional chemical waste mgt. capacities	Servicing only countries including LVCs
Component 1: Investment in ODS/HFC capture and collection at source from RAC operating and retiring bank of equipment			
1(a Provision of additional technician equipment/tools and training. *1(b) Additional OPEX (labour/logistics) associated with collection and return of EOL material*	• Generally assumed that the commercial servicing sector can incrementally add and optimize operations for capture and return of contaminated or unused refrigerant to support incremental investment required, provided market-based policy and financial incentives are in place	• Some incremental investment at the level of servicing technicians required to expand commercial servicing capability for capture and return and bring in informal capacity into the organized servicing sector to reach significant EOL volumes.	• Continued funding to build overall refrigerant management capability required generally, including the capability for refrigerant capture and return capacity at the technician level including continued investment in training.
Cost Items/Indicative Cost	• Incremental technician time to recover, collect and return material to servicing operation base shop (RRR centre) integrated with servicing calls/equipment maintenance • Recovery machines, recovery cylinders, associated tools, refrigerant quality identifiers US$ 1,000 per kit for recovery, US$ 5,000 per identifier • Technician time, return transport costs Variable with sector and local conditions (i.e., residential AC unit at US$45, other local rates applicable to other sectors) • Technician training, certification, and awareness Variable depending on sector, maturity of servicing sector and /local conditions. Average technical training cost is US$ 400/technician. Average certification programme cost up to US$ 100,000.		
Component 2: Investment in collected EOL testing, storage capacity, treatment and RRR			
Operational, secure storage capacity for accumulated EOL ODS/HFC	• Assume that commercial servicing sector well supported with local/regional base operations centres with available expandable space for secure storage sufficient to accumulate economic quantities for treatment or	• Assume the commercial servicing sector has local/regional base operational centres that will require modest incremental investment to accumulate economic quantities for treatment or onward shipment for destruction. This	• Initial development of centralized storage capability and supporting infrastructure serving country or major population centre suitable for incremental expansion as

Process step/Cost factor	Large, industrialized countries with national chemical waste mgt. capabilities	Countries with mature servicing operations and potential access to regional chemical waste mgt. capacities	Servicing only countries including LVCs
	onward shipment for destruction without significant investment or can be made as co-financing contribution if supported.	may involve establishment of centralized national storage infrastructure depending on country size and expectations of EOL collection potential.	collected EOL volumes increase would require funding.
Testing equipment	• Required analytical equipment assumed to be generally available within the commercial servicing sector	• Required analytical equipment likely available to a limited degree within existing commercial servicing system or externally accessible. Additions required justification of need.	• Existing suitable analytical equipment availability likely limited and would need funding.
Capacity for consolidation in larger containers cylinders for transportation	• Bulk storage prior to shipping for destruction or reclamation/reprocessing assumed to available or accessible through partnerships with others (chemical distributors/ waste managers) involving exchange arrangements. Existing refrigerant transfer/purging equipment/ tools and materials handling equipment should be available.	• Bulk storage prior to shipping for destruction or reclamation/reprocessing may be available or accessible through partnerships with others (chemical distributors/ waste managers) involving exchange arrangements for larger countries/operators but may need supplementary generally need investment support. Existing refrigerant transfer/purging equipment/ tools and materials handling equipment should be available but may need funding support as justified.	• Equipment for bulk storage will be country specific depending on potential for recovery and can be expected to develop with initial funding ranging from relatively small units upwards over time. Likewise, additional refrigerant transfer/purging equipment/ tools and basic materials handling equipment will require funding support.
Reclamation	• Assume that reclamation has achieved economies of scale and price of reclaimed refrigerant is competitive with new material and no direct investment required.	• Assume that generally reclamation has achieved economies of scale and price of reclaimed refrigerant is competitive with new material with investment support provided as justified, or potential support in pursuing an option	• Investment will depend on ability to capture sufficient material to be justified economically with likely option of accessing regional capability if available (potentially

Process step/Cost factor	Large, industrialized countries with national chemical waste mgt. capabilities	Countries with mature servicing operations and potential access to regional chemical waste mgt. capacities	Servicing only countries including LVCs
		of accessing a regional capability could be funded.	supported with funding as part of a regional initiative)
Cost Items/Indicative Cost	• Covered floor space sufficient to house: i) two shipping containers to accumulate consolidated EOL ODS/HFCs inclusive of workspace; ii) refrigerant container storage (range of sizes); iii) laboratory/testing equipment (clean room); iv) reclamation and blend separation (potential future additions) as needed (likely only viable in large countries or regional facilities). – Cost variable with scope and scale of requirement based on construction local market. • Evaluate recovered EOL ODS/HFC samples to determine whether it is waste or treatable for reuse – i) Refrigerant identifiers (US$ 5,000/unit); ii) Gas Chromatography (GC) equipment (US$ 45K to 50K); and iii) Cost per GC analysis (US$ 500). • Bulk storage containers of various sizes up to ISO tanks depending on scale and justified demand forecasts, refrigerant transfer/purging equipment and tools (US$ 1,500/set), material handling equipment scaled to requirement. • Investment in reclamation in the near to medium terms will generally be selective based on economic justification and market opportunity with some potential for simple single component decontamination investment in individual countries (i.e., up to US$ 30,000 contribution per facility) and facilitation participation in larger regional multi-component separation installations undertaken in partnership with private sector players (i.e., up to US$ 500,000 contribution to such initiatives).		
Component 3: Institutional strengthening and technical assistance			
Policy & regulatory development	• Assumed that a mature national policy and regulatory framework linked to both climate and circular economy objectives will be in effect for sustained EOL management and sustainable with any funding support being limited to innovative improvements and to transfer/ sharing of best practices.	• Assume support for advancing the national policy and regulation framework for EOL management to the point that it is fully developed will be selectively provided in the near term with the objective that a mature policy and regulatory framework is in place and sustainable in the longer term	• Continued support for national policy and regulation framework for EOL management required to allow these countries to advance and capitalize on opportunities in the longer term,
Updating bank inventories and EOL management plan	• Assume that these countries have fully implemented the initial plan and have embedded mechanisms to main bank inventories to support its ongoing execution.	• Assume that a one-time review and update of the initial EOL management plan supported in a future triennium with the objective of its maintenance would be sustained beyond that except	• Provision of regular non-investment funding scaled in appropriate brackets would be available in successive near-

Process step/Cost factor	Large, industrialized countries with national chemical waste mgt. capabilities	Countries with mature servicing operations and potential access to regional chemical waste mgt. capacities	Servicing only countries including LVCs
		under circumstances justified on a country specific basis.	term triennium based on review of performance and need.
Sustainable collection incentive and financing mechanisms	• Assume these countries either now have or intend to have internal capability to establish the required national incentive and financing mechanisms to support operation of collection and supporting infrastructure.	• Assume that these countries receive near term support to development effective sustainable incentive and financing mechanisms to support operation of collection and supporting infrastructure	• Provision of support in several future triennium to support to development of effective sustainable incentive and financing mechanisms to support operation of collection and supporting infrastructure
Reclamation/blend separation feasibility assessment	• On a selective and justified basis, support feasibility studies of development of self- sustaining national reclamation/blend separation capability.	• Support feasibility studies of development for self-sustaining national reclamation/blend separation capability or participation in regional facilities including addressing regulatory and convention issues associated with transborder movement of EOL ODS/HFCs.	• Support feasibility studies for participation in regional facilities including addressing regulatory and convention issues associated with transborder movement of EOL ODS/HFCs.
Destruction technical and business option evaluation	• Assume that available commercial destruction facilities exist in these countries and support on a selective basis would be limited to cases where qualification of such facilities in terms of TEAP DRE requirements and environmental performance guidelines was required. • Support investigation of attracting EPR and/or carbon finance options to support economic destruction.	• Support for feasibility studies related to the qualification of existing industrial facilities offering capability to destroy EOL ODS/HFCs or technical development and the business case for development of partner financed national or regional ODS/HFC destruction capability including potential development of down-sized variants of approved technologies.	• Support for evaluation of options related to i) the export of EOL ODS/HFCs, ii) feasibility studies related to the qualification of existing industrial facilities offering capability to destroy EOL ODS/HFCs, and/or iii) development of down-sized variants of approved technologies. • Support investigation of attracting EPR and/or carbon

Process step/Cost factor	Large, industrialized countries with national chemical waste mgt. capabilities	Countries with mature servicing operations and potential access to regional chemical waste mgt. capacities	Servicing only countries including LVCs
		• Support investigation of attracting EPR and/or carbon finance options to support economic destruction.	finance options to support economic destruction.
Cost Items/Indicative Cost	• Funding for the above activities will generally involve national/or international consultant studies costed based on prevailing market values and country specific scope definition. • Reference indicative destruction cost are i) Commercial hazardous waste chemical destruction US$ 2-3/kg (assumes economies of scale) are potentially achievable; and ii) Range of destruction costs, as demonstrated in MLF pilot projects: US$ 5 to US$ 20/kg.		

