MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

REPORT OF THE TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

MAY 2026

VOLUME 2: ASSESSMENT OF THE FUNDING REQUIREMENT FOR THE REPLENISHMENT OF THE MULTILATERAL FUND FOR THE PERIOD 2027-2029

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

May 2026

VOLUME 2: ASSESSMENT OF THE FUNDING REQUIREMENT FOR THE REPLENISHMENT OF THE MULTILATERAL FUND FOR THE PERIOD 2027-2029

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Co-ordination: TEAP Decision XXXVII/6 Replenishment Task Force

Composition of the report: Suely Carvalho, Bella Maranion
Layout and formatting: Bella Maranion
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Foreword

The TEAP Decision XXXVII/6 Replenishment Task Force:

Co-chairs	Affiliation	Country
Suely Carvalho	TEAP Senior Expert	Brazil
Bella Maranion	TEAP Co-chair	United States of America (USA)
Members		
Omar Abdelaziz	Refrigeration, Air Conditioning, and Heat Pumps Technical Options Committee (RTOC) Co-chair	Egypt
Adam Chattaway	Fire Suppression Technical Options Committee (FSTOC) Co-chair	United Kingdom (UK)
Sukumar Devotta	TEAP Senior Expert	India
Gabrielle Dreyfus	RTOC Member	USA
Bassam Elassaad	TEAP Senior Expert and RTOC Member	Lebanon
Carlos Froes Lima	Independent consultant	Brazil
Marco Gonzalez	TEAP Senior Expert	Costa Rica
Mary Najjuma	Independent consultant	Uganda
Marta Pizano	TEAP and Methyl Bromide Technical Options Committee (MBTOC) Co-chair	Colombia
Pallav Purohit	RTOC Member	India
Rajan Rajendran	RTOC Co-chair	USA
Bettina Schreck	Medical and Chemical Technical Options Committee (MCTOC) Member	Argentina
John Telesford	Independent consultant	Grenada
Helen Tope	MCTOC Co-chair	Australia
Helen Walter-Terrinoni	Flexible and Rigid Foams Technical Options Committee (FTOC) Co-chair	USA
Shiqiu Zhang	TEAP Senior Expert	People's Republic of China
Consulting Expert		
Rick Cooke	MCTOC Member	Canada

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MAY 2026 REPORT

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Executive Summary

The Montreal Protocol Multilateral Fund (MLF) has been replenished eleven times since its initial capitalisation of US$ 240 million for the period 1991-1993. The replenishments of the MLF are indicated in Table ES.1, which include anticipated contributions from the MLF and other sources from the previous triennium, known as "carry-over", and from interest accruing to the Fund during that triennium.

Table ES.1: Replenishments of the MLF (US$) *

Triennium	Approved	Carry-over	Interest accrued	Total MLF Budget
1994-1996	$ 455,000,000	$ 55,000,000	N/A	$ 510,000,000
1997-1999	$ 466,000,000	$ 74,000,000	N/A	$ 540,000,000
2000-2002	$ 440,000,000	$ 35,700,000	N/A	$ 475,700,000
2003-2005	$ 474,000,000	$ 76,000,000	$ 23,000,000	$ 573,000,000
2006-2008	$ 400,400,000	$ 59,600,000	$ 10,000,000	$ 470,000,000
2009-2011	$ 400,000,000	$ 73,900,000	$ 16,100,000	$ 490,000,000
2012-2014	$ 400,000,000	$ 34,900,000	$ 15,100,000	$ 450,000,000
2015-2017	$ 437,500,000	$ 64,000,000	$ 6,000,000	$ 507,500,000
2018-2020**	$ 500,000,000	$ 34,000,000	$ 6,000,000	$ 540,000,000
2021-2023	$ 475,000,000	$ 65,000,000	N/A	$ 540,000,000
2024-2026	$ 525,600,000	$ 428,699,680	$ 10,700,320	$ 965,000,000

***** Does not include the initial capitalisation of US$ 240 million for 1991-1993.
** In addition, the Fifth Extraordinary Meeting of the Parties also noted that US $246 million in remaining funds that were due to the Multilateral Fund during the triennium 2018 – 2020 will be used after 2023 to support the implementation of the Montreal Protocol (decision Ex.V/1).

Since its inception and as of the 97th meeting of the Executive Committee (ExCom-97), the MLF has supported 144 Article 5 (A5) parties by approving US$ 4.38 billion (including support costs) for a total of 10,363 projects, 87% of which have been completed.[1]

The replenishment of the MLF for the 2027-2029 triennium will provide financing to A5 parties for the incremental costs to complete the phase-out of ODS and to continue implementing the phase-down of hydrofluorocarbons (HFCs). Annex C Group I (hydrochlorofluorocarbons (HCFCs)) and Annex F (HFCs) substances are the only substances under the Montreal Protocol where consumption and production are still allowed.

- For Annex C, Group 1, controlled substances (HCFCs), the compliance target for the 2027-2029 triennium is a 97.5% reduction from baseline by 1 January 2030.
  An annual average of 2.5% is restricted to the servicing of refrigeration and air-conditioning equipment existing during 2030-2040. Decision XXX/2 referring to Annex I of the MOP-30 report[2], adjusted this part of A5 (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 2027-2029 and the subsequent two triennia are as follows:
  Group 1 parties: A 10% reduction from baseline by 1 January 2029, and for future triennia 2030-2032 and 2033-2035, a 30% reduction from baseline by 1 January 2035.

[1] https://www.multilateralfund.org/our-impact

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

Group 2 parties[3]: A freeze of production and consumption by 1 January 2028, and for future triennia 2030-2032 and 2033-2035, a 10% reduction from baseline by 1 January 2032, and a 20% reduction by January 1, 2037.

Decision XXXVII/6 and TEAP approach

At the Thirty-seventh Meeting of the Parties (MOP-37), parties adopted Decision XXXVII/6 which 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 2027-2029. The parties requested the TEAP to prepare a report for submission to MOP-38, and presentation to the Open-ended Working Group at its Forty-eighth Meeting (OEWG-48), to enable parties at MOP-38 to take a decision.

The TEAP established a Decision XXXVII/6 Replenishment Task Force (RTF), with members from TEAP, its Technical Options Committees, and other outside experts. In December 2025, one TEAP Senior Expert attended the ExCom-97 to conduct informal discussions with ExCom members and bilateral and IAs present at that meeting.

In this report, the RTF estimated the funding requirements for the 2027-2029 triennium and future triennia based on official Article 7 (A7) data and informed by the "Consolidated Business Plan of the Multilateral Fund for 2026-2028,"[4] relevant decisions of the ExCom up to its 97th meeting, and information available through the Multilateral Fund Secretariat (MLFS) and Ozone Secretariat (OS). The RTF worked primarily online and held a meeting in Montreal in February 2026, during which the RTF also held discussions with the MLFS. The RTF prepared its draft report which was reviewed at the TEAP's meeting held in April 2026 in Brussels. After addressing all comments, the TEAP submitted the RTF's report to the Ozone Secretariat in May 2026 for posting and review by parties.

HCFC phase-out in the consumption and production sectors

Consumption sector

Most A5 parties have submitted last stage/tranches for the complete phaseout of HCFCs by 2030. Therefore, at the end of 2027-2029 triennium the MLF will be celebrating the fact that the Fund will be addressing the last remaining consumption of HCFCs for the few parties that will be submitting their last HPMPs stages and tranche requests.

That said, the HCFC phase-out funding requirement for this triennium was calculated considering that the large majority of HPMPs are addressing complete phaseout by 2030. Parties that wish to phase out HCFCs completely by 1 January 2030 may do so but must ensure through regulatory and policy measures that HCFCs would not be imported after that date, except for those allowed for a servicing tail between 2030 and 2040, where required, consistent with the provisions of the Montreal Protocol.

The ExCom decided (Decision 86/51) that, to allow for consideration of the final tranches of the HCFC phase-out management plans (HPMPs) for any consuming country requesting funding for the complete phase-out of HCFCs, the relevant Government should submit a detailed description of the regulatory and policy framework in place to implement measures to ensure that HCFC consumption was in compliance with paragraph 8 ter(e)(i) of Article 5 of the Montreal Protocol for the period 2030-2040. If the country is intending to have consumption during the period 2030–2040, modifications need to be made to its Agreement with the ExCom covering the period beyond 2030. It is important to emphasize that parties with HPMPs for total phase-out have no more remaining HCFC

[3] Decision XXVIII/2, para. 2, under the Montreal Protocol refers to Article 5, group 2, parties as Bahrain, India, the Islamic Republic of Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, and the Unted Arab Emirates.

[4] UNEP/OzL.Pro/ExCom/97/20

consumption eligible for funding. Accordingly, changes to the Agreement might affect targets but not funding levels.

The TOR, approved by parties in Decision XXXVII/6, instructed the RTF to use "a clearly explained compliance-based methodology that is informed by, but independent of, the business plan of the Multilateral Fund, and that applies a range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee". Responding to that, the RTF considered a range for the estimated funding requirements, for the HCFC consumption sector, based on two cost-effectiveness (CE) scenarios, and applied to 15 non-LVC parties (including the largest consuming party-China) with remaining eligible consumption in manufacturing sectors, as follows:

- **HCFC scenario 1**: Applying average historical CE thresholds in manufacturing sectors for those non-LVCs with remaining eligible consumption;
- **HCFC scenario 2:** Applying CEs in cost guidelines,[18] in manufacturing sectors, for those non-LVCs with remaining eligible consumption.

In calculating funding, RTF applied a deduction of 15% to manufacturing sectors to account for potential ineligible foreign ownership of enterprises.

RTF considered the total phaseout to happen by 2030 with the special allowances under the Montreal Protocol, as described previously, regarding the servicing tail. ExCom Decision 62/17 “requested the bilateral and IAs, when preparing multi-year HPMPs, to ensure that the last tranche comprised 10% of the total funding for the refrigeration servicing sector in the agreement and was scheduled for the last year of the plan.” RTF considered that the last tranche of the HPMPs would occur in 2030; consequently, 90% of the total phase-out resource allocation would be within the 2027-2029 triennium and the 10% for the last tranche would be allocated to the next triennium 2030-2032, following the intention of decision ExCom 62/17.

Production sector

The total production of HCFC is well below the aggregated production baseline. Only one production sector project (China Stage III HCFC Production Phaseout Management Plan (HPPMP)) had been included in the “Consolidated Business Plan of the Multilateral Fund for 2026-2028” and would require funding in the 2027-2029 triennium.

Summary of Funding Estimates for HCFC Phaseout in the Consumption and Production Sectors

The estimated total funding requirement range for 2027-2029 triennium and 2030-2032 triennium for the HCFC consumption and production sectors are summarised below and in Table ES.2:

- **2027-2029: US$ 451 million to US$ 573 million**
- **2030-2032: US$ 83 million to US$ 96 million**

Table ES.2: **Estimated funding requirement for HCFC total phase-out for 2027-2029 and 2030-2032 (US$ million)**

Triennium	Sector	HCFC ESTIMATED FUNDING RANGE	
		HCFC Scenario 1 with 90%/10% Allocation	HCFC Scenario 2 with 90%/10% Allocation
2027-2029	HCFC Consumption sector	427.56	549.44
	HCFC Production sector	23.54	23.54
	TOTAL RANGE	451.10	572.98
2030-2032	HCFC Consumption sector	58.96	72.50
	HCFC Production sector	23.54	23.54
	TOTAL RANGE	82.5	96.04

HFC phase-down in the consumption and production sectors

HFC consumption sector

The estimates for the HFC phase-down funding requirement for the 2027-2029 triennium and future triennia, 2030-2032 and 2033-2035, are based on A5 parties meeting the relevant Group 1 (G1) or Group 2 (G2) reduction targets.

Estimated funding requirements for the HFC consumption sector include the following:

- Committed Funding for approved Kigali HFC Implementation Plans (KIPs);
- Estimated Funding for new KIPs;
- Estimated Funding for project preparation costs;
- Estimated Funding for HFC consumption verification;
- Estimated Funding associated with energy efficiency activities (ExCom Decision 91/65 for the servicing sector, ExCom Decision 94/60 for the manufacturing sectors, and ExCom Decision 95/87 for a revolving fund); and
- Funding for enhancing regional atmospheric monitoring capacity.

As of 8 April 2026, 125 A5 parties, out of 144, had ratified the Kigali Amendment. For the analysis of estimated funding in the 2027-2029 triennium for HFC phase-down, the RTF assumed ratification by the remaining 19 parties will happen by 2029.

Given that KIPs are only in the early stages of implementation, RTF did not identify sufficient historical analysis of CEs for the manufacturing sectors from approved KIPs, and available data did not provide sufficient information to consider historical values beyond the CE cost guidelines. RTF estimated the funding based on HFC KIP Stage I Cost Guidelines for the agreed manufacturing sectors. When these were absent for some individual sectors treated on a case-by-case basis, the RTF used CEs based on TEAP, the TOCs, and the RTF sector experts' advice. Funding was also estimated for Stage II KIPs, using Stage I CEs, without considering any potential impact of the guidelines review expected in 2028. Important to note that the CE for servicing under Stage I was considered for the period when a country's KIP and HPMP would be implemented simultaneously. Stage II would be predominantly implemented when such simultaneous implementation did not take place.

RTF is using the Kigali Amendment schedules for its compliance model and using reductions from the established baseline definition. For funding estimates, the 65% HCFC component of the baseline

is considered as consumption under the servicing sector, and funding calculated following cost guidelines CE thresholds approved for the sector.

As detailed in Chapter 3 and Annexes 3 and 4 of this report, the RTF compliance model methodology for the consumption sector calculates funding to address the needs of parties to comply with the Kigali Amendment phase-down schedules, as follows:

- G1 parties: 10% reduction from the baseline by 2029 (Stage I KIP), 30% reduction by 2035 (Stage II KIP),

- G2 parties: freeze by 2028; a 10% reduction from the baseline by 2032 (Stage I KIP).

The RTF compliance model to estimate required funding reflects the MLF project cycle to account for different progress by different parties, as well as reductions that exceed control targets for some parties. The model takes into consideration each individual country reduction addressed under a KIP. The model estimates funding for the HFC consumption sector by starting with the calculation of the total funding required to address both Stage I and Stage II reduction targets for G1 parties, and for G2 parties Stage I reduction target. These totals cover funding needs for a 9-year period (2027-2035).

Then, RTF distributed the estimated total to each of the three triennia in the 2027 -2035 period, using two Resource Allocation Proposals (A and B), suggested for parties' consideration, and/or any further instructions for the RTF supplementary report. This methodology allows consideration of different compliance targets for G1 and G2 parties while addressing national circumstances and different control targets in the country groups.

The TOR, approved by parties in Decision XXXVII/6, instructed the RTF to use "a clearly explained compliance-based methodology that is informed by, but independent of, the business plan of the Multilateral Fund, and that applies a range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee". In response to this request and in the absence of historical CE values due to limited experience with KIP implementation, and in order to present an estimated funding range, RTF based its calculations on two scenarios, as follows:

- HFC Scenario 1: applying the approved CEs for the different sectors as per cost guidelines, and without small- and medium-sized enterprises (SMEs) consideration;

- HFC Scenario 2: applying CEs according to the percentage (SMEs) participation in some manufacturing sectors and applies their (larger) CE thresholds;

For both scenarios:

- a 15% deduction was applied to account for ineligible foreign ownership in the manufacturing sectors (please refer to note below);

- Stage I cost guidelines CEs were applied to Stage II funding calculations. The potential impact of any guidelines review in 2028 was not considered.

There are two considerations mentioned under caveats in section 1.6.10 regarding the additional costs of project management units were not included in the modelling, and the 15% foreign ownership deduction for the manufacturing sectors which was included. The combined effect of these two considerations is to potentially increase the total estimated funding requirement by around 15%. RTF

made these deviations for reasons explained in section 1.6.10 and appreciates the parties' guidance on the need to adjust its estimates accordingly for the RTF supplementary report.

HFC production sector

HFC production sector and HFC-23 mitigation funding estimates include:

- Estimated Funding for HFC Production project preparation;
- Estimated Funding for Kigali HFC Production Phase-down Management Plan (KPPMPs), if any;
- Estimated Funding for HFC-23 mitigation investment project;
- Estimated Funding for HFC-23 mitigation project preparation; and
- Committed Funding for approved HFC-23 mitigation project.

RTF considered two A5 HFC producing countries for estimated funding requirement for the production sector 2027-2029. Both China (G1) and India (G2) reported production of HFC are significantly below the 10% reduction target from baseline for G1 parties and the 2028 freeze and 10% reduction target for G2 parties. RTF estimated that for the 2027-2029 triennium, only project preparation funding may be needed for HFC production sector plans preparation for the two parties, with no investment funding required in this triennium.

To support A5 parties in meeting their obligations under the Kigali Amendment, the MLF funds the costs for A5 parties to reduce emissions of HFC-23, a by-product of the production process of HCFC-22, by reducing emission rate in the process, destroying it from the off-gas, or by collecting and converting it to other environmentally safe chemicals. For the 2027-2029 triennium, the RTF estimated funding requirements for two parties with approved HFC-23 phase-out plans and project preparation and implementation funding for two additional parties.

Summary of funding estimates for HFC phase-down in the consumption and production sectors

The range of estimated total funding requirement for the HFC consumption and production sectors for the 2027-2029 and future triennia are summarised below and in Table ES.3.

For the 2027-2029 triennium:

- **US$ 970-1,053 million under a resource allocation schedule A**
- **US$ 702-781 million under a resource allocation schedule B**

Table ES.3: **Estimated total funding requirement for HFC phase-down for 2027-2029 and future triennia (US$ million)**

Triennium	Sector	HFC ESTIMATED FUNDING RANGE (US$ million)	
		HFC Scenario 1 with Resource Allocation A	HFC Scenario 2 with Resource Allocation B
2027-2029	HFC Consumption sector	958 – 1,042	690 – 769
	HFC Production sector and HFC-23 mitigation	11.76	11.76
	TOTAL RANGE	**970 – 1,053**	**702 – 781**
2030-2032	HFC Consumption sector	876 – 907	1,049 – 1,084
	HFC Production sector and HFC-23 mitigation	0.51	0.51
	TOTAL RANGE	**877 – 908**	**1,050 – 1,085**
2033-2035	HFC Consumption sector	487 – 503	583 – 600
	HFC Production sector and HFC-23 mitigation	0	0
	TOTAL RANGE	**487 – 503**	**583 – 600**

Other funding considerations and information for parties

In accordance with the Decision XXXVII/6 TOR for the RTF's assessment, funding requirements were estimated for institutional strengthening and standard activities, funding for energy efficiency, and a funding modality for pilot projects aimed at enhancing regional atmospheric monitoring. RTF also provided updated information on "the special needs of low-volume-consuming and very-low-volume consuming countries", and on "digital technologies and tools within the servicing sector".

Range of estimated total funding requirements for the 2027-2029 triennium

The range of total estimated funding requirement for the replenishment of the MLF in the 2027-2029 triennium, including support costs, is presented in Tables ES.4.

Table ES.4: **Range of total funding requirement for the replenishment of the MLF 2027-2029 based on different scenarios and resource allocation schedules, and IS and SA (US$ million)**

2027-2029 Triennium	Low-end Range	High-end Range
SUBTOTAL – HCFC ACTIVITIES	**451**	**573**
SUBTOTAL – HFC ACTIVITES	**702 – 781**	**970 – 1,053**
SUBTOTAL – IS & SA	**129**	**129**
GRAND TOTAL	**1,282 – 1,361**	**1,672 – 1,755**

1 Introduction

1.1 Terms of reference

"Decision XXXVII/6: Terms of reference for the study on the 2027–2029 replenishment of the Multilateral Fund for the Implementation of the Montreal Protocol," adopted at the Thirty-seventh Meeting of the Parties (MOP-37), 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 Multilateral Fund for the Implementation of the Montreal Protocol (MLF) for the triennium 2027-2029. The parties requested the TEAP to prepare a report for submission MOP-38, and to present it to the Open-ended Working Group at its Forty-eighth meeting (OEWG-48), to enable parties at MOP-38 to take a decision.

1.2 Scope and coverage

The text of Decision XXVII/6 is as follows:

The Thirty-Seventh Meeting of the Parties,

Recalling *the decisions of the Meetings of the Parties 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 decisions of the Meetings of the Parties on previous replenishments of the Multilateral Fund,*

Decides:

1. *To request the Technology and Economic Assessment Panel to prepare a report for submission to the Thirty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, and to submit it through the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-eighth meeting, to enable the Thirty-Eighth Meeting of the Parties to adopt a decision on the appropriate level of the 2027–2029 replenishment of the Multilateral Fund for the Implementation of the Montreal Protocol;*

2. *That, in preparing the report referred to in paragraph 1 above, 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 those relevant to decision XXVIII/2, and the decisions of the Meeting of the Parties up to and including the Thirty-Seventh Meeting of the Parties and of the Executive Committee up to and including its ninety-eighth meeting, insofar as those decisions will necessitate expenditure by the Multilateral Fund during the period 2027-2029;*
   b) *The special needs of low-volume-consuming and very-low-volume-consuming countries, taking into account relevant decisions of the Executive Committee pertaining to those 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 to 2J of the Protocol, and the reductions and extended commitments made by parties operating under paragraph 1 of Article 5 under approved hydrochlorofluorocarbon phase-out management plans and Kigali implementation plans;*
   d) *The integration of digital technologies and tools within the servicing sector;*

e) *A scenario to allocate resources for a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol, taking into account decision XXXVI/1 and any other decisions of the Meetings of the Parties and the Executive Committee;*

3. *That, in estimating the funding requirement associated with the reduction 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, and that applies a range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee;*

4. *That, separately from the main estimated funding requirement, the Panel should prepare scenarios for varying numbers of Article 5 parties that have not yet submitted Kigali implementation plans for phasing down hydrofluorocarbons in advance of the Montreal Protocol targets on a voluntary basis;*

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-eighth meeting of the Open-ended Working Group;*

7. *That the Panel should provide indicative figures for the periods 2030-2032 and 2033-2035 to support a stable and sufficient level of funding, on the understanding that those figures will be updated in subsequent replenishment studies.*

8. *That the Panel should share the details of the calculations in the form of an appendix to the report to enable parties to fully understand the Panel's analysis.*

1.3 TEAP approach to Decision XXXVII/6

1.3.1 2026 TEAP Decision XXXVII/6 Replenishment Task Force

In response to Decision XXXVII/6, 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 below.

Table 1.1: Composition of the 2026 TEAP Replenishment Task Force

Co-chairs	**Affiliation**	**Country**
Suely Carvalho	TEAP Senior Expert	Brazil
Bella Maranion	TEAP Co-chair	United States of America (USA)
Members		
Omar Abdelaziz	Refrigeration, Air Conditioning, and Heat Pumps Technical Options Committee (RTOC) Co-chair	Egypt
Adam Chattaway	Fire Suppression Technical Options Committee (FSTOC) Co-chair	United Kingdom (UK)
Sukumar Devotta	TEAP Senior Expert	India
Gabrielle Dreyfus	RTOC Member	USA
Bassam Elassaad	TEAP Senior Expert and RTOC Member	Lebanon
Carlos Froes Lima	Independent consultant	Brazil
Marco Gonzalez	TEAP Senior Expert	Costa Rica

Mary Najjuma	Independent consultant	Uganda
Marta Pizano	TEAP and Methyl Bromide Technical Options Committee (MBTOC) Co-chair	Colombia
Pallav Purohit	RTOC Member	India
Rajan Rajendran	RTOC Co-chair	USA
Bettina Schreck	Medical and Chemical Technical Options Committee (MCTOC) Member	Argentina
John Telesford	Independent consultant	Grenada
Helen Tope	MCTOC Co-chair	Australia
Helen Walter-Terrinoni	Flexible and Rigid Foams Technical Options Committee (FTOC) Co-chair	USA
Shiqiu Zhang	TEAP Senior Expert	People's Republic of China
Consulting Expert		
Rick Cooke	MCTOC Member	Canada

Rick Cooke, a member of the MCTOC from Canada, served as a consulting expert to the RTF. TEAP is grateful for the contributions of these experts to this report.

1.3.2 Development of the report

In December 2025, several RTF members attended the 97th meeting of the Executive Committee of the MLF (ExCom-97) to conduct informal consultations with ExCom members and bilateral and implementing agencies (IAs) present at that meeting. The RTF also considered any relevant discussions and decisions taken at this meeting that could have potential implications in the preparation of this report.

In February 2026, the RTF met in Montreal hosted by the MLFS to plan its work in response to Decision XXXVII/6. RTF prepared its report in consultation with MLFS staff. Following that meeting, the RTF worked primarily online to develop its draft report for review and discussion by the TEAP at the panel's April 2026 meeting in Brussels. Considering all comments and suggestions, the RTF submitted a final report to the Ozone Secretariat (OS) in May 2026.

TEAP extends its sincere appreciation to the MLFS and the OS for their ongoing support of the RTF on this important work for parties.

1.3.3 Organization of report

The report is organised to provide the RTF estimated funding requirements for 2027-2029 according to the estimated cost categories in the following chapters:

Chapter 2	Estimated funding for hydrochlorofluorocarbon (HCFC) phase-out including consumption and production
Chapter 3	Estimated funding for hydrofluorocarbon (HFC) phase-down for consumption sector
Chapter 4	Estimated funding for HFC phase-down for production sector and mitigation of HFC-23 emissions
Chapter 5	Estimated funding for institutional strengthening and standard activities
Chapter 7	Estimated funding for energy efficiency activities
Chapter 10	Estimated funding for pilot projects to enhance regional atmospheric monitoring

In response to the Decision XXXVII/6, the RTF also discussed a number of topics in the following chapters:

Chapter 6	Special needs of low-volume consuming (LVC) and very-low-volume consuming (VLVC) countries
Chapter 8	Lifecycle refrigerant management
Chapter 9	Digital technologies and tools in the servicing sector.

The methodology and underlying information used by the RTF to calculate the estimated funding for the consumption sector for the HCFC phase-out and HFC phase-down for the 2027-2029 and next two triennia are contained in the body of the report and detailed in annexes to this report, as follows:

Annex 1	Estimated funding methodology for HCFC consumption sector
Annex 2	RTF analysis and proposal for historical cost-effectiveness values to be applied to HCFC manufacturing sectors for a funding scenario
Annex 3	Methodology for filling baseline gaps – estimates and assumptions
Annex 4	Methodology to estimate funding requirements for HFC phase-down in the consumption sector
Annex 5	List of parties funded as LVC under the HCFC phase-out and HFC phase-down
Annex 6	List of parties pending ratification of the Kigali Amendment (KA)
Annex 7	Relevant Executive Committee decisions on institutional strengthening and standard activities
Annex 8	Decisions related to enhancing regional atmospheric monitoring
Annex 9	Project preparation for Kigali HFC Implementation Plans (KIPs) and cost details
Annex 10	Indicative cost for end-of-life ozone-depleting substances (ODS)/HFC management

1.4 Overview of the Multilateral Fund for the Implementation of the Montreal Protocol[5]

The MLF was set up by the parties to the MP to assist developing countries[6] to comply with the terms of the MP which sets out a timetable for the phase-out of ODS in both developed and developing countries. The MLF provides assistance to Article 5 (A5) parties.[7] As stated in the terms of reference of the MLF, and in accordance with paragraph 6 of Article 10 of the MP, contributions to the MLF are made by non-Article 5 (non-A5) parties, based on a scale of contributions decided by the parties at their annual meeting. The annual contribution for each party is based on the United Nations scale of assessment, adjusted to ensure that no one contribution shall exceed 22% of the total. These contributions may be made either in cash, using promissory notes, or bilateral contributions.

The ExCom divides projects into investment and non-investment projects. The MLF provides financing for the incremental costs of the phase-out of substances controlled by the MP including investment projects and the costs of other activities, e.g., institutional strengthening (IS) projects, project preparation, training, and associated activities. MLF also provides funding for other initiatives as per decisions made by the ExCom, such as energy efficiency (EE) and lifecycle refrigerant

[5] This section is based on information from the "Policies, Procedures, Guidelines and Criteria of the Multilateral Fund," available at https://www.multilateralfund.org/policy-frameworks.

[6] For the purposes of this report, "parties" and "countries" are used interchangeably.

[7] The MLF provides assistance to countries that are parties to the Montreal Protocol and whose annual per capita consumption and production of CFCs and halons is less than 0.3 kg on the date of entry into force of the Montreal Protocol or any time thereafter until 1 January 1999. The developing countries that meet these criteria are referred to as Article 5 parties.

management (LRM) and gender. The parties to the MP agreed on an indicative list of such costs, which includes:

- Costs involved in converting to and adopting substitutes, including in the existing production facilities and equipment or establishing new facilities, paying for patents, designs and royalties, training personnel, adapting technology to local circumstances, premature retirement of capital equipment and importing substitutes

- Costs involved where controlled substances used as feedstock and process agents in manufacturing, including converting existing equipment and facilities, paying for patents, designs and royalties, training, research and development and paying for raw materials, and

- Costs involved in end use, including prematurely modifying or replacing user equipment, recycling and destroying controlled substances and providing technical assistance to reduce consumption and unintended emissions.

As per MLF guidelines, projects are approved based on the rules and regulations regarding financing eligible incremental costs agreed by parties.

A party is considered in compliance when it meets its specific obligations under the MP, including control measures and reporting requirements. The MLF's strategy is based on a compliance-driven business planning approach, in which the level of controlled substance phase-out has been calculated for each country so that resources can be appropriately targeted to parties. This calculation has been made on the basis of an agreed starting point for aggregate reduction in controlled substances. Multi-year agreements (MYAs) are established with parties to assist them in meeting the phase-out targets set out in the MP. As noted above, other funding not directly related to compliance is also provided to respond to ExCom decisions. Table 1.2 provides a summary of the A5 compliance schedule for the main controlled substances as set out in the MP. Annex C Group I (hydrochlorofluorocarbons (HCFCs)) and Annex F (hydrofluorocarbons (HFCs)) substances are the only substances under the MP where consumption and production are still allowed.

Table 1.2: Montreal Protocol compliance schedule for main controlled substances for A5 parties[8]

Controlled substance	Compliance Schedule for A5 parties
Annex A – Group I: Chlorofluorocarbons (CFCs)	Freeze at average 1995-1997 level on 1/7/1999; 50% reduction by 1/1/2005; 85% reduction by 1/1/2007; Total phase-out by 1/1/2010
Annex A – Group II: Halons	Freeze at average 1995-1997 level on 1/1/2002; 50% reduction by 1/1/2005; Total phase-out by 1/1/2010
Annex B – Group II: Carbon tetrachloride (CTC)	85% reduction at average 1998-2000 on 1/1/2005; Total phase-out by 2010
Annex B – Group III: Methyl chloroform (TCA)	Freeze at average 1998-2000 level on 1/1/2003; 30% reduction by 1/1/2005; 70% reduction by 1/1/2010; Total phase-out by 1/1/2015
Annex C – Group I: Hydrochlorofluorocarbons (HCFCs)	Baseline is the average of 2009 and 2010 production and consumption Freeze at average 2009-2010 level on 1/1/2013; 10% reduction by 1/1/2015; 35% reduction by 1/1/2020; 67.5% reduction by 1/1/2025; **97.5% reduction by 1/1/2030****; Total phase-out by 1/1/2040 **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. Note that Decision XXX/2 referring to Annex I of the

[8] Freezes and reductions refer to baseline levels. Full details of control measures are published on the Ozone Secretariat's website, including decisions XXVIII/1 and XXVIII/2 regarding the Kigali Amendment at: https://ozone.unep.org/treaties/montreal-protocol/summary-control-measures-under-montreal-protocol.

Controlled substance	Compliance Schedule for A5 parties
	MOP30 report, 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.
Annex C – Group II: HBFC	Total phase-out by 1/1/1996
Annex C – Group III: Bromochloromethane (BCM)	Total phase-out by 1/1/2002
Annex E: Methyl bromide (Horticultural uses)	Freeze at average 1995-1998 level on 1/1/2002; 20% reduction by 1/1/2005; Total phase-out by 1/1/2015
Annex F: Hydrofluorocarbons (HFCs) (Groups I and II – also emissions)	Group 1 Parties Baseline is average HFC for 2020-2022 + 65% of HCFC baseline Freeze on 1/1/2024 at baseline level; **10% reduction by 1/1/2029; 30% reduction by 1/1/2035**; 50% reduction by 1/1/2040; 80% plateau by 1/1/2045 Group 2 Parties Baseline is average HFC for 2024-2026 + 65% of HCFC baseline **Freeze on 1/1/2028 at baseline level; 10% reduction by 1/1/2032; 20% reduction by 1/1/2037**; 30% reduction by 1/1/2042; 85% plateau by 1/1/2047

Since its inception and as of the ExCom-97, the MLF has supported 144 A5 parties by approving US$ 4.38 billion (including support costs) for a total of 10,363 projects, 87% of which have been completed.[9]

1.5 Replenishment of the Multilateral Fund

The MLF has been replenished eleven times since its initial capitalisation of US$ 240 million for the period 1991-1993. The replenishments of the MLF are indicated in Table 1.3, which include anticipated contributions from the MLF and other sources from the previous triennium, known as "carry-over", and from interest accruing to the Fund during that triennium.

Table 1.3: Replenishments of the MLF (US$) *

Triennium	Approved	Carry-over	Interest accrued	Total MLF Budget
1994-1996	$ 455,000,000	$ 55,000,000	N/A	$ 510,000,000
1997-1999	$ 466,000,000	$ 74,000,000	N/A	$ 540,000,000
2000-2002	$ 440,000,000	$ 35,700,000	N/A	$ 475,700,000
2003-2005	$ 474,000,000	$ 76,000,000	$ 23,000,000	$ 573,000,000
2006-2008	$ 400,400,000	$ 59,600,000	$ 10,000,000	$ 470,000,000
2009-2011	$ 400,000,000	$ 73,900,000	$ 16,100,000	$ 490,000,000
2012-2014	$ 400,000,000	$ 34,900,000	$ 15,100,000	$ 450,000,000
2015-2017	$ 437,500,000	$ 64,000,000	$ 6,000,000	$ 507,500,000
2018-2020**	$ 500,000,000	$ 34,000,000	$ 6,000,000	$ 540,000,000
2021-2023	$ 475,000,000	$ 65,000,000	N/A	$ 540,000,000
2024-2026	$ 525,600,000	$ 428,699,680	$ 10,700,320	$ 965,000,000

***** Does not include the initial capitalisation of US$ 240 million for 1991-1993.

******In addition, the Fifth Extraordinary Meeting of the Parties also noted that US $246 million in remaining funds that were due to the Multilateral Fund during the triennium 2018–2020 will be used after 2023 to support the implementation of the Montreal Protocol (decision Ex.V/1).

[9] https://www.multilateralfund.org/our-impact

For the last nine replenishments (2000-2002, 2003-2005, 2006-2008, 2009-2011, 2012-2014, 2015-2017, 2018-2020, 2021-2023, and 2024-2026), a fixed-exchange-rate mechanism (FERM) was agreed upon at the same MOP that considered the replenishment. The FERM for the previous 2024-2026 period was based on the average United Nations (UN) exchange rate for the six-month period commencing 1 January 2023 (Decision Ex.V/2).[10] The impact of the FERM on the value of resources available to the Fund is monitored by the Treasurer as part of the report on the status of contributions and disbursements to each meeting of the ExCom.

At the MOP-35, October 2023, for the previous 2024-2026 triennium, the parties established a replenishment budget of US$ 965 million (Decision XXXV/1).[11] "Carry-over" amounts from the 2024-2026 triennium as well as interest accrued to the MLF during that triennium will be reflected in the total MLF budget for the 2027-2029 triennium.

1.6 Overview of RTF estimated funding methodology

The replenishment of the MLF for the 2027-2029 triennium will provide financing to A5 parties for the incremental costs to complete the phase-out of HCFCs and to begin implementing the phase-down of HFCs. As previously noted, HCFCs and HFCs are the only substances under the MP where consumption and production are still allowed. Decision XXXVII/6, paragraphs 3 and 8, request the TEAP:

> *That, in estimating the funding requirement associated with the reduction 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, and that applies a range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee;*
>
> *That the Panel should share the details of the calculations in the form of an appendix to the report to enable parties to fully understand the Panel's analysis.*

The estimated funding requirement for the HCFC phase-out consumption and production sectors for the 2027-2029 triennium is provided in Chapter 2, and detailed information on the methodology is provided in Annexes 1 and 2. The estimated funding requirement for the HFC phase-down for the three triennia (2027-2029, 2030-2032, 2033-2035) is provided in Chapter 3 for the consumption sector and Chapter 4 for the production sector and HFC-23 emissions mitigation; the detailed methodology for RTF approach to fill the baseline gaps is presented in Annex 3 and the detailed methodology for the HFC phase-down funding estimates is provided in Annex 4.

Estimated funding requirement for the 2027-2029 triennium also includes IS and standard activities (SA) (costs of institutions that support the MLF, such as the ExCom, MLFS, UNEP's Compliance Assistance Programme (CAP), Treasurer and core unit funding of Implementing Agencies (IAs), which are dealt with separately in Chapter 5). The estimated funding requirement for funding windows established by ExCom decisions for EE are provided in Chapter 7. The funding for enhancing regional atmospheric monitoring is provided in Chapter 10.

Also addressed in separate chapters are topics specified in Decision XXXVII/6 or relevant to estimating funding for the 2027-2029 triennium: "special consideration of low-volume consuming (LVC) and very low-volume consuming (VLVC) countries" and "the use of digital technologies and tools in the servicing sector". Information is provided on these topics for the consideration of parties but is not included in the RTF estimated funding requirements for the three triennia (2027-2029, 2030-2032, and 2033-2035).

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[10] UNEP/OzL.Pro.ExMOP.5/3/Add.1

[11] UNEP/OzL.Pro.35/12/Add.1

1.6.1 References and assumptions

For Annex C, Group 1, controlled substances (HCFCs), RTF considered funding for a 100% complete phase-out by 2030. The following considerations below apply to parties that need to use the servicing tail:

- The annual average of 2.5% is restricted to the servicing of refrigeration and air-conditioning equipment existing during the period of 2030-2040. Decision XXX/2, referring to Annex I of MOP-30, 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 the next two triennia 2030-2032 and 2033-2035, the HCFC phase-out compliance target is a total phase-out by 1 January 2040.