7.3 ITEM 27: SCENARIO FOR EOL ACTIVITIES

Item 27: "Consider a scenario for end-of-life (EOL) activities considered under ExCom decision 91/66 where only 30 % of countries request funding during this replenishment."

Scenario for EOL activities with only 30% of countries requesting funding

Table 6-1 of the May 2023 Replenishment Task Force Report estimated the maximum funding under the funding window established in decision 91/66, based on the inclusion of all 144 countries, using the funding bands specified in the decision, and assuming all funding commitments for EOL activities are within the replenishment period.

Table 7-2 shows the original Table 6-1 with additional columns to include the scenario for EOL activities considered under ExCom Decision 91/66 where only 30 % of countries request funding within the replenishment period.

This scenario under item 27 reduces the updated estimated funding for the 2024–2026 triennium by **US$ 9,151,000**.

Table 7-2 Funding scenarios under the funding window established in decision 91/66

HCFC baseline (ODPt) Group	Decision 91/66 Funding (US$)	Total No. of countries by Group	Maximum Funding by Group (US$)	33% of Total Number of Countries by Group*	33% Scenario Funding by Group (US$)
Below 1	$ 70,000	22	$ 1,540,000	7	$ 490,000
Between 1 and 6	$ 80,000	36	$ 2,880,000	12	$ 960,000
Above 6 and up to 100	$ 90,000	62	$ 5,580,000	20	$ 1,800,000
Above 100	$ 100,000	24	$ 2,400,000	8	$ 800,000
Total without support costs (US$)		**144**	**$ 12,400,000**	**47**	**$ 4,050,000**
TOTAL with support cost of 9.6% (US$)			**$ 13,590,000**		**$ 4,439,000**

* 33% of the total number of countries has been calculated by rounding the number of countries up or down to the closest whole number.

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CLASP 2022	https://www.clasp.ngo/research/all/guide-to-building-sustainable-testing-capacity-in-ecowas/
The International Monetary Fund (IMF) 2022	Report provides data to estimate growth rates by country in Gross Domestic Product (GDP) annually. Available at: https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD
MLF 2019	HCFC phase-out management plans and HCFC production phase-out management plans (December 2019)
MLF 2020	Executive Committee Primer – 2020: An introduction to the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol. http://www.multilateralfund.org/aboutMLF/executivecommittee/Shared%20Documents/2020%20Primer.pdf.
MLF 2020	Factsheets and final reports for demonstration projects on low-global-warming-potential alternatives to HCFC technologies. http://www.multilateralfund.org/Our%20Work/DemonProject/default.aspx.
MLF 2020	Executive Committee Primer – 2020
MLF 2020	Report on ODS approved for phase-out in HPMPs by Article 5 country and HCFC (As of December 2020)
MLF 2021	HCFC phase-out management plans and HCFC production phase-out management plans (June 2021): http://www.multilateralfund.org/Our%20Work/policy/Shared%20Documents/HPMPs-HPPMPs%2085.pdf
MLF 2022	"Policies, Procedures, Guidelines and Criteria of the Multilateral Fund",(as at December 2022) http://www.multilateralfund.org/Our%20Work/policy/default.aspx
MLF 2022	Factsheets and final reports for demonstration projects on low-global-warming-potential alternatives to HCFC technologies
MLF 2022	Policies, procedures, guidelines and criteria http://www.multilateralfund.org/Our%20Work/policy/Shared%20Documents/Policy91-Introduction.pdf
MLF 2022	Report on the review of the implementation of the operational policy on gender mainstreaming for multilateral fund-supported projects (Decision 84/92).
MLF/IACM. 2018	2018/2/17 Guide for the Presentation of Tranches of HCFC Production Sector Phase-out Management Plan
MOP Decisions	https://ozone.unep.org/meetings?field_date_range_end_value%5Bmin%5D=1980-01-01&field_date_range_end_value%5Bmax%5D=2020-12-31&field_meeting_type_value%5BMOP%5D=MOP
Ozone Secretariat	https://ozone.unep.org/treaties/montreal-protocol/meetings/thirtieth-meeting-parties/decisions/annex-i-adjustments
SACREEE EACREEE	The East African Centre of Excellence for Renewable Energy and Efficiency

SEAD Global Appliance Testing Costs Catalogue.	https://www.clasp.ngo/research/all/sead-global-appliance-testing-costs-catalogue/
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UNEP/OzL.Pro/ExCom/91/8	Country Programme Data and Prospects for Compliance
UNEP/OzL.Pro/ExCom/91/22	Consolidated Business Plan of the Multilateral Fund for 2023–2025
UNEP/OzL.Pro/ExCom/91/22p2	Consolidated Business Plan of the Multilateral Fund for 2023–2025
UNEP/OzL.Pro/ExCom/91/71	Report of the Sub-Group on the Production Sector
UNEP/OzL.Pro/ExCom/91/72	Report of the Ninety-First Meeting of the Executive Committee
UNEP/OzL.PRO/ExCom/92/49	Report on the local installation and assembly subsector, including types of equipment and refrigerants and challenges in transitioning to low-GWP alternatives
UNEP/OzL.Pro/ExCom/92/5	Country Programme Data and Prospects for Compliance.
UNEP/OzL.Pro/ExCom/92/11	Update on the Status of Implementation of the 2023–2025 Consolidated Business Plan of the Multilateral Fund
UNEP/OzL.Pro/ExCom/92/55	Report of the Sub-Group on the Production Sector
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ANNEX 1: TERMS OF REFERENCE FOR THE STUDY ON THE 2024–2026 REPLENISHMENT OF THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

The text of Decision XXXIV/2: "Terms of reference for the study on the 2024–2026 replenishment of the Multilateral Fund for the Implementation of the Montreal Protocol" is as follows:

Recalling the parties' decisions on previous terms of reference for studies on the replenishment of the Multilateral Fund for the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer,

Recalling also the parties' decisions on previous replenishments of the Multilateral Fund,

1. To request the Technology and Economic Assessment Panel to prepare a report for submission to the Thirty-Fifth Meeting of the Parties to the Montreal Protocol, and to submit it through the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-fifth meeting, to enable the Thirty-Fifth Meeting of the Parties to adopt a decision on the appropriate level of the 2024–2026 replenishment of the Multilateral Fund;

2. That, in preparing the report referred to in paragraph 1 of the present decision, the Panel should take into account, among other things:

    a) All control measures and relevant decisions agreed upon by the parties to the Montreal Protocol and the Executive Committee of the Multilateral Fund, including paragraphs 9 through 25 of decision XXVIII/2, and the decisions of the Thirty-Fourth Meeting of the Parties and the Executive Committee at its meetings, up to and including its ninety-second meeting, insofar as those decisions will necessitate expenditure by the Multilateral Fund during the period 2024–2026;

    b) The special needs of low-volume-consuming and very-low-volume-consuming countries;

    c) The need to allocate resources to enable all parties operating under paragraph 1 of Article 5 of the Montreal Protocol to comply with Articles 2A–2J of the Protocol, and the reductions and extended commitments made by parties operating under Article 5 of the Protocol under approved hydrochlorofluorocarbon (HCFC) phase-out management plans and Kigali hydrofluorocarbon (HFC) implementation plans;

    d) Decisions, rules and guidelines agreed by the Executive Committee at all its meetings, up to and including its ninety-second meeting, in determining eligibility for the funding of investment projects and non-investment projects;

    e) The need to allocate resources for activities to maintain and/or enhance energy efficiency while phasing down HFCs including those relating to pilot and demonstration projects, in accordance with any energy efficiency cost guidance developed by the Executive Committee, or, should the Executive Committee not adopt cost guidance in time to be considered in the report, for a scenario for a funding window to support such activities;

    f) The need to allocate resources for supporting activities related to gender mainstreaming as part of the gender policy of the Multilateral Fund, taking into account the implementing agencies' existing policies to promote gender mainstreaming and the mandate set out in Executive Committee decision 84/92;

    g) The need to allocate resources for a funding window for activities to support end-of-life management and disposal of controlled substances in an environmentally sound manner, in accordance with any relevant decisions by the Executive Committee, or, should the

Executive Committee not adopt relevant decisions in time to be considered in the report, for a scenario for funding a limited number of demonstration projects;

h) A scenario to increase funding for institutional strengthening and the compliance assistance programme to assist parties operating under paragraph 1 of Article 5 to strengthen their national capacities to address challenges associated with implementing the Kigali Amendment;

3. That in estimating the funding requirement associated with the HCFC and HFC targets, the Panel will use a clearly explained compliance-based methodology that is informed by, but independent of, the business plan of the Multilateral Fund, taking into account policy guidance provided by the meeting of the parties and/or the Executive Committee;

4. That the Panel should provide indicative figures associated with enabling parties operating under paragraph 1 of Article 5 to implement HCFC phase-out management plans and Kigali HFC implementation plans in a coordinated manner. Indicative figures should be provided for a range of typical scenarios, using all relevant data available to the Panel;

5. That, in preparing the report, the Panel should consult widely, including all relevant persons and institutions and other relevant sources of information deemed useful;

6. That the Panel should strive to complete the report in good time to enable it to be distributed to all parties two months before the forty-fifth meeting of the Open-ended Working Group;

7. That the Panel should provide indicative figures for the periods 2027–2029 and 2030–2032 to support a stable and sufficient level of funding, on the understanding that those figures will be updated in subsequent replenishment studies.

ANNEX 2: LIST OF PROJECTS AND ACTIVITIES APPROVED FOR FUNDING AT EXCOM-92 (UNEP/OZL.PRO/EXCOM/92/56)

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
ALBANIA	HCFC phase out plan	Preparation of HCFC phase-out management plan (stage III)			$10,000	$1,300	$11,300
		Preparation of HCFC phase-out management plan (stage III)			$20,000	$1,400	$21,400
	Total for Albania				**$30,000**	**$2,700**	**$32,700**
ARGENTINA	HCFC phase out plan	HCFC phase-out management plan (stage II, third tranche) (PU foam manufacturing sector)	UNIDO	28.3	$2,125,793	$148,806	$2,274,599
		HCFC phase-out management plan (stage II, third tranche) (PMU)	UNIDO		$262,799	$18,396	$281,195
		HCFC phase-out management plan (stage II, third tranche) (refrigeration servicing sector)	UNIDO	17	$1,474,458	$103,212	$1,577,670
	Ozone unit support	Extension for institutional strengthening project (phase XI: 9/2023-9/2026)	UNDP		$825,528	$57,787	$883,315
	Total for Argentina			**45.3**	**$4,688,578**	**$328,201**	**$5,016,779**
BENIN	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Total for Benin				**$30,000**	**$3,900**	**$33,900**
BHUTAN	HCFC phase out plan	Verification report on the implementation of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Total for Bhutan				**$30,000**	**$3,900**	**$33,900**
BOSNIA AND HERZEGOVINA	Ozone unit support	Extension of the institutional strengthening project (phase VIII: 6/2023-5/2026)	UNIDO		$252,594	$17,682	$270,276
	Total for Bosnia and Herzegovina				**$252,594**	**$17,682**	**$270,276**
BURKINA FASO	HCFC phase out plan	HCFC phase-out management plan (stage II) (energy efficiency - related activities under decision 89/6))	Germany		$120,000	$15,600	$135,600
		HCFC phase-out management plan	UNEP	1.3	$125,000	$15,536	$140,536

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
		(stage II, first tranche)					
		HCFC phase-out management plan (stage II, first tranche)	UNIDO	2.0	$200,000	$14,000	$214,000
	Total for Burkina Faso			**3.3**	**$445,000**	**$45,136**	**$490,136**
BURUNDI	HFC PHASE-DOWN PLAN	Preparation of a Kigali HFC implementation plan	UNIDO		$51,000	$3,570	$54,570
		Preparation of a Kigali HFC implementation plan	UNEP		$119,000	$15,470	$134,470
	Total for Burundi				**$170,000**	**$19,040**	**$189,040**
CAMBODIA	Ozone unit support	Extension of institutional strengthening project (phase XII:1/2024-12/2026)	UNEP		$298,522	$0	$298,522
	Total for Cambodia				**$298,522**	**$0**	**$298,522**
CAMEROON	HFC phase-down plan	Kigali HFC implementation plan (stage I, first tranche)	UNIDO	161.1	$355,500	$24,885	$380,385
	Total for Cameroon			**161.1**	**$355,500**	**$24,885**	**$380,385**
CHILE	Ozone unit support	Extension of the institutional strengthening project (phase XV: 6/2023-5/2026)	UNDP		$494,283	$34,600	$528,883
	Total for Chile				**$494,283**	**$34,600**	**$528,883**
CONGO, DR	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Total for Congo, Dr				**$30,000**	**$3,900**	**$33,900**
CUBA	HCFC phase out plan	HCFC phase-out management plan (stage II, second tranche)	UNDP		$260,000	$18,200	$278,200
	Total for Cuba				**$260,000**	**$18,200**	**$278,200**
DOMINICAN REPUBLIC	HCFC phase out plan	HCFC phase-out management 12.6plan (stage III, second tranche)	UNEP	1.5	$111,160	$14,451	$125,611
		HCFC phase-out management plan (stage III, second tranche)	UNDP	12.6	$964,808	$67,537	$1,032,345
	Ozone unit support	Extension of the institutional strengthening project (phase XII: 7/2023-6/2026)	UNEP		$355,929	$0	$355,929
	Total for Dominican Republic			**14.1**	**$1,431,897**	**$81,988**	**$1,513,885**

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
ECUADOR	Ozone unit support	Extension of institutional strengthening project (phase VIII: 6/2023-5/2026)	UNIDO		$468,452	$32,792	$501,244
	Total for Ecuador				**$468,452**	**$32,792**	**$501,244**
ERITREA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Ozone unit support	Renewal of the institutional strengthening project (phase VI: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Eritrea				**$210,000**	**$3,900**	**$213,900**
ESWATINI	Ozone unit support	Extension of institutional strengthening project (phase VIII: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Eswatini				**$180,000**	**$0**	**$180,000**
ETHIOPIA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Total for Ethiopia				**$30,000**	**$3,900**	**$33,900**
FIJI	HCFC phase out plan	Verification report on the implementation of the HCFC phase-out management plan	UNDP		$30,000	$3,900	$33,900
	Total for Fiji				**$30,000**	**$3,900**	**$33,900**
GAMBIA	Ozone unit support	Extension of the institutional strengthening project (phase XII: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Gambia				**$180,000**	**$0**	**$180,000**
GEORGIA	Ozone unit support	Extension of the institutional strengthening project (phase XII: 7/2023-6/2026)	UNDP		$180,000	$12,600	$192,600
	Total for Georgia				**$180,000**	**$12,600**	**$192,600**
GUYANA	HCFC phase out plan	HCFC phase-out management plan (stage II, third tranche)	UNDP	0.3	$125,000	$8,750	$133,750
		HCFC phase-out management plan (stage II, third tranche)	UNEP	0.1	$45,500	$5,915	$51,415
	Total for Guyana			**0.4**	**$170,500**	**$14,665**	**$185,165**
HONDURAS		HCFC phase-out management plan	UNIDO		$80,000	$5,600	$85,600