For Annex F controlled substances (HFCs), the compliance targets for the 2027-2029 and next two triennia are as follows:

- Group 1 (G1) parties: In the 2027-2029 triennium, a 10% reduction from baseline by 1 January 2029; for the next two triennia 2030-2032 and 2033-2035, a 30% reduction from baseline by 1 January 2035.

- Group 2 (G2) parties: In the 2027-2029 triennium, a freeze of production and consumption by 1 January 2028; for the next two triennia 2030-2032 and 2033-2035, a 10% reduction from baseline by 1 January 2032 and a 20% reduction from baseline by 1 January 2037.

For this report, the RTF calculated the funding requirements using Article 7 (A7) data from OS, information from the "Consolidated Business Plan for the Multilateral Fund for 2026-2028" (BP) for the purpose of forecasting funding requirements only, as well as by relevant decisions of the ExCom through its 97th meeting, and other information provided by the MLFS. The RTF relied on existing cost guidelines under the MLF and, where cost-effectiveness (CE) thresholds were defined on a case-by-case basis, the RTF noted these limitations and provided the values it used in its estimates.

The objective has been to produce an assessment of the next replenishment of the MLF that is transparent, policy consistent, and with defensible funding projections, aligned with the compliance obligations of A5 parties.

Some additional key assumptions made by the RTF for its estimates included:

- IAs' support costs were considered at an average of 9.6%, unless indicated otherwise;
- A 15% deduction for foreign ownership was applied in manufacturing sectors - please refer to caveats under section 1.6.10;
- At the time of finalization of this report, ratification of the KA was still missing for 19 remaining parties (16 in G1 and three in G2). RTF assumed that by the end of 2029 all parties will have ratified, making them all eligible for funding for the HFC phasedown in the 2027-2029 triennium and beyond. The RTF considered cash flow in its assessment by applying resource allocation schedules in the estimated funding model.

The RTF funding estimates and associated tables cover the periods for the 2027-2029 triennium and future two triennia, 2030-2032 and 2030-2035. Please note that for all tables and figures, totals may not sum exactly due to rounding.

1.6.2 HCFC phase-out estimated funding for production and consumption sectors

Chapter 2 covers the total estimated funding requirements for the phase-out of HCFCs, including consumption and production sectors, and Annexes 1 and 2 provide information on the funding methodology for HCFC funding calculation and historical HCFC CE analysis, respectively.

For the phase-out of HCFCs, the estimated funding requirement for the 2027-2029 triennium is based on A5 parties completing the phase-out by 2030, with no new funding for the triennia after 2030, other than committed funding for approved HPMPs. That is, for the HCFC consumption sector, the estimated funding is all the committed funding for countries with approved HCFC Phase-out Management Plans (HPMPs) plus new funding for the 28 countries (15 non-LVCs, 10 LVCs, and three countries with cancelled HPMPs) that still need to complete their phase-out. The situation of one of the three countries with cancelled HPMP is pending further clarification, so an adjustment may be made in the RTF supplementary report.

Estimated funding requirement for the HCFC consumption and production sectors include the following:

- HCFC consumption sector funding estimates include:
    - Funding for approved HPMPs (including projects for HCFC-141b polyols);
    - Funding for project preparation costs;
    - Funding for remaining HPMPs;
    - Funding for EE under ExCom Decision 89/6 (LVCs); and
    - Funding for HPMP verification.
- HCFC production sector funding estimates include funding for remaining HCFC Production Phaseout Management Plans (HPPMPs), including verification activities.

Decision XXXVII/6 requested TEAP to "use a clearly explained compliance-based methodology that is informed by, but independent of, the business plan of the Multilateral Fund, and that applies a range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee." In response to this request from parties, the RTF considered a range for the estimated funding requirements based on two CE values scenarios, applied to 15 non-LVC parties with remaining eligible consumption in manufacturing sectors, as follows:

- **HCFC scenario 1**: Applying an average historical CE in manufacturing sectors for those non-LVCs with remaining eligible consumption;
- **HCFC scenario 2:** Applying CEs in cost guidelines[18] in manufacturing sectors, for those non-LVCs with remaining eligible consumption.

RTF considered the total phaseout to happen by 2030 with the special allowances under the MP, as described previously, regarding the servicing tail. ExCom Decision 62/17 "requested the bilateral and IAs, when preparing multi-year HPMPs, to ensure that the last tranche comprised 10% of the total funding for the refrigeration servicing sector in the agreement and was scheduled for the last year of the plan."

RTF considered that the last tranche of the HPMPs would occur in 2030; consequently, 90% of the total phase-out resource allocation would be within the 2027-2029 triennium and the 10% for the last tranche would be allocated to the next triennium 2030-2032, following the intention of Decision 62/17.

1.6.3 HFC phase-down estimated funding requirements

Chapter 3 and Chapter 4 cover the total estimated funding requirements for the phase-down of HFCs in the consumption sector and production sector (including HFC-23 emission control and mitigation activities), respectively, and Annexes 3 and 4 to this report provides information on the funding methodology and calculation, including the RTF approach to filling any data gaps, e.g., in baselines.

As of 8 April 2026, 125 of the 144 A5 parties had ratified the Kigali Amendment (KA). For its analysis of estimated funding for the 2027-2029 triennium related to HFC phase-down, the RTF assumed that all parties would complete ratification by 2029, making all A5 parties eligible for funding for the HFC phasedown in the 2027-2029 triennium. Annex 6 presents a list of the remaining 19 A5 parties to ratify the KA.

Estimated funding requirement for the HFC consumption sector includes the following:

- Funding committed for approved Kigali HFC Implementation Plans (KIPs);
- Funding estimated for new KIPs;
- Funding for project preparation costs;
- Funding for KIP verification;
- Funding for EE (ExCom Decisions 91/65, 94/60, and 95/87); and
- Funding to support pilot projects to enhance regional atmospheric monitoring (Decision XXXVII/6).

Estimated funding requirement for the HFC production sector includes the following:

- Funding for project preparation;
- Funding for Kigali HFC Production Phase-down Management Plans (KPPMPs), if any;
- Funding for HFC-23 mitigation project preparation; and
- Funding for approved HFC-23 mitigation project.

RTF developed a funding model to estimate the HFC phase-down funding requirements for the consumption sector for the 2027-2029 triennium and future triennia, 2030-2032 and 2033-2035, based on A5 parties meeting the relevant G1 or G2 reduction targets. RTF HFC consumption sector model does the following:

- For G1 parties, estimates funding requirement to achieve both 10% reduction from the baseline by 2029 (Stage I KIP) and 30% reduction by 2035 (Stage II KIP); those parties with KIPs approved to reduce more than 30% of the baseline are not considered for additional funding for KIPs Stage I and II. Nevertheless, all committed funding for approved KIPs is reflected, according to the tranches schedule provided by the MLFS.
- For G2 parties, estimated funding requirement to meet the freeze by 2028 and achieve 10% reduction from the baseline by 2032 (Stage I KIP);
- The model uses the available baselines for A5 parties as calculated and posted on the Ozone Secretariat Data Centre; for parties without a baseline, RTF used the same methodology as in its 2023 reports to estimate missing baselines and is described in Chapter 3 and detailed in Annex 3.
- The model calculates each individual country's agreed reduction from baseline, taking into account reductions in already approved KIPs and needed reductions to meet the G1 (Stage I and II KIP) and G2 (Stage I KIP) targets.

- The model applies CE values based on KIP Stage I cost guidelines based on Decision 95/86, and where these were on a case-by-case basis for some sectors, the RTF estimated CEs based on TEAP/TOCs RTF sector experts' advice and best available information and noted these in its methodology.
- The model calculates the estimated funding requirement over the **three triennia (2027 to 2035 period)**, which cover different compliance targets for G1 and G2 parties in both Stage I and Stage II KIPs. The model mirrors to the extent possible, the MLF project submission and funding approval cycle to account for different progress for different parties. RTF is introducing into its estimated funding the concept of resource allocation across triennia to take into account different project cycles, pace of implementation, and the fact that funding requirements may overlap across different triennia for different parties depending on national circumstances.

To provide a range for the estimated funding requirement to address Stage I and Stage II targets over three triennia (2027-2035 period), RTF applied the following two scenarios:

- **HFC scenario 1:** Applied CE thresholds according to HFC cost guidelines or RTF derived-CEs for sectors considered on a case-by-case basis;
- **HFC scenario 2:** Applied CE thresholds for small- and medium-sized enterprises (SMEs) according to assumptions based on the percentage of SMEs participation in some manufacturing sectors.

For both HFC scenarios 1 and 2, RTF proposes resource allocation schedules per triennium as shown in Table 1.4. For both proposals, RTF assumed full ratification for G1 and G2 parties by 2029.

Table 1.4 Resource allocation schedule A and B

Group	KIP Stage	Schedule A (% per triennium)	Schedule B (% per triennium)
G1 parties without KIPs	I	100% - 2027-2029	90% - 2027-2029 10% - 2030-2032
	II	60% - 2030-2032 40% - 2033-2035	60% - 2030-2032 40% - 2033-2035
G1 parties with KIPs	II	60% - 2027-2029 40% - 2030-2032	60% - 2030-2032 40% - 2033-2035
G2 parties without KIPs	I	60% - 2027-2029 40% - 2030-2032	90% - 2030-2032 10% - 2033-2035

The two resource allocation schedules differ in the percentage of the KIP funding to be allocated to each different triennium.

- For G1 and G2 parties without KIPs, schedule A for funding Stage I is faster while schedules A and B are the same for funding Stage II for G1 parties without KIPs.
- For G1 parties with KIPs Stage I, schedule A proposes faster funding for Stage II.

1.6.4 Institutional strengthening and standard activities estimated funding requirements

The estimated funding requirement for IS and SA is presented in Chapter 5.

The estimated funding necessary to cover the IS project of each party follows the criteria agreed by ExCom-91 in Decision 91/63, which defined an increase in funding for all IS projects and renewals at a level 38% higher than that agreed at ExCom-74, with a minimum level of funding of US$ 60,000

per year and to extend the duration of IS renewal implementation phases from two years to three years for IS renewal proposals submitted from ExCom-92 onwards.

The SA funding covers the UNEP CAP; the core unit cost of the IAs: United Nations Development Programme (UNDP), United Nations Industrial Development Organization (UNIDO), and the World Bank (WB); and the funding of the ExCom, the MLFS including the monitoring and evaluation functions, as well as UNEP's Treasurer function. The estimated funding for these were informed by BP and the 2027 and 2028 MLF budget as approved by the ExCom as well as by the relevant decisions and budgetary practices of the ExCom.

The RTF has discussed different options to estimate funding for future triennia 2030-2032 and 2033-2035, under different elements and criteria. RTF first considered the estimated funding requirement for the 2027-2029 triennium and the average amount of previous replenishments. It has also considered the relative changes of workload and institutional structure of the MLFS and the IAs over the years. It is important to highlight that over these years, the institutional structure of the MLF and the IAs have remained the same with relatively minor increases in staffing in comparison to the increase the volume and complexity of work. The degree of complexity of this work has increased with the adoption of the KA and additional considerations such as EE, to the preparation and implementation of projects.

The RTF has included a 3% annual increase in professional staff salaries for IS and SA for future triennia, which it considers to be inadequate considering the above considerations. The RTF looks for further guidance from parties to estimate more realistic scenarios for staff support for funding future triennia, especially considering the expected review of IS in 2028.

1.6.5 Energy efficiency estimated funding requirements

Chapter 7 of this report reviews the following ExCom decisions related to funding for EE which are incorporated into the RTF estimated funding requirements for the HCFC phase-out and HFC phase-down in the 2027-2029 triennium:

1) Decision 89/6 established a funding table and defined additional activities for inclusion in existing and future HPMPs for LVC countries in response to paragraph 16 of decision XXVIII/2 and paragraph 2 of decision XXX/5 of the parties – as described in chapter 2, section 2.4.6.
2) Decision 91/65 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) of the decision – as described in section 7.3.
3) Decision 94/60 established a funding window in the amount of US$ 100 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) of the decision' – as described in section 7.4.
4) Decision 95/87 established a funding window in the amount of US$ 40 million in the context of HFC phase-down as specified in decision XXVIII/2, following the criteria identified in subparagraph (b) of the decision' – as described in section 7.5.

1.6.6 Estimated funding requirement for pilot projects to enhance regional atmospheric monitoring

Decision XXXVII/6 requests the TEAP to develop "a scenario to allocate resources for a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol". In Chapter 10, the RTF summarizes the relevant

decisions of the parties under the MP and the ExCom related to the identification, selection, and consideration of potential funding of pilot projects intended to enhance regional atmospheric monitoring capacity in support of the objectives of ODS phase-out and HFC phase-down.

ExCom Decision 96/56 requests the MLFS to prepare for ExCom-98 draft guidelines for the preparation and implementation of pilot projects to enhance regional atmospheric monitoring, a draft template agreement between the ExCom and the A5 country concerned for a pilot project to establish a station, and information on the potential for the World Meteorological Organization to take on a role as implementing agency for pilot project. At ExCom-98, members would consider establishing a funding window for three pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP.

Assuming an ExCom decision to establish a funding window, RTF estimated the funding requirements to support pilot projects establishing three atmospheric monitoring stations and their initial operation, covering the period for the 2027-2029 and 2030-2035 triennia. RTF did not estimate funding beyond this period and would seek guidance from parties with regard to this funding window approach for pilot projects and interest in extending the estimated funding for the ongoing operation of three pilot stations as well as funding for initializing testing and operation of additional stations.

1.6.7 Special needs of LVC and VLVC countries

Decision XXXVII/6 requests the TEAP to consider the "special needs of low-volume-consuming (LVC) and very-low-volume-consuming (VLVC) countries, taking into account relevant decision of the ExCom pertaining to those countries." In Chapter 6, RTF provides information for the consideration of parties on the continuing challenges and ways to address these for LVC and VLVC countries for the ODS phase-out and HFC phase-down under the MP. There are no funding implications (to the funding calculation in the model adopted by RTF) regarding the considerations provided in Chapter 6. RTF is however providing information to parties to support discussions regarding the potential review of cost guidelines in 2028.

1.6.8 Lifecycle refrigerant management

Parties have had longstanding discussions on the importance of LRM under the MP during the ODS phase-out and HFC phase-down. TEAP has provided a number of related reports responding to requests for information on LRM from decisions of parties. ExCom Decision 97/89 requests the "Secretariat to prepare, for the 100th meeting, a document on funding modalities, including elements for draft cost guidelines to implement plans developed in accordance with decision 91/66, with a view to considering the establishment of a funding window."

In Chapter 8 of this report, RTF provides updated information on LRM for the consideration of parties.

1.6.9 Digital technologies and tools in the servicing sector

Decision XXVII/6 requests TEAP to consider "integrating digital technologies within the servicing sector." For the consideration of parties, Chapter 9 of this report provides information and an approach to considering digital technologies and tools to support transitions under the MP.

1.6.10 Caveats

The RTF has estimated the funding requirements for the 2027-2029 triennium and future triennia with strict adherence to the relevant compliance targets as requested by the TOR. Funding estimates are presented for items requested under RTF's TOR in the summary tables.

Items that were requested in the TOR but are complementary to the compliance model, such as the challenges faced by LVCs or digitisation efforts, were presented in separate chapters but not totalled or added to the summary tables. Similarly, other items that were not requested in the TOR or where the RTF needed further guidance, were not included in the totals and are presented in the respective chapters and annexes for parties' information and considerations, and, if needed, for further guidance.

RTF assumed that all parties in G1 and G2 will be ratifying the KA by 2029. The sensitivity of assumptions made for parties that have not yet reported baseline data are presented in Annex 3.

RTF calculated funding for future KIP Stage II using the same CE thresholds as those approved for Stage I, even though some of those CEs may be revised in a review in 2028 for eventual use in Stage II.

The model did not consider funding for Project Management Units (PMUs) which is additional for non-LVC parties due to the variability of the funds' calculations for the different parties and even the different projects for the same parties. PMU costs range from 5% to 10%. Since the RTF did not find reference studies for PMU costs, it deferred the calculations of these costs to the supplementary report to get additional guidance from the parties.

The model takes into consideration a 15% non-A5 ownership content for all manufacturing sectors which reduces funding for those sectors by the same percentage. This consideration has the following limitations: a) it is not applicable to SMEs benefitting from higher CEs as presented in HFC scenario 2 in chapter 3 since by definition those SMEs need to be 100% locally owned as per Decision 96/56(c)(iii), and b) the general practice under the HPMPs was to defer enterprises with non-A5 ownership to later stages which would impact the resource allocation calculations for this triennium and the next triennium to varying degrees. RTF included the 15% reduction for the manufacturing sectors in its calculations and would rectify in the supplementary report after getting guidance from the parties.

A distinction was made between the allocation of funds for the implementation of the KIP plans in the different triennia and the request for project preparation (PRP) funding; consequently, the number of parties requesting PRP funding and those being allocated KIP funding for the same stage do not necessarily match. A review and update of PRP costs will be done for the RTF supplementary report for MOP-38, considering approvals at the 98th ExCom.

Scenarios for HCFC did not include the additional 25% for introduction of low-GWP alternatives allowed under decision 74/50(c)(iii) for those sectors with a CE threshold (polyurethane (PU) foam and commercial refrigeration) nor the 40% additional funding for foam SMEs.

Total values were calculated by rounding so small differences may appear in different tables in this report.

2 Funding for HCFC Phase-out

This chapter provides the total estimated funding requirements for the phase-out of HCFCs, including consumption and production sectors, and Annex 1 provides information on the funding methodology and calculation.

For the phase-out of HCFC consumption and production, the estimated funding requirement for the 2027-2029 triennium is based on A5 parties completing the phase-out by 2030, with no new funding for the triennia after 2030, other than committed funding for approved HPMPs/HPPMPs.

2.1 Background: HCFC Phase-out

The MOP-19 in 2007 agreed to accelerate the phase-out of production and consumption of HCFCs (Decision XIX/6). Table 2.1 summarise the reduction steps for A5 parties to meet this accelerated phaseout schedule. For the 2027-2029 triennium and subsequent triennia (2030-2032 and 2033-2035), A5 compliance targets require a 97.5% reduction from baseline by 1 January 2030, followed by a total phase-out of production and consumption by 1 January 2040.

Table 2.1: Montreal Protocol compliance schedule for HCFC phase-out for A5 parties[12]

Controlled substance	Compliance Schedule for A5 parties
Annex C – Group I: Hydrochlorofluorocarbons (HCFCs)	Baseline is the average of 2009 and 2010 production and consumption Freeze at average 2009-2010 level on 1/1/2013; 10% reduction by 1/1/2015; 35% reduction by 1/1/2020; 67.5% reduction by 1/1/2025; **97.5% reduction by 1/1/2030****; Total phase-out by 1/1/2040 **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. Note that Decision XXX/2 referring to Annex I of the MOP30 report, 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 HCFCs, the compliance target for the 2027-2029 triennium is a 97.5% reduction from baseline by 1 January 2030.

For funding estimation, the RTF model assumes a 100% phaseout of controlled consumption by 2030, bearing in mind the servicing tail provisions of the MP, as outlined below:

- The remaining 2.5% of baseline consumption is restricted to servicing of refrigeration and air-conditioning equipment existing during 2030-2040. Decision XXX/2, referring to Annex I of the MOP-30 report[13], amends this provision of A5 (as well as

[12] Freezes and reductions refer to baseline levels. Full details of control measures are published on the Ozone Secretariat's website, including decisions XXVIII/1 and XXVIII/2 regarding the Kigali Amendment.

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

2F) to include other uses, namely servicing of fire suppression and fire protection equipment existing as of 1 January 2030; solvent applications in rocket engine manufacturing; and topical medical aerosol applications for the specialised treatment of burns.

For future triennia (2030-2032 and 2033-2035), funding needs will be the committed funding in agreements with A5 parties for the complete phaseout of HCFCs by 2040.

2.2 2026 Status overview of the HCFC consumptions sector

Table 2.2 shows the aggregate remaining HCFC consumption[14] by type of HCFCs in A5 countries that are receiving assistance from the MLF.[15] Implementation of approved Stages I, II and III of the HPMPs will result in the phase-out of approximately 84% of the starting point for aggregate reduction of HCFC consumption and 96% of the consumption of HCFC-141b contained in imported pre-blended polyols.

Table 2.2: Total remaining HCFC consumption by substance (ODP tonnes) *

HCFC	Baseline	Starting point	Approved	Remaining	% of approved
HCFC-123	31.9	30.2	24.8	5.4	82.1
HCFC-124	26.4	26.1	24.0	2.2	92.0
HCFC-141	0.9	0.9	0.9	0.0	100.0
HCFC-141b	10,668.2	10,674.8	10,644.1	29.4	99.7
HCFC-142b	2,000.8	2,016.8	1,538.3	476.8	76.3
HCFC-21	0.7	0.7	0.7	0.0	100.0
HCFC-22	20,424.7	19,884.9	15,605.7	4,278.5	78.5
HCFC-225	2.8	2.8	1.5	1.3	53.6
HCFC-225ca	0.4	0.4	0.0	0.4	0.0
HCFC-225cb	0.7	0.7	0.0	0.7	0.0
Grand Total	**33,157.6**	**32,638.4**	**27,840.0**	**4,794.6**	**85.3**
HCFC-141b (polyols)**	0.0	657.0	631.1	19.4	96.1

* As of ExCom-97
** HCFC-141b contained in imported pre-blended polyols

2.3 Overview of HCFC funding requirement

Most A5 parties have submitted their last stage/tranches for the complete phaseout of HCFCs by 2030. ***Therefore, the 2027-2029 Replenishment will celebrate the fact that the MLF will be addressing the last remaining consumption of HCFCs for the few parties, that will be submitting their last stage/ or tranche of HPMPs in the triennium, for the complete (100%) phaseout of HCFCs***!

That said, the HCFC phase-out funding requirement for the 2027-2029 triennium was calculated considering that the large majority of HPMPs are addressing complete phaseout by 2030. According to the ExCom, parties that wish to phase out HCFCs by 1 January 2030 may do so but have to guarantee that HCFCs would not be imported after that date, except for those allowed for a servicing tail between 2030 and 2040, where required, consistent with the

[14] The remaining HCFC consumption eligible for funding depends on the starting point for aggregate reductions in HCFC consumption selected by each A5 country in their HPMP.

[15] UNEP/OzL.Pro/ExCom/97/8

provisions of the MP. The ExCom decided (Decision 86/51), that, to allow for consideration of the final tranches of the HCFC HPMPs for any consuming country requesting funding for the complete phase-out of HCFCs, the relevant Government should submit a detailed description of the regulatory and policy framework in place to implement measures to ensure that HCFC consumption was in compliance with paragraph 8 ter(e)(i) of Article 5 of the MP for the period 2030-2040. If the party intends to have consumption during the period 2030–2040, modifications need to be made to its agreement with the ExCom covering the period beyond 2030. It is important to emphasize that parties with HPMPs for total phase out have no more remaining HCFC consumption eligible for funding. Accordingly, changes to the agreement might affect targets but not funding levels.

The compliance model for HCFC phase-out consolidates data from the following sources:

- A7 consumption data reported to the OS, current as of January 2026;
- CP data submitted to the MLFS, as of 13 January 2026;
- MLFS provided information on approved HPMPs including agreed reduction from the starting point, funding and tranche schedules, project preparation and verification, and information on EE;
- ExCom documents and decisions, including cost guidelines, up to and including the ExCom-97; and
- Classification of LVCs based on HCFC baseline consumption (presented in Annex 5).

The BP was used to inform RTF on future requests to IAs for projects to be submitted to MLFS, therefore guiding RTF to forecast potential new funding needed.

The estimated funding requirements for the HCFC consumption sector include the following:

- Committed funding for approved HCFC Phase-out Management Plans (HPMPs) (including projects for HCFC-141b polyols);
- Estimated funding for project preparation costs;
- Estimated funding for HPMP verification.
- Estimated funding for new HPMPs stages for 25 parties (15 non-LVCs and 10 LVCs) with approved HPMPs that do not address the complete phaseout by 2030. And for three parties for re-submission of their cancelled HPMPs.
- Estimated funding for EE (ExCom Decision 89/6 for LVCs).

2.4 HCFC Funding Methodology

2.4.1 Remaining HCFC phase-out funding

RTF treated the 144 A5 parties based on their HPMPs' implementation status and eligible remaining consumption by sector, and grouped them accordingly, for funding calculation purposes. Funding for project preparation, verification, and EE are presented in separate cost line items.

With the approaching HCFCs phaseout date and the HPMPs implementation progress, and as mentioned, 116 A5 parties have been already assisted, and/or have approved plans, to address all HCFC phaseout targets. The number of parties that still need new funding is limited to a total of 28 parties: 25 (15 non-LVCs parties, 10 LVCs parties), and three parties with canceled HPMPs (one non-LVC and two LVCs) that may need funding if they can re-submit their HPMPs. The situation of one of the three countries with cancelled HPMP is pending further clarification, so an adjustment may be made in the RTF supplementary report.

For the 15 non-LVC parties, the 2024 CP data indicated consumption mostly in servicing sector, but some parties, consumption was also reported in one or more manufacturing sectors, such as, rigid PU foam, extruded polystyrene (XPS) foam, fire extinguishing, solvents, domestic air conditioning (AC), and other refrigeration and AC manufacturing sectors. For the largest consuming party among all the A5 (China), the eligible remaining consumption is only in three sectors/subsectors: residential AC, industrial and commercial refrigeration and AC (ICR/AC), and servicing. Consumption in those sectors was used for new funding estimates.

2.4.2 Methodology

Annex 1 provides details on the model structure and flow, showing a flow chart with scenarios to address parties' requests and indicates the output number related to the analysis.

RTF used CP reports, as of January 2026, to inform on chemicals percentage (%) sector distribution, and reported A7 data. For those 25 parties, CP and A7 data were not significantly different, and RTF used the lower consumption value from the most recent year reported. This approach reflects the agreed value-reduction as a reference for the country's actual achieved reduction level.

Some additional key assumptions made by the RTF for its estimates included:

- IAs' support costs were considered at an average of 9.6%, unless indicated otherwise;
- A 15% deduction for ineligible foreign non-LVCs A5 ownership was applied in manufacturing sectors.

The methodology used for new funding calculations was based on sector CEs applied to eligible remaining consumption (in tonnes) in each sector, i.e., manufacturing or servicing, as per equation below.

For each party

$$\sum (\boldsymbol{eligible\ remaining\ consumption\ to\ be\ phased-out\ by\ sector}) \boldsymbol{x}\ (\boldsymbol{sector\ cost-effectiveness})$$

For this assessment, RTF grouped parties following their HPMP status and the eligible remaining consumption still to be addressed for complete HCFC Phase-out, and following the steps below:

STEP 1. Grouped parties (116) with approved HPMPs with agreements with ExCom covering 100% of their phase-out obligation

Funding for those 116 parties has already been approved by the ExCom. Other than the funding already committed, no new funding is projected for those 116 parties, nor for 2.5% HCFC servicing tail for the ones with 2.5% remaining (1 party). Committed funding amounts to **US$ 76.73 million in the 2027 to 2029 triennium and US$ 20.13 million in the 2030 to 2031 period**, as per information received from the MLF Secretariat. Funding commitments go only until 2031. This methodology step is shown in the flow chart in the Model Description in Annex 1. The committed funding is shown as the model **Output 1.**

STEP 2. Calculation of new funding for three A5 parties with cancelled HPMPs

This includes 2 LVC parties (baselines 12 and 6.8 ODP tonnes) and one (1) non-LVC party (baseline 158.2 ODP tonnes). [16] Funding was calculated separately for LVCs and non-LVCs, using the CEs in cost guidelines for non-LVC, and the cost framework in Decision 74/50 for the LVCs.

For the three parties that had their HPMP cancelled, future funding requests remain uncertain and depend on whether new submissions are prepared and subsequently approved. In addition, RTF may need to adjust the number of cancelled HPMPs, pending further clarification regarding the HPMP status for one LVC party. For the sake of funding estimates and considering no party is left behind, RTF calculated the funding needs for those three parties assuming they can still request all eligible funds in the next triennium to phase out 100% of remaining HCFCs. The reduction was calculated based on reported last (2024) HCFC consumption for each party. This methodology step is shown in the flow chart in Annex, under model **Output 2**, with a total of **US$ 10.22 million in 2027-2029 and zero in the following triennia.**

STEP 3. Calculation of committed and new funding estimates for 25 parties with remaining eligible consumption, and with HPMP agreements that do not achieve the complete phaseout"

Step 3.1. Accounts for the c**ommitted funding** for HPMPs/stages approved for those 25 A5 parties, where the phase-out has not yet been 100% completed. The total is **US$ 1.33 million,** as **per** MLFS information shared on 13 January 2026. This methodology step is shown in the flow chart in Annex 1, and committed funding is indicated in the model as **Output 3.**

Step 3.2. Estimates new funding for those 25 parties with Agreements approved for less than 100% phase-out. These parties have eligible consumption that needs to be addressed before 2030, and for which new funding is required. The remaining eligible HCFC consumption was provided by MLFS to RTF for each of those parties, and new funding was calculated individually, to account for each party's own reduction schedule in the agreements. There are two scenarios for the estimates in Step 3.2 as explained below.

2.4.3 Scenarios for 15 non-LVC parties

The TOR for the replenishment requested TEAP to apply "a *range of cost-effectiveness figures for the manufacturing sectors based on historical experience rather than only on cost-effectiveness thresholds approved by the Executive Committee".* Therefore, RTF considered funding estimates using CE in cost guidelines and historical CE values for the manufacturing sectors, so a range could be provided. RTF presents two HCFC scenarios 1 and 2 as follows.

- **HCFC Scenario 1: estimated funding for 15 non-LVC parties using historical CEs**

The RTF analyzed data from document UNEP/OzL.Pro/ExCom/89/10/Rev.1 summarised in Annex 1 **"RTF analysis of document ExCom 89/10/Rev1"** and used historical CEs to

[16] The situation of one of the three countries with cancelled HPMP is pending further clarification, so an adjustment may be made in the RTF supplementary report.

calculate new funding for 15 non-LVC parties indicated as **Output 4** in model flow chart. (Annex1)

For its analysis, RTF separated projects for the largest consuming party (China) from projects for the other 14 parties and extracted an average historical Sector CE by sector. Because CEs for China projects were significantly lower, results were presented, and CEs applied, separately. Sectors with no remaining eligible consumption were discarded. Funding estimates were calculated for eligible consumption in China in sectors eligible for additional funding (foam, fire extinguishing, and solvents sectors excluded).

Then RTF applied the separate historical CEs, as described to estimate total new funding, as per HCFC Scenario 1. That is, total estimates are the sum of funding estimates for 14 parties plus China's funding estimates. The historical CEs applied by RTF to HCFC manufacturing sectors (as requested in the TOR) are in Table 2.3 below. The servicing sector was fixed at US$ 4.8/kg.

Table 2.3: Historical CEs applied to 15 parties with manufacturing sectors (US$/kg)

	Aerosol	XPS	PU	Fire Ext.	ICR/ AC	Res. AC	Solvents
One party (China)	0.00	0.00	0.00	0.00	6.97	4.74	0.00
Other 14	0.00	5.74	7.37	4.80	14.57	10.05	10.51

The following Table 2.4 presents the estimated total funding when applying the historical CE values.

Table 2.4: Estimated total funding with historical CE values only applied to the manufacturing sectors (US$ millions)

	XPS Foam	PU Foam	Fire Ext.	ICR	Res. AC	Solvents	Servicing	Total (with 9.6% support costs)
One party (China)	-	-	-	94.31	66.10	-	144.37	334.05
14 parties	0.10	0.36	0.06	6.11	0.00	2.11	49.75	64.11
Total for 15 parties	0.10	0.36	0.06	100.43	66.10	2.11	194.12	398.15
Total with 15% deduction*	**0.08**	**0.31**	**0.05**	**85.36**	**56.18**	**1.79**	**194.12**	**370.34**

* Includes 15% deduction for ineligible foreign ownership in the manufacturing sectors

- **HCFC Scenario 2: estimated funding for 15 non-LVC parties using CEs from cost guidelines**

CE values in HCFC cost guidelines for all 15 parties, and for some case-by-case sectors, CE gaps were filled by RTF. This scenario estimated new funding calculations using This calculation is represented in Annex 1 as **Output 5** in the flow chart. CEs used and associated estimated funding are shown in Tables 2.5 and 2.6 below.

Table 2.5: Cost guidelines CEs applied to 15 parties with manufacturing sector (US$/kg)

	Aerosol	XPS	PU	Fire Ext.	ICR/ AC	Res. AC	Solvents
All 15 parties*	0	8.22	7.83	4.8	15.21	7.15	10.13

*Including China

Table 2.6: Estimated funding applying cost guideline CEs to 15 manufacturing sector parties (US$ millions)

	XPS Foam	PU Foam	Fire Ext.	ICR	Resid. AC	Solvents	Servicing	Total	Total (with 9.6% support costs)
Total for 15 parties	0.14	0.38	0.06	212.20	99.70	2.03	194.12	508.64	557.47
15% deduction *	0.12	0.33	0.05	180.37	84.75	1.73	194.12	461.46	**505.76**

* 15% deduction for ineligible foreign ownership in the manufacturing sectors. Only sectors with remaining consumption for each individual party were considered.

As mentioned in section 1.6.10, RTF was unable to estimate and has not included PMU for remaining HPMPs (PMU is outside cost guidelines values for non-LVCs). RTF, in consultation with the MLFS, believes the costs could be about 5, 7, or 10% depending upon the party.

2.4.4 Estimated funding for 10 LVC parties

Out of 25 parties, 10 are LVCs. For those, RTF estimated new funding taking into account a separate cost framework, as per ExCom Decision 74/50. New funding estimates are under **Output 6** in the flow chart. Based on the most recent reported data (2024), two parties have completed their phaseout processes. Considering the amounts already committed for the remaining eight countries, as well as the funding levels established under Decision 74/50 for phaseout, the total amount to be allocated to these countries is **US$ 2.56 million.**

2.4.5 Total estimated funding for remaining phase-out in the consumption sector

The total estimated funding requirement for 2027-2029 for all 25 parties, which have eligible remaining consumption, to reach complete phase-out ranges from **US$ 373 million to US$ 508 million.**

Table 2.7: Total estimated funding for remaining HCFC consumption sector phase-out for 25 parties (US$ millions)

HCFC Consumption Sector	HCFC Scenario 1 (historical CE)	HCFC Scenario 2 (cost guidelines CE)
Estimated new funding: 10 LVC* parties to complete phase-out	2.56**	2.56**
Estimated new funding: 15 non-LVC parties to complete phase-out	370.34	505.76
Total with 9.6% support costs	**372.90**	**508.32**

*Actual number is 8 LVCs when taking into consideration the two parties who have completed their phaseout in 2024

**Calculation based on remaining funding after considering the already approved amounts

It is important to note that the RTF methodology is applicable to all parties and that RTF used historical CEs as documented in ExCom 89/10/Rev1. This methodology provides a consistent and transparent basis for estimating remaining funding requirements for complete phaseout of HCFCs, based on actual implementation experience and the policy ceilings defined by existing cost guidelines. The low-end historical CE scenario, in Table 2.7 above, includes US$ 372.90 million as the funding needed for 25 countries with remaining consumption.

For the highest consumption party (China), approval of HPMP stages/tranches is decided on a case-by-case basis. The ExCom approved several tranches for HPMP I and II with costs, and associated sector CEs that are different than the historical CE (in document 89/10/Rev1). RTF used these costs in its modelling. In addition, HPMP II was approved by the ExCom at a level lower than for HPMP I, so when compared, the funding for China has decreased considerably for the different sector plans.

The RTF considered whether to apply China's CE for sectors according to the approval for HPMP II tranches; but would need guidance from parties. This approach would imply using a different methodology than was used above and would have a very large impact on the range for the total estimated funding for the HCFC consumption sector phaseout.

2.5 Verification

Regarding the verification costs, the adjusted consolidated 2026-2028 business plan includes the amounts for 2027 and 2028, but not 2029. A total of US$ 588,600 per year for 2027 and 2028 is included in the "Adjusted Consolidated Business Plan of the Multilateral Fund for 2026-2028" [17] for 18 countries. RTF has used the same annual amount as an estimate for HPMP verification for 2029 as can be seen in Table 2.8 below. The total estimated funding requirement for HPMP verification for 2027-2029 is **US$ 1,765,800.**

Table 2.8: Estimated funding requirement for HPMP verification for 2027-2029 (US$ millions)

HPMP Verification	2027	2028	2029	Total 2027-2029
18 LVC countries	588,600	588,600	588,600	1,**765,800**

[17] https://www.multilateralfund.org/meetings/97/post-session

2.6 Project preparation

Remaining PRP requests for HPMPs are in the list of countries in Table 2.9 below that have preparation costs required. RTF used only values after 2026 that are listed in the BP, because these fall within the 2027-2029 triennium. The total estimated funding requirement for HPMP project preparation for 2027-2029 is **US$ 43,840** with support costs. It should be noted that the BP did not include PRP required for all the remaining countries; consequently, the numbers might be higher.

Table 2.9: Estimated funding requirement for HPMP project preparation (US$)

Country	Status	HPMP PRP Required for Total Phase-Out	Funding Eligibility for Servicing (excluding support costs)	PRP in BP 2006 and before	PRP in BP 2027 or 2028 (US$)
Afghanistan	Non-LVC	Yes	40,000	No	40,000 (in 2027)
China	Non-LVC	Yes	Case by case basis	Yes	No
Democratic People's Republic of Korea (the)	Non-LVC	Yes	70,000	-	No
Libya	Non-LVC	Yes	60,000	-	No
Mauritania	Non-LVC	Yes	30,000	Yes	No
Senegal	Non-LVC	Yes	40,000	Yes	No
Total				**-**	**40,000**
Total including 9.6% support costs					**43,840**

2.7 Energy Efficiency (Decision 89/6)

In the context of HCFC phase-out, parties agreed in Decision XXVIII/2 paragraph 16 to request the ExCom to increase funding available to LVC countries for maintaining EE in the servicing/end-use sector. In Decision 89/6 the ExCom established a funding table and defined additional activities for inclusion in existing and future HPMPs for LVC countries in response to paragraph 16 of Decision XXVIII/2 and paragraph 2 of Decision XXX/5 of the parties. The ExCom in Decision 91/37 decided that Decision 89/6 applies to LVC countries that have already completed their HPMPs. Informed by BP, RTF estimated funding requirement for EE for 2027-2029 including an average of 9.6% support costs to be **US$ 3.4 million**, and further details can be found in Chapter 7.