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
	HCFC phase out plan	(stage II, second tranche) (energy efficiency - related activitites under decision 89/6)					
		HCFC phase-out management plan (stage II, second tranche) (energy efficiency - related activitites under decision 89/6)	UNEP		$40,000	$5,200	$45,200
		HCFC phase-out management plan (stage II, second tranche)	UNIDO	2.8	$164,500	$11,515	$176,015
		HCFC phase-out management plan (stage II, second tranche)	UNEP	0.6	$36,500	$4,745	$41,245
	Total for Honduras			**3.4**	**$321,000**	**$27,060**	**$348,060**
INDIA	HFC PHASE-DOWN PLAN Preparation of project proposal	Preparation of a KIP investment project in the air conditioner (AC) manufacturing sector for Voltas Limited	UNDP		$30,000	$2,100	$32,100
		Preparation of a KIP investment project in the refrigeration manufacturing sector for Mech Air Industries	UNDP		$30,000	$2,100	$32,100
		Preparation of a KIP investment project in the refrigeration manufacturing sector for Rockwell Industries	UNDP		$30,000	$2,100	$32,100
		Preparation for a pilot project to maintain and/or enhance energy efficiency	Germany		$30,000	$3,900	$33,900
	Total for India				**$120,000**	**$10,200**	**$130,200**
INDONESIA	HCFC phase out plan	HCFC phase-out management plan (stage II, fourth tranche)	UNDP	25.8	$433,300	$30,331	$463,631
		HCFC phase-out management plan (stage III, first tranche)	Australia	6.1	$495,000	$57,388	$552,388
		HCFC phase-out management plan (stage III, first tranche)	UNDP	49.1	$3,520,244	$246,417	$3,766,661
	HFC Preparation of project proposal	Preparation of a Kigali HFC implementation plan	IBRD		$220,000	$15,400	$235,400
	Total for Indonesia			**81.0**	**$4,668,544**	**$349,536**	**$5,018,080**

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
KENYA	Ozone unit support	Extension of institutional strengthening project (phase XIII: 7/2023-6/2026)	UNEP		$401,857	$0	$401,857
	Total for Kenya				**$401,857**	**$0**	**$401,857**
KIRIBATI	Ozone unit support	Renewal of institutional strengthening project (phase IX: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Kiribati				**$180,000**	**$0**	**$180,000**
KUWAIT	Ozone unit support	Extension of institutional strengthening project (phase IX: 6/2023-5/2026)	UNEP		$279,056	$0	$279,056
	Total for Kuwait				**$279,056**	**$0**	**$279,056**
KYRGYZSTAN	HCFC phase out plan	HCFC phase-out management plan (energy efficiency - related activities under decision 89/6)	UNEP		$100,000	$13,000	$113,000
	Total for Kyrgyzstan				**$100,000**	**$13,000**	**$113,000**
LEBANON	HCFC phase out plan	Preparation of HCFC phase-out management plan (stage III) (Overarching)	UNDP		$60,000	$4,200	$64,200
		HCFC phase-out management plan (stage II, fourth tranche)	UNDP		$259,364	$18,155	$277,519
	Ozone unit support	Extension of the institutional strengthening project (phase XIII: 8/2023-7/2026)	UNDP		$410,926	$28,765	$439,691
	Total for Lebanon				**$730,290**	**$51,120**	**$781,410**
LESOTHO	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	Germany		$30,000	$3,900	$33,900
	Total for Lesotho				**$30,000**	**$3,900**	**$33,900**
LIBERIA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Ozone unit support	Extension of the institutional strengthening project (phase X: 11/2023-10/2026)	UNEP		$225,780	$0	$225,780
	Total for Liberia				**$255,780**	**$3,900**	**$259,680**
MALAWI		HCFC phase-out management plan	UNEP		$120,000	$15,169	$135,169

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
	HCFC phase out plan	(stage II, second tranche) (energy efficiency - related activities under decision 89/6)					
		HCFC phase-out management plan (stage II, second tranche)	UNIDO	1.5	$100,000	$9,000	$109,000
		HCFC phase-out management plan (stage II, second tranche)	UNEP	2.0	$140,000	$17,697	$157,697
	Total for Malawi			**3.5**	**$360,000**	**$41,866**	**$401,866**
MALI	HCFC phase out plan	HCFC phase-out management plan (stage I, fifth tranche)	UNDP		$28,000	$2,100	$30,100
		HCFC phase-out management plan (stage I, fifth tranche)	UNEP		$28,000	$3,640	$31,640
	Ozone unit support	Extension of the institutional strengthening project (phase X: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Mali				**$236,000**	**$5,740**	**$241,740**
MEXICO	REFRIG. Commercial Conversion	refrigerators from HFC-134a to propane (R-290) at the enterprise Friocima	UNDP		$136,500	$12,285	$148,785
	HCFC phase out plan	HCFC phase-out management plan (stage II, fifth tranche)	UNIDO	21.7	$450,600	$31,542	$482,142
	HFC-23 emission control	Destruction of emissions of HFC-23 generated in the production of HCFC-22 in Quimobasicos (second tranche)	UNIDO		$387,561	$27,129	$414,690
	Total for Mexico			**21.7**	**$974,661**	**$70,956**	**$1,045,617**
MOLDOVA, REP	Ozone unit support	Extension of the institutional strengthening project (phase XII: 7/2023-6/2026)	UNEP		$183,707	$0	$183,707
	Total for Moldova, Rep				**$183,707**	**$0**	**$183,707**
MONGOLIA	Ozone unit support	Renewal of the institutional strengthening project (phase XIII: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Mongolia				**$180,000**	**$0**	**$180,000**
MOROCCO	HFC PHASE-DOWN PLAN	Preparation of project proposal Preparation of a KIP investment project in the refrigeration	UNIDO		$30,000	$2,100	$32,100

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
		manufacturing sector for MANAR					
	Total for Morocco				**$30,000**	**$2,100**	**$32,100**
NAMIBIA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	Germany		$30,000	$3,900	$33,900
	Total for Namibia				**$30,000**	**$3,900**	**$33,900**
NICARAGUA	HCFC phase out plan	HCFC phase-out management plan (stage II, second tranche) (energy efficiency - related activities under decision 89/6)	UNIDO	0.5	$49,000	$3,430	$52,430
		HCFC phase-out management plan (stage II, second tranche) (energy efficiency - related activities under decision 89/6)	UNEP		$51,000	$6,630	$57,630
		HCFC phase-out management plan (stage II, second tranche)	UNIDO	1.4	$148,817	$10,417	$159,234
	Ozone unit support	Renewal of institutional strengthening project (phase XI: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Nicaragua			**1.9**	**$484,749**	**$27,748**	**$512,497**
NIGER	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNIDO		$30,000	$2,700	$32,700
	Total for Niger				**$30,000**	**$2,700**	**$32,700**
NIUE	Ozone unit support	Extension of the institutional strengthening project (phase IX: 1/2024-12/2026)	UNEP		$100,000	$0	$100,000
	Total for Niue				**$100,000**	**$0**	**$100,000**
NORTH MACEDONIA	Ozone unit support	Extension of the institutional strengthening project (phase VIII: 7/2023-6/2026)	UNIDO		$350,666	$24,547	$375,213
	Total for North Macedonia				**$350,666**	**$24,547**	**$375,213**
OMAN	Ozone unit support	Renewal of institutional strengthening support (phase IX: 9/2023-8/2026)	UNIDO		$181,410	$12,699	$194,109
	Total for Oman				**$181,410**	**$12,699**	**$194,109**

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
PALAU	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Ozone unit support	Renewal of institutional strengthening project (phase X: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Palau				**$210,000**	**$3,900**	**$213,900**
PANAMA	HCFC phase out plan	HCFC phase-out management plan (stage III, second tranche)	UNDP	8.1	$497,612	$34,833	$532,445
	Total for Panama			**8.1**	**$497,612**	**$34,833**	**$532,445**
PAPUA NEW GUINEA	HCFC phase out plan	Verification report on the implementation of stage I of the HCFC phase-out management plan	Germany		$30,000	$3,900	$33,900
	Total for Papua New Guinea				**$30,000**	**$3,900**	**$33,900**
PHILIPPINES	Ozone unit support	Extension of institutional strengthening project (phase XIV: 1/2024-12/2026)	UNEP		$479,930	$0	$479,930
	Total for Philippines				**$479,930**	**$0**	**$479,930**
RWANDA	Ozone unit support	Extension of the institutional strengthening project (phase X: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Rwanda				**$180,000**	**$0**	**$180,000**
SAINT VINCENT AND THE GRENADINES	HCFC phase out plan	Verification report on the implementation of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Total for Saint Vincent and the Grenadines				**$30,000**	**$3,900**	**$33,900**
SAMOA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Ozone unit support	Extension of institutional strengthening project (phase XII: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Samoa				**$210,000**	**$3,900**	**$213,900**
SEYCHELLES	HCFC phase out plan	Verification report on the implementation of stage I of the HCFC phase-out management plan	Germany		$30,000	$3,900	$33,900
	Total for Seychelles				**$30,000**	**$3,900**	**$33,900**