2.8 Resource Allocation Proposals for HCFC Funding Estimates in 2027-2029 and 2030-2032

The total HCFC phase-out is scheduled for 2030 with the special allowances for the servicing tail. ExCom Decision 62/17 "requested the bilateral and IAs, when preparing multi-year HPMPs, to ensure that the last tranche comprised 10% of the total funding for the refrigeration servicing sector in the agreement and was scheduled for the last year of the plan."

RTF considered that the last tranche of the HPMPs would occur in 2030; consequently, 90% of the total phase-out resource allocation would be within the 2027-2029 triennium and the 10% for the last tranche would be allocated to the next triennium 2030-2032, following decision 62/17.

Applying the HCFC scenarios 1 and 2 based on historical versus cost guidelines CEs, respectively, and considering Decision 62/17, and allocating funding resources 90% to 2027-2029 and 10% to 2030-2032, the ranges for the estimated funding requirement for the HCFC consumption sector total phase-out for the 2027-2029 and 2030-2032 are summarised in Table 2.10.

Table 2.10: Range of estimated funding requirement for total HCFC consumption sector phase-out for 2027-2029 and 2030-2032 (US$ millions)

HCFC CONSUMPTION SECTOR	2027-2029 and 2030-2032 Total Estimated Funding for Complete Phaseout		Proposed Resource Allocation		Proposed Resource Allocation	
			2027-2029	2030-2032	2027-2029	2030-2032
	2 Scenarios applying different CEs to manufacturing sectors		Scenario 1		Scenario 2	
	Scenario 1	Scenario 2	90%	10%	90%	10%
Funding Committed * for Approved HPMPs	98.19*	98.19*	78.06*	20.13*	78.06*	20.13*
Estimated New Funding for Project Preparation (PRP)	0.0438	0.0438	0.04	0.00	0.04	0.00
Estimated New Funding to Address Remaining Consumption in 25 Parties for Complete Phaseout	372.9	508.32	335.61	37.29	457.49	50.83
Estimated New Funding for re-submission of 3 cancelled HPMPs	10.22	10.22	9.20	1.02	9.20	1.02
HCFC Verification Funding	1.77	1.77	1.59	0.18	1.59	0.18
Energy Efficiency Funding for LVCs (Decision 89/6)	3.4	3.4	3.06	0.34	3.06	0.34
Total for HCFC Consumption Sector	**486.52**	**621.94**	**427.56**	**58.96**	**549.44**	**72.50**

*The values for committed funding follow the exact amount in tranches agreed, and the suggested 90/10% allocation by triennium does not apply.
** Project preparation all considered upfront.

As mentioned earlier, RTF was unable to estimate and has not included PMU for remaining HPMPs (PMU is outside cost guidelines for non-LVCs). RTF, in consultation with the MLFS,

believes the costs could be about 5, 7, or 10 per cent depending upon the party. This can be considered further in the RTF supplementary report.

In summary, Table 2.11 presents the following rounded ranges per triennium for the estimated funding requirement for the HCFC consumption sector (considering resource allocation as per Decision 62/17):

Table 2.11: Summary of range of total estimated funding requirement for HCFC consumption sector phase-out for 2027-2029 and 2030-2032 (US$ millions)

Triennium	HCFC CONSUMPTION SECTOR ESTIMATED FUNDING RANGE (US$ million)	
	Scenario 1 with 90%/10% Allocation	Scenario 2 with 90%/10% Allocation
2027–2029	428	549
2030–2032	59	73

2.9 Estimated Funding Requirement for the HCFC Production Sector

2.9.1 Status overview of the HCFC production sector

Seven (7) A5 parties produced HCFCs, with the total production reported as 13,322.9 ODP-tonnes (ODP t) in 2024, including Argentina, China, Democratic People's Republic of Korea (DPRK), India, Mexico, Republic of Korea and Venezuela (Bolivarian Republic of). As of December 2024, completed projects had phased out 204,536 ODP t of production. [18] The total production of HCFC in 2024 was 60% below the aggregated production baseline. The levels of the three main HCFCs produced (i.e., HCFC-22, HCFC-141b, HCFC-142b) are shown in Table 2.12.

[18] UNEP/OzL.Pro/ExCom/97/8

Table 2.12: Production levels of three main HCFCs during 2016-2024 (A7, ODPt)

Party	Baseline	2016	2017	2018	2019	2020	2021	2022	2023	2024
HCFC-22										
Argentina	224.6	95.8	100.3	65.6	88.3	66.3	56.6	72.1	91.8	100.0
China	29,122.0*	14,086.3	13,445.7	13,636.4	13,598.2	11,042.2	10,011.8	11,155.9	9,730.6	9,477.5
DPRK	27.6	24.8	24.8	24.8	27.0	27.0	24.8	24.8	24.8	21.6
India	2,399.5	1,665.5	1,789.5	1,936.4	1,937.0	1,354.8	1,156.2	942.0	1,218.3	1,362.0
Mexico	697.0	166.8	190.1	183.8	134.8	56.7	138.4	217.4	147.2	176.3
Republic of Korea	395.1	240.3	305.6	289.9	271.5	254.3	221.0	199.6	167.2	230.8
Venezuela (Bolivarian Republic of)	123.1	14.3	15.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal HCFC-22	**32,988.9**	16,293.8	15,871.0	16,138.7	16,056.7	12,801.3	11,608.7	12,611.8	11,379.9	11,368.2
China - HCFC-141b	*	7,278.2	7,076.8	6,321.1	6,101.6	4,623.3	3,545.1	3,850.4	1,770.8	1,686.9
China - HCFC-142b	*	1,110.5	1,115.5	756.3	816.0	418.3	472.3	126.7	185.5	267.8
Total	**32,988.9**	24,682.6	24,063.3	23,216.1	22,974.3	17,842.9	15,626.2	16,588.9	13,336.2	13,322.9

* The HCFC production baseline is 29,122 ODP tonnes and includes all HCFCs produced by China, mainly HCFC 22, HCFC 141b and HCFC 142b, and to a lesser extent HCFC-123 and HCFC-124.

The ExCom decided to consider HCFC-22 production in Mexico and Argentina in the context of its discussions on by-product controls for HFC-23 arising from the KA. The issues and estimated funding for HFC-23 mitigation are discussed in Chapter 4 of this report.

Based on the current guidelines and the agreements between A5 parties that produced HCFCs and the ExCom, the Republic of Korea produces HCFC-22 with production of 230.8 ODP t and has been urged not to request funding from the MLF. [19]

The DPRK has reported 21.6 ODP t of HCFC production for the year 2024, which is above the production target set in the plan of action in Decision XXXII/6. The 69th meeting of the Implementation Committee (ImpCom-69) requested the country to provide an explanation for the deviations as a matter of urgency and no later than 15 March 2023, and, if appropriate, to submit a revised plan of action to ensure its return to compliance with the control measures of the MP for HCFCs in 2023, for consideration by ImpCom-70.[20]

ExCom-91 addressed the implementation of the first tranche of Stage II of the HPMP for the Bolivarian Republic of Venezuela and the revised plan of action for the period from 2022 to 2026, on the understanding that no additional funding from the MLF would be provided for the phase-out of production and consumption of HCFCs: "The Government of the Bolivarian Republic of Venezuela commits to issue a ban on the production of HCFC-22 by 1 January 2027."[21]

[19] UNEP/OzL.Pro/ExCom/91/71

[20] Recommendation 69/4 of document UNEP/OzL.Pro/ImpCom/69/5

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

India submitted a request for a technical audit of the production sector to be considered by the Sub-group on the Production Sector in the margins of ExCom-86, but there were no further discussions and agreement on approving the request until ExCom-97. In the ExCom-86 report, members requested that the activities relating to the HPPMP for India be removed from the consolidated business plan, [22] and this was reflected in the TEAP RTF September 2023 report. [23]

China was in compliance with the MP targets for HCFC production and consumption according to the 2024 verification report (report of the Sub-group on the Production Sector at ExCom-97). [24]

Only one HCFC production sector project (China's HPPMP) had been submitted and discussed and included in the BP.

2.9.2 HCFC Production Phase-out Management Plans (HPPMPs)

One party (China) needs to be considered for funding for HCFC production phase-out during the 2027-2029 triennium.

The Agreement between China and the ExCom species the maximum funding envelope for the entire phase-out of production for controlled uses of $385 million (para 2 of Agreement). To date, the ExCom has approved a total of $95 million (Stage I) and $67 million. The HPPMP agreement specifies agency support costs of 5.6% for the duration of the HPPMP.

A total of US$ 47.08 million is planned for Stage III of the HPPMP for China, including US$ 23.54 million for 2026-2028 which was listed in the BP to address 4,146.00 ODPt. RTF assumed the funding for 2027-2029 is equivalent to the funding in the business plan of 2026-2028 because the US$ 47.08 million was divided equally over the six years of HPPMP Stage III.

2.9.3 Total estimated funding requirement for the HCFC production sector (2027-2029)

The total funding requirement for the 2027-2029 triennium for the production sector is estimated at **US$ 23.54 million**, including agency support costs of 5.6% (Table 2-13). RTF notes that the verification costs are included in the agency's support costs and are not a separate item for the production sector.

Table 2.13: Estimated funding requirement for HCFC production sector (US$ million)

2027-2029 Triennium Estimated Funding	
HCFC Production Sector	
HCFC Production Sector Stage III HPPMP (China)	**$ 23.54**
Subtotal – HCFC Production Sector (including support costs of 5.6%)	**$ 23.54**

[22] UNEP/OzL.Pro/ExCom/86/100

[23] September 2023 TEAP Decision XXXIV/2 Replenishment Supplementary Report

[24] UNEP/OzL.Pro/ExCom/97/91

2.10 Summary of estimated total HCFC funding requirement for the 2027-2029 triennium and future triennia [25]

Adding the range of estimated total funding requirement for the HCFC consumption sector as presented in section 2.7 with the above section 2.8 estimate for the production sector, the estimated total funding requirement for 2027-2029 triennium and future triennia for the HCFC consumption and production sectors are summarised below and in Table 2.14:

- **2027-2029: US$ 451 million to US$ 573 million**
- **2030-2032: US$ 83 million to US$ 96 million**

Table 2.14: Estimated total funding requirement for HCFC phase-out for 2027-2029 and future triennia (US$ million)

Triennium	Sector	HCFC ESTIMATED FUNDING RANGE (US$ million)	
		Scenario 1 with 90%/10% Allocation	Scenario 2 with 90%/10% Allocation
2027-2029	HCFC Consumption sector with scenarios and resource allocations	427.56	549.44
	HCFC Production sector	23.54	23.54
	TOTAL RANGE	451.10	572.98
2030-2032	HCFC Consumption sector with scenarios and resource allocations	58.96	72.50
	HCFC Production sector	23.54	23.54
	TOTAL RANGE	82.5	96.04

[25] IS and Standard Activities are presented in another chapter and not part of this total.

3. Estimated Funding Requirement for HFC Phasedown

3.1 Background: HFC phase-down

Nearly ten years ago at MOP-28 in KA, parties adopted Decision XXVIII/2 establishing a compliance schedule for the phasedown of HFCs in A5 parties as in Table 3.1. For A5 Group 1 (G1) parties, this represents an 80% reduction from the baseline by January 1, 2045. For A5 Group 2 (G2) parties, this represents an 85% reduction from the baseline by January 1, 2047.

Table 3.1: Baseline and HFC phase-down schedule of A5 and non-A5 parties

	A5 Parties Group 1*		**A5 Parties Group 2****	
Baseline Years	2020, 2021 & 2022		2024, 2025 & 2026	
Baseline calculation	Average production /consumption of **HFCs** in 2020, 2021, and 2022 *plus* **65%** of **HCFC** baseline production/consumption		Average production /consumption of **HFCs** in 2024, 2025, and 2026 *plus* **65%** of **HCFC** baseline production/consumption	
Reduction steps Freeze	**2024**		**2028**	
Step 1	2029	10%	2032	10%
Step 2	2035	30%	2037	20%
Step 3	2040	50%	2042	30%
Step 4	2045	80%	2047	85%

* Group 1: A5 parties not part of Group 2

** Group 2: Bahrain, India, the Islamic Republic of Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia and the United Arab Emirates

Source: UNEP (2016). *Further Amendment of the Montreal Protocol: Submitted by the Contact group on HFCs.* Twenty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, United Nations Environment Programme (UNEP), UNEP/OzL.Pro.28/CRP/10, Kigali, 10–14 October 2016.

HFC baselines are calculated in tonnes CO_2-equivalent (tCO_2-eq) as the average of HFC consumption over 2020- 2022 for group 1 countries and over 2024-2026 for G2 countries, plus 65% of the country's HCFC baseline for both G1 and G2, as shown in Table 3.1.

The compliance targets for A5 parties for the 2027-2029 period and the following two triennia are as follows:

- G1 parties: In the 2027-2029 triennium, a 10% reduction from baseline by 1 January 2029; for the next two triennia 2030-2032 and 2033-2035, a 30% reduction from baseline by 1 January 2035.
- G2 parties: In the 2027-2029 triennium, a freeze of production and consumption by 1 January 2028; for the next two triennia 2030-2032 and 2033-2035, a 10% reduction from baseline by 1 January 2032, and a 20% reduction from baseline by 1 January 2037.

3.1.1 Status of Ratification

The list of A5 parties that have ratified the KA continues to increase rapidly. As of 8 April 2026, 119 A5 parties in G1 and six in G2 had ratified the KA. As of 6 May 2026, 113 eligible A5 parties in G1 had provided HFC baseline data to the OS, while 24 parties had not yet reported sufficient data to enable the calculation of their baseline.

Eleven parties reported some HFC use through the A7 reporting process, but not a complete dataset to establish baselines. 13 parties had not reported HFC data through the A7 portal. Given that baseline years are still ongoing, all G2 baselines were estimated.

In the MLFS document "Country Programme Data and Prospectus for Compliance" [26] prepared for ExCom-97, Annex III presents an analysis of reported 2023 or 2024 HFC consumption data (A7 or CP data) and provides the control measures addressed by approved KIPs. Of the parties that have established HFC baselines or have reported data for the baseline years and have reported 2023 or 2024 A7 or CP data, 14 countries[27] reported consumption levels that are greater than their baseline levels (one country for 2023 and 13 countries for 2024). Eight of these 14 countries have their Stage I of KIPs approved, five countries have KIP preparation projects already approved, and one country has a KIP preparation project included in the BP.

3.1.2 Kigali HFC Implementation Plans (KIPs)

To meet the compliance schedule, the ExCom adopted guidelines to structure the phase-down. At ExCom-87, the ExCom adopted the guidelines for the preparation of KIPs (decision 87/50). The MLFS subsequently prepared the "Guide for the Presentation of Stage I of Kigali HFC Implementation Plans (KIPs)"[28] guidelines set out a staged approach to meet the reduction targets for a country's HFCs within the framework of an overarching strategy. The main objective of Stage I of KIPs is, in line with the overarching strategy, to develop and implement a plan of action to allow A5 countries to meet the freeze in HFC consumption and the 10% reduction from the baseline in accordance with the control schedules established by the parties. The guide was updated in September 2025 following agreement reached by the ExCom on the cost guidelines for the phase-down of HFCs, the template Agreement between the Governments and the ExCom for Stage I of the KIPs, the distribution of funding tranches, and the funding of the phase-out of HFCs contained in imported pre-blended polyols in the PU foam sector.

3.1.3 Cost Guidelines

Decision XXVIII/2, related to the amendment to the MP to phase down HFCs, requested the ExCom to develop, within two years of the adoption of the Amendment, guidelines for financing the phase-down of HFC consumption and production, including CE thresholds, and to present those guidelines to the MOP for the parties' views and inputs before their finalization by the ExCom. ExCom had been discussing cost guidelines since adoption of that decision, and at ExCom-95,[29] in its decision 95/86, the ExCom reached agreement on the cost guidelines for the phase-down of HFCs in A5 countries.

The RTF has taken these agreed cost guidelines into account in developing its estimated funding for the phase-down of HFCs for the 2027-2029 triennium. A review is expected in 2028, and RTF has not considered its potential impact when calculating KIP Stage II funding estimates.

3.1.3 2026 Status overview of the HFC consumption sector

In 2024, the five sectors with the largest consumption of HFCs (measured in tonnes) in decreasing order were refrigeration manufacturing – AC (38.6% of the total), the refrigeration servicing (31.2%), refrigeration manufacturing – refrigeration (17.8%), firefighting (4.3%) and aerosol (3.1%). [30]

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[26] UNEP/OzL.Pro/ExCom/97/8

[27] One of which has not ratified the Kigali Amendment.

[28] https://www.multilateralfund.org/resources/project-guides-tools

[29] UNEP/OzL.Pro/ExCom/95/86 and background document UNEP/OzL.Pro/ExCom/93/97

[30] UNEP/OzL.Pro/ExCom/97/8

In tCO_2eq terms, CP data (converted from reported metric tonnes) indicated that the most consumed HFCs including blends were HFC-134a (31.1% of the total), R-404A (25.2%), R-410A (22.1%), R-507A (9.5%), R-407C (6.1%) and R-407A (1.9%) for LVC countries, and R-410A (29.5% of the total), HFC-134a (23.0%), HFC-32 (12.4%), R-404A (8.9%), HFC-227ea (8.6%), and R-507A (7.3%) for non-LVC countries.[31] [32]

RTF used A7 data for its funding calculations. CP data was used to inform the sector distribution of consumption as there were discrepancies found, such as, consumption allocated in manufacturing sectors for some LVC, and missing consumption in manufacturing sectors for some non-LVCs. RTF used market distribution of chemical consumption applied to A7 consumption data and based on a similar approach used for the 2023 RTF report.

3.2 Overview of HFC funding requirement

The estimate for the HFC phase-down funding requirement for the 2027-2029 triennium and future triennia, 2030-2032 and 2033-2035, is based on A5 parties meeting the relevant G1 and G2 reduction targets.

Estimated funding requirement for the HFC consumption sectors include the following:

- Funding committed for approved Kigali HFC Implementation Plans (KIPs);
- Funding estimated for new KIPs;
- Funding for project preparation costs;
- Funding for KIP verification;
- Funding for EE (ExCom Decision 91/65, 94/60 and 95/87); and
- Funding to support pilot projects to enhance regional atmospheric monitoring (Decision XXXVII/6).

Estimated funding requirement for the HFC production sectors include the following:

- Funding for project preparation;
- Funding for Kigali HFC Production Phase-down Management Plan (KPPMP), if any;
- Funding for HFC-23 mitigation project preparation; and
- Funding for approved HFC-23 mitigation project

3.3 Methodology to Estimate Funding Requirements for the HFC Consumption Sector

As of 8 April 2026, 125 A5 parties, out of 144, had ratified the KA. For the analysis of estimated funding for HFC phase-down, the RTF assumed that the remaining 19 parties would be ratifying by 2029. By the 97th ExCom (December 2025), 83 G1 parties[33] had their KIPs approved and the balance of G1 parties who have ratified the KA could request funding during the 2027-2029 triennium. Some of those parties may also be ready to request funding for Stage II in the 2027-2029 triennium. Some G2 parties, have included project preparation funding requests for KIP Stage I. Some have already

[31] UNEP/OzL.Pro/ExCom/97/8

[32] LVC and non-LVC classification is based on HCFC baseline.

[33] In addition, one country has a first tranche KIP approved without an approved agreement.

been included in the BP, before their baselines are established. Some parties in both Group 1 and Group are still to ratify KA but have requested project preparation funding for KIP.

In order to develop the model, RTF assumed that an average four-year period is realistic for the inclusion of requested HFC phasedown activities in the MLF business plan, project preparation and submission processes, and approval and implementation start of the KIPs.[34] Therefore, the model required looking at the needs of parties in different stages of progress, as well as looking at allocation of funds for activities approved in one triennium but mostly implemented in the following one.

The model accounts for several parties that have already approved KIPs that meet the 10% reduction from the baseline, with some going from 10 to 30% and others even going beyond 30% reduction. For calculating the funding, the latter (beyond the 2035 scheduled target) were excluded from new funding estimates (other than considering committed funding already in their agreements).

Therefore, funding needs were estimated at different stages of the project cycle, that may overlap in different triennia, for different parties, depending on their national circumstances. While the RTF model provides the granularity needed for individual reductions in ExCom agreements for every party, the report itself anonymizes individual party's estimated funding needs and presents results based on clusters of parties.

The RTF calculated funding needs for addressing both 10% reduction from the baseline by 2029 (Stage I KIP) and 30% reduction by 2035 (Stage II KIP) for G1 parties, plus, a freeze by 2028 and a 10% reduction from the baseline by 2032 for G2 parties (Stage I KIP). Stages I and II total funding estimates were then allocated among the three triennia for the period between 2027 and 2035 covering different compliance targets for G1 and G2 parties and addressing the diversity of national circumstances and different control targets.

The RTF compliance model provides a funding range based on **two CE based HFC scenarios 1 and 2.** Then, for each scenario, RTF presents **two resource allocation proposals (A and B)** as discussed below and in Annex 4**.**

The model mirrors to the extent possible, the MLF project cycle to account for different progress by the different parties, as well as reductions that can exceed control targets for some parties. The model takes into consideration each individual country reduction addressed under a KIP.

There are two considerations mentioned under caveats in section 1.6.10 regarding the additional costs of PMUs which was not included in the model, and the 15% foreign ownership deduction for the manufacturing sectors which was included in the model. The combined effect of these two considerations is to increase the budget by around 15%. RTF made these deviations for reasons explained in section 1.6.10 and appreciates the parties' guidance to help RTF reflect these changes in the supplementary report.

3.3.1 HFC scenarios 1 and 2

Given that KIPs are still in the early stages of implementation, the RTF did not find any analysis of CEs in ExCom documentation based on experience in the HFC manufacturing sectors under approved KIPs, and data, when available, did not present a robust case for considering historical values other than approved CE cost guidelines that could be applied for all parties and regions. RTF considered applying the HCFC historical CE values to HFCs; however, since the approved CE guidelines for

[34] Total needed Stage I and II for G1 and Stage I for G2 have been estimated without certainty of the number of G2 submissions prior to 2030.

HFCs were higher than the thresholds for HCFCs, any such application would not have been representative of the funding levels needed for KIPs.

- **HFC Scenario 1** considers the approved **HFC KIP Stage I cost guidelines (CE) thresholds** for all enterprises in the manufacturing sectors. When CE values were not available for specific case-by-case sectors, the RTF used CE estimates based on guidance from TEAP /TOC/RTF sector experts. Funding was also estimated for Stage II KIPs, using Stage I CEs, without considering any potential impact of the guidelines review expected in 2028.

- **HFC Scenario 2** considers the application of the higher CE thresholds approved by Decision 95/86 for SMEs in the different sectors (32% for RAC, and 40% for PU Foam above the CE threshold). RTF did not consider funding at 2.5 times CE thresholds for umbrella projects by micro enterprises as these projects would have to cover all enterprises in the sector with no additional funding in later stages, which is difficult to determine at present. Without implementation experience with HFCs and lack of information that RTF could access in the short timeframe for this report, TOC experts were consulted to estimate the percentage of SMEs' participation in sectors.For both scenarios, a 15% deduction was applied to account for ineligible foreign ownership in the manufacturing sectors, and Stage I cost guidelines CEs were applied to Stage II funding calculations, and no potential impact of the expected guidelines review in 2028. RTF will consider further how this should be applied in the supplementary report with guidance from parties.

The new compliance model was developed to follow the steps of the project cycle of the ExCom, to the extent possible, in order to forecast funding needs, as well as the steps parties are taking according to their pace and readiness in the preparation and processes leading to KIPs approval. The RTF assumed all parties will have ratified the KA by 2029.

RTF did not have information on national priorities by sectors and did not prioritize one market sector over another in the funding estimates. RTF considered the sensitivity of prioritizing certain sectors, i.e., using historic cost-effectiveness values.

3.3.2 Important Considerations

The model relies primarily on two parameters to calculate funds: cost thresholds and consumption (converted into tonnes). Consumption is set by baselines reported to the OS, and cost thresholds are set for available CEs by the ExCom. Total funding is mostly influenced by these two inputs, largely fixed for this replenishment report. Minor modifications to funding (<1.5% of total funding in the 2027-2029 triennium) could be made by changing assumptions in baselines for parties that had not yet reported baselines (by 30%), and cost effectiveness factors could be varied, where parties had not yet determined them by decision, pending a review in 2028.

Without changing cost thresholds and consumption, the development of broad ranging funding scenarios was challenging. Through a sensitivity analysis, it was determined that parameters would have to be significantly different to make broad changes to the compliance model.

RTF based its calculations on available A7 data and KA baseline (with the 65% HCFC component), following decisions of parties and in the KA. Therefore, RTF used reductions from the KA baseline. Since funding for investment projects in the manufacturing sectors is based on actual HFC consumption by the sectors, the 65% HCFC component of the baseline was considered “consumption under the servicing sector”, and funding for that component was calculated following cost guidelines CE thresholds established for the servicing sector.

Funding uncertainties remain where there are ongoing discussions by parties,

- the starting point for aggregate consumption,
- the potential review of cost guidelines in 2028,
- unknown sector prioritization and CEs for sectors still to be addressed (MAC, MDIs)
- correct reporting of sector distribution of remaining consumption.

As these discussions are resolved by the ExCom, the uncertainty in future funding forecasts will be reduced.

RTF offers the parties two alternative scenarios and proposes two resource allocation options and would welcome any further guidance, especially with respect to more sensitive parameters, for the RTF Supplementary Report.

3.4 HFC Phase-down compliance model for the consumption sector

Annex 4 contains further information and details on the RTF estimated funding model for the HFC consumption sector.

3.4.1 Model calculations steps

RTF followed, as close as possible, the ExCom project approval cycle in its HFC estimated funding model for the consumption sector. The steps in the model calculation are as follows:

STEP 1. 83 parties in G1 have approved KIP Stage I for a 10% reduction from the baseline.

Those parties have different agreed percentage reductions from the baseline. Some even higher than 30% reduction required by 2035. The model was designed to consider:

a. The committed funding for all 83 approved Stage I KIPs;
b. New funding for KIP Stage II for 70 parties that have reductions from the baseline below 30%. 13 parties that have reductions from the baseline equal to or above 30% are not considered for new funding.

STEP 2. 42 parties in G1 and G2 without approved KIP Stage I (as of 97th ExCom), and that ratified KA.

a. G1: New Funding for 36 A5 parties to prepare and/or submit KIP-Stage I and Stage II (10% by 2029; 30% by 2035).
b. G2: New funding to six parties (freeze by 2028 and 10% by 2032).

STEP 3. 19 parties that have not ratified the KA yet (RTF forecasted 100% ratification by 2029)

a. G1: New funding for 10% reduction by 2029 and 30% by 2035 (16 parties)
b. G2: New funding for freeze by 2028 and 10% reduction by 2032 (3 parties)

RTF believes that ratification by 2029 by all A5 parties is critical to access technical and financial support in time to meet compliance targets.

3.4.2 Filling data gaps

Annex 3 contains the RTF methodology and calculations to fill data gaps, including baselines.

OS baseline and A7 data by chemical yearly reported, available CP sector distribution, individual reduction schedule agreed in approved KIPs for each party, CE thresholds per sector and others defined by ExCom decisions, form the basis of the model core information data.

For G2 parties, where baseline years extend to 2024–2026, estimates relied more heavily on extrapolation of available data using gross domestic product (GDP) growth rates. RTF filled data gaps as per methodology detailed in Annex 3. In order to reflect uncertainty, a range was developed with a low-end value, using GDP growth rates, and a high-end value, assuming 30% increases in relevant markets. The assumption sensitivity analysis introduces additional uncertainty into the funding estimates, which is reflected in the range presented (1.5% increase in the next triennium and 4.5% over the phase down).

Country clusters were used to facilitate sector distribution assumptions based on market split and were classified according to the following clusters as shown in Table 3.2:

- Highest baseline consumption party
- Next largest Top 10
- G2 parties;
- Other G1 parties; and
- LVCs.

In one sensitivity analysis of the uncertainty of the unreported HFC component of the HFC baselines, RTF increased their estimates by 30% to ensure that a broad range of outcomes had been considered. Group 2, Other and LVC cluster results are shown above in Table 3.2. Overall baselines increased by less than 5%. The impact to the next triennium was smaller at less than 1.5%. Other baselines and the HCFC component of all baselines are now known.

Table 3.2: Sensitivity analysis of estimated and reported HFC baselines (million tCO_2eq)

Groupings	Estimated and Reported HFC Baseline	Higher Estimate of HFC Baseline Component for Parties with no Baseline Combined with Reported HFC Baselines
Largest	907	907
Top 10	374	374
Group 2	254	330
Other	167	171
LVC	32	33
Total	1734	1812

CE thresholds vary by sector. Sector data is not reported through A7 reporting. CP reporting is by sector but data are incomplete, and RTF analysis identified inconsistencies (e.g., chemical consumption in an unexpected sector). RTF used CP sectors by percentage of chemical by cluster to apply to A7 data to estimate manufacturing sectors. This sector data was combined with CE values where available to calculate funding. Table 3.3 below indicates results of analysis made by RTF based on sector distribution of consumption.

Table 3.3 Percentage sector distribution used for the consumption sector

Percentage Sector distribution/ country cluster (%)	Aerosol	Foam	Fire Ext.	Dom. Ref.	Res. AC	Com Ref.	Com AC	Ind. Transport Ref	RAC Manuf. Other	Solvent	Servicing	Other
Highest	**1.1**	**2.8**	**7.5**	**9.7%**	**19.7**	**15.3**	**19.7**	**2.8**	**0.9**	**0.6**	**19.6**	**0.3**
Top 10	**6.2**	**2.6**	**2.3**	**2.4**	**13.4**	**3.8**	**13.4**	**0.7**	**1.3**	**0.3**	**51.2**	**2.4**
Group 2	**6.1**	**7.1**	**1.1**	**2.7**	**22.8**	**4.2**	**22.8**	**0.8**	**0.1**	**0.0**	**28.4**	**4.1**
Other	**1.7**	**0.8**	**0.7**	**0.3**	**2.6**	**0.5**	**2.6**	**0.1**	**1.6**	**0.0**	**87.6**	**1.5**
LVCs	**1.0**	**3.3**	**0.3**	**0.4**	**0.1**	**0.7**	**0.1**	**0.1**	**0.3**	**0.0**	**92.9**	**0.7**

3.4.3 Resource allocation schedules

As mentioned earlier, for this assessment, the RTF calculated total funding required for parties to reach Stage I and Stage II targets for G1, and Stage I, for G2 parties. For each of the "Model" steps, RTF presented funding estimates for two CE-based scenarios, and for each scenario, the total estimated funding for KIP Stages I and II (G1); and Stage I (G2), is then split according to two resource allocation proposals (A and B), such as in Table 3.4, for the different triennia.

That means, the model database was set for each individual party and shows each agreed reduction from the baseline in the previous approved KIP stage. Any additional funding needed to meet a compliance target is then calculated based only on the consumption not yet addressed for that party. RTF assumed that KA ratification for all parties will happen by 2029.

Table 3.4: Resource allocation schedule A and B

Group	KIP Stage	Schedule A (% per triennium)	Schedule B (% per triennium)
G1 parties without KIPs	I	100% - 2027-2029	90% - 2027-2029 10% - 2030-2032
	II	60% - 2030-2032 40% - 2033-2035	60% - 2030-2032 40% - 2033-2035
G1 parties with KIPs	II	60% - 2027-2029 40% - 2030-2032	60% - 2030-2032 40% - 2033-2035
G2 parties without KIPs	I	60% - 2027-2029 40% - 2030-2032	90% - 2030-2032 10% - 2033-2035

The two resource allocation schedules differ in the percentage of the KIP funding to be allocated to each different triennium.

3.4.5 HFC Scenario 1: Applying CE from cost guidelines

The methodology used for new funding calculations, **HFC Scenario 1,** was based on cost guidelines sector CEs applied to sector remaining consumption (converted to metric tonnes), and according to the reduction target for each individual party (bearing in mind the consumption already addressed by approved KIP Stage I). The CE values applied are shown in Table below.

Table 3.5: CE thresholds used for HFC Scenario 1*

Cost effectiveness ($/kg)	Aerosol	Foam	Fire Extinguishing	Domestic Refrigeration	Residential AC	Comm Refrigeration	Comm AC	Industrial Transport Ref	Refrigeration/AC Manufacturing Other	Solvents	Servicing	Other	65% of HCFC baseline component
Highest	5.00	9.00	5.10	13.76	13.60	16.50	15.00	16.50	15.75	10.13	5.10	5.00	5.10
Group 1 non-LVCs	5.00	9.00	5.10	13.76	13.60	16.50	15.00	16.50	15.75	10.13	5.10	5.00	5.10
Group 2	5.00	9.00	5.10	13.76	13.60	16.50	15.00	16.50	15.75	10.13	5.10	5.00	5.10

*Case by case sector CEs: For industrial/transport refrigeration RTF used same CE as for commercial refrigeration (16.50 $/kg); for Solvents used average in Table 12 of document 89/10/Rev1 (10.13 $/kg); for Refr. and Air Conditioning (AC) manufacturing/other, used 15.75, that is the average of 10.50 and 15 (CEs for Com Refr. and Com. AC). Other case by case sectors, RTF suggested CEs (Aerosol, Fire Extinguishing. and Other). Same CEs for all countries/groups. RTF included mobile air conditioning (MAC) in Refrigeration AC Manufacturing/ Other.

The total funding estimates for three triennia (9 years) to reach Stage I (10% reduction by 2029), and Stage II (30% reduction by 2035), for CE Scenario I, are presented in Table 3.6, totaling **US$ 2,190.44 million** (rounded).

As in the case of HCFC, RTF did not add the cost of PMUs for non-LVC parties as explained in the caveats under section 1.6.10

Please note that the column named "Output" refers to the Annex 4 HFC methodology indicating the flow-chart sequence of the analysis and outputs.

Table 3.6: Funding Estimates for HFC Scenario 1 considering Stage I and II Targets (US$ million)

Total: 144 A5 parties	Reduction targets: 10% for Stage I and 30% for Stage II		Output	Funding for Stage I (US$ million)	Funding for Stage II (US$ million)
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 48.77	$ -
		50 LVCs parties (G1)			
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 30% and over were excluded	29 non-LVCs parties (G1)	2	$ -	$ 184.74
		41 LVCs parties (G1)	3	$ -	$ 16.55
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	**Group1:** Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 93.43	$ 186.85
		1 non-LVC party -Highest consumption (G1)		$ 492.81	$ 985.61
		24 L VCs parties (G1)	5	$ 4.96	$ 9.92
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties **(G2)**	6	$ 130.56	$ -
3. 19 countries assumed will ratify Kigali by 2029	**Group 1**: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.60	$ 11.20
		9 LVCs countries (G1)	8	$ 1.73	$ 3.45
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries **(G2)**	9	$ 14.25	$ -
			Total	$ 792.11	$ 1,398.33
			Stage I plus Stage II		$ 2,190.44

The funding per triennium for the HFC Scenario 1, applying resource allocation schedule A is in Table 3.7 below.

Table 3.7: Resource Allocation A proposed by RTF for HFC Scenario 1 (US$ million)

Total: 144 A5 parties	Reduction targets: 10% for Stage I and 30% for Stage II		Output	2027-2029	2030-2032	2033-2035
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 46.83	$ 1.94	$ -
		50 LVCs parties (G1)				
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 30% and over were excluded	29 non-LVCs parties (G1)	2	$ 110.84	$ 73.90	$ -
		41 LVCs parties (G1)	3	$ 9.93	$ 6.62	$ -
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	Group1: Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 93.43	$ 112.11	$ 74.74
		1 non-LVC party -Highest consumption (G1)		$ 492.81	$ 591.37	$ 394.25
		24 L VCs parties (G1)	5	$ 4.96	$ 5.95	$ 3.97
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties (G2)	6	$ 78.34	$ 52.22	$ -
3. 19 countries assumed will ratify Kigali by 2029	Group 1: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.60	$ 6.72	$ 4.48
		9 LVCs countries (G1)	8	$ 1.73	$ 2.07	$ 1.38
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries (G2)	9	$ 8.55	$ 5.70	$ -
			Total	$ 853.01	$ 858.61	$ 478.82
			Stage I plus Stage II		$ 2,190.44	

Applying **resource allocation schedule A**, the new funding estimates for each triennium for HFC Scenario 1 are:

- **2027-2029: US$ 853.01 million**
- **2030-2032: US$ 858.61 million**
- **2033-2035: US$ 478.82 million**

As per resource allocation schedule A, for Stage I G1 parties without approved KIPs, the allocation is set at 100% for the period 2027–2029. This reflects the need to provide full support during the initial implementation phase for parties that have not yet developed or approved their implementation plans to achieve the 10% reduction target by 2029.

For Stage II G1 parties without approved KIPs as of 97th ExCom, the allocation is divided into two phases: 60% upfront during 2030–2032 and the remaining 40% during 2033–2035. This phased distribution is intended to ensure continuity of support while aligning with the longer-term implementation schedule, in accordance with ExCom Decision 94/59, which states that "Article 5 countries could submit the final funding tranche for Stage I of KIPs, at the earliest, two years prior to the last year of the plan for which a consumption target had been established, on the understanding that the first tranche of Stage I of their KIP should be at a funding level not higher than 60 per cent of the total funding for the plan."

For Stage II G1 parties with approved KIPs as of 97th ExCom, the allocation is brought forward to an earlier implementation period, with 60% allocated during 2027–2029 and 40% during 2030–2032, also in line with ExCom Decision 94/59. This approach recognizes that parties with approved KIPs are better positioned to initiate implementation activities earlier.

For Stage I G2 parties, the allocation follows a similar phased approach, with 60% allocated during 2027–2029 and 40% during 2030–2032. This structure supports an orderly transition and implementation process following the freeze target in 2028.

Overall, the allocation framework is designed to balance readiness, implementation capacity, and the timing of approved plans, while ensuring a gradual, predictable, and equitable distribution of resources.