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
SOLOMON ISLANDS	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan			$30,000	$3,900	$33,900
	Total for Solomon Islands				**$30,000**	**$3,900**	**$33,900**
SURINAME	HCFC phase out plan	HCFC phase-out management plan (stage I, fourth tranche)	UNEP		$13,500	$1,755	$15,255
		HCFC phase-out management plan (stage I, fourth tranche)	UNIDO		$9,000	$810	$9,810
	Total for Suriname				**$22,500**	**$2,565**	**$25,065**
THAILAND	HCFC phase out plan	HCFC phase-out management plan (stage II, second tranche) (refrigeration servicing sector)	IBRD	10.5	$912,757	$63,893	$976,650
		HCFC phase-out management plan (stage II, second tranche) (PMU)	IBRD		$156,708	$10,969	$167,677
		HCFC phase-out management plan (stage II, second tranche) (Spray foam manufacturing sector)	IBRD	19.1	$1,047,067	$73,295	$1,120,362
	Total for Thailand			**29.6**	**$2,116,532**	**$148,156**	**$2,264,688**
TONGA	HCFC phase out plan	Verification report on the implementation of stage II of the HCFC phase-out management plan	UNEP		$30,000	$3,900	$33,900
	Ozone unit support	Renewal of institutional strengthening project (phase X: 1/2024-12/2026	UNEP		$180,000	$0	$180,000
	Total for Tonga				**$210,000**	**$3,900**	**$213,900**
TUNISIA	HCFC phase out plan	HCFC phase-out management plan (stage II, second tranche)	UNEP	2.8	$100,000	$13,000	$113,000
		HCFC phase-out management plan (stage II, second tranche)	UNIDO	12	$386,640	$27,065	$413,705
	Total for Tunisia			**14.8**	**$486,640**	**$40,065**	**$526,705**
TUVALU	Ozone unit support	Extension of the institutional strengthening project (phase IX: 1/2024-12/2026)	UNEP		$180,000	$0	$180,000
	Total for Tuvalu				**$180,000**	**$0**	**$180,000**
URUGUAY	HCFC phase out plan	HCFC phase-out management plan (stage III, second tranche)	UNDP	5.9	$349,118	$24,438	$373,556

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
		HCFC phase-out management plan (stage III, second tranche)	UNIDO	1.6	$96,200	$8,658	$104,858
	Total for Uruguay			**7.5**	**$445,318**	**$33,096**	**$478,414**
VENEZUELA	Ozone unit support	Renewal of institutional strengthening project (phase XV: 7/2023-6/2026)	UNDP		$756,407	$52,948	$809,355
	HFC phase-down plan	Preparation of a Kigali HFC implementation plan	UNIDO		$220,000	$15,400	$235,400
	Total for Venezuela				**$976,407**	**$68,348**	**$1,044,755**
VIETNAM	HFC PHASE-DOWN PLAN	Preparation of project proposal Preparation of a KIP investment project in the commercial refrigeration sector for Sanaky	IBRD		$30,000	$2,100	$32,100
		Preparation of a KIP investment project in the domestic refrigeration sector for Aqua Electrical Appliances, Darling Electronics, and Hoa Phat Refrigeration Engineering	IBRD		$80,000	$5,600	$85,600
		Preparation of a KIP investment project in the industrial refrigeration sector for Quang Thang Refrigeration	IBRD		$30,000	$2,100	$32,100
		Preparation of a KIP investment project in the mobile airconditioning sector for Thaco Auto	IBRD		$30,000	$2,100	$32,100
	Total for Vietnam				**$170,000**	**$11,900**	**$181,900**
ZAMBIA	Ozone unit support	Extension of the institutional strengthening project (phase IX: 7/2023-6/2026)	UNEP		$180,000	$0	$180,000
	Total for Zambia				**$180,000**	**$0**	**$180,000**
ZIMBABWE	HCFC phase out plan	HCFC phase-out management plan (stage II, second tranche) (energy efficiency - related activities under decision 89/6	UNEP		$120,000	$14,706	$134,706

COUNTRY	PROJECT	PROJECT TITLE	AGENCY	AMOUNT (ODP-MT)	FUNDS APPROVED (US$)		
					PROJECT	SUPPORT	TOTAL
		HCFC phase-out management plan (stage II, second tranche)	UNDP	2.5	$150,000	$10,500	$160,500
		HCFC phase-out management plan (stage II, second tranche)	UNEP	3.2	$192,500	$23,591	$216,091
	Ozone unit support	Renewal of the institutional strengthening project (phase XII: 7/2023-6/2026)	UNEP		$392,782	$0	$392,782
	Total for Zimbabwe			**5.8**	**$855,282**	**$48,797**	**$904,079**
GRAND TOTAL				**401.4**	**$27,533,267**	**$1,720,721**	**$29,253,988**

ANNEX 3: EXCOM INFORMATION AND DECISIONS THAT IMPACT RTF SUPPLEMENTARY REPORT (BASED ON 92ND EXCOM REPORT IN UNEP/OZL.PRO/EXCOM/92/56)

Decision 92/37: Analysis of the level and modalities of funding for HFC phase-down in the refrigeration servicing sector (paragraph 226 of document UNEP/OzL.Pro/ExCom/91/72)

The Chair recalled that the consideration of the agenda sub-item was a continuation of discussions held at previous meetings of the Executive Committee. The representative of the Secretariat introduced document UNEP/OzL.Pro/ExCom/92/44.

Members agreed on the importance of the sub-item and of reaching consensus on the issues thereunder. One member said that it would be helpful to discuss, in a contact group, matters including the provision of incentives for HFC phase-down, particularly in the servicing sector, and the updated information UNEP/OzL.Pro/ExCom/92/56 40 set out in annex II to the document on proposals made for LVC countries and non-LVC countries, on which he would appreciate clarification.

The Executive Committee agreed to establish a contact group to discuss the sub-item further.

Subsequently, the Executive Committee decided:

(a) To note the analysis of the level and modalities of funding for HFC phase-down in the refrigeration servicing sector, contained in documents UNEP/OzL.Pro/ExCom/91/61 and UNEP/OzL.Pro/ExCom/92/44;

(b) To apply the following principles with regard to the eligible incremental costs in the refrigeration servicing sector for stage I of the Kigali HFC implementation plans (KIPs), on the understanding that the funding levels specified below would be revised for activities submitted for future KIP stages when activities under HCFC phase-out management plans (HPMPs) had been completed:

(i) Article 5 countries must include in their KIPs, at a minimum:

a. A commitment to meeting, without further requests for funding, at least the 10 per cent reduction target in HFC consumption in line with the compliance schedule of the Montreal Protocol, and to restricting imports of HFC-based equipment, if feasible, and if necessary to achieve the compliance schedule and support relevant phase-down activities;

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

c. A description of the roles and responsibilities of major stakeholders and the lead implementing agency and the cooperating agencies, where applicable; d. A description of how activities in the servicing sector under KIPs and HPMPs would be coordinated in their implementation;

(ii) Article 5 countries that had an average HFC consumption in the servicing sector during the baseline years of up to 360 metric tonnes would 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 would still need to demonstrate that the funding level was necessary to achieve at least the 10 per cent of the Montreal Protocol HFC reduction target;

Average HFC consumption in servicing in baseline years (metric tonnes)	Funding for meeting the 10 per cent Montreal Protocol HFC reduction target (US$)*
>0 <15	135,000
15 <40	145,000
40 <80	158,000
80 <120	170,000
120 <160	180,000
160 <200	190,000
200 <300	325,000
300 <360	360,000

*Plus 20 per cent funding for countries committing to reduce consumption by 10 per cent of the average HFC consumption in the baseline years