The funding per triennium, for HFC Scenario 1, applying resource allocation schedule B is presented in Table 3.8 below.

Table 3.8: Resource Allocation B proposed by RTF for HFC Scenario 1 (US$ million)

Total: 144 A5 parties	Reduction targets: 10% for Stage I and 30% for Stage II		Output	2027-2029	2030-2032	2033-2035
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 46.83	$ 1.94	$ -
		50 LVCs parties (G1)				
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 20% and over were excluded	29 non-LVCs parties (G1)	2	$ -	$ 110.84	$ 73.90
		41 LVCs parties (G1)	3	$ -	$ 9.93	$ 6.62
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	**Group1:** Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 84.08	$ 121.45	$ 74.74
		1 non-LVC party -Highest consumption (G1)		$ 443.53	$ 640.65	$ 394.25
		24 L VCs parties (G1)	5	$ 4.46	$ 6.45	$ 3.97
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties **(G2)**	6	$ -	$ 117.51	$ 13.06
3. 19 countries assumed will ratify Kigali by 2029	**Group 1**: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.04	$ 7.28	$ 4.48
		9 LVCs countries (G1)	8	$ 1.55	$ 2.25	$ 1.38
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries **(G2)**	9	$ -	$ 12.83	$ 1.43
			Total	$ 585.50	$ 1,031.12	$ 573.81
			Stage I plus Stage II			$ 2,190.44

Applying **resource allocation schedule B**, the new funding estimates for the HFC Scenario 1 are:

- **2027-2029: US$ 585.50 million**
- **2030-2032: US$ 1,031.12 million**
- **2033-2035: US$ 573.81 million**

As per resource allocation schedule B, for Stage I G1 parties without approved KIPs, the allocation is distributed with 90% during 2027–2029 and the remaining 10% during 2030–2032. This allocation approach reflects the need to provide the majority of support during the initial implementation phase while maintaining a smaller portion of funding for follow-up activities and completion of implementation targets.

For Stage II G1 parties without approved KIPs, the allocation is divided into two phases: 60% during 2030–2032 and 40% during 2033–2035. This phased distribution is intended to ensure continuity of support while aligning with the longer-term implementation schedule, in accordance with ExCom Decision 94/59 regarding the submission and funding structure of KIPs.

For Stage II G1 parties with approved KIPs, the allocation also follows a phased structure, with 60% allocated during 2030–2032 and the remaining 40% during 2033–2035. This approach recognizes that parties with approved KIPs are positioned to proceed with implementation activities according to the established Stage II schedule.

For Stage I G2 parties without KIPs, the allocation provides 90% during 2030–2032 and the remaining 10% during 2033–2035. This structure may bring delays in support for implementation activities that will assist the freeze and 10% reduction by 2032.

For Stage I G1 parties, that have not ratified, RTF assumed they "will-ratify by 2029" and the allocation for Stage I follows the same approach as "Stage I G1 parties without approved KIPs", with 90% allocated during 2027–2029 and 10% during 2030–2032. This allocation assumes that these parties will complete ratification and begin implementation activities during the initial funding period.

For Stage II G1 parties, RTF assumed they "will-ratify by 2029" and the allocation for Stage II is structured with 60% during 2030–2032 and 40% during 2033–2035, consistent with the phased implementation approach applied to Stage II activities.

For Stage I, G2 parties that have not ratified, RTF assumed they "will-ratify by 2029", and the allocation follows a similar pattern to Stage I G2 parties, without a KIP, with 90% allocated during 2030–2032 and the remaining 10% during 2033–2035.

Overall, **Resource Allocation Schedule B** is designed to provide implementation support while maintaining sufficient funding. The framework also reflects potential implementation lag, KIP approval status, and expected ratification timelines but may bring delay for some G2 parties that have ratified and are ready to start KIP Stage I implementation in the next triennium.

3.4.6 HFC Scenario 2: Applying CEs for SMEs' participation

Decision 95/87 defines "SMEs in the commercial RAC manufacturing sector as enterprises with HFC consumption of 15 metric tonnes or less, and 20 metric tonnes for polyurethane foam" with certain considerations and limitations. The decision accorded SMEs "32 per cent above the CE threshold" for RAC enterprises with HFC consumption of 15 metric tonnes or less, and 40 per cent for polyurethane foam enterprises with 20 metric tonnes or less."

RTF reviewed documents UNEP/OzL.Pro/ExCom/93/96, UNEP/OzL.Pro/ExCom/92/45, and UNEP/OzL.Pro/ExCom/92/46 for information on the number and percentage participation of SMEs in the different sectors but did not find such information which can feed a scenario on the impact of SME funding. RTF made its own estimation of the percentage participation of SMEs in some sectors based on TEAP/TOC and RTF sector experts. Table 3.9 shows the commercial refrigeration sector having the highest percentage at 55 per cent with other sectors in RAC, and foam polyurethane with up to 15 per cent participation of SMEs in the sector. RTF did not consider micro enterprises benefitting up to 2.5 times through umbrella projects as mentioned in sub-paragraph e) of decision 95/86.

Table 3.9: RTF Assumptions for SMEs' Participation in some sectors and CE Thresholds Applied*

Cost Effectiveness ($/kg) LOW END	Aerosol	PU Foam	Fire Suppression	Domestic Refrigeration	Residential AC	Comm Refrigeration	Comm AC	Industrial Transport Ref	Refrigeration/AC Manufacturing Other	Solvents	Servicing	Other	65% of HCFC baseline component
Group 1 ex LVC	5.00	9.00	5.10	13.76	13.60	16.50	15.00	16.50	15.75	10.13	5.10	5.00	5.10
Group 2	5.00	9.00	5.10	13.76	13.60	16.50	15.00	16.50	15.75	10.13	5.10	5.00	5.10
SME percentage		15%		0%	10%	55%	2%	15%	25%				
SME CE ($/kg)		12.60			17.95	21.78	19.80	20.08	18.88				

* Not considering installation and assembly

Based on the above considerations, a **HFC Scenario 2** was developed to estimate funding for both Stages I and II, considering higher CEs applied for the assigned percentage participation of SMEs in specific manufacturing sectors. Tables 3.10, 3.11, and 3.12 show the total estimated funding for Stage I and Stage II and application of two resource allocation schedules A and B.

Table 3.10: Funding Estimates for the HFC Scenario 2 considering Stage I and II Targets (in US$ million)

Total: 144 A5 parties	Reduction targets: 10% for Stage I and 30% for Stage II		Output	Funding for Stage I (US$ million)	Funding for Stage II (US$ million)
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 48.77	$ -
		50 LVCs parties (G1)			
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 30% and over were excluded	29 non-LVCs parties (G1)	2	$ -	$ 187.72
		41 LVCs parties (G1)	3	$ -	$ 16.55
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	Group1: Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 94.84	$ 189.68
		1 non-LVC party -Highest consumption (G1)		$ 511.13	$ 1,022.25
		24 L VCs parties (G1)	5	$ 4.96	$ 9.92
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties (G2)	6	$ 133.30	$ -
3. 19 countries assumed will ratify Kigali by 2029	Group 1: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.62	$ 11.24
		9 LVCs countries (G1)	8	$ 1.73	$ 3.45
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries (G2)	9	$ 14.54	$ -
			Total	$ 814.88	$ 1,440.83
			Stage I plus Stage II		$ 2,255.71

Table 3.11 HFC Scenario 2, using Resource Allocation A considerations proposed by RTF (US$ million)

Total: 144 A5 parties	eduction targets: 10% for Stage I and 30% for Stage		Output	2027-2029	2030-2032	2033-2035
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 46.83	$ 1.94	$ -
		50 LVCs parties (G1)				
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 30% and over were excluded	29 non-LVCs parties (G1)	2	$ 112.63	$ 75.09	$ -
		41 LVCs parties (G1)	3	$ 9.93	$ 6.62	$ -
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	Group1: Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 94.84	$ 113.81	$ 75.87
		1 non-LVC party -Highest consumption (G1)		$ 511.13	$ 613.35	$ 408.90
		24 L VCs parties (G1)	5	$ 4.96	$ 5.95	$ 3.97
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties (G2)	6	$ 79.98	$ 53.32	$ -
3. 19 countries assumed will ratify Kigali by 2029	Group 1: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.62	$ 6.75	$ 4.50
		9 LVCs countries (G1)	8	$ 1.73	$ 2.07	$ 1.38
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries (G2)	9	$ 8.72	$ 5.81	$ -
			Total	$ 876.37	$ 884.72	$ 494.62
			Stage I plus Stage II		$ 2,255.71	

Applying **resource allocation schedule A**, the new funding estimates for each triennium for HFC Scenario 2 are:

- **2027-2029: US$ 876.37 million**
- **2030-2032: US$ 884.72 million**
- **2033-2035: US$ 494.62 million**

Table 3.12: HFC Scenario 2, using Resource Allocation B considerations proposed by RTF (US$ million)

Total: 144 A5 parties	eduction targets: 10% for Stage I and 30% for Stage		Output	2027-2029	2030-2032	2033-2035
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	1	$ 46.83	$ 1.94	$ -
		50 LVCs parties (G1)				
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP Stage I with reductions	29 non-LVCs parties (G1)	2	$ -	$ 112.63	$ 75.09
		41 LVCs parties (G1)	3	$ -	$ 9.93	$ 6.62
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	Group1: Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	4	$ 85.36	$ 123.29	$ 75.87
		1 non-LVC party -Highest consumption (G1)		$ 460.01	$ 664.46	$ 408.90
		24 L VCs parties (G1)	5	$ 4.46	$ 6.45	$ 3.97
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties (G2)	6	$ -	$ 119.97	$ 13.33
3. 19 countries assumed will ratify Kigali by 2029	Group 1: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	7	$ 5.06	$ 7.31	$ 4.50
		9 LVCs countries (G1)	8	$ 1.55	$ 2.25	$ 1.38
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries (G2)	9	$ -	$ 13.08	$ 1.45
			Total	$ 603.28	$ 1,061.32	$ 591.11
			Stage I plus Stage II			$ 2,255.71

Applying **resource allocation schedule B**, the new funding estimates for each triennium for HFC Scenario 2 are:

- **2027-2029: US$ 603.28 million**
- **2030-2032: US$ 1,061.32 million**
- **2033-2035: US$ 591.11 million**

3.5 Verification: consumption sector

Funding for KIP verification is normally requested to accompany submissions for stages or tranches, but can also be requested to be submitted yearly for certain parties according to the need. For instance, for HCFCs, verification for 18 LVCs is done every year, according to RTF's understanding of MLF information available.

If it is considered that all 144 parties will have KIPs Stage I and II in the next 3 triennia, tranche verification costs will have to be thought accordingly. RTF considered for each triennium three tranches per party, and two tranche verification requests per triennium each, that is, six tranche verifications for the three triennia, for each of the 144 A5 parties. With this in mind, RTF estimated for three triennia (2027 to 2035 period), **around US$ 26 million in verification costs** (at US$ 30,000 each, used for LVCs). RTF will have to deduct approvals in 2026.

Without more information, including approvals at the upcoming ExCom-98, RTF is unable to provide a robust cost figure, nor ascertain at this time the number of parties that will request verification funding. RTF will have to come back with a more detailed analysis for the supplementary report, if instructed by parties.

3.6 Project preparation: consumption sector

For the forecast of PRP needs for the consumption sector in 2027-2029, RTF considered that for every new KIP to be submitted, the country can request project preparation. Several parties already received PRP as of the 97th ExCom, according to the MLF Secretariat information provided.

The list of remaining parties eligible for Stage I KIP PRP contains 29 parties without PRP request, and 19 of them have included PRP requests in the BP.

The total for 28 countries, not including China which is case-by-case, new requests is **US $ 5,074,480** including 9.6% support costs if all is requested for the 2027-2029 triennium. If all the 29 parties request PRP in 2026, then no PRP for KIP Stage I would be needed and RTF would have to update that figure for Supplementary Report, after 98th ExCom in June 2026.

Annex 9 shows the details for the 29 countries for which PRP funding for KIP Stage I is needed.

For KIP Stage II, RTF considered that all countries with approved project preparation funding for Stage I would be eligible for project preparation funding for KIP Stage II since they would have progressed in their implementation of Stage I and would be ready to submit requests for Stage II, except for those countries that exceeded 30% reduction from their baseline or went beyond 2030 for Stage I.

- RTF considered those countries with approved project preparation funding for Stage I eligible even if they have not submitted their KIP Stage I yet, i.e., those with blank spaces in the control measure column in the Table A9.2. The justification is that KIPs are normally submitted within one year maximum from approval of funding and hence their submission will fall either in 2026 or within the 2027-2029 triennium;
- RTF considered that all countries who were included in the Table A9.1 for KIP Stage I, "not eligible" for project preparation funding for Stage II, including all G2 countries and those who have not ratified the KA;
- RTF used a similar costing schedule as for the consumption levels of KIP Stage I harmonising the values for the different groups.

Table A9.2 shows a list of countries for which project preparation funding was calculated for KIP Stage II in the 2027-2029 triennium. The total project preparation cost for KIP Stage II is US$ 15,660,000, and cost including agency support cost is **US$ 17,163,360**.

Table 3.13 provides a summary of the estimated funding requirement for PRP for KIP Stages I and II in the 2027-2029 triennium.

Table 3.13: Estimated funding for PRP for KIP Stages 1 and II for 2027-2029 (US$)

KIP Stage	Total project preparation cost (US$)	Total including Agency Support Cost @ 9.6% (US$)
I	4,630,000	5,074,480
II	15,660,000	17,163,360
Total for Stages I & II	**20,290,000**	**22,237,840**

3.7 Energy efficiency

Chapter 7 of this Report discusses the relevant decisions related to funding for EE in this triennium, and those related to HFC phase-down estimated funding requirements are discussed in this section. It also provides examples of approaches in support of EE that could be useful to inform consideration of the possibility of augmenting the funding window in the future and in ongoing discussions on HFC guidelines.

Decision 91/65 [35] has 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 energy efficiency in the context of HFC phase-down as specified in decision XXVIII/2, following the criteria identified in subparagraph(b)." The BP estimates a total of US $15.83 million is included in the business plan under the funding window for pilot projects for EE for 2026–2027 for 17 countries and two regions (Africa and the Pacific Island countries). In addition, a total of US $187,400 is included in the BP for project preparation for two countries and one region (Africa) for 2026. The RTF estimated funding for EE pilot projects for 2027-2029 in the amount of **US$ 3.4 million**.

Decision 94/60[36] has established a "a funding window of US$ 100 million for projects developed and implemented under the framework, subject to further augmentation by the Executive Committee." These projects focus on enhancing EE when phasing down HFCs in the manufacturing of domestic refrigerators, commercial refrigeration display cabinets, commercial refrigeration chest freezers, residential air conditioners and commercial air conditioners. These activities were later extended to include compressors, heat exchangers, and heat pumps according to Decision 95/87[37] paragraphs (b) and (c). The current funding window suggests that a total of US$ 77,966,2000 is still available. Assuming two preparatory and two investment projects are approved in 2026 at the average cost of projects approved to date, an additional US$ 8,772,554 of the remaining funding window would be used this triennium, leaving a remaining approximately US$ 70,000,000 available in the window for the next triennium. However, it is not clear what would be the countries' submission in the next triennium. Below are 2 scenarios based on available trends.

- Scenario 1: Assume the same level of funding over the next three years; total needed funding = **US$ 66,101,400**.
- Scenario 2: countries ramp up their EE activities and deplete the funding window over the next triennium; total needed funding = **US$ 77,966,200** (assumes no additional activities approved in 2026)

Decision 95/87[38] established a "funding window of US$ 40 million for two energy-efficiency end-user projects using a revolving fund mechanism developed and supported by IAs, over a duration of eight years, after which funds would be returned to the Multilateral Fund, on the understanding that it would not be operationalized until the ExCom had agreed on the modalities for operationalizing the revolving fund;" and in paragraph g agreed to "provide funding, for the preparation of no more than five projects, of no more than US$ 100,000 per project, on the understanding that those proposals would be submitted to the 96th meeting and that only up to two projects would be selected for the funding window referred to in subparagraph (f) above." Pending decisions at ExCom-98 and -99, the RTF currently assumes the full funding window amount of **US$ 42,800,000** including support costs will be needed for the next triennium.

3.8 Total Estimated Funding Requirement for the HFC Consumption Sector

The summary of estimated funding requirements to address Stage I and Stage II for the HFC phasedown in the consumption sector based on HFC Scenarios 1 and 2 and the resource allocation schedules A and B is presented in Tables 3.14 and 3.15.

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

[36] UNEP/OzL.Pro/ExCom/94/67

[37] UNEP/OzL.Pro/ExCom/95/94

[38] UNEP/OzL.Pro/ExCom/95/94

Table 3.14: Total funding estimate for HFC consumption sector for HFC Scenario 1 to address Stage I and II targets (US$ million)

HFC CONSUMPTION SECTOR	Total for 3 Triennia (2027 to 2035 period)	Resource Allocation A			Resource Allocation B		
HFC Scenario 1 (CE in cost gudelines)	**Funding for Stage I and II**	**2027-2029**	**2030-2032**	**2033-2035**	**2027-2029**	**2030-2032**	**2033-2035**
Funding **Committed *** for Approved KIPs	48.77	46.83	1.94	0.00	46.83	1.94	0.00
Estimated New Funding to Address Stage II for parties with KIPs Stage I approved	201.29	120.77	80.52	0.00	0.00	120.77	80.52
Estimated New Funding to Address Stages I and II for parties without approved KIPs	1,904.14	669.53	761.66	472.96	532.07	886.06	486.01
Estimated New Funding to Address KIPS Stages I and II for countries pending ratification / RTF assumed all will ratify by 2029	36.23	15.88	14.49	5.86	6.59	22.35	7.29
Sub-Total 1	**2,190**	**853.01**	**858.61**	**478.82**	**585.50**	**1,031.12**	**573.81**
		2,190			2,190		
Funding for Project Preparation (PRP)	22.24	22.24	0.00	0.00	22.24	0.00	0.00
Funding for KIP Verification	26	8.70	8.70	8.70	8.70	8.70	8.70
Energy Efficiency (low-end option)	73.26	73.26	0.00	0.00	73.26	0.00	0.00
Pilot Projects for Regional Atmospheric Monitoring	9.72	0.85	8.87	0.00	0.85	8.87	0.00
Sub-Total 2	**131**	**104.56**	**17.57**	**8.70**	**104.56**	**17.57**	**8.70**
Total for HFC Consumption Sector	**2,321**	**958.06**	**876.18**	**487.52**	**690.55**	**1048.69**	**582.51**

Table 3.15: Total funding estimate for HFC consumption sector for the HFC Scenario 2 to address Stage I and II targets (US$ million)

HFC CONSUMPTION SECTOR	Total for 3 Triennia (2027 to 2035 period)	Resource Allocation A			Resource Allocation B		
HFC Scenario 2 (CEs for SMEs)	**Funding for Stages I and II**	**2027-2029**	**2030-2032**	**2033-2035**	**2027-2029**	**2030-2032**	**2033-2035**
Funding **Committed *** for Approved KIPs	48.77	46.83	1.94	0.00	46.83	1.94	0.00
Estimated New Funding to Address Stage II for parties with KIPs Stage I approved	204.27	122.56	81.71	0.00	0.00	122.56	81.71
Estimated New Funding to Address Stages I and II for parties without approved KIPs	1,966.08	690.91	786.43	488.74	549.83	914.18	502.07
Estimated New Funding to Address KIPS Stages I and II for countries pending ratification / RTF assumed all will ratify by 2029	36.58	16.07	14.63	5.88	6.61	22.64	7.33
Sub-Total 1	**2,256**	**876.37**	**884.72**	**494.62**	**603.28**	**1,061.32**	**591.11**
		2,256			2,256		
Funding for Project Preparation (PRP)	22.24	22.24	0.00	0.00	22.24	0.00	0.00
Funding for KIP Verification	26	8.70	8.70	8.70	8.70	8.70	8.70
Energy Efficiency (high-end option)	133.48	133.48	0.00	0.00	133.48	0.00	0.00
Pilot Projects for Regional Atmospheric Monitoring	14.59	0.85	13.73	0.00	0.85	13.73	0.00
Sub-Total 2	**196**	**165.37**	**22.43**	**8.70**	**165.37**	**22.43**	**8.70**
Total for HFC Consumption Sector	**2,452**	**1041.64**	**907.15**	**503.32**	**768.56**	**1083.75**	**599.81**

Table 3-16 below summarises the total estimated funding requirement for the HFC consumption sector for the 2027-2029 and future triennia and presents a range per triennium.

Table 3.16

Triennium	HFC CONSUMPTION SECTOR ESTIMATED FUNDING RANGE (US$ million)	
	Resource Allocation A	Resource Allocation B
2027–2029	958 – 1,042	690 – 769
2030–2032	876 – 907	1,049 – 1,084
2033–2035	488 – 503	583 – 600

4 HFC Production Sector and HFC-23 By-Product Emission Mitigation

4.1 Introduction

Paragraph 6 of Article 2J of the KA states that "Each Party manufacturing Annex C, Group I, or Annex F substances shall ensure that for the twelve-month period commencing on 1 January 2020, and in each twelve-month period thereafter, its emissions of Annex F, Group II, substances generated in each production facility that manufactures Annex C, Group I, or Annex F substances are destroyed to the extent practicable using technology approved by the Parties in the same twelve-month period." HFC-23 is listed as a controlled (HFC) substance in Annex F, Group II.

HFC-23 is produced as a by-product of HCFC-22 production (for both emissive uses and for feedstock production). HCFC-22 production facilities with Clean Development Mechanism (CDM)[39] projects installed destruction technologies; however, not all facilities were eligible for CDM projects; a number of facilities may not have installed emission abatement technology. Various emissions mitigation options are available, including closure of HCFC-22 production, on-site incineration of HFC-23, and off-site destruction of HFC-23. Destruction technologies for HFC-23 have been evaluated by TEAP[40] and approved by parties. [41] [42] [43] [44] [45] [46] [47] [48]

ExCom 89, part II, June 2022, decided to confirm: [49]

- That HFC-23 by-product was destroyed to the extent practicable in the context of Multilateral Fund-supported projects when up to a maximum of 0.1 kg of HFC-23 by-product was emitted per 100 kg of the relevant Annex C, Group I or Annex F substance produced.
- That HFC-23 by-product controls would be eligible independent of whether the relevant production that generated the HFC-23 was for controlled or for feedstock uses.
- That the term "production" in the context of HFC-23 by-product emission control projects supported by the Multilateral Fund meant the total amount of relevant Annex C, Group I or Annex F substance produced for all uses, including controlled and feedstock uses, irrespective of any subsequent destruction, recycling, and reuse.

[39] https://cdm.unfccc.int/

[40] 2018 TEAP Report, Supplement to the April 2018 Decision XXIX/4 TEAP Task Force Report on Destruction Technologies for Controlled Substances.

[41] 2018 TEAP Report, Supplement to the April 2018 Decision XXIX/4 TEAP Task Force Report on Destruction Technologies for Controlled Substances.

[42] The themes on "Key aspects related to HFC-23 by-product control technologies" (Decision 82/69; 83/44; 84/70; 85/63; 86/94; 87/52).

[43] UNEP May 2020 TEAP Progress Report. Medical and Chemicals Technical Options Committee Progress Report

[44] 2018 TEAP Report, Supplement to the April 2018 Decision XXIX/4 TEAP Task Force Report on Destruction Technologies for Controlled Substances.

[45] TEAP September 2024: Response to decision XXXV/7: Emissions of HFC-23 (volume 5)

[46] TEAP September 2025: Response to decision XXXVI/3: Emissions of HFC-23 (volume 2)

[47] UNEP 2024, September 2024 Report of the Science Assessment Panel, Response to Decision XXXV/7: Emissions of HFC 23.

[48] UNEP 2023, September 2023 TEAP Report, Volume 6: Response to Decision XXXIV/7: Strengthening Institutional Processes with Respect to Information on HFC-23 By-Product Emissions.

[49] UNEP/OzL.Pro/ExCom/89/16

4.2 Overview of HFC production sector and HFC-23 by-product emission mitigation

4.2.1 HFC production

Five A5 parties (Argentina, China, India, the DPRK, and Mexico) have an obligation to report 2021 data on HFC production and HFC-23 by-product generation under the KA. Currently, three parties report their HFC production according to CP and A7 data. As of 9 October 2025, A7 data on HFC production was available for the three HFC producing countries, as shown in Table 4.1 and Table 4.2. In 2024, China (Group 1) produced 719,399 tonnes, India (Group 2) produced 46,500 tonnes in 2024, and the DPRK produced 372 tonnes in 2022.[50] The DPRK is currently ineligible for funding

Table 4.1: HFC production by chemicals (tonnes)

Country	HFCs	2021	2022	2023	2024
China	HFC-32, HFC-41, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, HFC-236ea, HFC-236fa, HFC-245fa	739,579.44	815,768.44	791,937.61	719,399.76
DPRK	HFC-134a	357.00	372.00	-	-
India	HFC-32, HFC-125, HFC-134a	26,172.87	33,072.77	35,217.33	46,500.08

Table 4.2: Production of HFCs (A7, CO_2-equivalent (CO_2-eq) tonnes)[51]

Country	2019	2020	2021	2022	2023	2024	Baseline
China		1,212,188,514	1,427,291,523	1,581,392,661	1,471,784,754	1,529,647,937	1,852,528,591
DPRK	430,430	496,210	510,510	531,960	593,450	656,370	1,102,320
India			40,516,755	58,175,796	62,993,108	68,449,052	100,000,000*

* Baseline data from OS websites and with estimates for Group 2

4.2.2: HFC-23 by-product emission mitigation

Five parties (Argentina, China, India, the DPRK, and Mexico) have an obligation to report data on HFC-23 production and by-product generation under the KA.

[50] Cited from ExCom documents "Country Programme Data and Prospects for Compliance." (UNEP/OzL.Pro/ExCom/91/8), UNEP/OzL.Pro/ExCom/93/8), UNEP/Ozl.Pro/ExCom/95/8, UNEP/OzL.Pro/ExCom/97/8), and Article 7: Reporting of data

[51] China has also set the 2025 HFC production quota at 1.853 billion tCO2 equivalent, and the production quota of 11 types of HFCs is 792,000 tons (equivalent to 1.464 billion tCO2 equivalent). The quota management system controls the total production capacity and indirectly affects the production cost of HFC enterprises. https://www.mee.gov.cn/ywdt/zbft/202411/t20241113_1095266.shtml

The amounts of HFC-23 emissions in 2024, as reported by those countries, are: Argentina (0 tonnes), China (937.75 tonnes), India (0 tonnes), the DPRK (7.312 tonnes) and Mexico (0.00038 tonnes), as shown in Table 4.3.[52] [53] [54]

Table 4.3: Reported HFC-23 emissions by countries (tonnes)[55] [56] [57]

Country	2021	2022	2023	2024
Argentina	33.31	17.31	0	0
China	1089.95	637.39	901.72	937.75
India	0	0	0	0
DPRK	8.40	8.38	8.37	7.312
Mexico	128.52	31.89	0.0047	0.00038

The parties to the MP had determined that production (and consumption) of controlled substances for feedstock uses should be excluded from control measures, based on the understanding that the controlled substance would be transformed during the manufacture of other chemicals and, therefore, would result in insignificant emissions into the atmosphere.[58]

ExCom Decision 89/7 confirmed "that the term 'production' in the context of HFC-23 by-product emission control projects supported by the [MLF] meant the total amount of relevant Annex C, Group I or Annex F substance produced for all uses, including controlled and feedstock uses, irrespective of any subsequent destruction, recycling, and reuse; and when approving projects to control HFC-23 by-product emissions from production lines that would continue to produce the relevant Annex C, Group I or Annex F substance after the completion of the project, to invite the relevant A5 country to consider requesting additional funding for independent verification of the HFC-23 by-product generated, destroyed, sold, stored and emitted, under the subsequent stage of its HCFC phase-out management plan, until approval of its Kigali HFC implementation plan, at which time verification would continue under that plan."[59]

4.3 Estimating funding requirements for HFC production sector

There are three HFC producers — China, India (Group 2), and the DPRK. The RTF estimated funding requirements for HFC production sector phase-down for the 2027-2029 triennium covers only China and India.

[52] The data for Argentina, China, India, the DPRK and Mexico are cited from the ExCom documents "Country Programme Data and Prospects for Compliance." (UNEP/OzL.Pro/ExCom/91/8), UNEP/OzL.Pro/ExCom/93/8), UNEP/Ozl.Pro/ExCom/95/8)

[53] TEAP September 2025: Response to decision XXXVI/3: Emissions of HFC-23 (volume 2)

[54] https://ozone.unep.org/hfc-23-emissions

[55] TEAP September 2025: Response to decision XXXVI/3: Emissions of HFC-23 (volume 2)

[56] UNEP/OzL.Pro/ExCom/97/91

[57] https://ozone.unep.org/hfc-23-emissions

[58] UNEP/OzL.Pro/ExCom/89/13

[59] UNEP/OzL.Pro/ExCom/89/16

4.3.1 Eligible costs and CE values for the production sector

ExCom-95 includes decisions for HFC production sector,[60] which indicate that the Sub-group on the Production Sector would consider compensation for compliance-related control obligations for the production sector on a case-by-case basis once official reporting of HFC production had been submitted by A5 countries, specifically:

1. To make the following categories of costs eligible for funding and to include them in the cost calculation associated with the phase-down of HFCs in the production sector:
2. Lost profit due to the shutdown/closure of production facilities and to production reduction;
3. Compensation for displaced workers;
4. Dismantling of production facilities;
5. Technical assistance activities;
6. Research and development related to the production of low-GWP or zero-GWP alternatives to HFCs with a view to lowering the costs of alternatives;
7. Costs of patents and designs or incremental costs of royalties;
8. Costs of converting facilities to produce low-GWP or zero-GWP alternatives to HFCs when technically feasible and cost-effective;
9. Costs of reducing emissions of HFC-23, a by-product of the production process of HCFC-22, by reducing the HFC-23 emission rate in the process, destroying it from the off-gas, or by collecting and converting it to other environmentally safe chemicals–such costs should be funded by the Multilateral Fund to meet the obligations of A5 parties specified under the KA.

Although the Decision 95/96 provide the categories of costs eligible for funding and to include them in the cost calculation associated with the phase-down of HFCs in the production sector, because there is very limited information available for assessing the CE of the HFC production phase-down, RTF draws on the experience from the HCFC production sector phase-out and the HPPMP, and CE values for estimating funding requirements of the HFC production sector.

In its 2023 September report, RTF noted 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 the DPRK and India, and 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$eq tonnes of HFC production, the RTF derived a CE for China of approximately US$ 0.15/CO_2eq tonnes, and US$ 0.78/CO_2eq tonnes for the DPRK and India.

4.3.2 Estimated funding for the production sector

The 2024 production of HFC in China is 70% of the baseline, which is much lower than the 10% reduction target by 2029 for G1 parties. India is 78% of the baseline, which is much lower than the freeze in 2028 and 10% reduction target by 2032 for G2 parties. This implies that on a strictly compliance basis, only project preparation cost may be needed (RTF assumes that US$ 2,000,000 for HFC production sector plans preparation for the two parties), and no investment funding would be needed for the 2027-2029 triennium.

[60] UNEP/OzL.Pro/ExCom/95/94

4.3.3 Total Funding Requirement for the HFC Production Sector (2027-2029)

Table 4.4 provides the estimated funding requirement for the HFC production sector for the 2027-2029 triennium which is **US$ 2 million.**

Table 4.4: Estimated Funding for the HFC Production Sector for 2027-2029 (US$)

	Estimated funding 2027-2029 (US$)
HFC Production Sector Prep	2,000,000
HFC Production Sector KPPMP	0
Subtotal – HFC Production Sector	**2,000,000**

4.4 Estimated funding requirement for HFC-23 by-product emission mitigation

ExCom Decision 95/94 states, "costs of reducing emissions of HFC-23, a by-product of the production process of HCFC-22, by reducing the HFC-23 emission rate in the process, destroying it from the off-gas, or by collecting and converting it to other environmentally safe chemicals–such costs should be funded by the Multilateral Fund to meet the obligations of A5 Parties specified under the Kigali Amendment."

Five parties (Argentina, China, India, the Democratic People's Republic of Korea and Mexico) produce and report HFC-23 by-production and generation. The HFC-23 phase-out plans of Argentina and Mexico had been approved and implemented. The DPRK currently is not considered for funding. China and India need to consider project preparation and project implementation during 2027-2029 triennium.

4.4.1 CE for HFC-23 emission mitigation

At ExCom-82, [61] in response to Decision 81/68(e), parties discussed the CE values for controlling HFC-23 by-product emissions. By estimating the overall CE of closure of CFC production projects and HPPMPs, MLFS assessed that the CE (including the additional funding provided for the accelerated phase-out for some of the plans) ranged 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 is the CE for stage II of the HPPMP in China.[62] 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)."

RTF reviewed the ExCom discussion on CE for controlling HFC-23 for Argentina and Mexico, and the HFC-23 funding approved as in Table 4.5 below.

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

[62] UNEP/OzL.Pro/ExCom/87/58. Report of Eighty-seventh Meeting of the Executive Committee.

Table 4.5: HFC-23 approved projects 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

Table 4.5 summaries the analysis for HFC-23 projects approved for Argentina and Mexico.

- The overall CE of approved projects is US$ 6.28/kg and US$ 4.19/kg for Argentina and Mexico, respectively;
- 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 relevant parties 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;
- The IOCs in each annual tranche is calculated by multiplying the number of kgs of HFC-23 destroyed by US$ 1.4/kg and US$ 3.28/kg for Argentina and Mexico, respectively;
- Agency support cost is 7% of the total funding approved.

4.4.2 Project preparation costs

China reported its HFC-23 emissions of 937.75 tonnes in 2024. At ExCom-95, the Sub-group on the Production Sector considered matters related to HFC-23 under the HPPMP for China. The report submitted by the WB provided an update on the development of technical guidelines for reporting on HFC-23 generation and emissions, the most recent information on HFC-23 generation, destruction and emissions, and regulatory and implementation updates, as well as an analysis of the discrepancy between HFC-23 emissions reported under A7 and those in the verification reports. As members felt there was insufficient time to consider the matter fully, the recommendation to the ExCom was to defer further discussion on the matter to its following meeting. At ExCom-96 in May 2025, ExCom in its Decision 96/58[63] agreed:

> *To invite the Government of China, in collaboration with the World Bank, to implement a technical assistance project to study the economics and broader application of the HFC-23 transformation process to convert HFC-23 to HCFC-22 and HCFC-21, as described in document UNEP/OzL.Pro/ExCom/96/SGP/2, and to provide a report on the outcome of that study to the 99th meeting.*

Therefore, RTF estimate US$ 150,000 for project preparation of HFC-23 emissions mitigation for China during 2027-2029.

4.4.3 HFC-23 mitigation projects already approved and agreed: Argentina and Mexico

Argentina

- On behalf of Argentina, UNIDO has submitted project proposal options to control and phase-out HFC-23 emissions at Frio Industrias Argentinas (FIASA). The Agreement between

[63] UNEP/OzL.Pro/ExCom/96/58

Argentina and the ExCom was submitted to ExCom-88. At ExCom-87, the ExCom inter alia approved in principle, US$ 2,262,630, plus agency support costs of US$ 158,384 for UNIDO, to enable Argentina to comply with the HFC-23 by-product emission control obligations under the KA.

- In ExCom-91, the ExCom agreed to consider the draft of agreement on ExCom Decision 88/79 regarding "the blanket approval" with a total funding of individually the project in Argentina on the control of emissions of HFC-23 generated in the production of HCFC-22, with a total agreed funding of US$ 2,421,014 , while US$ 217,966 was listed for 2026 and 2027 in the BP and Adjusted BP for 2026-2028.

- RTF uses the cost agreed by Argentina and the ExCom Decision 88/77, to estimate the funding requirements for HFC-23 mitigation.

Mexico

- On behalf of Mexico, UNIDO has submitted project proposal options to control and phase-out HFC-23 emissions at Quimobasicos.[64]

- The 86th ExCom approved, in principle, US$ 3,833,384, plus agency support costs of US$ 268,337 for UNIDO, to enable the Mexico to comply with the HFC-23 by-product emission control obligations under the KA.[65] The Agreement between Mexico and the ExCom of the MLF for the destruction of emission of HFC-23 generated in the production of HCFC-22 in Quimobasicos approved at ExCom-87, a maximum amount of US$ 2,995,047, out of the total funding specified in Appendix 1A, was associated with IOCs and would be divided into annual tranches to be provided to the country upon verification of the quantity of HFC-23 by-product destroyed. US$ 906,838 was listed for 2026 and 2027 in the "Consolidated Business Plan of the Multilateral Fund for 2026-2028."

- RTF uses the cost agreed by Mexico and the ExCom (87/IAP/3) [66] to estimate the funding requirements.

Table 4.6 provides the total funding requirement for HFC-23 mitigation projects agreed in principle for Argentina and Mexico, estimated to be US$ 6,522,735, has a combined investment and operating cost of US$ 6,096,014 plus agency support cost of US$ 426,721 from 2021 to January 2031. The approved tranches differed based on the quantity of HCFC-22 produced, the by-product generation rate, and the quantity of HFC-23 destroyed and emitted.

The RTF estimated funding requirement for approved HFC-23 mitigation projects for Argentina and Mexico for the 2027-2029 triennium is US$ 1,614,312.

[64] UNEP/OzL.Pro/ExCom/84/72

[65] UNEP/OzL.Pro/ExCom/86/100

[66] UNEP/OzL.Pro/ExCom/87/IAP/3

Table 4.6: HFC-23 By-Product Mitigation Costs Estimated for Argentina and Mexico 2021-2030 (US$)

	Cost item	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
By Country												
Mexico	Total agreed investment+ operating costs	483,058	-	492,160	374,381	473,131	433,131	414,381	374,381	414,381	374,380	3,833,384
	Total agency support costs	33,814	-	34,451	26,207	33,119	30,319	29,007	26,207	29,007	26,206	268,337
	Total agreed costs for Mexico	**516,872**	**-**	**526,611**	**400,588**	**506,250**	**463,450**	**443,388**	**400,588**	**443,388**	**400,586**	**4,101,721**
Argentina	Total approved investment + operating	1,527,851	-	-	112,757	112,757	101,853	101,853	101,853	101,853	101,853	2,262,630
	Total agency support costs	106,950	-	-	7,893	7,893	7,130	7,130	7,130	7,129	7,129	158,384
	Total approved costs for Argentina	**1,634,801**	**-**	**-**	**120,650**	**120,650**	**108,983**	**108,983**	**108,983**	**108,982**	**108,982**	**2,421,014**
Total HFC-23 Mitigation Costs Estimated for Argentina and Mexico 2021-2030												
Total funding requirement	Total investment + operating for Mexico and Argentina	2,010,909		492,160	487,138	585,888	534,984	516,234	476,234	516,234	476,233	6,096,014
	Total agency support costs	140,764		34,451	34,100	41,012	37,449	36,137	33,337	36,136	33,335	426,721
	TOTAL	**2,151,673**		**526,611**	**521,238**	**626,900**	**572,433**	**552,371**	**509,571**	**552,370**	**509,568**	**6,522,735**

4.4.4 Investment project cost: India

US$ 8,000,000 for HFC-23 mitigation investment project for control and phase out HFC-23 by-product emissions in India is included in the BP (for year 2027). RTF estimated this is the investment project funding for HFC-23 mitigation for the 2027-2029 triennium.

4.5 Total estimated funding requirement for HFC production sector phase-down and HFC-23 mitigation for the period 2027-2029

Table 4.7 shows the total estimated funding requirement for the 2027-2029 triennium for the HFC production sector and HFC-23 mitigation is **US$ 11.76 million**.

Table 4.7: HFC production sector phase-down and HFC-23 mitigation estimated funding requirements for the triennium 2027-2029 (US$)

HFC Production Sector	2027-2029 Estimated funding requirement (US$)
HFC Production Sector Project Prep (China and India)	2,000,000
HFC Production Sector KPPMP (China and India)	0
HFC-23 Mitigation Project Prep (China)	150,000
HFC-23 Mitigation Project Approved (Argentina and Mexico)	1,614,312
HFC-23 Investment Project Estimated (India)	8,000,000
Subtotal – HFC Production and HFC-23 Sector	**11,764,312**

4.6 Indicative funding for HFC production sector phase-down and HFC-23 mitigation for future triennia 2030-2032 and 2033-2035

The estimation for future triennium does not include possible funding requirements for HFC production in China, the DPRK and India due to limited information, audits in process and pending issues.

RTF estimates the funding requirements for future triennium for Argentina and Mexico only (Table 4.8). The HFC-23 mitigation funding requirements are only for the 2030-2032 triennium for **US$ 509,568**.

Table 12.2: HFC-23 mitigation funding requirements for future triennia (US$)

	2030-2032	2033-2035
HFC-23 Mitigation Approved (Argentina and Mexico)	**509,568**	0
Subtotal – HFC Production and HFC-23 Sector	**509,568**	**0**

5 Funding Requirements for Institutional Strengthening and Standard Activities for the 2027-2029 Triennium

5.1 Introduction

This chapter presents the funding requirements for IS and SA for the 2027-2029 triennium. The main sources of information used in this section are informed by the relevant ExCom decisions, the BP, reports of the meetings of the ExCom and relevant meeting documents prepared by the MLFS at the request of the ExCom. Consultations with secretariat staff have been very valuable and their inputs and insights are well appreciated.

IS and SA are the core components of the operation of the MLF and constitute key elements of the overall governance of the MP. Decision XIX/6 by MOP-19 accelerated the phase out of HCFCs to protect the ozone layer and climate, and Decision XXVIII/1 by MOP-28 adopted the KA to control and phase down HFCs because of their high global warming potential (GWP). These groundbreaking decisions have unveiled the policy, technical and administrative complexities in the overall implementation of the MP and further highlights the strategic value of IS and SA.

IS funding is directly linked to the implementation of the obligations of parties operating under paragraph 1 of A5 and it plays a major role in establishing, supporting and accompanying the operation of the National Ozone Units (NOUs). The four IAs, UNEP, UNDP, UNIDO and the WB, manage the IS projects and work with the NOUs to maintaining, building and developing the institutional capacity necessary to comply with obligations of A5 parties.

SA cover all activities related to the operation of the MLF, the operation of the ExCom, the MLFS, its monitoring and evaluation functions, and its Treasury functions, the Core Unit funding of the IAs UNDP, UNIDO and the WB, and UNEP's CAP.

5.2 Estimated funding requirements for institutional strengthening

IS is the core capacity-building programme of the MP; this programme supports A5 parties in their national efforts to comply with obligations under the MP and its amendments. IS has been instrumental for the phase out of ODS and HFCs; the NOUs established in A5 parties under this programme have ensured continuity, enhanced institutional capacity, and policy leadership in the implementation of the MP. Perhaps more importantly, it has cemented a unique compliance-driven implementation of the MP. As of today, a total amount of approximately US$ 210 million has been approved by the ExCom for IS, which represents about 5% of total funds approved under the MLF, which benefits about 146 parties (including Croatia and Romania which no longer received funding from the MLF).

IS projects were approved for the first time at ExCom-7 (June1992) where the initial rules for this programme were established. In consideration of the importance of IS, its funding levels and criteria have been reviewed over the years. An overview of relevant decisions taken by the ExCom are in Annex 7.

IS estimates are based on historical levels and considering all relevant decisions approved by the ExCom. In particular, for this replenishment study, the last decision on IS agreed by ExCom-91, Decision 91/63, extend the duration of IS renewal implementation phases from two years to three years for IS renewal proposals submitted from ExCom-92 onwards. That same decision also increased the funding level of IS projects by 38% with respect to what was agreed at ExCom-74, with minimum funding level of US$ 60,000 per year.

Accordingly, funding estimates for 2027 and 2028 are respectively, US$ 19,545,691 and US$ 5,717,815. For 2029, the RTF, in accordance with the practice by the ExCom to replicate the funding

of the previous year of the current triennium, has used US$ 19,593,580 as per the revised budget adopted by the ExCom for 2026. Consequently, the total estimated funding for the triennium 2027-2029 is thus **US$ 44.9 million** as shown in Table 5.1. All IS project costs include agency support costs, apart from IS projects that fall under UNEP.

Table 5.1: Estimated funding requirement for institutional strengthening for 2027-2029 (US$)

	2027	2028	2029	TOTAL
Institutional Strengthening	19,545,691	5,717,815	19,593,580	**44,857,086**

5.3 Estimated funding for standard activities

5.3.1 UNEP Compliance Assistance Programme

The CAP is implemented by UNEP's OzoneAction in its role as an Implementing Agency. UNEP's OzonAction was established in 1991 and was relaunched through a substantive transformation as the CAP in early 2000, when the programme was restructured from a centralized to a regionalized operation located in UNEP's five regional offices. The CAP provides support and assistance to A5 parties through a dedicated team in each region. The CAP is a natural complement to the IS projects of each A5 party individually and provides a permanent forum of communication.

The CAP has been instrumental in building and maintaining the Regional Networks of Ozone Officers, where the officers periodically exchange views, experiences, information and knowledge. Over the years, this mechanism has proven to be very cost-effective; originally designed as a coordination and information-sharing mechanism, it has become a more comprehensive and focused compliance mechanism, dealing with higher levels of complexity as the parties agree new decisions strengthening the Protocol, e.g. the HCFCs accelerated phase-out, the KA, aligning EE with the HFC phase-down, LRM, complex technologies transitions, etc.

At an operative level, the Regional Network Meetings facilitate the sharing of relevant decisions of the MOPs and the ExCom, the consideration of different technical reports of the assessment panels, the development of training initiatives and the exchange of policy, technical and administrative initiatives as well as sharing implementation experiences within a solid institutional structure. Such networking has fostered much needed dialogues serving as catalysers for the implementation of control measures agreed under the MP. Regional networks have become a unique and effective two-way platform not only for National Ozone Officers (NOOs) but also for other bodies such as IAs, bilateral agencies, the OS, the MLFS and the assessment panels to exchange latest developments and gather updated information from NOOs.

Almost 10 years after the KA was adopted parties at MOP-28, implementation of HFC phase-down obligations involves a variety of policy, regulatory and technical issues requiring assertive actions through open communication and engagement at the national levels. In response to these requirements, Regional Network Meetings have been exchanging information and knowledge in new and complex technical issues related to safety standards, flammable refrigerants, EE, feedstocks, illegal trade, dumping, LRM, and other issues of interest to the parties.

Annex 7 includes information on the most relevant decisions taken by the ExCom on this important programme; they show the evolution and signals the approach followed by the ExCom to continuously strengthen the CAP.

The RTF used the level of funding of the revised budget for 2026, approved at ExCom-97, and applied a 3% increase per year for the triennia 2027-2029. These figures also include 8% for

programme support costs. Consequently, as shown in Table 5.4, the estimated total funding requirement for CAP during the period 2027-2029 is **US$ 39.4 million**.

Table 5.2: Estimated funding requirement for CAP for 2027-2029 (US$)

	2027	2028	2029	TOTAL
CAP Funding Requirements per year and total for triennium	12,748,967	13,131,436	13,525,3793	**39,405,782**

5.3.2 Core Unit Funding for UNDP, UNIDO and the World Bank

The current administrative cost regime provides for the staffing levels of UNDP, UNIDO and the WB to be maintained by the core unit funding, which is additional to the agency fees (support costs) applied to projects. For UNDP, UNIDO and the WB, agency support costs vary from 6.5 to 9%, depending on the type and cost of the project.[67]

The core unit budgets for UNDP, UNIDO and the WB were first approved at ExCom-38, while agency support costs associated with project proposals were adjusted. Main duties for both core unit and administrative and technical project staff include financial reporting to MLFS on expenditures and interest accrued on funding balance with the agency; reviewing project applications and preparing project proposals; coordinating with representatives from the Governments, establishing legal agreements and terms of reference for subcontracts; submission of project reports, business plans, project proposals on behalf of A5 parties, reports on specific on-going projects, project completion reports for consideration by the ExCom, addressing all issues raised by the Secretariat; mobilizing additional resources for implementation of approved projects when required, processing contractual and accounting project documents, and undertaking bidding process, following up on implementation status, including country visits if there is evidence of undue delays or difficulties; and participating in meetings of the ExCom, and the MLFS.[68] In addition, IAs also participate in regional CAP meetings at their own cost.

The RTF used the level of funding approved by the ExCom in 2025 for 2026, and applied a 0.7% increase per year, according to the current administrative cost regime for UNDP, UNIDO, and the WB; these figures do not include programme support costs. The total funding is estimated at **US$ 18,432,779**, as shown in Table 5.5.

Table 5.3: 2027-2029 Core Unit Funding requirements of UNDP, UNIDO and the World Bank (US$)

Years	2027	2028	2029	TOTAL
0.7% annual increase applied to Core Unit Funding	6,101,450	6,144,160	6,187,169	**18,432,779**

[67] For Bilateral Agencies and UNEP, agency support costs vary from 11 to 13% depending on the cost of the project.

[68] UNEP/OzL.Pro/ExCom/84/65 para 54

5.3.3 Operating Costs of the MLFS, the ExCom, and Treasury Functions

Funding required for ExCom operating costs including the MLFS and monitoring and evaluation (M&E) costs was determined through consultations with the MLF Secretariat, ExCom members and considering the relevant decisions and documents. In particular, in ExCom-97, the ExCom adopted Decision 97/5[69], where an adjusted budget for 2026 was approved reflecting retroactive salary increases for the 2024 and 2025 as well as an increase for 2026 in the scale of salaries of the general staff, to account for the revised salary scale for general staff as informed by the Lead United Nations Headquarters Agency in Montreal , ICAO. The RTF used the figures approved by the ExCom in 2025 for 2026, and budgets projected for 2027 and 2028, and applied an average annual increase for staff costs of 3% for 2029 following the scale established by the UN General Assembly on the recommendation of the International Civil Service Commission (ICSC).

These figures aim to cover operation of the ExCom and the MLFS and do not consider the provision of additional services related to any support needed in relation to the continued implementation of HCFC phase out projects or the increasing number of KIPs to phase down HFCs.

As in the previous triennium, costs for the Treasurer are budgeted at US$ 0.5 million per year for a total funding requirement of US$ 1.5 million for the 2027-2029 triennium (as per ExCom 59/51(b).

The estimated total funding requirement for the MLFS, the cost of M&E and the ExCom is presented in Table 5.4 for the 2027-2029 triennium at **US$ 26.4 million**.

Table 5.4: 2027-2029 funding requirements for the operating costs of the ExCom, MFLS, including monitoring and evaluation, and Treasurer (US$)

	2027	2028	2029	TOTAL
ExCom, MLFS* and Monitoring & Evaluation	8,192,234	8,280,544	8,462,073	**24,934,851**
Treasurer	500,000	500,000	500,000	**1,500,000**
Subtotal	8,692,234	8,780,544	8,962,073	**26,434,851**

* RTF used the figures approved by the ExCom in 2025 for 2026. For 2027 and 2028, RTF projected the budgets, and applied an increase for staff costs of 3% for 2029.

5.4 Summary of funding requirements for IS and SA for 2027-2029

The estimated total funding requirement for the 2027-2029 triennium for IS and SA is **US$ 129.1 million**, as shown in Table 5.5.

[69] UNEP/OzL.Pro/ExCom/97/91 Decision 97/5

Table 5.5: 2027-2029 funding requirements for the operating costs of the ExCom, MFLS, including monitoring and evaluation, and Treasurer (US$)

2027-2029 Triennium	Estimated Funding (US$)
Institutional Strengthening	44,857,086
UNEP Compliance Assistance Programme	39,405,782
UNDP, UNIDO, World Bank Core Unit	18,432,779
ExCom, MLFS, M&E	24,934,851
Treasurer functions	1,500,000
SUBTOTAL - IS & Standard Activities	**129,130,498**

5.5 Indicative funding for future triennia, 2030-2032 and 2033-2035

The IS funding requirements recognise that a revision is expected, and revised funding levels will be introduced with effect from 2029 (Decision 91/63).

RTF assumed that the UNEP CAP would increase by 3% per year in both triennia, to reflect increasing staff costs. RTF also assumed that the budget for UNDP, UNIDO, and WB as well as the MLFS would rise by 3% per year in both triennia to reflect increasing staff costs.

The estimated total funding requirement for the 2030-2032 and 2033-2035 triennia for IS and SA is estimated to be **US$ 137 million and US$ 145 million,** respectively, as shown in Table 5.6.

Table 5.6: Funding requirement for IS and SA in Future Triennia (US$)

	2030-2032	2033-2035
Institutional Strengthening	44,857,086	44,857,086
UNEP Compliance Assistance Programme	43,069,762	47,052,564
UNDP, UNIDO, World Bank Core Unit	20,141,995	22,009,702
ExCom, MLFS, M&E	27,246,985	29,773,516
Treasurer functions	1,500,000	1,500,000
SUBTOTAL - IS & Standard Activities	**136,805,828**	**145,192,869**

6 Special Needs of LVC and VLVC Countries

Paragraph 2 (b) of Decision XXXI/1 directs the RTF to "consider the special needs of low volume- and very-low-volume-consuming countries" and emphasizes these special needs in Paragraph 2 (f). RTF has in the past two reports included sections on LVCs and VLVCs addressing their challenges and making recommendations on better addressing their needs. While not adopting RTF recommendations fully, the ExCom did consider providing funding for KIP Stage I at higher relative cost effectiveness factors than what used for the HPMPs; noting that in both cases LVCs and VLVCs are funded as a lumpsum and not based on CE factors.

6.1 Background and summary from 2020 and 2023 RTF reports

This section provides a synopsis of the challenges and recommendations for VLVCs and LVCs articulated in the 2020 and 2023 RTF reports.

6.1.1 RTF 2020 Report

The 2020 RTF report highlighted some key challenges for V/LVCs. These challenges include: 1) the implementation of the HPMPs; 2) the uptake of new technologies, which possess safety issues and the high emissions of GHGs, 2) policy issues, including end-user incentives to increase the use of new technologies; 4) paradigm shift required to improve and upgrade training to include EE, CO2 emissions and equipment design, and 5) disposal and destruction of refrigerants.

The RTF further considered the potential to integrate HPMPs and KIPs for servicing sector activities in LVC countries to maintain the momentum of activities under the HPMP, while building on those under KIPs. In this regard, the concept of 'maintain and build' was proposed, which was to "maintain the programs that were developed for the HPMPs, and build additional programs under the KIPs." Moreover, the "... approach described the activities needed to build on the declining funds available from the HPMPs which would allow for the maintenance of a sustainable funding infrastructure for LVCs and VLVCs to respond to the dual challenges of the phaseout out ODS and phasing down HFCs." And calculated a cost that was fixed across the different categories of LVC funding.

Additionally, the RTF report focused on the need for updated and upgraded training for technicians in alternative technologies, including those with safety (flammability) issues. Regional and national Centres of Excellence were suggested for the training of technicians and engineers and the demonstration of the applications of low-GWP refrigerants in refrigeration and air-conditioning systems. It was also noted that funding for training was low and that, to have been effective and efficient training, some LVC and VLVCs expended much of their funding on training leaving scarce funds for other programmes and activities.

6.1.2 RTF 2023 Report

The RTF report 2023 noted the overarching challenge that "... the proposed funding limits within LVCs to implement activities in the first tranche of the KIP Stage 1 are close in value to the budgets received for the preparation of the KIP project document."

Other challenges discussed in the 2023 report included the lack of direct policy options that can transform the market. It was noted that the policies were geared mainly to the supply side of the market, using quotas to restrict the consumption of controlled substances. It was recommended that demand side management is employed to deal with the challenge. This would include activities to increase the demand for alternatives to reduce the natural transition to high-GWP refrigerants and raise consumers' and technicians' awareness of these technologies. However, it was also noted that there is difficulty in implementing demand side policies, such a ban on equipment, which can lead to market reduction in future consumption. These policies can also result in unintended market confusion around equipment shortages and illegal importation of equipment. The RTF 2023 Report noted that a "rough

estimate for the cost of demand side management is around US$ 100,000 which is close to the total proposed KIP budget for KIP Stage I for VLVCs."

Limited success to early equipment replacement/end user programmes was identified as a critical challenge citing low implementation mainly due to some projects being redirected by Decisions 72/17, 72/40, and 73/34 as mentioned in Document UNEP/OzL.Pro/ExCom/84/63. It was suggested that LVCs can benefit from the application of lessons learned from the earlier experience to make these programmes work.

Low private sector interest in domestic market pull is a problem. LVC markets are generally small, with a limited number of importers who are generally not interested or motivated to create technology pull. Moreover, as technology takers highly dependent on what is available on the international market, these LVCs are influenced by global market trends, which may not be in sync with the local market.

As the markets in LVCs slowly transition to alternative technologies, consumer concerns are raised. These relate to issues of safety (flammability) and toxicity of new refrigerants, concerns with the initial costs to obtain lower GWP, energy efficient equipment employing inverter technology, the expertise of technicians to install, service, and operate these new technologies, and the availability of parts and refrigerant replacements.

Outside of the *ad hoc* training sessions that may be offered by manufacturers, training of technicians is mainly offered with funding from the MLF, which leaves gaps in accessibility to continuous and timely training. New technologies are sometimes introduced into the market without properly training technicians to install or maintain these technologies.

LVCs parties experience difficulty in enforcing labelling and other standards since markets are fragmented with diversified products from different regions of the world. Additionally, the specifications of the imported equipment might not fit well local climate conditions and the status of power supply, such as frequency and current stability. Dumping of obsolete technologies is also a challenge.

6.2 Approach to understanding LVC and VLVC challenges

In order to provide a more detailed analysis, RTF worked on a sample case based on one LVC party to assess the needs for implementing KIP Stage II. The assessment sought to determine which current activities need to be enhanced and what additional activities would be needed for Stage II. The survey identified 11 activities prioritised in the following order: 1) demonstration projects for lower GWP technologies; 2) strengthening of the RAC servicing sector, 3) the establishment of regional service centers, 4) the establishment of EOL/LRM facilities, 5) strengthening policy and regulatory frameworks, 6) strengthening customs and enforcement mechanisms, 7) conducting feasibility studies, 8) development of the cold chain, 9) data monitoring and market intelligence, 10) regional cooperation, and 11) gender youth and workforce development.

The RTF adopted a two-pronged approach to understanding the challenges facing LVCs and VLVCs in designing and implementing plans to phase-down HFCs in the context of the KA. Based on the needs assessment mentioned above and through deliberations, RTF determined that there are two issues related to the funding of LVC and VLVC plans that impact their ability to transition out HFCs into low-GWP alternatives and energy efficient systems.

The first issue is related to activities that countries incur system-building at fixed costs irrespective of their level of consumption and consequently the funding bracket into which they fall.

The second issue is related to the cost and accessibility to technician training to enable a safe and efficient transition to lower GWP refrigerants with flammable or toxic properties and its share of the total funding provided under KIP Stage I, as well as strengthening the RAC servicing sector.

As a reminder, LVCs & VLVCs parties are funded in bracket depending on the average consumption in the servicing sector in the baseline years as per Table 6.1 below.

Table 6.1: LVC and VLVC brackets

Bracket	Average consumption in baseline years in the servicing sector (metric tonnes)
1	> 0 < 15
2	15 < 40
3	40 < 80
4	80 < 120
5	120 < 160
6	160 < 200
7	200 < 300
8	300 < 360

6.2.1 Cost of fixed-cost activities across all brackets

This section provides an in-depth analysis of the first issue mentioned related to system-building activities that are fixed cost across all brackets. The objective is to find whether these costs are sufficiently compensated across the brackets by the total funding available for KIP Stage I.

6.2.1.1 Concept

A review of the eight representative countries indicates a consistent structural feature across all funding brackets. A significant proportion of Stage I resources is allocated to the establishment of the minimum enabling systems required to operationalize HFC phasedown. These activities include, among others, the preparation and enforcement of regulatory measures and bans, refinement of quota and licensing systems, development of customs and enforcement procedures, standards-related work, revision of training curricula, establishment of reporting and monitoring arrangements, and overall programme coordination. These costs are largely fixed or quasi-fixed in nature, as they are incurred irrespective of the relative size of the national servicing sector.

Technician training, provision of equipment, demonstration projects, broad awareness campaigns, and gender outreach are scale-sensitive deployment activities reflecting the size of the servicing sector. Other costs such as management and monitoring were apportioned between the two.

6.2.1.2 Methodology and result

RTF analysed one country per bracket to calculate the fixed costs mentioned above. Only countries with 10% reduction from baseline were selected for comparison and analysis. Analysing one country per bracket gives only indicative results, but it can reveal trends that are inducive to conclusions. Table 6.2 below shows those costs and the corresponding percentage of the total available KIP Stage I funding for LVCs in brackets 2 to 8.

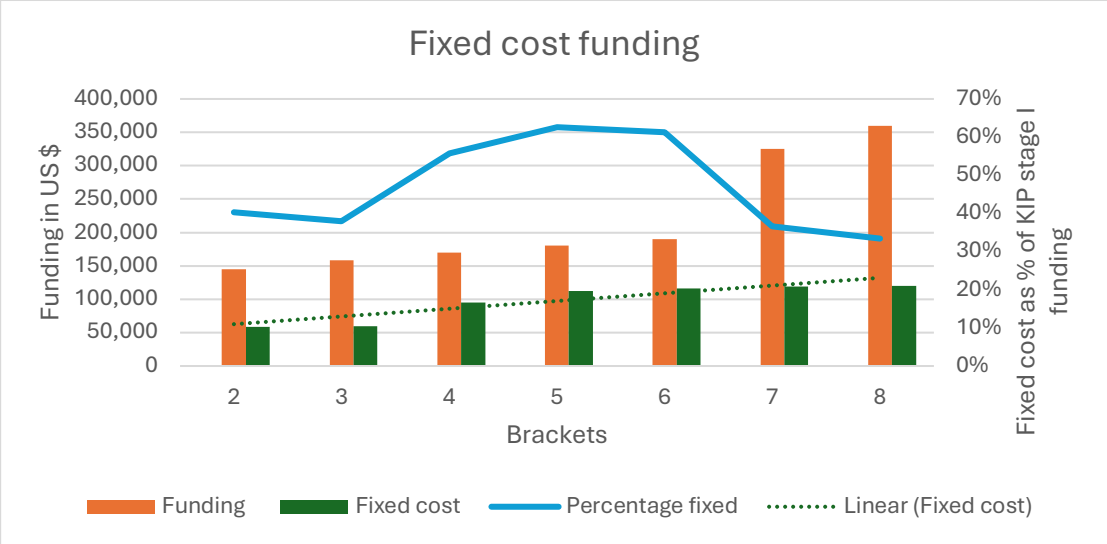
Table 6.2: Fixed cost activities and their percentage of KIP Stage I funding for LVCs

Bracket	Stage I KIP total (US$)	Estimated fixed cost amount (US$)	Estimated fixed cost share %	Main fixed-cost drivers identified from line items
2	145,000	58,500	**40.3**	Policy/licensing update; certification scheme; customs/curriculum revision
3	158,000	60,000	**38.0**	Guidelines and bans/incentives; curricula update; leakage/energy study; project support
4	170,000	94,935	**55.8**	Licensing/data system review; bans and supply-chain study; standards/curriculum integration
5	180,000	112,700	**62.6**	Quota/bans/building-code package; curriculum and centre-of-excellence set-up; coordination
6	190,000	116,400	**61.3**	New legislation; customs-broker guidelines; trainer development; coordination
7	325,000	118,800	**36.6**	Customs market-monitoring and illegal-trade system; revised regulations; standards/labelling; coordination
8	360,000	120,100	**33.4**	Database and reporting architecture; licensing/quota completion and bans; standards/codes; coordination

6.2.1.3 Analysis

Figure 6.1 below shows a chart of the funding for the fixed costs in absolute terms and as a percentage of the total funding available for KIP Stage I.

Figure 6.1 Fixed costs as a percentage of total costs for KIP Stage I



The system-building fixed costs vary between US$ 60,000 and US$ 120,000 with a proportional trendline across the brackets; however, their percentage of the total available funding varies and the

curve indicates a bell-jar behaviour with lowest two brackets 2 and 3, and the highest two brackets 7 and 8 having almost similar percentages at around 30%+, while for brackets 4, 5, and 6 those costs account for almost double the percentage at around 60%.

In the lowest two brackets, the total funding amount does not allow adequate funding for either the system-building fixed costs activities nor the deployment activities which include provision of equipment, technician training, and demonstration projects. For the middle three brackets, the higher percentage for the fixed costs indicates that the deployment costs are underfunded to maintain adequate systems.

An example from Mongolia, the only VLVC other than PICs with an approved KIP, shows that the country plans to spend 35.2% of its funding on the fixed cost activities as shown in Table 6.3 below, with the balance on training trainers and technicians.

Table 6.3: Fixed cost activities and their percentage of KIP Stage I funding for VLVCs

Bracket	KIP Stage I total (US$)	Estimated fixed cost amount (US$)	Estimated fixed cost share %	Main fixed-cost drivers identified from line items
1	135,000	47,500	35.2	Policy feasibility/regulatory package; SOPs and standards; monitoring/reporting.

RTF concluded that in the higher brackets, countries with larger overall allocations, the additional funding mainly provides scope for broader deployment activities, including larger equipment packages, expanded technician training, and demonstration or market-support measures. This indicates that the principal difference between lower and higher funding brackets is extent to which countries are able to fund activities beyond the basic system-building activities.

Accordingly, consideration may be given to whether funding approaches for subsequent stages could more explicitly account for: (a) the minimum system-building activities required in all countries, irrespective of size; and (b) the need to sustain, deepen and operationalize the deployment activities under Stage I while also supporting broader implementation. Absent such recognition, lower funding brackets may face a greater risk that essential system-building expenditures crowd out deployment activities, resulting in programmes that are compliant in design but constrained in implementation depth.

In this regard, the distinction between system-building fixed costs and scalable deployment costs may be relevant to future discussions on bracket design and stage funding levels.

6.2.2 Technician training – an analysis of approved KIPs until the 97th ExCom

Regarding the second issue on the adequacy of technician training and to further understand the needs and challenges of the LVC and VLVCs, the RTF analysed the KIPs submitted and approved up to the 97th ExCom. This analysis allows the determination of how the available funds were used and if there were any trends that might present some commonalities among the different categories. There were 40 KIPs submitted, with one KIP covering all 12 Pacific Island Countries which are all VLVCs as shown in Figure 6.2 below.

Table 6.4: LVC categories and KIPs submitted and approved until the 97th ExCom

Bracket	Average HFC consumption (metric tonnes)	Number of KIPs approved up to 97th ExCom	Number of KIPs with reduction above 10%
1	> 0 < 15	2 (for 13 countries)	1
2	15 < 40	4	-
3	40 < 80	6	4 (3 benefitting from the 20% bonus)
4	80 < 120	5	1
5	120 < 160	2	1 (benefitting from the 20% bonus)
6	160 < 200	5	1 (benefitting from the 20% bonus)
7	200 < 300	12	4 (2 benefitting from the 20% bonus)
8	300 < 360	4	2 (benefitting from the 20% bonus)
Total		**40 KIPs for 52 parties**	**14**

The analysis is done for LVCs in categories 2 to 8 and separately for VLVCs in bracket 1 to determine whether there are any determining differences between LVCs and VLVCs.

6.2.2.1 Trends in LVCs

The RTF reviewed all the KIPs submitted documents from the ExCom-93 to ExCom-97, tabulating the total KIPs, the breakdown into tranches and identifying regulatory costs including training of customs and enforcement officers, versus capacity building costs including updating of curricula, training, certification, and supply of equipment. A further breakdown identified the cost of training alone. An example is shown in Table 6.5.

Table 6.5: An example of countries per bracket of the KIPs funding analysed

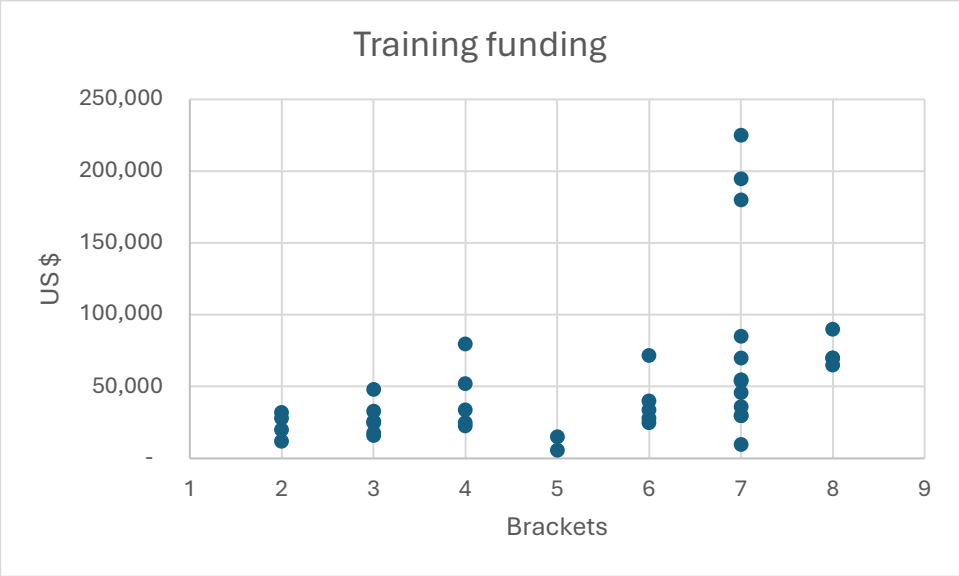
Bracket	Period	ExCom Document	Target reduction (%)	Total KIP (US$)	2024 (US$)	2025 (US$)	2026-2029 (US$)	Regulatory (US$)	Capacity Building (US$)	Tech training (US$)
1	2025-2029	9761	10.0	135,000		81,000	54,000	44,500	65,000	62,000
2	2024-2030	9435	10.0	145,000	63,500		81,500	43,000	32,000	32,000
2	2024-2029	9450	10.0	145,000	70,000		75,000	12,000	74,000	12,000
3	2024-2029	9452	10.0	158,000	81,680		76,320	17,000	62,000	26,000
4	2025-2029	9782	10.0	170,000		95,500	74,500	45,000	73,400	25,000
5	2024-2029	9453	10.0	180,000	86,500		93,500	69,100	34,300	6,000
7	2024-2029	9421	10.0	325,000	165,075		159,925	117,000	159,150	55,000
8	2024-2029	9434	10.0	360,000	180,000		180,000	80,013	247,260	90,000

The analysis found that the total funding for KIP Stage I for all countries is US$ 9,460,600. Out of this total, regulatory activities were budgeted at US$ 2,397,713 or 25.3% of total, while capacity building activities amounted to US$ 4,694,270 corresponding to 48.9% of total. The rest were for awareness raising, end user and demo projects, and management and coordination (equivalent to PMU costs for non-LVCs but included in the bracket costing) costs.

Training costs were more difficult to identify as some KIPs only provided total capacity building costs without further breakdown. Whenever costs were not indicated, the RTF calculated training costs by estimating training cost by technician and by trainer and multiplying by the reported number of technicians to be trained. Training costs totaled US$ 2,002,950 or 21.2% of total funding (43.3% of the capacity building total).

A plot of budgets amounts in US$ for training by bracket is found in Figure 6.2 below

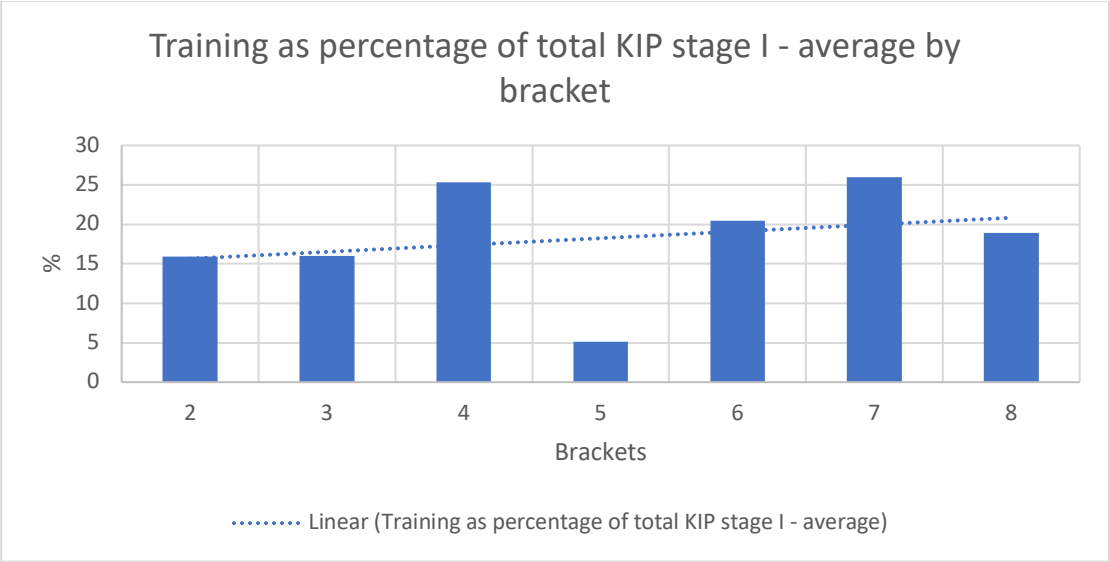
Figure 6.2 Training budget for LVCs in approved KIPs for brackets 2 to 8 (US$)



There are two takeaways from Figure 6.2, a) training costs within the same bracket are close in value except for brackets 5 and 7 which have some outliers, and b) that higher brackets can afford training budgets almost equivalent to the total KIP budget of lower brackets.

RTF then calculated the average percentage cost of training out of the total funding for Stage I for each bracket. The result is a curve as in Figure 6.3 below.

Figure 6.3 Chart showing the average training budgets for brackets 2 to 8



Apart from bracket 5, which is an outlier, spending on training was in the range of 16 to 26 per cent as shown by the linear trend line in Figure 6.3 above.

The budget for training for the two lowest brackets (brackets 2 & 3) was a lower percentage than the other brackets. This observation is in line with the observation on system-building first costs in the previous section and the conclusion that funding for countries in those two brackets is too small to adequately spread it among all the needed activities.

The other two Middle brackets, i.e., brackets 4 and 6, budget around 25 per cent of their total KIP Stage I for training, which is similar to the percentage of bracket 7. The percentage for bracket 8 is lower at around 19 per cent due to the availability of more funds. In comparison, non-LVCs budget less than 10 per cent for technician training.

RTF estimates that the total amount available for funding is sufficient to train around 10,300 technicians. RTF could not estimate the total number of technicians in the corresponding countries to determine the reach of the training programmes. RTF is aware that the amounts from KIP Stage I are being supplemented by funding available from the last stage of the HPMP. This harmonisation of activities will be covered in later sections.

6.2.2.2 VLVCs

For VLVCs, document UNEP/OzL.Pro/ExCom/95/71 for the submittal of KIP by the PICs provides a resume of KIP activities across 11 VLVCs in bracket 1 and one LVC (Solomon Island) in bracket 2, with a total funding of US $1,630,000. The PICs budgeted a total of US $260,500 to train 822 technicians in MAC and RAC, which is the total number of technicians in the 12 countries. The high cost of training per technician is due to the logistics cost related to holding sessions for a group of islands. Training cost is 16 percent of the total budget which is in line with brackets 2 and 3.

Mongolia, another VLVC, budgeted 46 per cent of its total KIP Stage I for training of trainers and technicians as mentioned earlier.

6.3 Why LVC and VLVC countries may struggle to meet HFC phase-down requirements

LVC and VLVC countries are being asked to reduce HFCs at a time when cooling demand and infrastructure are growing at an accelerated pace particularly in emerging economies. As the KA HFC phase-down steps move beyond the initial 10% reduction, these countries may find it harder to comply because they often have limited technical capacity, smaller markets, and fewer economies of scale opportunities than larger A5 countries. The HCFC contribution to the HFC baseline provides for additional growth. The 2023 RTF Supplementary Report identified challenges for parties that had a relatively small HCFC baseline contribution to the HFC baselines. These challenges are especially apparent for parties with no manufacturing or export markets where the entire baseline is used primarily for servicing domestic equipment.

Gender gaps can further slow compliance. In many LVC and VLVC contexts, women are underrepresented in refrigeration and air-conditioning training and businesses and may face barriers to finance and formal employment. This can limit the pool of technicians, entrepreneurs, and decision-makers needed to adopt lower GWP technologies safely and at scale, unless projects include targeted training, outreach, and support to ensure women can participate and benefit.