(iii) Article 5 countries with average HFC consumption above 360 metric tonnes and below 25,000 metric tonnes in the servicing sector in the baseline years would be provided funding, which would be deducted from their starting point for aggregate reductions in HFC consumption, at a level up to US $5.10/kg on the understanding that project proposals would still need to demonstrate that the funding level was necessary to achieve at least the 10 per cent HFC reduction target;

(iv) Funding for Article 5 countries that had an average HFC consumption in servicing in baseline years above 25,000 metric tonnes would be considered on a case--by--case basis;

(c) That Article 5 countries referred to in subparagraph (b)(iii) above that could achieve the 10 per cent reduction step in HFC consumption in line with the compliance schedule of the Montreal Protocol could receive funding up to the level determined for low-volume-consuming countries with average HFC consumption in servicing in the baseline years between 300 and 360 metric tonnes as specified in subparagraph (b)(ii) above, on the understanding that they must include in their HFC phase-down plans, as a minimum, the requirements described in subparagraph (b)(i) above; and

(d) To include the principles referred to in subparagraphs (b) and (c) in the draft cost guidelines for the phase-down of HFCs and revisit the principles in 2028 for the funding of future stages of the KIPs.

(Decision 92/37)

Decision 92/44: HFC phase-down in advance of the Kigali Amendment targets

Presenting a draft decision thereon, the representative of the United States of America raised, for consideration by the Executive Committee, the possibility of approving, on a case-by-case basis, a phase-down of HFCs that was more rapid than required under the Kigali Amendment. He explained that the Committee could follow the approach taken in relation to HCFC phase-out under decision 60/15 and that any accelerated phase-down of HFCs would be entirely voluntary for Article 5 countries where there was a strong national level of commitment.

Several members requested additional information on the proposal, including on the funds that would be made available and on the requirement that there be a strong national level of commitment.

The representative of the Secretariat recalled that, to demonstrate a strong national level of commitment to support the accelerated phase-out of consumption of HCFCs, countries submitting HPMP proposals had been required by the Secretariat to include a letter of commitment from a high-level government authority.

The Executive Committee decided that proposals for projects that reduced HFC consumption in advance of Montreal Protocol targets could be considered on a case-by-case basis for countries that had a strong national level of commitment in place to support such reductions.

(Decision 92/44)

ANNEX 4: HFC BASELINES AS REPORTED UNDER A7 TO THE OZONE SECRETARIAT AS AT AUGUST 7 2023

A7 Country	Kigali Baseline as Reported on the Ozone Secretariat Website on August 7 2023
Brazil	79.50
Mexico	76.98
Colombia	8.62
Malaysia	**26.70**
Philippines	11.90
South Africa	13.84
Türkiye	**37.12**
Venezuela (Bolivarian Republic of)	5.16
Benin	1.76
Cameroon	4.76
Chile	6.70
Côte d'Ivoire	21.29
Dominican Republic	3.83
Gabon	1.94
Guinea	1.83
Kenya	1.54
Morocco	2.13
Niger	1.22
Panama	2.52
Peru	2.74
Senegal	2.66
Togo	1.12
Trinidad and Tobago	5.68
Tunisia	2.37
Armenia	0.475
Barbados	0.30
Belize	0.50
Bosnia and Herzegovina	1.07
Botswana	0.39
Burkina Faso	1.05
Burundi	0.21
Cambodia	1.26
Cabo Verde	0.04
Chad	4.15
Comoros	0.03
Congo	0.69
Cook Islands	0.01

A7 Country	Kigali Baseline as Reported on the Ozone Secretariat Website on August 7 2023
Costa Rica	1.45
Cuba	1.03
Ecuador	3.18
El Salvador	0.96
Equatorial Guinea	0.27
Gambia	0.27
Grenada	0.05
Guatemala	1.22
Guinea Bissau	0.72
Guyana	0.15
Haiti	0.15
Honduras	1.44
Kyrgyzstan	0.45
Lesotho	0.10
Liberia	0.18
North Macedonia	0.40
Malawi	0.43
Maldives	0.43
Mali	0.40
Mauritius	0.67
Republic of Moldova	0.37
Mongolia	0.06
Montenegro	0.16
Mozambique	0.66
Nauru	0.00
Nicaragua	0.58
Paraguay	1.68
Rwanda	0.34
Saint Lucia	0.10
Saint Vincent and the Grenadines	0.03
Sao Tome and Principe	0.07
Serbia	3.25
Seychelles	0.25
Sierra Leone	0.35
South Sudan	0.22
Eswatini	0.11
Turkmenistan	0.60
Uganda	0.04
Zambia	0.70
Zimbabwe	1.21

ANNEX 5: ESTIMATED FUNDING FOR NEW HPMPS AS PER ITEM 2 SUGGESTION AT OEWG-45

Item 2 Scenario 1- New HPMPs

Summary calculation is shown in table below.

Table A5-1: Item 2 Summary Calculation for Estimating Funding for New HPMPs using Actual Consumption

All Countries	Baseline	Starting Point	Approved	Remaining ODP t	CP Data 2021	CP data 2022	80.5% target	Has country actual consumption reached 80.5% target?	RTF Estimate of additional needed (ODP t)	HCFC-22 kg	Cost for servicing (US$)
Total	26,675,5	26,539.9	19,417.6	7,122.0	13,551.84	13,667.84	5,201.33	No	1,972.76	35,868.30	174,806,658
Total with Support Costs											**192 million**

Item 2 Scenario 2 - New KIPs

The estimated funding for new KIPs was calculated using the same methodology described in the May 2023 RTF Report, but instead of using the Kigali baseline, RTF used the HFC portion of the baseline, not accounting for the 65% HCFC agreed in Kigali. A7 data was updated as of 7 August 2023. The estimated funding for new Kips using only HFC consumption instead of the Kigali baseline is **US$ 405 million including support costs**.

ANNEX 6: STATUS OF KIP PROJECT PREPARATION (PRP) AS PER MLFS INFORMATION

Country	HCFC Status	HCFC baseline (ODP tonnes)	Funding Eligibility for preparation of stage I of the KIPs (US $) (Excluding Support Costs)	KIP PRP Approved (Excluding Support Costs)	KIP Investment PRP Approved (Excluding Support Costs)	In 2023–2025 Business Plan
KIP PRP To be Approved						
Afghanistan	Non-LVC	23.6	190,000			Yes
Algeria	Non-LVC	62.1	190,000			Yes
Antigua and Barbuda	LVC	0.3	100,000			
Bahamas	LVC	4.8	130,000			
Bahrain	Non-LVC	51.9	190,000			
Barbados	LVC	3.7	130,000			Yes
Belize	LVC	2.8	130,000			Yes
Brazil	Non-LVC	1,327.3	230,000			
Brunei Darussalam	LVC	6.1	170,000			Yes
Central African Republic	LVC	12.0	170,000			
China	Non-LVC	19,269.0	case by case			Yes
Croatia	LVC	14.5	170,000			
Democratic People's Republic of Korea	Non-LVC	78.0	190,000			Yes
Democratic Republic of the Congo	Non-LVC	66.2	190,000			
Djibouti	LVC	0.7	100,000			Yes
Dominica	LVC	0.4	100,000			
Egypt	Non-LVC	386.3	220,000			Yes
Equatorial Guinea	LVC	6.3	170,000			Yes
Eritrea	LVC	1.1	130,000			Yes
Georgia	LVC	5.3	130,000			Yes
Guatemala	LVC	8.3	170,000			Yes
Guyana	LVC	1.8	130,000			Yes
Haiti	LVC	3.6	130,000			Yes
India	Non-LVC	1,608.2	230,000		90,000	Yes
Iran (Islamic Republic of)	Non-LVC	380.5	220,000			Yes
Iraq	Non-LVC	108.4	220,000			Yes
Jamaica	LVC	16.3	170,000			
Kenya	Non-LVC	52.2	190,000			Yes
Kuwait	Non-LVC	418.6	220,000			
Libya	Non-LVC	118.4	220,000			Yes
Madagascar	Non-LVC	16.6	170,000			Yes
Mali	LVC	15.0	170,000			Yes
Mauritania	Non-LVC	20.5	190,000			Yes
Myanmar	LVC	4.3	130,000			Yes
Nepal	LVC	1.1	130,000			Yes
Oman	Non-LVC	31.5	190,000			Yes
Pakistan	Non-LVC	248.1	220,000			Yes
Papua New Guinea	LVC	3.3	130,000			
Qatar	Non-LVC	86.9	190,000			Yes