Meeting the phase-down requirements necessitates a major shift in technology: replacing or converting equipment, moving to alternative refrigerants with safety considerations, improving EE, and potentially adding LRM. This transition can be more complex and expensive than past changes, and LVC and VLVC countries may also struggle with the technology transition and at the same time to maintain older HFC-based systems on which they still depend as global markets move to lower GWP, high-efficiency options. Over time, delays in achieving phase-down targets could affect economic development and the availability of essential services such as food cold chains and safe space cooling. Even if the problem is not fully visible during the later part of KIP Stage I, it is likely to grow in later compliance steps. Future replenishments may need to include proactive, tailored and targeted funding support, starting with monitoring KIP Stage I implementation, to identify capacity gaps and where long-term phase-down progress may be at risk.

6.4 Funding for KIP Stage II and scenario for 2028 revision of CE factors

RTF compared LVC funding guidelines for all stages of HPMPs with those approved for KIP Stage I. Table 6.6 below is a reminder of those guidelines. RTF will try to estimate in this section the amount of funding needed for KIP Stage II to reach 30 per cent reduction while covering the needs for the two issues of fixed-cost system building funding and technician training presented in the previous section. The scenario is suggested for the revision of guidelines which is planned for 2028.

Table 6.6: Funding guidelines for all stages of HPMP and KIP Stage I (US$)

Category	Consumption limits in mt	HPMP up to 2020	HPMP up to 2025	HPMP total phaseout	HPMP 2025-2030	KIP Stage I
Reduction %		**35**	**65**		**35**	**10**
1	> 0 <15	205,625	396,500	587,000	190,500	135,000
2	15 < 40	262,500	506,250	750,000	243,750	145,000
3	40 < 80	280,000	540,000	800,000	260,000	158,000
4	80 <1 20	315,000	607,500	900,000	292,500	170,000
5	120 < 160	332,500	641,250	950,000	308,750	180,000
6	160 < 200	350,000	675,000	1,000,000	325,000	190,000
7	200 < 300	560,000	1,080,000	1,600,000	520,000	325,000
8	300 < 360	630,000	1,215,000	1,800,000	585,000	360,000

LVCs and VLVCs receive the full funding of the fixed amounts irrespective of their consumption levels; consequently, the amounts shown in the "HPMP 2025-2030" in Table 4.6 above are assumed to be available for all countries. It follows then that the 52 countries with approved KIPs, and potentially all countries with KIPs, would have the combined HPMP last stage (herein referred to as HPMP-III) and KIP Stage I (referred to as KIP-I) available to them until 2030. Those amounts are shown in Table 6.7 below.

Table 6.7: Combined funding for last tranche of HPMP and KIP Stage I for the years 2025-2030 (US$)

Category	HPMP-III	KIP-I	Combined	% of Combined compared to KIP-I
1	190,500	135,000	325,500	241
2	243,750	145,000	388,750	268
3	260,000	158,000	418,000	265
4	292,500	170,000	462,500	272
5	308,750	180,000	488,750	272
6	325,000	190,000	515,000	271
7	520,000	325,000	845,000	260
8	585,000	360,000	945,000	263
Average of combined funding compared to KIP-I in %				**264**

The conclusion from Table 6.7 is that between 2025 and 2030, the funds needed to phase out HCFCs and transition to alternatives other than HFC while also reducing HFC baseline by 10 per cent, LVCs and VLVCs would be receiving funds that are on average **2.64 times higher** than KIP-I funding

For the next five years until 2035, and assuming that for KIP Stage II to reach 30 per cent reduction is funded at the same rate as KIP Stage I, then the guidelines funds for that stage would be double the amounts for Stage I in order to achieve the 20 per cent additional reduction. At this level of funding the amounts will fall below what is available to countries in the years up to 2030. With HCFCs phased out, it would be harder for LVCs and VLVCs to transition away from HFCs if they do not have sufficient funds to cover the two challenges of fixed-cost system building activities and providing sufficient training to transition to flammable refrigerants.

Table 6.8 below is an example of funding for Stage II to meet the needs of LVCs while correcting the lowest two categories to account for the challenges mentioned in the previous sections.

Table 6.8: An example of funding for KIP Stage II by bracket (US$)

Category	KIP-II at double KIP-I	KIP-II at combined KIP-I + HPMP-III	Example funding corrected for first 2 brackets
1	270,000	325,500	418,000
2	290,000	388,750	418,000
3	316,000	418,000	418,000
4	340,000	462,500	462,500
5	360,000	488,750	488,750
6	380,000	515,000	515,000
7	650,000	845,000	845,000
8	720,000	945,000	945,000

The example in table 6.8 is built on the notion that the first two LVC categories are underfunded compared to the other categories when taking into account the facts regarding the fixed costs and the additional training needs elaborated in this chapter. This would in effect reduce the number of categories from eight to six.

7 Funding Estimate for Maintaining and/or Enhancing Energy Efficiency While Phasing Down HFC

7.1 Introduction

Parties asked TEAP to look at "[all] control measures and decisions agreed on by the Meetings of the Parties to the Montreal Protocol and the Executive Committee of the Multilateral Fund, including those relevant to decision XXVIII/2, and the decisions of the Meetings of the Parties up to and including the Thirty-Seventh Meeting of the Parties and of the Executive Committee up to and including its ninety-eighth meeting, insofar as those decisions will necessitate expenditure by the Multilateral Fund during the period 2027–2029."

Decision XXVIII/2 requested the ExCom "to develop cost guidance associated with maintaining and/or enhancing the energy efficiency of low-GWP or zero-GWP replacement technologies and equipment" during the phase-down of HFC.[70] TEAP has responded to MOP decisions XXVIII/3, XXIX/10, XXX/5, XXXI/7, XXXIII/5, XXXIV/3, XXXV/10, and produced reports to support MP parties in issues pertaining to maintaining and/or enhancing EE while phasing down HFCs. In addition, Decision XXXVII/5 invited parties to submit information related to "policies, activities, key lessons learned, in relation to centres of excellence for sustainable cooling and testing centres for energy efficiency related to the implementation of the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer;". This information will be provided by 1 June 2026 and will not be available to the RTF.

In addition to the relevant MOP decisions above related to EE, several ExCom decisions and their relevance are summarised below:

- Decision 89/6: Additional EE activities in servicing as part of HPMPs for LVC countries; establishes a defined activity list and two-tier funding levels tied to HCFC baseline.
- Decision 91/65: Pilot projects on EE establishing criteria, eligible activities, country/enterprise commitments, and US$ 20 million augmentable funding window. Decision 95/87 extended the window only for servicing activities to the 100th ExCom.
- Decision 94/60: Operational framework for EE in manufacturing with an incentive-based methodology for five product categories, and US$ 100 million augmentable funding window.
- Decision 95/87: Extending the incentive-based operational framework to cover heat pumps, compressors, and heat exchangers. In addition, it established a US$ 40 million revolving-fund pilot window for end users.

In responding to the parties' mandate, the RTF interpreted Decision XXXVII/6 (paragraphs 2(a) and 2(b)) to cover the following EE-related items when taking into consideration all relevant decisions agreed upon by the parties to the MP and the ExCom:

1) Decision 89/6 established a funding table and defined additional activities for inclusion in existing and future HPMPs for LVC countries in response to paragraph 16 of decision XXVIII/2 and paragraph 2 of decision XXX/5 of the parties – as described in chapter 2, section 2.4.6.

[70] Decision XXVIII/2, para 22: "To request the Executive Committee to develop cost guidance associated with maintaining and/or enhancing the energy efficiency of low-GWP or zero-GWP replacement technologies and equipment, when phasing down hydrofluorocarbons, while taking note of the role of other institutions addressing energy efficiency, when appropriate;" https://ozone.unep.org/treaties/montreal-protocol/meetings/twenty-eighth-meeting-parties/decisions/decision-xxviii2-decision-related-amendment-phasing-down-hydrofluorocarbons

2) Decision 91/65 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) of the decision – as described below in section 7.3.
3) Decision 94/60 established a funding window in the amount of US $100 million with the possibility of augmenting that funding window at a future meeting to maintain and/or enhance EE in the context of HFC phase-down as specified in decision XXVIII/2, following the criteria identified in subparagraph (b) of the decision' – as described below in section 7.4.
4) Decision 95/87 established a funding window in the amount of US$ 40 million in the context of HFC phase-down as specified in decision XXVIII/2, following the criteria identified in subparagraph (b) of the decision' – as described below in section 7.5.

7.2 Estimated funding related to EE based on Decision 89/6 for LVCs

In the context of HCFC phase-out, parties agreed in Decision XXVIII/2 paragraph 16 to request the ExCom to increase funding available to LVCs for maintaining EE in the servicing/end-use sector. In decision 89/6 the ExCom established a funding table (Table 2.7) and defined additional activities for inclusion in existing and future HPMPs for LVCs in response to paragraph 16 of Decision XXVIII/2 and paragraph 2 of Decision XXX/5 of the parties. The ExCom Decision 91/37 decided that Decision 89/6 applies to LVCs that have already completed their HPMPs.

The maximum funding eligibility for Decision 89/6 based on 95 LVC countries and 9.6% support costs is US$ 11,135,360. By ExCom-97, 66 parties and one region have approved projects funded under Decision 89/6 with a total funding of US$ 7,733,556. The remaining 29 parties may apply for funding for support during the upcoming triennium or in future triennia. The RTF estimates that US$ 3,400,000 is required to support the remaining LVCs in the 2027-2029 triennium (including support costs).

7.3 Approved EE funding window in Decision 91/65

Decision 91/65[71] has 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)". This funding window is currently extended until ExCom-100 for servicing only activities. [72]

The expenditures under this funding window are summarised in the Table 7-1 below.

Table 7.1: Funding under Decision 91/65 by project type (till ExCom 97)

Project Type	Number of Projects	Funding amount, US $
Demonstration	11	4,774,743
Investment	18	6,027,695
Project Preparation	13	474,450
Technical Assistance	11	2,353,754
Total	**53**	**13,630,372**

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

[72] Decision 95/87 paragraph (d). UNEP/OzL.Pro/ExCom/95/94

It is worth noting that only 13 PRP were approved with 8 follow-on approved projects (2 demonstration projects, 5 investment projects, and 1 technical assistance project); the additional 32 approved projects were approved without a PRP. In addition, according to the BP, there are projects worth US$ 6,149,000 to be submitted in 2027.

This pilot window proved to be a successful way for countries to integrate EE in their MP activities; in the initial phases of the funding window, the focus was on Demonstration projects, it was then focused on technical assistance and non-investment (still categorized as investment) projects that support countries to build capacity to maintain or enhance EE while phasing down HFCs.

The largest amount approved under decision 91/65 was in ExCom-93 with US$ 4,872,573 that included investment and demonstration activities that are no longer eligible under this pilot EE funding window. Since then, countries have been ramping up programmatic activities that twin EE with their HFC phase down commitments supported by this funding window with another record funding in ExCom-97 of US$ 3,384,486.

As discussed later, funding under decision 94/60 is limited to manufacturing countries and funding under decision 95/87 might not be readily accessible to LVCs. As such, this pilot window provides the means for non-manufacturing A5 countries to enable their EE activities while phasing down HFC consumption in line with Decision XXVIII/2.

Furthermore, if we consider the BP, projects for which PRPs have already been approved, and the committed funding in the 97th ExCom, and the funding in the BP for 2026 and 2027, the RTF estimate the total required funding to be US$ 15,682,500 for the 2027-2029 triennium. The remaining balance in the funding window by ExCom-97 is US$ 6,369,628.

- Scenario 1: no extension/augmentation: In this scenario, the currently remaining funds within the funding window will be exhausted on a first-come, first-serve basis. This would require a funding of US$ 6,369,628 in the next triennium.
- Scenario 2: no extension with augmentation: In this scenario, the ExCom may wish to augment the funding window to accommodate projects within the business plan. This would require a funding of US$ 3,754,162 in the next triennium.
- Scenario 3: extension and augmentation: In this scenario, the ExCom may wish to extend the funding window to fund projects during the next triennium- US$ 9,312,872.

7.4 Approved EE funding window in Decision 94/60

Decision 94/60[73] has established a "a funding window of US$ 100 million for projects developed and implemented under the framework, subject to further augmentation by the Executive Committee." These projects focus on enhancing EE when phasing down HFCs in the manufacturing of domestic refrigerators, commercial refrigeration display cabinets, commercial refrigeration chest freezers, residential air conditioners and commercial air conditioners. These activities were later extended to include compressors, heat exchangers, and heat pumps according to Decision 95/87[74] paragraphs (b) and (c).

To date, seven PRP were approved at a total funding level of US$ 358,450 for seven countries and five investment projects for country-wide industry conversion projects at a total funding level of US$ 21,675,350 for four countries (Table 7.2). It is also worth noting that this decision is limited to about

[73] UNEP/OzL.Pro/ExCom/94/67

[74] UNEP/OzL.Pro/ExCom/95/94

35 manufacturing countries, and that the remaining A5 parties will not be able to access funding from this window for enabling EE activities.

Table 7.2: Approved funding under window 94/60 including support costs (through ExCom 97)

	PRP	PRP Cost (US$)	INV	INV Cost (US$)	Total Cost (US$)
Air conditioning	2	77,040	1	1,441,675	1,518,715
Commercial			1	444,787	444,787
Compressor			1	1,343,118	1,343,118
Domestic	2	58,850	2	18,445,770	18,504,620
Domestic/Commercial	3	222,560			222,560
TOTAL		**358,450**		**21,675,350**	**22,033,800**

There is a learning curve associated with the submission process for this decision with the required data and information. Countries are starting to submit higher quality proposals to improve the synergies between their KIP activities and their EE investments projects. The current funding window suggests that a total of US$ 77,966,200.00 is still available. Assuming two preparatory and two investment projects are approved in 2026 at the average cost of projects approved to date, an additional US$ 8,772,554 of the remaining funding window would be used this triennium, leaving a remaining approximately US$ 70,000,000 available in the window for the next triennium. However, it is not clear what would be the countries' submission in the next triennium.

Below are two scenarios based on available trends:

- Scenario 1: Assume the same level of funding over the next three years; total needed funding = US$ 66,101,400.
- Scenario 2: Countries ramp up their EE activities and deplete the funding window over the next triennium; total needed funding = US$ 77,966,200 (assumes no additional activities approved in 2026).

7.5 Approved EE funding window in Decision 95/87

Decision 95/87[75] has established in paragraph f a "funding window of US$ 40 million for two energy-efficiency end-user projects using a revolving fund mechanism developed and supported by IAs, over a duration of eight years, after which funds would be returned to the Multilateral Fund, on the understanding that it would not be operationalized until the Executive Committee had agreed on the modalities for operationalizing the revolving fund;" and in paragraph g agreed to "provide funding, for the preparation of no more than five projects, of no more than US$ 100,000 per project, on the understanding that those proposals would be submitted to the 96th meeting and that only up to two projects would be selected for the funding window referred to in subparagraph (f) above."

Pending decisions at ExCom-98 and -99, the RTF currently assumes the full funding window amount of US$ 42,800,000 including support costs will be needed for the next triennium.

7.6 Summary of funding needs for EE during the HFC phase-down in the 2027-2029 triennium

Table 7.3 summarizes estimated funding, taking into consideration the funding available for EE activities under various decisions, without considering the possibility of augmentation.

[75] UNEP/OzL.Pro/ExCom/95/94

Table 7.3: Estimated funding needs for EE in 2027-2029 (US$)

	Low-end	High-end
Dec 89/6	3,400,000	3,400,000
Dec 91/65	6,369,628	9,312,872
Dec 94/60	66,101,400	77,966,200
Dec 95/87	-	42,800,000
Total US$ (with support costs)	**73,255,562**	**133,479,072**

8 Lifecycle Refrigerant Management

ExCom has had a long history of discussions on the importance of LRM and interest in meaningful actions to address the issue. This is evidenced in decisions taken by ExCom and by the MOP on this issue. This is also evidenced by the large number of countries that had initiated projects under ExCom Decision 91/66,[76] which established a funding window for the preparation of national inventories of banks of used or unwanted controlled substances and a plan for the collection, transport and disposal of such substances, including consideration of recycling, reclamation and cost-effective destruction. LRM was most recently discussed at the 97th ExCom meeting with consideration for establishment of a funding window. In its Decision 97/89, [77] ExCom decided:

1. *To note the report prepared pursuant to decision 93/104 on life-cycle refrigerant management with a view to considering the establishment of a funding window in line with decision XXXV/11 of the Thirty-Fifth Meeting of the Parties contained in document UNEP/OzL.Pro/ExCom/97/87;*

2. *To encourage the bilateral and implementing agencies to intensify their efforts to assist Article 5 countries in finalizing projects under decision 91/66 as soon as feasible and in submitting the final reports and a copy of the resulting national inventories and national action plans in line with decision 91/66(e)(iii);*

3. *To request the Secretariat to update, for the 99th meeting, the information in document UNEP/OzL.Pro/ExCom/97/87 in light of completed inventory projects and national plans and other relevant information, including on the movement of controlled substances for destruction or reclamation; and*

4. *To request the Secretariat to prepare, for the 100th meeting, a document on funding modalities, including elements for draft cost guidelines to implement plans developed in accordance with decision 91/66, with a view to considering the establishment of a funding window in line with decision XXXV/11, taking into consideration the information provided in the report referred to in subparagraph (c) and the views on that report expressed by the Executive Committee.*

RTF was requested to estimate funding needs for the 2027-2029 triennium and beyond, considering ExCom decisions, and those are pending on this matter. Even though LRM was not explicitly included in the TOR, item 4 above indicates the potential for the establishment of a funding window to implement LRM plans. If agreed by the ExCom, a decision would come but not earlier than ExCom-100 in 2027 prompting the RTF to include a discussion on LRM in its report.

Noting the continued interest of the ExCom and parties on LRM and future consideration for establishing a funding window, this chapter and Annex 10 of this report provide information to support those ongoing discussions.

8.1 Introduction

LRM is increasingly recognized as a critical component in achieving the environmental objectives of the MP and its KA and mitigating compliance risks through providing additional HFC supply during challenging consumption reduction steps. While the Protocol has historically focused on controlling the production and consumption of ODS, the large quantities of refrigerants already contained in existing equipment, referred to as refrigerant banks, represent a significant potential source of

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

[77] UNEP/OzL.Pro/ExCom/97/91

emissions if not properly managed at the end of equipment life. In 2022, the active global refrigerant bank contained around 6 million metric tonnes (Mt) of ODS and HFCs, equivalent to approximately 16 Gt CO_2e.[78] Effective management of these banks through recovery, recycling, reclamation, and destruction (RRRD) can substantially reduce emissions of both ODS and high-GWP HFCs. TEAP has emphasized that strengthening lifecycle management practices is essential for maximizing the climate and ozone benefits of the MP framework. [79]

LRM encompasses the set of activities that ensure refrigerants are responsibly handled throughout their entire lifecycle, from installation and servicing through to equipment retirement and end-of-life management. These activities include refrigerant handling during servicing and decommissioning, collection, aggregation and logistics systems, reclamation and purification infrastructure, and environmentally sound destruction where reuse or reclamation is not feasible. By minimizing leakage during servicing and ensuring maximum effective recovery at the end of equipment life, LRM contributes to reducing both direct emissions and the demand for newly produced refrigerants. Improving LRM activities can significantly mitigate emissions from existing refrigerant banks, which remain a major contributor to projected future emissions even as production and consumption controls tighten.[80]

Within the MP implementation architecture, several elements of LRM are already embedded within existing programme structures, particularly HPMPs and now KIPs. These programmes typically include activities such as technician training on refrigerant recovery practices, provision of basic recovery equipment, development of servicing sector regulations, and pilot reclamation initiatives. Such interventions contribute to strengthening lifecycle management systems and can indirectly support refrigerant bank management. However, these activities have historically been designed primarily to facilitate compliance with production and consumption phase-out/down schedules, rather than to establish comprehensive national capability for end-of-life refrigerant management.

The current funding architecture of the MLF provides only limited and fragmented support for the full spectrum of LRM activities. While certain upstream measures, such as servicing sector training and provision of recovery equipment, are eligible for funding, broader system elements including nationwide collection networks, large-scale reclamation infrastructure, refrigerant destruction capacity, and long-term refrigerant bank management strategies, remain insufficiently addressed. This gap has been highlighted in several policy discussions of the MLF ExCom, including UNEP/OzL.Pro/ExCom/97/87, which examined options for strengthening LRM and improving the treatment of refrigerant banks within the MP framework (UNEP, 2022).

Addressing the above gap will require a more systematic approach to assessing the financial and institutional requirements associated with end-of-life refrigerant management in A5 parties. Establishing effective LRM activities involves multiple cost elements across the refrigerant value chain, including deployment of recovery equipment, development of collection and logistics systems that incentivise technicians to return recovered refrigerants to collection centres, establishment of reclamation and purification facilities, access to destruction technologies, and the strengthening of regulatory, monitoring and enforcement frameworks. The scale of these requirements varies significantly depending on national circumstances, including the size of the installed equipment base, historical refrigerant consumption levels, and the maturity of servicing sector infrastructure.

[78] Through leakage reduction/prevention during the use of RACHP equipment.

[79] UNEP, 2024. *Lifecycle Refrigerant Management Task Force Report.* Technology and Economic Assessment Panel (TEAP). United Nations Environment Programme.

[80] Ibid.

This chapter therefore examines the funding requirements associated with strengthening LRM under the MP. It draws on findings from the TEAP 2024 LRM Task Force Report[81], relevant policy discussions of the ExCom, and existing literature on refrigerant bank management[82]. The analysis reviews typical cost components associated with key LRM activities, including recovery, collection, transport, reclamation, and environmentally sound destruction, this chapter adopts an approach to examining future opportunities for additional funding for LRM services, designed to complement existing HPMPs and KIPs in supporting the phase-out and phase-down of controlled substances under the MP. Most servicing-sector infrastructure, training, and IS are expected to continue to be funded through HPMPs and KIPs.

In this context, the chapter considers the following high-level LRM activities for purposes of informing development potential future consideration of a formal LRM implementation funding window:

1. Enhancing recovery, recycling and collection systems,
2. Expanding access to reclamation,
3. Facilitating transboundary shipment of recovered refrigerants under the Basel Convention (for reclamation and/or destruction), and
4. Enabling destruction where possible.

Each of these activities corresponds to a specific function within the LRM chain and can be implemented independently or in combination.

While Decision 91/66 provides funding for preparatory activities, such as national inventories and action plans. The decision on funding those plans is expected within the 2027 – 2029 triennium. At the time of preparation of this report the RTF have not seen any of the proposed action plans. A gap persists between existing funding provisions and the broader requirements for comprehensive end-of-life management systems, including collection networks, reclamation capacity, destruction infrastructure, and national regulatory and monitoring frameworks (Table 8.2). Bridging this gap is necessary to enable an effective management of refrigerant banks, with associated ozone and climate benefits, while improving the availability of recovered refrigerants and reducing pressures on virgin supply chains.

[81] UNEP, 2024. *Lifecycle Refrigerant Management Task Force Report.* Technology and Economic Assessment Panel (TEAP). United Nations Environment Programme.

[82] Theodoridi, C.; Hillbrand, A.; Starr, C.; Mahapatra, A.; Taddonio, K. (2022). *The 90-Billion-Ton Opportunity: How Minimizing Leaks and Maximizing Reclaim Can Avoid Up to 91 Billion Tons of CO_2-equivalent Emissions*; Environmental Investigation Agency (EIA): Washington, DC.

Table 8.2: Gap between current funding provisions and comprehensive LRM needs

Aspect	Current funding / provision	Needs/Expectation
Institutional support	Limited technical assistance	Strengthened regulatory frameworks, monitoring and enforcement systems, extended producer responsibility (EPR) schemes, and mechanisms to enable environmentally sound transboundary movement and destruction (i.e., carbon finance integration, export of unwanted ODS/HFC for destruction)
Infrastructure	Limited to servicing-sector equipment	Dedicated infrastructure for refrigerant storage, reclamation facilities/labs, and destruction capacity
Coverage	Focused on selected HCFC/HFC sectors	Comprehensive coverage of all controlled substances (ODS and HFCs) across all relevant sectors (RACHP, foams, fire protection)

8.2 Enhanced recovery, recycling and collection

In addition to leak detection and prevention in service, the basic foundational activity is the improvement of refrigerant recovery during servicing. This requires equipping technicians with appropriate tools, including recovery machines and cylinders, digital charging gauges, and related equipment. The cost of equipping one technician was estimated in 2024 at US$ 1,500 (UNEP, 2024) but currently is expected to be between US$ 1,500 and US$ 1,600. In addition to equipment provision, there is a need to incentivise recovery and recycling behaviour through a structured framework for refrigerant collection and profit sharing which would cover incremental return logistics cost. RTF estimated that establishing a recovered refrigerant trading platform is a one-time cost of US$ 10,000 per party, plus an annual technician subscription fee of US$ 250. Annex 9 provides indicative costs for EOL ODS/HFC management.

8.3 Expanded reclamation capacity

Currently, reclamation centres are limited to few parties[83] (UNEP, 2024) mainly due to the cost of establishing these centres which is an average of US$ 140,000 and the feasibility of putting an economically viable business mode. LVCs and VLVCs have no known reclamation facilities and have greater challenges with respect to economies of scale promoting the consideration of regional centres and integration with destruction capacity as required.

8.4 Facilitate transboundary shipment of recovered refrigerants

Where in-country recycling or reclamation is not sufficient or feasible, all eligible A5 parties would require an appropriate framework to enable the export of recovered refrigerants under the Basel Convention, either for chemical reclamation in distillation columns or for environmentally responsible destruction. The RTF estimates a cost of approximately US$ 51,300 per party, covering capacity building, instrumentation and equipment, and refrigerant handling safety.

[83] UNEP, 2024. *Lifecycle Refrigerant Management Task Force Report.* Technology and Economic Assessment Panel (TEAP). United Nations Environment Programme.

8.5 Enabling destruction where required

The final step in any LRM is the environmentally responsible destruction of refrigerants that cannot be reused or reclaimed. Dedicated destruction facilities are currently considered beyond the scope of the MP compliance model. The RTF notes that substantial cement kiln destruction capacity is available in A5 countries and can be qualified for controlled substance destruction. This could provide sufficient regional and geographical coverage and could be enabled for this purpose. Enabling a kiln would include retrofits for controlling refrigerant gas injection into the kiln, measuring waste feed, demonstrating destruction efficiency and licensing support is estimated at US$ 50,000 to US$ 100,000 per facility (UNEP, 2024).

8.6 Conclusions

The RTF has estimated some suggested activities that would enable implementation of LRM in A5 parties. This work should be considered preliminary because it was developed in absence of information related to submitted decision 91/66 action plans by participating parties. Therefore, RTF has not provided estimated costs related to implementation of LRM plans due to implications of potential decisions to happen in the 2027-2029 triennium. RTF requests more guidance on this matter from parties that could be taken on board for the Supplementary Report.

The RTF has not included a specific funding estimate for LRM in its 2027-2029 total because the modalities and timing of a potential funding window are pending at the ExCom. The analysis in this chapter is provided for the information of parties.

9 Integrating Digital Technologies and Tools in the Servicing Sector

Paragraph 2(d) of Decision XXXVII/6 requests the Replenishment Task Force to consider "[integrating] digital technologies and tools within the servicing sector."

9.1 Introduction

The use of digital technologies in the service sector can be classified as (1) digitization and (2) digitalization. ***Digitization*** transforms the RACHP service sector by replacing manual, paper-based workflows with integrated software that improves operational efficiency, technician productivity, and customer satisfaction. ***Digitalization***, on the other hand, shifts the focus from data to how the work (technical service) is performed. Some examples of digitalization include:

- Service technician training;
- Mobile field service apps for technicians (digital work orders, checklists, photos);
- Digital scheduling and dispatch systems with real-time technician tracking;
- Real-time digital support help;
- IoT-enabled HVAC systems that send fault alerts automatically;
- Predictive maintenance using sensor data instead of fixed service intervals; and
- Customer portals for service requests, approvals, and payments.

Digitalization achieves faster response times and fewer repeat visits, better first-time fix rates, improved customer experience, and data driven maintenance and service decisions. In short, digitalization changes how HVAC service is delivered, which includes end-of-life scenarios for the equipment, tracking technician time fix rates driven maintenance and service decisions.

9.2 Background

Integrating digital technologies and tools is a delivery and service efficiency improvement enabler. Formal reporting streams already exist (including A7 reporting, CP reporting, tranche reporting, and independent verification where required). The appropriate role of digital tools in this context is therefore to improve the quality, timeliness, traceability, and cost of implementing and documenting compliance-relevant actions, particularly in the servicing sector.

Accordingly, this section focuses on digital tools that either (i) reduce the transaction costs of delivering and evidencing compliance actions or (ii) demonstrably improve servicing-sector performance outcomes (e.g., improved performance, reduced maintenance, leakage reduction and EE), while remaining feasible and sustainable in a range of national contexts.

Therefore, in this section, integration refers to the incremental costs required to embed digital tools into existing service sector activities, rather than creating parallel reporting systems. Costs can be presented across as: (i) one-time setup and configuration, (ii) recurring operations, (iii) hardware and connectivity where applicable, and (iv) sustainability and governance. Depending on the tool type, costs are best expressed per technician, per servicing enterprise, per monitored system/ site, or per country programme.

Current baseline: digitalization is already underway within the MLF ecosystem. ExCom documentation indicates that digitalization is already progressing within MLF operations and related project contexts. OS reporting highlights live and developing knowledge-management components (including dashboards and a CP data centre), ongoing testing of digital modules to support workflows, and exploration of artificial intelligence (AI)-enabled tools intended to improve access to decision histories and policy-related analysis.

In addition, the ExCom has discussed better ways to use evidence from reports that are already produced (e.g., project completion reports and detailed final project reports), suggesting that "digital tools" can be meaningfully interpreted as strengthening how information is structured, accessed, and re-used thereby reducing repeated data requests and administrative load.

9.3 Approaches to integrating digital technologies and tools

The following is suggested as a practical structure for consideration (numbering is used as reference in later sections):

1. Transaction Efficiency Improvement

    (A) Certification, Registry and Training Management

    (B) Technician Servicing Records and Field Services App

2. Performance Tools

    (A) Digital Job Quality Tools

    (B) Targeted Monitoring for Optimization and Fault Alerts

3. Workflow and Knowledge Tools

9.3.1 Transaction-efficiency improvement (broadly applicable; LVC/VLVC-suitable)

These are low-complexity tools (often offline-first) that reduce the cost of meeting existing implementation and safeguarding requirements. Examples include technician certification registries and renewal tracking, training management (coverage and recertification), and basic digitized servicing records that help IAs and verifiers compile evidence efficiently. The primary benefit is reducing administrative time and improved traceability, rather than additional reporting.

An illustrative case for 1(A) is the MLF's CP Data Center,[84] which provides a centralized digital platform for country programme data, including historical reporting and visualization of trends through dynamic charts and graphs. While it is not a technician certification registry in itself, it demonstrates that the MLF context already uses light digital infrastructure to improve reporting, traceability, access to information, and programme oversight. This is relevant to 1(A) because the same type of low-complexity digital architecture could be adapted at country level to manage technician records, training completion, recertification dates, and links to licensing systems. Supporting evidence from the International Labour Organization[85] on the digital transformation of apprenticeship systems also shows that vocational and work-based learning systems are increasingly being modernized through digital learner records, training management platforms, and more efficient administration of certification processes. Together, these examples support Certification, Registry and Training Management as a realistic and implementable category of digital intervention focused on administrative efficiency and improved visibility of training and certification status.

[84] Multilateral Fund for the Implementation of the Montreal Protocol. CP Data Center. Available at: https://www.multilateralfund.org/our-work/cp-data-center

[85] International Labour Organization (ILO). *Digital transformation of apprenticeships: Emerging opportunities and barriers*. Available at: https://www.ilo.org/publications/digital-transformation-apprenticeships-emerging-opportunities-and-barriers

A relatable case study for 1(B) is provided by Microsoft Dynamics 365 Field Service,[86] which is designed to support work order management, scheduling, mobile access for technicians, and the shift from paper-based reactive service to more proactive and digitally managed service operations. The platform documentation highlights functions such as work order management, mobile tools for frontline workers, and workflow automation, all of which closely align with the concept of technician-facing digital service records. In the context of RACHP servicing, similar tools could be used to record leak checks, refrigerant use, component replacement, fault histories, and photographic evidence from service visits. The relevance of this example is not that a country programme would necessarily adopt this exact platform, but that it shows the maturity of mobile field-service systems as a proven class of tools capable of replacing fragmented paper records with structured digital job documentation. This supports the inclusion of Technician Servicing Records and Field Services App as a practical, low-to-medium complexity step beyond registry-only systems

9.3.2 Performance tools linked to improved comfort, reduced maintenance, refrigerant leakage reduction and increased energy efficiency (selective; case-based)

These are digital tools applied where there is a clear pathway to measurable servicing sector performance improvement such as targeted digital monitoring and management tools in cold-chain or commercial refrigeration contexts for example, where they can enable optimization, prevent leakage, and improve EE. Such tools are best treated as selective interventions, guided by clear criteria, and accompanied by sustainability provisions.

Digital tools for RACHP typically consist of sensors that collect data on refrigerant mass flows, refrigerant temperatures, pressures, compressor speed, valve position, equipment vibrations, and refrigerant levels in accumulators and receiver tanks. In addition, space temperature (e.g., indoor or cold room), humidity, CO_2-levels, and particle matters can be measured to allow multi-functional control. Both data storage and applications are typically Cloud-based, providing access worldwide and from a wide range of devices, including computers, tablets, and mobile phones.

An illustrative 2(A) case can be drawn from a compressor manufacturer's controls and monitoring systems, which are designed to improve refrigeration system performance through functions such as monitoring, alarm handling, and remote diagnostics[87]. These types of tools move beyond basic record-keeping and begin to influence the quality of servicing interventions by helping technicians identify faults earlier, respond to abnormal operating conditions, and reduce unnecessary reactive callouts. In terms of Digital Job Quality Tools, the significance of such systems is that they support more consistent service quality, better fault identification, and improved maintenance practice rather than only faster administration. In the MLF context, this tier could therefore include digital tools such as guided leak inspection workflows, structured maintenance checklists, or QA dashboards that allow supervisors and IAs to assess whether servicing practices are improving. This example strongly demonstrates that digital support for better service decisions is already embedded in commercial refrigeration practice and is not merely a theoretical extension of paper-based systems.

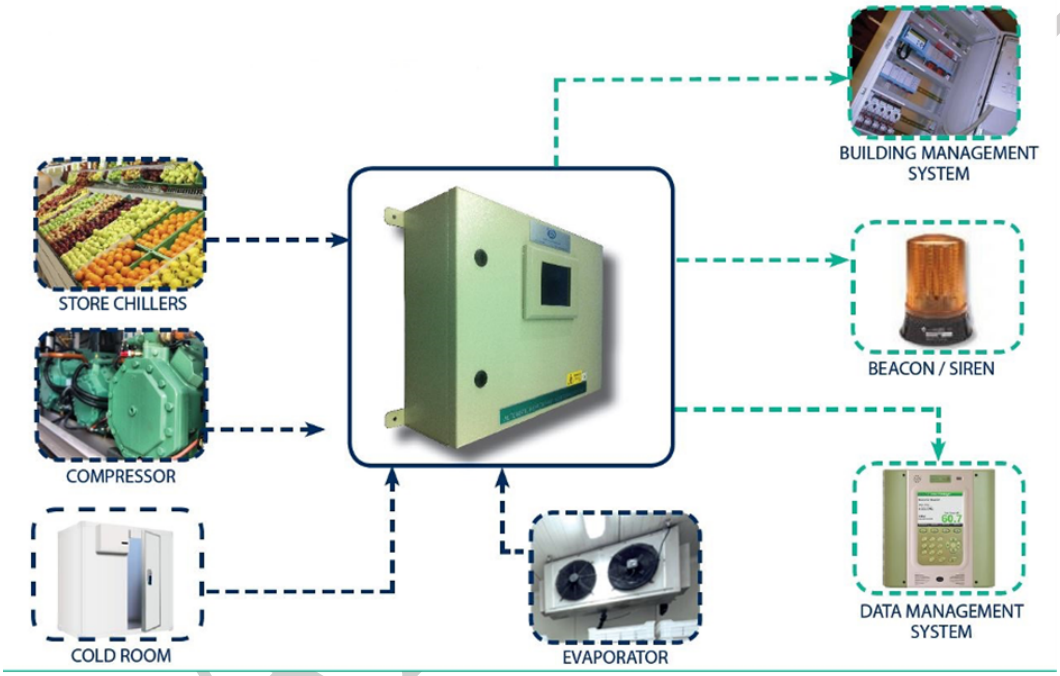
[86] Microsoft Learn. *Overview of Dynamics 365 Field Service 2025 release wave 1*. Available at: https://learn.microsoft.com/en-us/dynamics365/release-plan/2025wave1/service/dynamics365-field-service/

87 Copeland. HVAC Compressor Electronics for Commercial Applications | Copeland US

A relatable case study for 2(B) is another manufacturer's refrigeration control and monitoring platform used in food retail applications[88][89]. This system is an adaptive refrigeration control solution that automatically responds to changing operating conditions to improve refrigeration performance and EE. The benefits associated with using the platform include optimization of refrigeration, lighting, and HVAC, reduced maintenance needs, lower downtime, and improved food quality and loss prevention. In practical terms, this is closely aligned with the concept of monitoring and IoT-enabled tools that generate measurable operational outcomes rather than merely digitizing paperwork. This case is especially relevant because it shows how cloud-connected or controller-based systems can support energy optimization, alarm monitoring, service prioritization, and performance visibility across refrigeration assets.

Figure 9.1 illustrates an example of refrigerant monitoring, control, and alarm, which could typically be part of an overall digital solution for RACHP.

Figure 9.1 Example of RACHP digital solution



9.3.3 Workflow and knowledge tools

These system level efficiency improvement tools include further strengthening of Secretariat and IA workflows using knowledge-management assets (e.g., CP data center, structured decision databases) and, where appropriate, AI-enabled document handling with quality assurance. Their value lies in improving consistency, reducing processing time, and strengthening institutional memory.