Country	HCFC Status	HCFC baseline (ODP tonnes)	Funding Eligibility for preparation of stage I of the KIPs (US $) (Excluding Support Costs)	KIP PRP Approved (Excluding Support Costs)	KIP Investment PRP Approved (Excluding Support Costs)	In 2023–2025 Business Plan
Republic of Moldova	LVC	1.0	130,000			Yes
Saint Kitts and Nevis	LVC	0.5	100,000			
Saint Vincent and the Grenadines	LVC	0.3	100,000			
Saudi Arabia	Non-LVC	1,468.7	230,000			
South Sudan	LVC	4.1	130,000			Yes
Sudan	Non-LVC	52.7	190,000			Yes
Suriname	LVC	2.0	130,000			
Thailand	Non-LVC	927.6	220,000			Yes
Timor-Leste	LVC	0.5	100,000			Yes
Yemen	Non-LVC	158.2	220,000			
KIP PRP Approved						
Albania	LVC	6.0	130,000	130,000		
Angola	LVC	16.0	170,000	170,000		
Argentina	Non-LVC	400.7	220,000	220,000		
Armenia	LVC	7.0	170,000	170,000		
Bangladesh	Non-LVC	72.6	190,000	190,000		
Benin	Non-LVC	23.8	190,000	190,000		
Bhutan	LVC	0.3	100,000	100,000		
Bolivia	LVC	6.1	170,000	170,000		
Bosnia and Herzegovina	LVC	4.7	130,000	130,000		
Botswana	LVC	11.0	170,000	170,000		
Burkina Faso	Non-LVC	28.9	190,000	190,000		
Burundi	LVC	7.2	170,000	170,000		Yes
Cambodia	LVC	15.0	170,000	170,000		
Cameroon	Non-LVC	88.8	190,000	190,000		
Cape Verde	LVC	1.1	130,000	130,000		
Chad	LVC	16.1	170,000	170,000		
Chile	Non-LVC	87.5	190,000	190,000		
Colombia	Non-LVC	225.6	220,000	220,000		
Comoros	LVC	0.1	100,000	100,000		
Congo	LVC	10.1	170,000	170,000		
Cook Islands	LVC	0.1	100,000	65,000		
Costa Rica	LVC	14.1	170,000	170,000		
Côte d'Ivoire	Non-LVC	63.8	190,000	190,000		
Cuba	LVC	16.9	170,000	170,000		
Dominican Republic	Non-LVC	51.2	190,000	190,000		
Ecuador	Non-LVC	23.5	190,000	190,000		
El Salvador	LVC	11.7	170,000	170,000		
Eswatini	LVC	1.7	130,000	130,000		
Ethiopia	LVC	5.5	130,000	130,000		
Fiji	LVC	5.7	130,000	130,000		
Gabon	Non-LVC	30.2	190,000	190,000		
Gambia	LVC	1.5	130,000	130,000		
Ghana	Non-LVC	57.3	190,000	190,000		

Country	HCFC Status	HCFC baseline (ODP tonnes)	Funding Eligibility for preparation of stage I of the KIPs (US $) (Excluding Support Costs)	KIP PRP Approved (Excluding Support Costs)	KIP Investment PRP Approved (Excluding Support Costs)	In 2023–2025 Business Plan
Grenada	LVC	0.8	100,000	100,000		
Guinea	Non-LVC	22.6	190,000	190,000		
Guinea-Bissau	LVC	2.8	130,000	130,000		
Honduras	LVC	19.9	170,000	170,000		
Indonesia	Non-LVC	403.9	220,000	220,000		Yes
Jordan	Non-LVC	83.0	190,000	190,000		
Kiribati	LVC	0.1	100,000	65,000		
Kyrgyzstan	LVC	4.1	130,000	130,000		
Lao People's Democratic Republic	LVC	2.3	130,000	130,000		
Lebanon	Non-LVC	73.5	190,000	190,000		
Lesotho	LVC	3.5	130,000	130,000		
Liberia	LVC	5.3	130,000	130,000		
Malawi	LVC	10.8	170,000	170,000		
Malaysia	Non-LVC	515.8	220,000	220,000	260,000	
Maldives	LVC	4.6	130,000	130,000		
Marshall Islands	LVC	0.2	100,000	65,000		
Mauritius	LVC	8.0	170,000	170,000		
Mexico	Non-LVC	1,148.8	230,000	190,000		
Micronesia (Federated States of)	LVC	0.2	100,000	65,000		
Mongolia	LVC	1.4	130,000	130,000		
Montenegro	LVC	0.8	100,000	100,000		
Morocco	Non-LVC	51.4	190,000	190,000	30,000	
Mozambique	LVC	8.7	170,000	170,000		
Namibia	LVC	8.4	170,000	170,000		
Nauru	LVC	0.0	100,000	65,000		
Nicaragua	LVC	6.8	170,000	170,000		
Niger	LVC	16.0	170,000	170,000		
Nigeria	Non-LVC	344.9	220,000	220,000		
Niue	LVC	0.0	100,000	65,000		
North Macedonia	LVC	1.8	130,000	130,000		
Palau	LVC	0.2	100,000	65,000		
Panama	Non-LVC	24.8	190,000	190,000		
Paraguay	LVC	18.0	170,000	170,000		
Peru	Non-LVC	26.9	190,000	190,000		
Philippines	Non-LVC	162.0	220,000	220,000		
Rwanda	LVC	4.1	130,000	130,000		
Saint Lucia	LVC	1.1	130,000	130,000		
Samoa	LVC	0.3	100,000	65,000		
Sao Tome and Principe	LVC	2.2	130,000	130,000		
Senegal	Non-LVC	36.2	190,000	190,000		
Serbia	LVC	8.4	170,000	170,000		
Seychelles	LVC	1.4	130,000	130,000		
Sierra Leone	LVC	1.7	130,000	130,000		

Country	HCFC Status	HCFC baseline (ODP tonnes)	Funding Eligibility for preparation of stage I of the KIPs (US $) (Excluding Support Costs)	KIP PRP Approved (Excluding Support Costs)	KIP Investment PRP Approved (Excluding Support Costs)	In 2023–2025 Business Plan
Solomon Islands	LVC	2.0	130,000	65,000		
Somalia	Non-LVC	45.1	190,000	170,000		
South Africa	Non-LVC	369.7	220,000	220,000		
Sri Lanka	LVC	13.9	170,000	170,000		
Syrian Arab Republic	Non-LVC	135.0	220,000	220,000		
Togo	Non-LVC	20.0	170,000	170,000		
Tonga	LVC	0.1	100,000	65,000		
Trinidad and Tobago	Non-LVC	46.0	190,000	190,000		
Tunisia	Non-LVC	40.7	190,000	190,000		
Turkey	Non-LVC	551.5	220,000	220,000		
Turkmenistan	LVC	6.8	170,000	170,000		
Tuvalu	LVC	0.1	100,000	65,000		
Uganda	LVC	0.2	100,000	100,000		
United Republic of Tanzania	LVC	1.7	130,000	130,000		
Uruguay	Non-LVC	23.4	190,000	190,000		
Vanuatu	LVC	0.3	100,000	65,000		
Venezuela (Bolivarian Republic of)	Non-LVC	207.0	220,000	220,000		Yes
Viet Nam	Non-LVC	221.2	220,000	220,000	170,000	
Zambia	LVC	5.0	130,000	130,000		
Zimbabwe	LVC	17.8	170,000	170,000		

ANNEX 7: ENERGY EFFICIENCY INCENTIVE PERCENTAGES

A methodology to provide financial support proportional to the level of efficiency improvement achieved by the beneficiary was put forth in TEAP 2023[58]. The amount of financial support is indexed to the starting level of energy efficiency of the beneficiary factory. A factory with a low starting EE level should have more potential to cost effectively increase the efficiency of their RAC product than a manufacturer that already has a high level of energy efficiency and thus should receive a higher incentive amount, or financial support that translates to a higher fraction of the overall costs to upgrade the factory and purchase more efficient parts and components.