A useful case study for Workflow and Knowledge Tools is again the MLF's CP Data Center, but here the relevance is different. Rather than illustrating simple administrative digitalization, it illustrates the

[88]Danfoss. Optimised food safety, unsurpassed energy savings. Available at: https://assets.danfoss.com/documents/latest/95197/AD138986428387en-020201.pdf

[89] Copeland. Distribution Center Improves Food Safety and Quality_AFS.CS.Rev1.0418_Digital Copy.pdf

value of structured data systems for decision support, evidence retrieval, and programme-level visibility. The platform allows users to view long-term country programme data and visualize trends, which reflects the basic logic of these tools: helping institutions work more effectively with evidence rather than creating new technical servicing functions in the field. In the context of the present framework, system level efficiency tools therefore capture digital tools that support implementing agencies, NOUs, and the MLFS in tasks such as programme workflow management, structured storage of evidence, compliance review, and internal knowledge retrieval. The case supports the argument that higher-tier digitalization does not only mean sensors or AI in equipment but can also mean better institutional workflow tools that improve the quality, consistency and speed of programme oversight and decision-making.

Experience reflected in ExCom discussions suggests that successful digitalization depends less on the sophistication of tools and more on sustainability and ownership. This includes clarity on who owns and maintains systems and data, how tools remain functional after pilot phases, how they align with HFC phasedown and servicing-sector needs, and whether they are best integrated within existing HPMP/KIP servicing activities rather than established as standalone digital platforms. Therefore, digital tools should not create unfunded liabilities or divert scarce capacity away from core compliance delivery. This is particularly relevant for LVC/VLVC contexts, where offline-first "digital-light" solutions can provide high enabling value without imposing significant operational overhead.

Within a compliance-based approach, digital tools can be presented as either:

- **Cost-efficiency enablers** that lower the transaction costs of delivering and evidencing compliance actions (types 1 and 3), and/or

- **Targeted performance interventions** that demonstrably reduce maintenance, refrigerant leakage, and improve EE in selected sectors (type 2), with explicit sustainability provisions.

Indicative costs are provided below to illustrate the order of magnitude of funding that may be required to integrate digital tools into the servicing sector activities. Actual costs can vary by country's context, scale, connectivity, and the extent of localization and support.

9.4 Cost estimates

9.4.1 Transaction efficiency improvement cost estimates

Software and software companies exist globally that provide on-line services that could be customized to suit the needs of the service organization. As mentioned earlier, tools in this category are typically low-complexity, offline-first where needed and aimed at reducing transaction costs and improving traceability. Splitting these into two below:

- **1(A) Registry and training management**: technician certification/ recertification registry, training coverage tracker, and basic reporting outports for IAs/NOU. Costs are typically expressed per country programme and depend heavily on whether a country can adapt to an existing platform (preferred) versus procuring a more customized system. As an indicative range, one time configuration/ localization in the range of ~ US$ 10,000 – 30,000 for digital light deployments, with recurring operations and support of ~ US$ 3,000 – 10,000 per year (hosting, user support, minimal administration). Higher costs of more than ~ US$ 50,000 plus setup and ~ US$ 15,000+ per year may arise where there is multi- agency integration, multilingual roll-out, significant data migration, or a larger user base. However, these should be treated as case-specific rather than assumed.

- **1(B) Technician servicing records/ field service app**: digital work orders, checklists, photo evidence, and refrigerant handling logs aligned with good servicing practices. Indicative costs may be expressed per technician or enterprise with one time configuration in the range of

~US$ 500 – 5000 per enterprise, plus recurring license/ support typically in the range of ~ US$ 2 – 10 per technician per month (or an enterprise plan). Additional costs may apply where devices or data plans must be provided, where possible; programmes can reduce costs through BYOD (bring your own device), offline-first design, and limited sync windows.

The charges often are a one-time set up charge (US$ 500-$1500 depending on complexity of customization) followed by a monthly fee (ranging from US$ 50 to $1000) depending on features that are subscribed.

9.4.2 Performance tools cost estimates

Performance tools are selective, applied where there is a clear pathway to measurable improvements (e.g. reduced leakage and /or improved EE) and where sustainability can be assured. Two common deployment types may include:

- **2(A) Digital job quality tools – low hardware**: guided leak inspection/ repair workflows, refrigerant recovery and charging records, calibration reminders, supervisory dashboards for targeted programmes. Costs are often similar to that in Type1(B) tools – modest setup plus recurring license/ support typically in the range of ~US$ 5 – 20 per technician per month (scale dependent).

- **2(B) Monitoring/IoT-enabled optimization- hardware heavy**: targeted monitoring for commercial refrigeration/ cold chain systems with alerts and maintenance triggers. Costs are best expressed per monitored system/site: indicative one-time hardware plus installation/ commissioning in the range of ~US$ 1,000 – 10,000 per site (depending on sensor scope and robustness), plus recurring data hosting/ connectivity/ support typically ~US$ 100 – 500 per site per month. Sustainability provisions are critical (ownership, who pays connectivity, maintenance responsibilities, and post-pilot support).

9.4.3 Workflow and knowledge tools cost estimates

In 9.3.3, examples of existing and developing workflow and knowledge tools that can improve overall system efficiency are presented, Due to the wide nature of applicability and use, these software tools tend to be higher cost both upfront and annual maintenance. Initial investments can range in the hundreds of thousands in US dollars. Maintenance cost of the software systems developed or repurposed should also be taken into account and that can be upwards of 10% or more of the initial cost.

9.4.4 Summary

The average estimated costs are summarised in Tables 9.1 and 9.2 for common usage of digital technologies and the actual numbers can vary substantially from application to application within the RACHP sector and between parties and region.

Table 9.1: Summary of average estimated cost for each approach (US$)

Type	Description	Upfront set-up US$	Monthly on-going US$
1	Efficiency improvement	Varies, up to $50k	$50-$200/tech
2	Performance tools	~$10k	Up to $200/tech
3	Knowledge tools	Varies, up to $1250k	~$25k

Table 9.2: Summary of average estimated cost for the different options[90] [91] [92] [93] (US$)

Type	Typical use case	Unit basis	One-time integration (US$)	Recurring (US$/year)	Key cost drivers / notes
1A	Certification registry & training management	Per country programme	$10k–$30k Up to $50k+ (case specific	$3k–$10k $15k+	Adapting existing platforms, localization, user base, multi-agency integration, data migration, hosting/support model; offline-first where needed
1B	Technician servicing records / field-service app	$1.0k–$10k (org setup)	$0.5k–$5k (org setup)	$24–$120 per tech, enterprise plans were used	Licenses/support, onboarding, BYOD can reduce device cost, add devices/data plans if required, offline first with periodic sync
2A	Digital job-quality tools (leak workflows, QA dashboards)	Per tech or targeted programme	$1k–$10k (programme setup)	$60–$240 per tech	Scope of features, QA, supervisor/admin capacity
2B	Targeted monitoring/IoT for optimization & fault alerts	Per monitored system/site	$1k–$10k per site	$1.2k–$6k per site	Sensors/gateway, installation, connectivity, maintenance; sustainability provisions critical
3	Workflow/knowledge tools supporting servicing evidence & verification	Per country programme or shared platform	$25k–$150k	$10k–$50k	Interoperability, QA, governance, long-term ownership/support

[90] https://sprinto.com/blog/grc-pricing/

[91] https://buildops.com/resources/field-service-software-pricing/

[92] https://fieldservicepro.io/blog/cost-of-field-service-management-software/

[93] https://www.getmonetizely.com/articles/how-much-does-iot-integration-cost-breaking-down-pricing-for-connected-devices

10 Estimated Funding to Support Pilot Projects to Enhance Regional Atmospheric Monitoring

10.1 Introduction

Paragraph 2(e) of Decision XXXVII/6 requests the TEAP to provide "a scenario to allocate resources for a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP, taking into account decision XXXVI/1 and any other decisions of the meeting of the parties and the Executive Committee."

In order to respond to this request, the RTF considered the referenced Decision XXXVI/1 and other relevant decisions of the MOP and the ExCom which are listed in Table 10.1 and summarised in Annex 8:

Table 10.1: List of relevant MOP and ExCom decisions and other materials related to enhancing atmospheric monitoring

MEETING		DECISIONS AND RELATED REPORTS
2025	26-30 May 96th ExCom	ExCom Decision 96/56
2024	4-8 Dec 95th ExCom	ExCom Decision 95/97
	28 Oct-1 Nov 36th MOP	Decision XXXVI/1: Enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer
2023	23-27 Oct 35th MOP	Decision XXXV/14: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer
2021	23-29 Oct 33rd MOP	Decision XXXIII/4: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol *SAP Report on the Unexpected Emissions of CFC-11 (2021)* *SAP White Paper: Closing the Gaps in Top-Down Regional Emissions Quantification: Needs and Action Plan (2020) (UNEP/OzL/Conv.ResMgr/11/4/Rev.1)*
2019	4-8 Nov 31st MOP	Decision XXXI/3: Unexpected emissions of CFC-11 and institutional processes to be enhanced to strengthen the effective implementation and enforcement of the Montreal Protocol *Decision XXX/3 TEAP Task Force Report on Unexpected Emissions of CFC-11 – Final Report (September 2019)*
2018	5-9 Nov 30th MOP	Decision XXX/3: Unexpected emissions of trichlorofluoromethane (CFC-11)

10.2 Background

In 2018, a study published in *Nature*[94] reported an unexpected, global increase in global emissions of trichlorofluoromethane (CFC-11) after 2012. The study strongly suggested a concurrent increase in CFC-11 emissions from eastern Asia although the contribution of this region to the global increase was not quantified. The study also suggested that the CFC-11 emissions increase arises from new production that had not been reported to the OS, which is inconsistent with the agreed phase-out of CFC production by 2010. In response to these scientific findings of an unexpected increase in global emissions of CFC-11 after 2012, parties to the MP were compelled to act through decisions to identify and quantify the unexpected emissions, attribute them, and ensure that the recovery of the ozone layer was not jeopardized. Parties have adopted a number of decisions, realizing the importance of beginning to address the gaps in global coverage of atmospheric monitoring of controlled substances under the MP to ensure a sustained phaseout and phasedown is achieved. The latest decision and information are discussed below, and other decisions are summarised in Annex 8.

10.2.1 Decision XXXVI/1: Enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer (2024)

At MOP-36 in 2024, parties adopted "Decision XXXVI/1: Enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer" which included the following:

1. *To request the Ozone Secretariat, in consultation with the Advisory Committee of the General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention for the Protection of the Ozone Layer, to organize activities for the specific purpose of evaluating the suitability of potential sites for monitoring regional emissions of controlled substances with a 2025 budget line item of 400,000 United States dollars from the cash balance of the Trust Fund for the Montreal Protocol on Substances that Deplete the Ozone Layer, on an exceptional basis, and to request the Ozone Secretariat to report to the Open-ended Working Group of the Parties to the Montreal Protocol at its forty-seventh meeting and the Thirty-Seventh Meeting of the Parties to the Montreal Protocol on progress and any outcomes of those activities for review by the parties;*
2. *To also request the Ozone Secretariat to support the work of the Advisory Committee of the General Trust Fund in mapping possible locations for monitoring controlled substances using existing facilities that are currently being used to monitor other substances and reaching out to other organizations to determine possible interest in coordinating monitoring or sharing monitoring facilities;*
3. *To invite parties to the Vienna Convention to:*
    a. *Request the Ozone Secretariat, in consultation with the Advisory Committee of the General Trust Fund, to carry out projects to evaluate the suitability of potential sites for monitoring regional emissions of controlled substances, taking into consideration the following aspects:*
        i. *The suitability of potential sites, in consultation with the party concerned, for providing regionally representative data covering areas in which controlled substances are produced, used or emitted in substantial volumes at measurable concentration levels, while addressing existing gaps in atmospheric monitoring and avoiding duplication with the coverage of existing and planned monitoring sites;*

[94] Montzka, S. *et al.,* An unexpected and persistent increase in global emissions of ozone-depleting CFC-11, *Nature*, 2018, **557**, 413-417. https://doi.org/10.1038/s41586-018-0106-2

ii. *The potential for partnering with scientific institutions that can provide personnel for or technical expertise in the collection, management and analysis of data or other in-kind contributions;*
iii. *The potential cost savings and other benefits of relying on existing infrastructure and/or monitoring networks;*
iv. *The capacity to coordinate the calibration of equipment and validation of data with other controlled substance monitoring stations and networks;*
v. *The sharing of data between monitoring stations and the potential to integrate new monitoring capability and newly obtained data into existing monitoring and data networks;*
vi. *The importance of consulting with the relevant party prior to undertaking exploratory measurements at potential monitoring locations;*

b. *Add the atmospheric monitoring of controlled substances as a purpose of the General Trust Fund;*
c. *Confirm that the Advisory Committee of the General Trust Fund can include additional experts on the monitoring of controlled substances;*
d. *Entrust the Ozone Secretariat to modify the terms of reference of the General Trust Fund and of its Advisory Committee, in accordance with the present decision;*
e. *Request the Advisory Committee of the General Trust Fund to accept guidance and to report on its progress to the Thirty-Seventh Meeting of the Parties to the Montreal Protocol and to subsequent meetings of the parties;*

4. *To request the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to consider a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol, guided by the scientific advice of the Advisory Committee of the General Trust Fund in relation to the location and establishment of new monitoring facilities, and to report to the Thirty-Seventh Meeting of the Parties on work carried out to develop such a funding modality for further consideration;*

5. *To also request the Ozone Secretariat to provide any updates with regard to its cost estimates and options for long-term financing associated with enhancing atmospheric monitoring, as provided for under decision XXXV/14, for consideration by the Thirty-Seventh Meeting of the Parties.*

10.2.2 Progress in 2025: 10 selected locations

At OEWG-46 in 2025, the OS provided updated information[95] on the EU-funded pilot project that established a flask-sampling site on Bhola Island, Bangladesh. The measurement programme on Bhola Island was started in February 2023 and has successfully monitored more than 40 halogenated gases (controlled substances and related gases), with the flask sampling and analysis of data being managed by the University of Bristol in collaboration with the University of Dhaka. In late 2024, the steering committee decided to extend the measurement programme until the middle of 2025 to further assess issues related to the effectiveness of sampling frequency on the accuracy of quantified regional emissions and the suitability of regional locations for the establishment of potential sampling sites. The pilot project was completed in December 2025.

In 2025, the steering committee identified 10 locations based on an analysis of estimates of potential regional emissions (derived from information on population distribution, locations of potential emissive industries/activities and regions of high economic activity or growth) and prevailing atmospheric winds in regions currently not sampled. The identified and selected locations are: Southern Asia (India/Bangladesh), South-East Asia (Viet Nam), Southern Africa (Botswana/South

[95] UNEP/OzL.Pro.WG.1/47/2/Add.1, paras. 54-64. https://ozone.unep.org/system/files/documents/OEWG-47-2-Add-1E.pdf

Africa), Middle East (Saudi Arabia), and Central/Southern South America (Brazil/Argentina). Other potential regions examined are: North Africa (Algeria), North America (Mexico), Northern South America (Ecuador), Easter Europe (Russian Federation), and West Africa (Nigeria). Work to conduct observing system simulation experiments at the ten locations identified by the steering committee is currently ongoing, as is work on mapping existing stations and infrastructure in those locations by the OS, the WMO and other partners.

The OS also reported on progress in implementing Decision XXXVI/1.[96] Activities included a revised structure and new members endorsed by the General Trust Fund (GTF) Advisory Committee at its seventh meeting on 6 March 2025. Work on the terms of reference of the Advisory Committee was ongoing. The decision also provided the OS with a 2025 budget line item of $400,000 from the cash balance of the Trust Fund for the MP, on an exceptional basis, to organize activities for the specific purpose of evaluating the suitability of potential sites for monitoring regional emissions of controlled substances. Part of this funding also supported the development of the 2024 costing model and its further refinement in 2025. Based on various inputs, the model calculates the annual breakdown of estimated capital and operational costs with their low and high range of values reflecting costs of establishing and operating one monitoring site across different regions in the world.

10.2.3 Cost estimate modelling

At MOP-37 in 2025, the OS reported on further progress in implementing Decision XXXVI/1 in an addendum[97] to its note and provided a document, "Updates to the cost estimates associated with enhancing regional atmospheric monitoring of substances controlled by the Montreal Protocol,"[98] which updated its cost model for 2025 to be more realistic using a phased monitoring approach with the following steps:

> **Step 1**: Observing System Simulation Experiments analysis to assess site suitability on the basis of atmospheric transport patterns;
>
> **Step 2**: after the selection of a site based on the Observing System Simulation Experiments analysis, start of the measurement programme with a survey period for the collection of six months' worth of data through flask sampling at a frequency of two samples per week (approximately 60 samples, including some duplicate samples to check reproducibility) to verify operability, site representativeness and basic logistics;
>
> **Step 3**: subject to satisfactory performance after the survey period, continue the measurement programme with flask sampling for two years at a frequency of every two days (approximately 200 samples per year), regarded by Advisory Committee experts as the default operational setting in view of the need for balance between data value and cost/logistics;
>
> **Step 4**: transition to high-frequency in situ measurements (approximately 4,400 samples per year) or daily flask sampling (approximately 440 samples per year), provided that the programme objectives have been justified during the survey and the two-year flask sampling period (steps 2 and 3).

The paper considers nine cost categories considered for the establishment and operation of a measurement programme at a site. A short description of all nine cost categories along with key revisions made per category are provided and are further disaggregated to a total of 36 cost items, with

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[96] UNEP/OzL.Pro.WG.1/47/2, paras. 25-40. https://ozone.unep.org/system/files/documents/OEWG-47-2E.pdf

[97] UNEP/OzL.Pro.37/2/Add.1, paras. 20-60. https://ozone.unep.org/system/files/documents/MOP-37-2-Add-1E.pdf

[98] UNEP/OzL.Pro.37/INF/6. https://ozone.unep.org/system/files/documents/MOP-37-INF-6.pdf

the corresponding low- and high-cost ranges of capital and operational costs. The revised 2025 capital and operating cost estimates for a measurement programme resulting in the establishment and operation of a high-frequency in situ station or a daily manual flask-sampling station at one monitoring site over a five-year period were presented:

- High-frequency in situ station over a five-year period: US$ 1.082 million to US$ 2.437 million
- Daily manual flask sampling station over a five-year period: US$ 548,400 to US$ 1,432,800.

As reported by the OS at MOP-37,[99] the status of existing and potential financial options that are currently available to support work on atmospheric monitoring of controlled substances are the following:

1. **Pending EU grant to the GTF (€ 4.5 million, or approximately US$ 5.2 million)**. Assuming that the grant is approved in the first half of 2026, it is expected to support:
    a. Work regarding site selection for three selected locations (i.e. Observing System Simulation Experiments), in 2026, estimated to last about six months. Although experiments have already been carried out for 10 locations under the EU-funded pilot project, a decision on the exact location of a site, in consultation with the host country, may require additional experiments;
    b. Survey sampling for six months' worth of data at the three selected sites to ensure their suitability;
    c. Flask sampling every other day for two years at the three selected sites, or possible early transition to the establishment of a high-frequency in situ station if one of the sites is found to be exceptionally good;
    d. Continuation of the measurement programme (through high-frequency in situ or daily flask sampling) subject to the availability of the grant funds;
2. **Possible funding window under the MLF**. In line with paragraph (c) of Decision 96/56, the ExCom will consider establishing a funding window for three pilot projects to enhance regional atmospheric monitoring of controlled substances at ExCom-98 in June 2026.

A representative of the OS and of the Advisory Committee of the GTF presented their progress relevant to Decision XXXVI/1 at the high-level segment of MOP-37.[100]

10.2.4 Relevant Executive Committee decisions

In paragraph 4 of its decision XXXVI/1, the 36th MOP requested the ExCom "to consider a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol, guided by the scientific advice of the Advisory Committee of the [GTF] in relation to the location and establishment of new monitoring facilities, and to report to the [37th MOP] on work carried out to develop such a funding modality for further consideration."

10.2.4.1 Decision 95/97

At ExCom-95 in December 2024, the ExCom adopted Decision 95/97[101] requesting the MLFS "to prepare a paper for the 96th meeting on options for a funding modality as referred to in paragraph 4 of decision XXXVI/1 to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol, guided by the scientific advice of the

[99] UNEP/OzL.Pro.37/2/Add.1, paras. 20-60. https://ozone.unep.org/system/files/documents/MOP-37-2-Add-1E.pdf

[100] https://ozone.unep.org/system/files/documents/MOP37-agenda-item6-presentation.pdf

[101] UNEP/OzL.Pro/ExCom/95/94, paras. 444 and 445. https://www.multilateralfund.org/api/drupal-documents/download/file/b2acd4ea-c2d0-4fc2-9311-0602f425ba06?filename=9594.pdf

Advisory Committee of the General Trust Fund for Financing Activities on Research and Systematic Observations Relevant to the Vienna Convention in relation to the location and establishment of new monitoring facilities."

In response to ExCom Decision 95/97, the MLFS prepared a paper, "Options for a funding modality as referred to in paragraph 4 of Decision XXXVI/1 to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol."[102]

The paper considers establishing funding window for pilot projects to gain experience with these kinds of activities. Specifically, a funding window of US$10 million could support the establishment and operation of three pilot regional atmospheric monitoring stations for five years, with the possibility of augmenting the funding window at a future meeting. The indicative costs include the following and summarised in Table 10.2:

- **Project preparation costs**: for each of the three monitoring sites, a two-year flask sampling survey (US $250,000), possible travel of an Advisory Committee member (US $10,000), and preparation of a site-specific proposal based inter alia on the results of the survey (US $150,000), resulting in **total preparation costs of US $1,230,000**;
- **Establishment and operation of three stations**: The costs to establish three high-frequency monitoring stations and operate those stations for five years based on the estimates provided in table 1 of document UNEP/OzL.Pro.WG.1/46/2/Add.1, assuming two of those stations would be at sites where existing infrastructure already exists, and including annual personnel costs (including overhead) per station of US $100,000, and 10 per cent contingency, resulting in costs of **US $4,675,000 for three stations**;
- **Training and technical assistance at three stations**: annual trainings and technical assistance of US $30,000 per station, per year, resulting in costs of **US $450,000 for three stations over five years**;
- **Technical assistance for data storage and data management:** US $150,000 for each site to build capacity for data archiving and stewardship protocols, and to assist sites to make their data available according to FAIR data principle, resulting in costs of **US $450,000 for three stations**;
- **Flask sampling support to one region**: to build capacity of A5 countries in one region, US $175,000 per year to support to a regional laboratory to analyze samples from countries in the region, and US $500,000 to support periodic flask sampling in five countries in that region, resulting in costs of **US $1,375,000 for periodic flask sampling in five countries over five years**;
- **Support for calibration standards, measurement support software and an international conference on lessons learned**: technical assistance to support common calibration standards and support for an international conference to share lessons learned and best practices (**US $1,000,000**); and
- **Agency support costs**: calculated at **9.6 per cent of the project costs**.

[102] UNEP/OzL.Pro/ExCom/96/62. https://www.multilateralfund.org/api/drupal-documents/download/file/b745fd1a-eaa4-48f4-bbb2-ccada7b8aa17?filename=9662.pdf

Table 10.2: Indicative costs for a funding window for pilot stations and support over five years (US$)

	One pilot station	Three pilot stations
Project preparation	410,000	1,230,000
Establishment and operation	1,558,333	4,675,000
Training and technical assistance	150,000	450,000
Data storage and management	150,000	450,000
Agency support costs (9.6%)	217,760	653,280
SUBTOTAL FOR PILOT STATIONS	**2,486,093**	**7,458,280**
Flask sampling support (one region)	-	1,375,000
Support for calibration standards (global)	-	1,000,000
Agency support costs (9.6%)		228,000
SUBTOTAL FOR REGIONAL/GLOBAL PROJECTS		**2,603,000**
TOTAL		**10,061,280**

10.2.4.2 Decision 96/56

At ExCom-96 in May 2025, the ExCom adopted Decision 96/56[103] noting the above options paper and requesting the MLFS prepare for ExCom-98 the following:

- Draft guidelines for the preparation of pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP in regions that the parties to the MP had identified as being able to enhance understanding of regional emissions of controlled substances;
- Draft guidelines for the implementation of pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP in regions that the parties to the MP had determined as being able to enhance understanding of regional emissions of controlled substances;
- A draft template Agreement between the ExCom and the A5 country concerned for pilot projects to establish a regional atmospheric monitoring station;
- Information regarding the potential for the World Meteorological Organization to take on a role as implementing agency for pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP; and

[103] UNEP/OzL.Pro/ExCom/96/66, paras. 284-300. https://www.multilateralfund.org/api/drupal-documents/download/file/e68ad11a-f7c4-489c-ad51-cf948c61614e?filename=9666.pdf

- At the 98th meeting in June 2026, the ExCom would consider establishing a funding window for three pilot projects to enhance regional atmospheric monitoring of substances controlled by the MP.

10.3 RTF approach on funding scenario

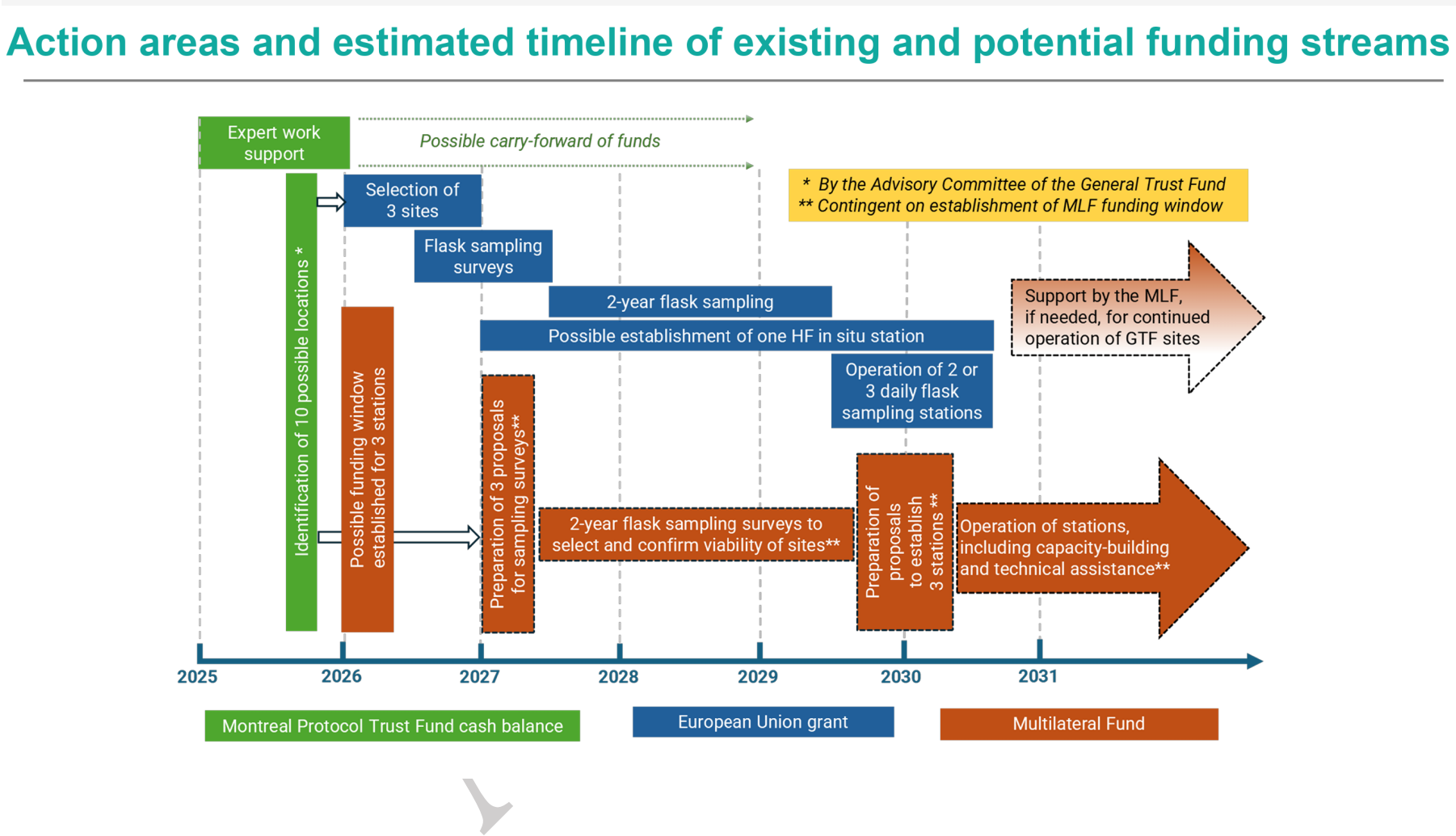
Decision XXXVII/6 requests TEAP to provide "a scenario to allocate resources for a funding modality to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol." The RTF considered the above, relevant decisions of the MOP and ExCom along with relevant documents and discussions related to support for enhancing regional atmospheric monitoring.

The RTF considered a funding timeline based on the OS's report on Decision XXXVI/1 to the 37th MOP which outlined the potential timeline of supported activities as below, assuming the ExCom established a funding window at its 98th meeting in June 2026:

1. Preparation of preparatory funding requests for three proposals by the MLF bilateral and Ias on behalf of A5 parties based on possible sites suggested by the Advisory Committee in 2027;
2. Sampling survey of candidate sites for approximately six months using a twice-weekly flask sampling and a two-year, every-other-day flask sampling to confirm the suitability of the site and determine whether regular flask sampling or high-frequency in situ measurements would be more appropriate in the long-term;
3. Submission of proposals in 2030 by the bilateral and/or IAs on behalf of three A5 parties to establish atmospheric monitoring stations on the basis of the sampling survey results;
4. Upon approval by the ExCom establishment in late 2030 or 2031 of three atmospheric monitoring stations (with a high-frequency in situ instrument or flask sampling) and support for their operation. Support would also be provided for capacity-building (e.g., related to calibration, data archiving and stewardship, support for participation in meetings led by the Advanced Global Atmospheric Gases Experiment (AGAGE) or other international halocarbon scientific research meetings, etc.);
5. Upon completion of the EU grant and if necessary, support could be provided by the MLF for the continued operation of the three stations established under the GTF.

A schematic of these activities and estimated timeline of the three funding streams is presented in Figure 10-1.

Figure 10.1 Action areas and estimated timeline of the three existing and potential funding streams to support the establishment and operation of stations for the atmospheric monitoring of controlled substances



The RTF considered the paper prepared by the MLFS in response to ExCom Decision 95/97, "Options for a funding modality as referred to in paragraph 4 of Decision XXXVI/1 to support a limited number of pilot projects to enhance regional atmospheric monitoring of substances controlled by the Montreal Protocol."[104] The paper considers establishing a funding window for pilot projects to gain experience with these kinds of activities. Specifically, a funding window of US$10 million could support the establishment and operation of three pilot regional atmospheric monitoring stations for five years, with the possibility of augmenting the funding window at a future meeting.

Assuming the establishment of a funding window at ExCom-98 in the amount of US$ 10 million, the RTF estimated funding for the 2027-2029 triennium would need to initially cover project preparation activities, specifically the costs for two-year sampling surveys for three sites at a total cost of US$ 850,200 (including 9.6 % agency support costs). The two-year flask sampling surveys will be used to select and confirm the viability of the sites.

The RTF considered that funding in the next triennia 2030-2032 will be based on selection of the sites and preparation of proposals for their establishment and operation, training and technical assistance support, support for data management and storage, regional flask sampling training, and support for calibration standards. The RTF considered a funding scenario, based on the revised 2025 estimated costs for establishment and operation of the one high-frequency in situ monitoring site over a five-year period presented in table 1 of document UNEP/OzL.Pro.37/2/Add.1. Including annual personnel costs (including overhead) per station of US $100,000, and 10% contingency, the resulting range of costs for three stations over a five-year period would be **US$ 4,252,000 to US$ 9,126,300**.

Allocation of the funding window for the 2027-2029 and 2030-2032 periods is shown in Table 10.3.

Table 10.3: Indicative Costs (US$) for 2027-2029 and Future Triennia for a Funding Window for Pilot Stations Over Five Years

	Pilot Station Cost for Five Years (US$)		Triennium
	Three pilot stations US$	With 9.6% agency support costs US$	
Project preparation – sampling surveys	780,000	854,880	2027-2029
Project preparation – site-specific proposal	450,000	493,200	2030-2032
Establishment and operation	3,869,320 - 8,304,900	4,240,775 - 9,102,170	2030-2032
Training and technical assistance	450,000	493,200	2030-2032
Data storage and management	450,000	493,200	2030-2032
Flask sampling support (one region)	1,375,000	1,642,630	2030-2032
Support for calibration standards (global)	1,000,000	1,507,000	2030-2032
TOTAL	**9,724,885 – 14,586,280**		

[104] UNEP/OzL.Pro/ExCom/96/62. https://www.multilateralfund.org/api/drupal-documents/download/file/b745fd1a-eaa4-48f4-bbb2-ccada7b8aa17?filename=9662.pdf

10.4 Estimated funding for regional atmospheric monitoring for 2027-2029 and 2030-2032

Table 10.4 provides the estimated funding for a funding window for pilot stations for the 2027-2029 and future triennia.

Table 10.4: Indicative Costs for 2027-2029 and Future Triennia for a Funding Window for Pilot Stations Over Five Years (US$)

	2027-2029	2030-2032
Regional Atmospheric Monitoring (including 9.6% agency support costs)	**$ 854,880**	**$ 8,870,005 – 13,731,400**
Subtotal – Regional Atmospheric Monitoring	**$ 854,880**	**$ 8,870,005 – 13,731,400**

11 Estimated Total Funding Requirements for the 2027-2029 Triennium and Indicative Funding Estimates for Future Triennia 2030-2032 and 2033-2035

In this chapter, RTF summarizes the ranges of total estimated funding requirement for the replenishment of the MLF in the 2027-2029 triennium, including support costs, as presented in Table 11.1 and based on the estimated HCFC and HFC funding as in Tables 11.2 and 11.3 and estimated IS and SA funding as in Table 11.4.

Table 11.1: Range of total funding requirement for the replenishment of the MLF 2027-2029 based on different scenarios and resource allocation schedules, and IS and SA (US$ million)

2027-2029 Triennium	Low-end Range	High-end Range
SUBTOTAL – HCFC ACTIVITIES	451	573
SUBTOTAL – HFC ACTIVITES	702 – 781	970 – 1,053
SUBTOTAL – IS & SA	129	129
GRAND TOTAL	1,282 – 1,361	1,672 – 1,755

Table 11.2: Range of indicative funding requirement for the replenishment of the MLF in future triennia 2030-2032 and 2032-2035 (US$ million)

2030-2032 Triennium	Low-end Range	High-end Range
SUBTOTAL – HCFC ACTIVITIES	83	96
SUBTOTAL – HFC ACTIVITES	877 – 908	1,050 – 1,085
SUBTOTAL – IS & SA	137	137
GRAND TOTAL	1,097 – 1,128	1,283 – 1,318

2032-2035 Triennium	Low-end Range	High-end Range
SUBTOTAL – HCFC ACTIVITIES	-	-
SUBTOTAL – HFC ACTIVITES	488 – 503	583 – 600
SUBTOTAL – IS & SA	145	145
GRAND TOTAL	633 – 648	728 – 745

Table 11.2: Estimated funding requirement for HCFC phase-out for 2027-2029 and future triennia (US$ million)

Triennium	Sector	HCFC ESTIMATED FUNDING RANGE	
		HCFC Scenario 1	HCFC Scenario 2
2027-2029	HCFC Consumption sector with scenarios and resource allocations	427.56	549.44
	HCFC Production sector	23.54	23.54
	TOTAL HCFC RANGE	**451.10**	**572.98**
2030-2032	HCFC Consumption sector with scenarios and resource allocations	58.96	72.50
	HCFC Production sector	23.54	23.54
	TOTAL HCFC RANGE	**82.5**	**96.04**

Table 11.3: Estimated total funding requirement for HFC phase-down for 2027-2029 and future triennia (US$ million)

Triennium	Sector	HFC ESTIMATED FUNDING RANGE (US$ million)	
		Resource Allocation A	Resource Allocation B
2027-2029	HFC Consumption sector with scenarios and resource allocations	958 – 1,042	690 – 769
	HFC Production sector and HFC-23 mitigation	11.76	11.76
	TOTAL HFC RANGE	**970 – 1,053**	**702 – 781**
2030-2032	HFC Consumption sector with scenarios and resource allocations	876 – 907	1,049 – 1,084
	HFC Production sector and HFC-23 mitigation	0.51	0.51
	TOTAL HFC RANGE	**877 – 908**	**1,050 – 1,085**
2033-2035	HFC Consumption sector with scenarios and resource allocations	488 – 503	583 – 600
	HFC Production sector and HFC-23 mitigation	-	-
	TOTAL HFC RANGE	**488 – 503**	**583 – 600**

Table 11.4: Funding requirement for IS and SA in 2027-2029 and future triennia (US$)

	2027-2029	2030-2032	2033-2035
Institutional Strengthening	44,857,086	44,857,086	44,857,086
UNEP Compliance Assistance Programme	39,405,782	43,069,762	47,052,564
UNDP, UNIDO, World Bank Core Unit	18,432,779	20,141,995	22,009,702
ExCom, MLFS, M&E	24,934,851	27,246,985	29,773,516
Treasurer functions	1,500,000	1,500,000	1,500,000
SUBTOTAL - IS & Standard Activities	**129,130,498**	**136,805,828**	**145,192,869**

ANNEX 1: ESTIMATED FUNDING METHODOLOGY FOR HCFC CONSUMPTION SECTOR

This annex provides information on the estimated funding methodology for the HCFC consumption sector. For HCFCs consumption, the assessment considers funding estimates for the completion of HCFC phase out by 2030, with no new funding for the triennia after 2030, other than committed funding in approved HPMPs. In addition, funds are considered for HPMP verification, project preparation, and EE according to Decision 89/6 (LVCs). Implementing agency support costs were considered at an average of 9.6%. RTF also applied 15% deduction for foreign ownership in the manufacturing sector.