Figure A6-1 and Table A6-1 show illustrative examples of this approach of EE-linked incentives for mini-split ACs. They show that for a factory with a baseline CSPF[59] of 2.8, the incentive index would be 100% whereas a factory with baseline CSPF of 3.1 would receive 43% of the full incentive, and a factory with a baseline CSPF of 3.4 would receive only 19% of the full incentive.

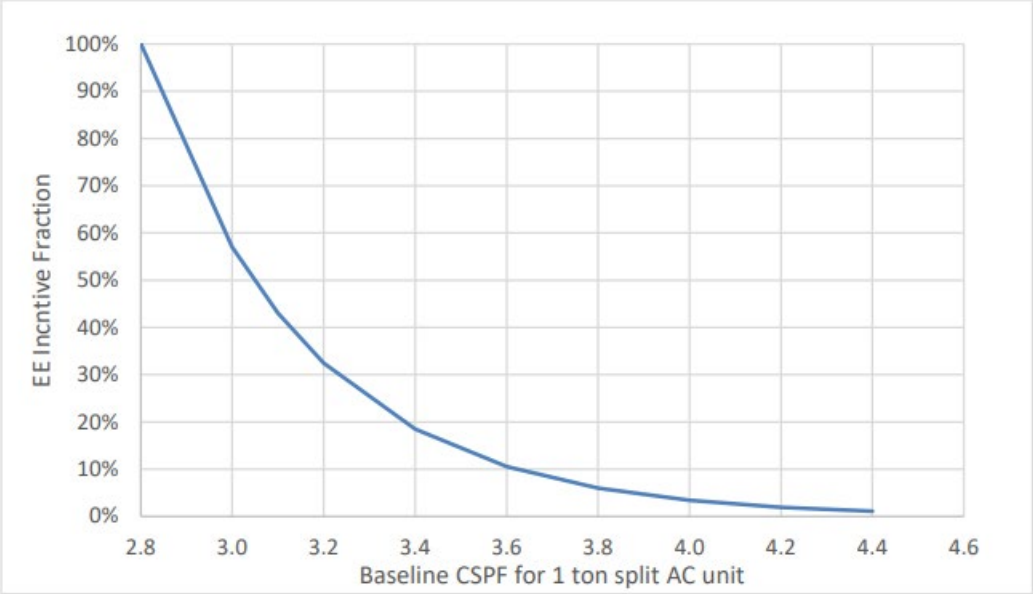

Figure A6-1: Illustrative EE incentive fractions for 1-ton split AC units. 100% support is provided for factories starting at or below CSPF of 2.8, with an exponentially decreasing fraction of support for factories that have a starting efficiency greater than 2.8. (Wei and Shah, 2023)

[58] "Supplement to the TEAP 2023 Progress Report: Decision XXXIV/3 Energy Efficiency Working Group Report"
https://ozone.unep.org/system/files/documents/TEAP-May2023-Progress-Report-Supplementary.pdf

[59] Cooling Seasonal Performance Factor (CSPF) - CSPF ratings measure annual energy consumption and efficiency. A higher CSPF rating reflects a more energy efficient air conditioning unit. The CSPF takes into account different seasonal periods and temperature fluctuations at different cooling loads. These include situations where the unit is on standby or operating at partial load, such as when inverter technology is involved. This results in a more accurate and realistic indication of energy efficiency over an entire cooling season.

Table A6-1: Values of CSPF, normalized EE level on a scale of 1 to 10, and Incentive index Support Percentage as a function of the factory's starting CSPF and normalized EE level for 1-ton mini split AC units

CSPF	EE_normalized	Incentive Index Support Pct.
2.80	1.0	100%
3.00	2.1	57%
3.10	2.7	43%
3.20	3.3	32%
3.40	4.4	19%
3.60	5.5	11%
3.80	6.6	6%
4.00	7.8	3%
4.20	8.9	2%
4.40	10.0	0%

ANNEX 8: ESTIMATING COST TO MAINTAIN THERMAL PERFORMANCE OF FOAM INSULATION

RTF modelled industry formulations using current and new foam blowing agents (FBAs) to estimate the cost of maintaining or improving energy efficiency in the transition to low GWP FBAs. The quantity of FBA needed in a particular foam with standard thermal performance is based on comparing the molecular weights of the FBAs. RTF adjusted components and additives used based on the unique molecular weights and needs of each FBA and then used raw material costs to estimate the cost to maintain or improve its thermal performance by comparing that cost to incumbent HFCs.

Adjusting Foam Formulation to Maintain or Enhance Energy Efficiency		FBA 1	FBA 2	FBA 3	FBA 4	FBA 5
Form Polyol + Additives	FBA molecular weight ratios	100	100	100	100	100
FBA 1	2	20.0				
FBA 2	1		10			
FBA 3	3			30		
FBA 4	2				20	
FBA 5	1	No	Yes	No	No	20
Isocyanate		145	145	145	145	155
Total parts		265	255	275	265	275
Lambda in milliwatt/meter-degree Kelvin measured at 24 Celsius		**0.019**	**0.02**	**0.019**	**0.019**	**0.024**
Thickness adjustment needed?		**No**	**No**	**No**	**No**	**Yes**

Figure A8-1. Adjusting Foam Formulation to Maintain or Enhance Energy Efficiency Performance of Insulating Polyurethane Foam

Foam formulations can be optimized to reduce cost or to adjust thermal performance. To maintain thermal performance for "drop-in" FBAs, an equivalent number of moles of fluorocarbon must be added. For other types of FBA, thicker foams may be needed to ensure the same thermal performance. The example above shows how formulations and application (e.g., thicker foam) may be adjusted. RTF used a generic foam formulation and estimated pricing from FTOC members to estimate the cost to maintain or enhance energy efficiency.

ANNEX 9: COST-EFFECTIVENESS (CE) THRESHOLDS FOR HCFC PHASE-OUT[60]

Sector	HPMPs (Decisions 60/44, 62/13 and 74/50)		
	Baseline substance	Main alternatives introduced	CE threshold (US $/kg)
Domestic refrigeration (refrigerant and PU foam panel components)	n.a.	n.a.	n.a.
	HCFC-141b	Cyclopentane	7.83*,**
Commercial refrigeration (refrigerant and PU foam panel components)	HCFC-22	HFC-32, R-290, HFC-134a, carbon dioxide (CO_2), ammonia (NH_3), cascade systems	15.21*
	HCFC-141b	Cyclopentane, water, MF, methylal, HFC-245fa, reduced HFO	
Rigid PU foam (including PU foam panel in commercial refrigeration)	HCFC-141b	Cyclopentane, water, MF, methylal, HFC-245fa, reduced hydrofluoroolefins (HFOs)	7.83*,**
Flexible PU foam	HCFC-141b	Cyclopentane, water, MF, methylal, HFC-245fa, reduced HFOs	6.23*,**
Integral skin	HCFC-141b	Cyclopentane, water, MF, methylal, HFC-245fa, reduced HFOs	16.86*,**
XPS foam	HCFC-22/ HCFC-142b	HC, CO_2	8.22*,**
Aerosol	HCFC-22/ HCFC-141b	HC HFC-134a, HFC-152a, perchloretylene, HFO	Case-by-case
Fire extinguishing	HCFC-123	No projects approved yet	Case-by-case
Solvent	HCFC-141b	Iso-paraffin	Case-by-case
Solvent	n.a	n.a	n.a
Metered dose inhaler (MDI)	n.a	n.a	n.a
Mobile AC	n.a	n.a	n.a
Domestic AC manufacturing (room AC, domestic heat pumps)	HCFC-22	R-410A HFC-32 R-290	Case-by-case
Other refrigeration and AC manufacturing (heat pumps, transport, chillers, industrial)	HCFC-22	R-410A HFC-32 R-290 CO_2, NH_3, cascade systems	Case-by-case

* 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-GWP alternatives (decision 60/44(f)(iv)).

** For SMEs in the foam sector with consumption of less than 20 mt, the maximum would be up to 40 per cent above the cost effectiveness threshold (decision 74/50(c)(iii)).