HCFC activities are approaching completion for most A5 parties, whereas HFC related activities, while progressing, remain at an earlier stage. The models are structured and customized to reflect the different stages of the two regimes while following to the extent possible the MLF project cycle, and consequently the required MLF Replenishment. The RTF also proposes a resource allocation suggestion in the 2027-2029 triennium and the following two triennia, for consideration of parties. The objective is to produce an assessment that is transparent, policy consistent, and with defensible funding projections, aligned with *compliance obligations* of A5 parties.

A1.1 Sources of Information

The RTF modelling approach consolidates data from the following sources:

- A7 consumption data as reported to the OS, as of January 2026.
- CP data submitted to the MLFS, as of 13 January 2026
- Information provided by the MLFS on approved HPMPs and KIPs, including agreed reductions from baseline consumption, funding and tranche schedules, project preparation and verification activities, as well as information on EE and the status of funding windows.
- ExCom documents and decisions, including cost guidelines, up to and including ExCom-97.
- Classification of LVCs based on HCFC and HFC baseline consumption (presented in Annex 5).
- BP, used to inform the RTF on future requests to IAs for projects to be submitted to MLFS, therefore guiding RTF to forecast potential new funding needed.
- Parties' ratification status of the KA, as of 8 April 2026 (Annex 6).

A1.2 HCFC Phase Out Funding Methodology for the Consumption Sector

The estimated funding requirements for the 2027-2029 triennium for the HCFC consumption sector include:

- Committed funding for approved HPMPs;
- New estimated funding required to achieve 100% phaseout of HCFCs;
- Funding for PRP;
- Funding for verification; and
- Funding for EE in line with ExCom Decision 89/6.

Some additional key assumptions made by the RTF for its estimates included:

- IAs' support costs were considered at an average of 9.6%, unless indicated otherwise;

- A 15% deduction was applied to account for ineligible foreign ownership in the manufacturing sectors (please see Caveat in section 1.6.10).

RTF treated the 144 A5 parties based on their HPMPs' approval and implementation status and grouped them accordingly, for funding calculation purposes. Funding for project preparation, verification, and EE are presented as separate lines. For HCFC, the model is simplified to encompass

new estimated funding calculations for the 25 parties that still need to complete their phaseout, and all the committed funding for all the other parties with approved HPMPs.

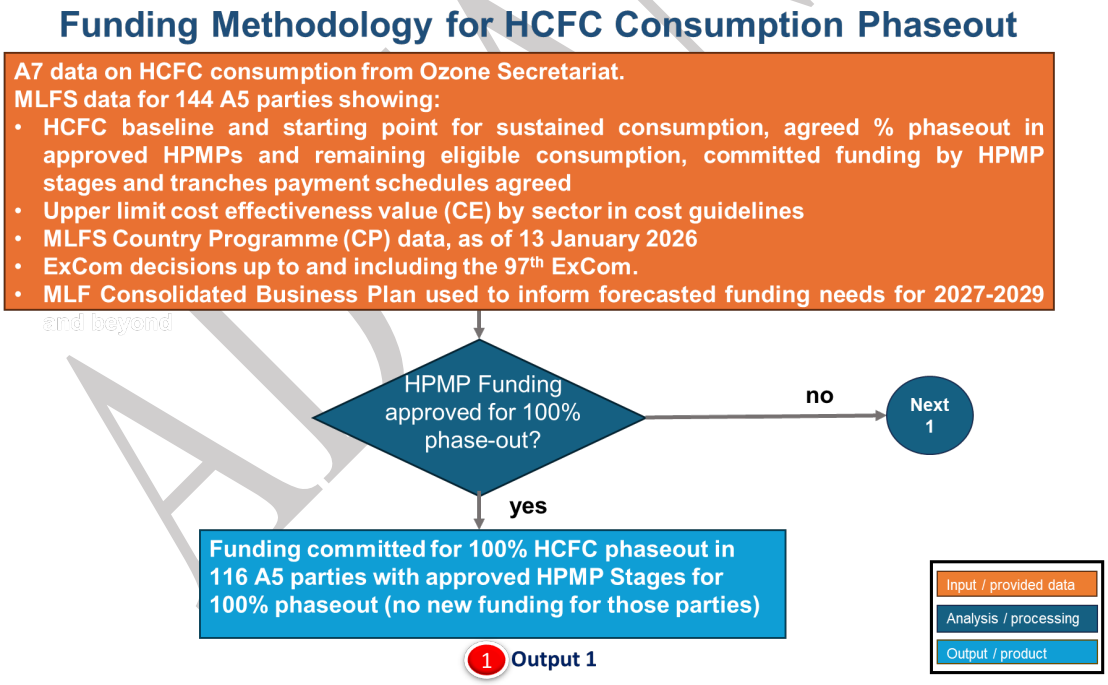
With the approaching HCFCs phaseout date and the HPMPs implementation progress, most of the 144 A5 parties have been assisted in addressing all HCFC phaseout targets. The number of parties that still need new funding is limited to 28, being 15 non-LVCs parties, 10 LVCs parties and three parties with cancelled HPMPs.

For this assessment, the RTF estimated funding approach grouped parties following their HPMP status following the steps below:

STEP 1. **Parties (116) with approved HPMPs with agreements with ExCom covering 100% of their phase out obligation**

Funding for those 116 parties has already been approved by the ExCom. Other than the funding already committed, no new funding is projected for those 116 parties, nor for 2.5% HCFC servicing tail for the ones with 2.5% remaining (one party). Committed funding amounts to **US$ 76.73 million in 2027 to 2029 triennium and US$ 20.13 million in 2030 to 2031 period**, as per information received from the MLFS. Funding commitments go only until 2031. This methodology step is shown in the Figure A1.1 flow chart below, and the committed funding is presented under **Output 1.**

Figure A1.1 Flowchart for estimating funding for Output 1: 116 parties with approved HPMPs for 100% phase-out



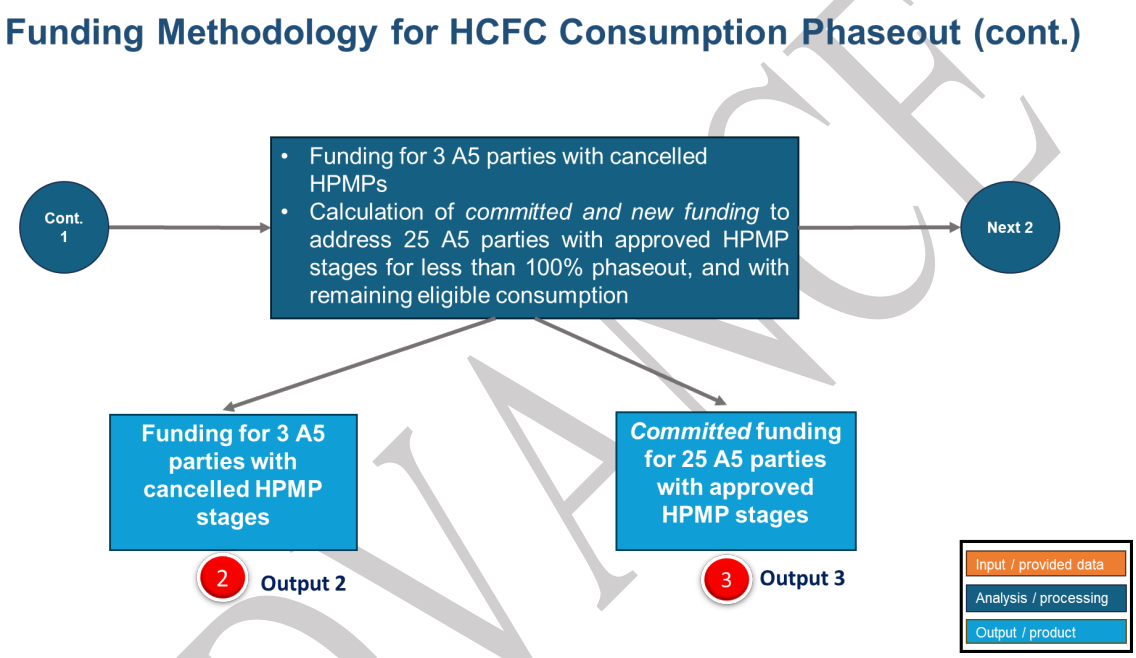
STEP 2. Funding for three A5 parties with cancelled HPMPs

This includes two LVC parties with baselines of 12 and 6.8 ODPt, and one non-LVC party, with a baseline of 158.2 ODPt. Funding requirements were calculated separately for LVC and non-LVC parties. For non-LVC parties, calculations were based on the CEs established in the applicable cost guidelines, while for the LVC parties, the cost framework as per ExCom Decision 74/50 was applied.

For the three parties with cancelled HPMPs, future funding requests remain uncertain and would depend on the preparation and subsequent approval of new submissions. To ensure completeness of the funding estimates and no party is left behind, the RTF calculated the funding needs for those three parties on the assumption that they can still request all eligible funds in the next triennium and achieve a 100% HCFC phaseout according to the control targets under the MP. Reduction estimates were based on reported 2024 HCFC consumption for the three parties.

This methodological step is shown in the Figure A1.2 flow chart below under **Output 2**, resulting in estimated funding requirements of **US$ 10.22 million in 2027-2029 and no additional funding assumed for subsequent triennia.**

Figure A1.2 Flowchart for Outputs 2 and 3: estimating funding for three cancelled HPMPs and committed funding for 25 parties with approved HPMPs less than 100% phase-out



STEP 3. **<u>Calculation of committed and new funding estimates for 25 parties with remaining eligible consumption, and with HPMP agreements that do not reach the complete phase-out</u>**

Step 3.1. **Committed funding** for HPMPs/stages approved for those **25 A5 parties**, where the phase-out has not yet been 100% completed is **US$ 1.33 million,** as provided by the MLFS. This methodology step is shown in the Figure A1.2 flow chart above, and committed funding is under **Output 3.**

Step 3.2. Estimated new funding for those 25 parties with Agreements with the ExCom approved for less than complete phaseout. These parties retain eligible consumption that needs to be addressed before 2030, and new funding is required. The remaining eligible HCFC consumption was provided by MLFS to RTF for each party, and new funding was calculated individually, to account for each party's own reduction schedule in the agreements. RTF used CP reports, as of January 2026, to inform on chemicals percentage (%) sector distribution in reported A7 data.

In the cases of eligible remaining consumption differing from the A7 data reported, the lower value from the most recent year reported was used. This approach reflects the agreed value-reduction as a reference for the country's actual achieved reduction level.

15 Non-LVC Parties out of total of 25 (Non-LVCs and LVC) parties

Out of the total of 25 parties, **15 are non-LVC.** For those, the CP indicated consumption mostly in servicing sector. For some parties, consumption was also reported in one or more manufacturing sectors, such as rigid PU foam, XPS foam, fire extinguishing, solvents, domestic AC, and other refrigeration and AC manufacturing sectors. For the largest consuming party among the A5 ones, eligible remaining consumption is only in three sectors: residential AC, industrial and commercial refrigeration and AC (ICR/AC), and servicing. Consumption in those three sectors was used for new funding estimates.

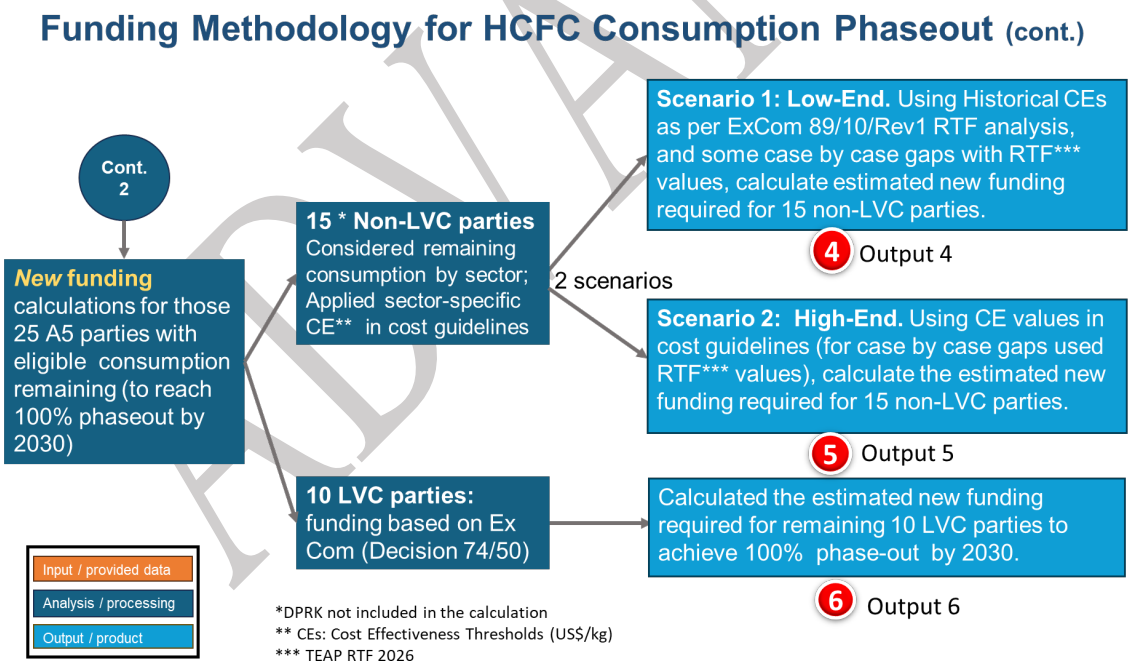
The methodology used for new funding calculations was based on sector CEs applied to remaining consumption (in tonnes) in each sector as per equation below.

For each party

$$\sum (\textit{eligible remaining consumption to be phased} - \textit{out by sector})\ x\ (\textit{sector cost} - \textit{effectiveness})$$

Decision XXXVII/6 on the TOR for the replenishment requested TEAP/RTF to consider funding estimates using cost guidelines and historical CE values for the manufacturing sectors, so a range can be provided. The following Figure A1.3 flow chart with scenarios addresses this request to the extent possible.

Figure A1.3 Flowchart for Outputs 4, 5, and 6: estimating new funding for 15 non-LVC parties (with two CE scenarios applied) and 10 LVC parties to reach 100% phase-out



Estimated Funding for 15 Non-LVC Parties: HCFC Scenario 1 - Using **historical CEs**, as per "RTF analysis of document ExCom 89/10/Rev1" in Annex 2, new funding was calculated for 15 non-LVC parties under **Output 4** in Figure A1.3.

For its analysis, RTF separated the largest consuming party (China) projects from the projects from the other 14 parties, for each sector, and extracted an average historical sector CE. Sectors with no remaining eligible consumption were discarded. Funds were calculated for eligible consumption for China in sectors other than foam, fire extinguishing, and solvents.

For **HCFC Scenario 1**, RTF applied the separate historical CEs, as described below, to estimate new funding. That is, total estimates are the sum of funding estimates for 14 parties plus a separate funding estimate for China.

The historical sector CEs applied to manufacturing sectors by RTF are in Table A1.1 below, and the estimated funding for these 15 parties for 2027-2029 is shown in Table A1.2.

Table A1.1 Historical CEs applied to manufacturing sectors for HCFC Scenario 1 (US$/kg)

HCFC Sector	XPS Foam	PU Foam	Fire Ext.*	ICR (Ind./Com Ref.& AC **	Residential AC	Solvents	Servicing
Historical CE (US$/kg) applied to 14 parties	5.74	7.37	4.8	14.57	10.05	10.51	4.8
Historical CE (US$/kg) applied to China				6.97	4.79		4.8

* RTF considered that in the fire extinguishing sector the activities are currently similar to the ones in the servicing sector (CE 4.8).
** RTF applied the average of the historical CE for Commercial Refrigeration (CE 10.96) and the one for Com. AC (CE 18.18), that can be found in RTF analysis of document 89/19/Rev1, as there is no information on historical Industrial Refr. and the AC in the document. For China RTF applied the average of the historical CE for Commercial Refrigeration in China (CE 9.15) and the one for Com. AC (CE 4.79), as in the RTF analysis document.

Table A1.2 2027 -2029 Funding Estimates for 15 parties with remaining HCFC consumption in different sectors (US$ millions)

Estimated Funding (in US$ million)	XPS Foam	PU Foam	Fire Ext.	ICR	Resid. AC	Solvents	Servicing	Total	Total (with 9.6% support cost)
1 party (China)	-	-	-	94.31	66.10	-	144.37	304.79	334.05
14 parties	0.10	0.36	0.06	6.11	0.00	2.11	49.75	58.49	64.11
Total for 15 parties	0.10	0.36	0.06	100.43	66.10	2.11	194.12	363.28	398.15
Total with 15% deduction*	0.08	0.31	0.05	85.36	56.18	1.79	194.12	337.90	370.34

* Includes 15% deduction for foreign ownership in manufacturing sectors

Estimated Funding for 15 Non-LVC Parties: HCFC Scenario 2 - Using CE values in cost guidelines (for some case-by-case sectors, CE gaps filled by RTF) calculated new funding estimates for 15 parties under **Output 5** in Figure A1.3.
In ExCom cost guidelines, domestic refrigeration (PU panel), foam and commercial refrigeration sectors have CEs defined. Other sectors, such as fire extinguishing, domestic AC manufacturing (room AC, domestic heat pumps) and other refrigeration and AC manufacturing (heat pumps, transport, chillers, industrial) are funded based on CEs defined on a case-by-case basis. For those cases, RTF used were suggested by TEAP/TOC/RTF expert members to fill gaps due to missing CEs for

individual sectors which are considered on a case-by-case in cost guidelines. Manufacturing sectors without remaining eligible consumption were disregarded. The CE values applied for scenario 2 are in Table A1.3 below.

Table A1.3: Cost Guidelines/ RTF CEs applied to Manufacturing Sectors for HCFC Scenario 2 (US$/kg)

HCFC Sector	XPS Foam	PU Foam	Fire Ext. *	ICR (Ind./Com Ref.& AC **	Residential AC***	Solvents ****	Servicing
CE applied to 15 parties (US$/kg)	8.22	7.83	4.8 (RTF)	15.21(RTF)	7.15 (RTF)	10.13(RTF)	4.8

* RTF considered that in fire extinguishing sector the activities are currently similar to the ones in servicing sector (CE 4.8). **For Commercial and Industrial Ref./AC, RTF applied the CE in cost guidelines for commercial refrigeration (15.21).
***For Residential AC, RTF applied CE of 7.15 $/kg (average of the CE for China, 4.74, and for projects elsewhere, 10.05 (Annex 2)
****RTF used CE of 10.13 for Solvents, using average of all projects in Solvents sector in document 89/10/rev1.

Estimated funding to address remaining consumption per sector for 15 non-LVC parties according to methodology explained above can be seen in Table A1.4 below. This scenario does not include the additional 25% for introduction of low-GWP alternatives allowed under decision 74/50(c)(iii) for those sectors with a CE threshold (PU foam and commercial refrigeration) and foam SMEs 40% additional funding.

Table A1.4: Funding estimates addressing 15 parties with remaining HCFC consumption in different sectors (US$ millions)

Estimated Funding (in US$ million)	XPS Foam	PU Foam	Fire Ext.	ICR	Resid. AC	Solvents	Servicing	Total	Total (with 9.6% SC)
Total for 15 parties	0.14	0.38	0.06	212.20	99.70	2.03	194.12	508.64	557.47
Total with 15% deduction*	0.12	0.33	0.05	180.37	84.75	1.73	194.12	461.46	505.76

* 15% deduction for foreign ownership in manufacturing sectors. Only sectors with remaining consumption for each individual party were considered.

10 LVC Parties (out of total of 25 non-LVCs and LVCs)

Out of 25 parties, **10 are LVCs.** For those**,** RTF estimated new funding considering a separate cost framework, as per ExCom Decision 74/50. New funding estimates are under **Output 6** in Figure A3. Based on the most recent reported data (2024), two parties have completed their phaseout processes. Considering the amounts already committed for the remaining eight countries, as well as the funding levels established under Decision 74/50 for phaseout, the total amount to be allocated to these countries is **US$ 2.56 million**.

The total estimated new funding for 25 parties (15 non-LVCs plus 10 LVCs) were calculated by adding the estimated funding for non-LVCs (Output 4 or 5) with the estimates for LVC parties (Output 6) and providing a range to parties based on two different CE scenarios.

That is, the total estimated funding for 25 parties (which have eligible remaining consumption to be addressed to reach complete phaseout) is:

- **For HCFC Scenario 1: US$ 372.90 million**
- **For HCFC Scenario 2: US$ 508.32 million**

Chapter 2 provides the following summary Table A1.5 for the total estimated funding for the HCFC consumption sector (including project preparation, verification, and EE funding). The ranges for the estimated funding for the HCFC consumption sector for 2027-2029 and 2030-2032 are derived by applying the HCFC scenarios 1 and 2 based on historical versus cost guidelines CEs, respectively, and considering Decision 62/17, and allocating funding resources 90% to 2027-2029 and 10% to 2030-2032. RTF believes that this methodology provides a consistent and transparent basis for estimating remaining funding requirements for complete phaseout of HCFCs, using information available based on actual implementation experience and the policy ceilings defined by existing cost guidelines.

Table A1.5: Range of estimated funding requirement for total HCFC consumption sector phase-out for 2027-2029 and 2030-2032 (US$ millions)

HCFC CONSUMPTION SECTOR	2027-2029 and 2030-2032 Total Estimated Funding for Complete Phaseout		Proposed Resource Allocation		Proposed Resource Allocation	
			2027-2029	2030-2032	2027-2029	2030-2032
	2 Scenarios Applying different CEs to manufacturing sectors		HCFC Scenario 1		HCFC Scenario 2	
	Scenario 1	Scenario 2	90%	10%	90%	10%
Funding Committed for Approved HPMPs	98.19*	98.19*	78.06*	20.13*	78.06*	20.13*
Estimated New Funding for Project Preparation (PRP)	0.0438	0.0438	0.04	0.00	0.04	0.00
Estimated New Funding to Address Remaining Consumption in 25 Parties for Complete Phaseout	372.9	508.32	335.61	37.29	457.49	50.83
Estimated New Funding for re-submission of 3 cancelled HPMPs	10.22	10.22	9.20	1.02	9.20	1.02
HCFC Verification Funding	1.77	1.77	1.59	0.18	1.59	0.18
Energy Efficiency Funding for LVCs (Decision 89/6)	3.4	3.4	3.06	0.34	3.06	0.34
Total for HCFC Consumption Sector	**486.52**	**621.94**	**427.56**	**58.96**	**549.44**	**72.50**

ANNEX 2: RTF analysis and proposal for historical CE values to be applied to HCFC manufacturing sectors for a funding scenario

The RTF consulted with parties and IAs in its efforts to identify robust CE values that could be used to establish average and historical CE ranges for funding estimates. Given the limited time available, and the availability constraints of RTF experts, the analysis relied primarily on the information contained in document UNEP/OzL.Pro/ExCom/89/10/Rev1.

The RTF found that the information presented in the document was not always representative of all parties owing to the diversity of projects and applications across different geographic regions, as well as difference in market conditions and the structure and size of enterprises. In several cases, the document combined multiple manufacturing subsectors into a single category, making it difficult to separate CE values for individual subsectors.

Nevertheless, the RTF reviewed document ExCom 89/10/Rev1 in detail and extracted information considered sufficiently robust for the purpose of deriving, at a minimum, average CE values for the RTF funding estimates. The RTF also separated projects in China from those in other parties in order to avoid deriving CE values that might not be representative of markets, enterprise structure, and size of enterprises.

Table A2.1 below presents the RTF compilation of information extracted from ExCom 89/10/Rev1. Only projects that provided clear CEs values for single sectors were included, while projects covering multiple subsectors were excluded. For instance, projects that combined residential AC with commercial AC and refrigeration applications under a single CE value were not considered in the analysis.

Table A2.1: RTF Analysis of CE Information contained document ExCom 89/10/Rev1, "HCFC Phaseout Investment Projects in different Sectors in HPMPs Stage I and II"*

Parties (number of enterprises)	Manufacturing Sector	Replacement Technology	CE Range (project with the lowest and the highest CE)	CE Average (US$/kg)
	Air Conditioning			
9 parties, excluding China, (40 enterprises)	Room AC	HFC-32, R-410A, R-290	6.14 – 15.71	10.05
China (2 projects/# of enterprises TBD)	Room AC	R-410A and R-290	1.63 – 8.68	4.74
2 parties excluding China, (6 enterprises)	Commercial AC	HFC-32	10.33 – 31.84	18.18
China (1 project /# enterprises TBD in another)	Commercial AC	R-410A, HFC-32 and HFC-134a	No range	4.79
	Refrigeration			
6 parties, excluding China, (108^{+} enterprises)	Commercial Ref.	R-290, R-410A, R-404A, R-32/ CO_2/ NH_3/HC/ R600a/ CO_2,	4.8 – 16.19	10.96

		HFOs pure/blends/low GWP		
China (5 enterprises)	Commercial Ref.	NH_3/ CO_2, NH_3, HFC-134a, CO_2	No range	9.15
	Foam			
46 parties, excluding China (900 + enterprises)	PU Foam	Cyclopentane/MF, Cyclopentane, Water/CO_2, Pre-blended HC, HFO, MF, Pentane, Methylal, Cyclopentane and n-pentane, HFC-245fa	5.12 – 9.89	7.37
China (54+ enterprises in 2 projects)	PU Foam	Cyclopentane, Water, HFO	No range	4.96
8 parties, excluding China (19 enterprises)	XPS Foam	CO_2/DME/HFO, HFO/DME, HFC-152a, Isobutane, HFC-152a/DME, CO_2/DME	2.14 – 13.24	5.74
China (149 enterprises)	XPS Foam	CO_2/DME	4.68 – 4.72	4.70
	Other Sectors			
2 parties, excluding China (3 projects)	Solvents	HFC-365mfc, Perchloretylene/ HFC-152a, HFO-1233zd(E))	3.19 – 21.47	10.51
China (5 projects)	Solvents	KC-6, HC, HFE, HC/HFE solvents, HC/HFE formulations	7.97 – 15.04	11.42
1 party, 1 project on technical aerosol products	Aerosol	HC, HFC-152a, HFC-134a, HFC-365mfc/HFC-227ea	No range	3.8

*System house foam projects and demonstration projects in general were not included

ANNEX 3: Methodology for Filling Baseline Data Gaps - Estimates and Assumptions

Parties that have ratified the KA are required to report on the import, export, and production of HFCs and HCFCs to the OS under A7. The list of A5 parties that have ratified the KA continues to increase rapidly. As of 8 April 2026, 119 A5 parties in G1 and six A5 parties in G2[105] had ratified the KA.

Baseline and Control Measures

For A5 G1 parties, KA baselines are calculated as an average HFC consumption for the years 2020-2022. HFC consumption is defined as production plus import minus export, expressed in metric tonnes for each chemical and multiplied by the respective GWP to obtain total carbon dioxide equivalent (CO_2eq) values. The average CO_2eq values for each chemical are then aggregated to determine the HFC baseline component. The HFC baseline component is subsequently added to the HCFC baseline component, which is calculated as 65% of the weighted average CO_2eq value of the chemicals used to establish the HCFC baseline.

KA baselines for A5 G2 parties are calculated using the same methodology as for G1 parties, except that the baseline period is based on the average HFC consumption for the years 2024-2026.

The HFC baseline formulas are as follows:

$$\text{Group 1 baseline} = \left(100\% \times \frac{HFC\ 2020 + HFC\ 2021 + HFC\ 2022}{3}\right) + (65\% \times HCFC\ Baseline)$$

$$\text{Group 2 baseline} = \left(100\% \times \frac{HFC\ 2024 + HFC\ 2025 + HFC\ 2026}{3}\right) + (65\% \times HCFC\ Baseline)$$

The baseline periods and corresponding control targets for both G1 and G2 parties are presented below.

Table A3.1: Baseline periods and control targets

	A5 Group 1	***A5 Group 2***
Baseline	2020-2022	2024-2026
Formula	Average HFC consumption	Average HFC consumption
HCFC	65% baseline	65% baseline
Freeze	2024	2028
1st step	2029 – 10%	2032 – 10%
2nd step	2035 – 30%	2037 – 20%
3rd step	2040 – 50%	2042 – 30%
4th step	2045 – 80%	2047 – 85%

Data Gaps

As of 6 May 2026, 113 eligible A5 parties in G1 had provided HFC baseline data to the OS. 11 parties reported some HFC use through the A7 reporting portal, with a complete dataset sufficient to establish baselines. An additional 13 parties had not reported any HFC data through the A7 portal. As the baseline years for G2 parties are still to be determined, their baselines were estimated by RTF.

HFC Data Analysis

Before estimating costs, the RTF analyzed several datasets, as summarised in Table A3.2 below, to ensure that the most detailed and complete data/information available was used in developing baseline estimates.

Table A3.2: Parties with A7 reporting for some, but not all, A7 HFC data but not all three years to estimate the HFC portion of the baseline

Available data	Missing data	Filling the Gap
Example 1: 2019 OS A7 data for Group 1 party	2020-2022	2019 increased by cumulative Gross Domestic Product (GDP) by year
100 tonnes; 1.03 GDP	2020 = 103 tonnes 2021 = 106.09 2022 = 109.27	HFC Contribution to Baseline = 106.12 tonnes
Example 2: 2021 OS A7 data for Group 2 party	2024-2026	2021 increased by cumulative Gross Domestic Product (GDP) by year
100 tonnes; 1.03 GDP	2024 = 109 tonnes 2025 = 112.55 2026 = 115.9	HFC Contribution to Baseline = 112.6 tonnes

Some parties provided HFC data through CP reporting to the MLFS, while others reported HFC data under A7 reporting requirements. Many parties reported both sets of data, whereas others were not yet required to report because they have not ratified the KA or belonged to the G2 compliance schedule.

Parties with complete data sets

A total of 113 G1 A5 parties provided sufficient HFC consumption data for 2020, 2021, and 2022 to calculate the HFC component of their baselines. For parties reporting complete three-year datasets, the RTF used that reported data to calculate the HFC baseline on a party-by-party basis and cross-checked the results against baseline values reported on the OS website.

Addressing Data Gaps

- ***Parties with A7 reporting some, but not all, A7 HFC data for baseline***

For parties that reported partial HFC data under A7 but did not provide complete datasets for all baseline years, missing values were estimated using national Gross Domestic Product (GDP) growth rates to extrapolate consumption[106] for the relevant earlier and later periods.

[106] Real GDP growth (Annual percent change) per the International Monetary Fund (IMF) by nationhttps://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD

- ***Parties not yet required to report***

For parties that have not reported any HFC data for any baseline year, the RTF applied a proxy estimation approach. This involved using year-on-year changes in national GDP[107] to extrapolate reported HCFC baseline data, thereby estimating a business-as-usual (BAU) trajectory for refrigerants and foam blowing agents from 2010 through baseline period. Actual HCFC consumption was then subtracted from the projected BAU scenario for the baseline years, with the difference assumed to have been converted either to HFCs or to other non-ODS alternatives.

The conversion factors from HCFCs to HFCs, as presented in **Tables A3.3-3.4,** were used to estimate HFC consumption in the baseline years based on the adjusted BAU HCFC values, not of continued use of HCFCs. An illustrative example of this methodology is provided in **Table A3.5**. The resulting HFC estimates were then used as a substitute for the missing HFC component of the baseline.

Table A3.3: Filling data gaps for parties that have not yet been required to report with only HCFC data available

Available data	Missing data	Filling the Gap
HCFC data from 2010 through 2021	HFC data for 2020, 21, 22	1. Grow HCFC Data from 2010 to 2020, 2021, 2022 by GDP 2. Subtract HCFC data from 2020 and 2021 3. Convert to HFC data per previously agreed upon assumptions
	or HFC data for 2024, 2025, 2026	1. Grow HCFC Data through 2026 by GDP 2. Reduce by compliance target for HCFC use 3. Convert to HFC data per previously agreed upon assumptions

[107] 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

Table A3.4: Filling data gaps for parties that have not yet been required to report: HCFC conversion factors to HFCs

Factors used for substituting reported A7 HCFC data with HFCs for baseline estimates	HCFC-22		HCFC-141b	HCFC-142b
	Commercial Refrigeration	AC	FBA	XPS
HFC-125	12%	33%		
HFC-134a	3%			5%
HFC-143	0%			
HFC-143a	12%			
HFC-23	0%			
HCFC-22				
HFC-32	7%	33%		
HFC-245FA			30%	
HFC-365MFC			10%	
HFC-152a				2%

Table A3.5: Example of HCFC conversion factors to HFCs

Available data	Missing data	Filling the Gap
100 Tonnes HCFC-22	HFC data	For refrigeration: 12 tonnes HFC-125 3 tonnes HFC-134a 12 tonnes HFC-143a 7 tonnes HFC-32
		For Air conditioning: 33 tonnes HFC-125 33 tonnes HFC-32

Results

To account for uncertainty in growth trends during periods with limited or missing data, a higher-case estimate was developed. Under this approach, estimated baselines for parties that had not yet reported baseline data were increased by 30%. This adjustment resulted in an additional estimate for the overall phasedown of approximately 4.5%, which in turn is projected to affect funding requirements for the next triennium by approximately 1.5%.

Using the available data and the methodologies described above, the estimated HFC consumption and the aggregate HFC baselines for parties are shown by bracket in Table A3.6.

Table A3.6: Estimated and Reported HFC Baselines

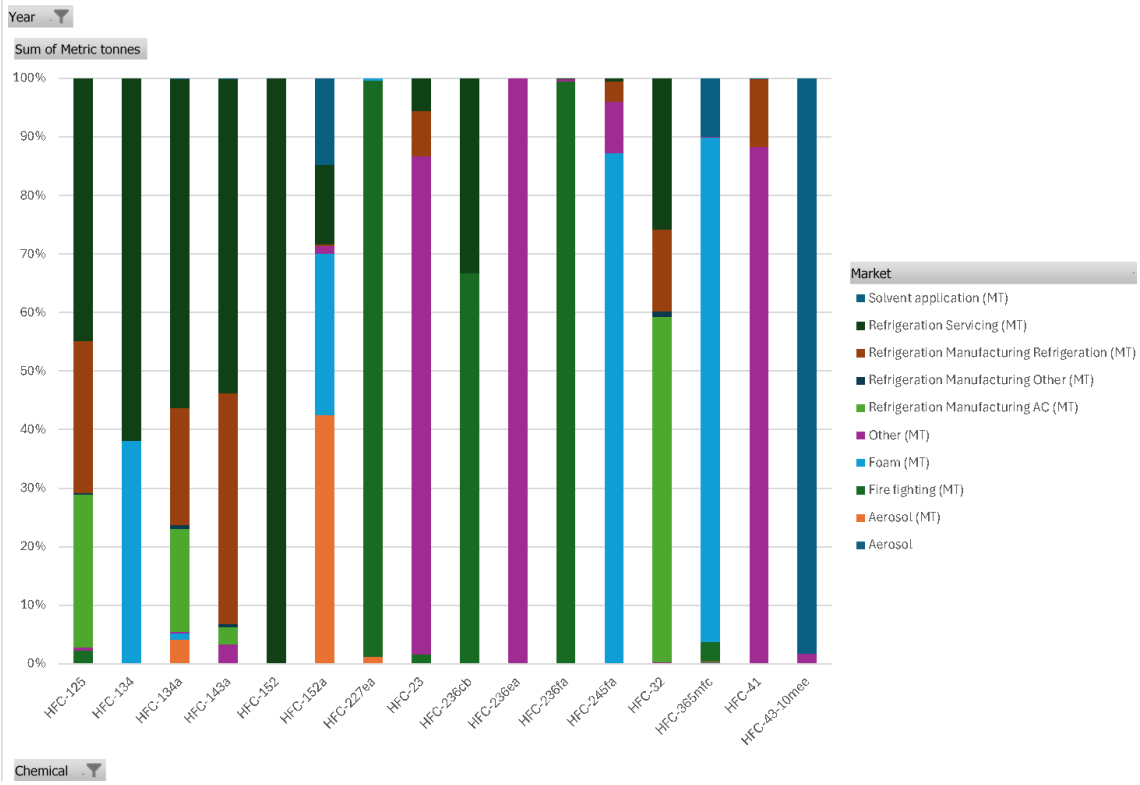
Country Brackets	Estimated and Reported HFC Baseline	Higher Estimate (30%) and Reported HFC Baseline
Largest	907	907
Top 10	374	374
Group 2	254	330
Other	167	171
LVC	32	33
Total	1734	1812

Markets of the HFC Component of the Baseline

CE factors (CEF) vary by market sector; however, sector level data are not systematically reported under A7 reporting. Some parties provide partial sectoral data through CP data submissions. The RTF therefore estimated manufacturing sector market shares using CP data where available, in combination with applicable CEF values. The CP data used in this assessment are based on the MLFS document "Country Programme Data and Prospectus for Compliance," prepared for ExCom-97. Of the 135 parties that submitted 2024 CP data as of 9 October 2025, 113 had ratified the KA. Of these, only 110 parties had submitted HFC data in their 2024 CP reports at the time of analysis (October 2025). In addition, nine non-ratifying parties also reported HFC data in their 2024 CP submissions. Overall, less than 70% of parties had reported CP data.

The RTF disaggregated CP blended data into individual chemicals to determine the sectoral distribution of each chemical by percentage within country clusters. An example of this disaggregation of the percentage of chemicals by various market sectors is shown in Figure A3.1.

Figure A3.1 Example of % of chemical used in various market sectors



This chemical level segmentation was then applied to corresponding A7-reported data by group. The HCFC component of the baseline was allocated to the servicing sector. Average GWPs were similarly estimated by applying CP-derived chemical splits by market segment to A7 data.

Because CP data and CEF frameworks use different sector classifications, the RTF further harmonized the datasets to align with cost-effectiveness reporting structures where party guidance differed. For example, CP data do not differentiate between the refrigerant use in mobile air conditioning servicing and new equipment; instead, these volumes are reported as a single aggregated category at the party party level. This treatment is consistent with methodologies applied in the 2020 and 2023 RTF reports.

. . **Table A3.7: Examples for filling data gaps for a G1 and a G2 party**

Available data	Missing data	Filling the Gap
R-410A 100 tonnes CP data	Chemical data	50 tonnes R-32, 50 tonnes R-125
R-404A 100 tonnes CP data	Chemical data	44 tonnes R-125, 52 tonnes R-143A. 4 tonnes R-134A
HFC-245fa 50 tonnes OS A7 data	No data missing	50 tonnes HFC-245fa

Country program reported in blends; OS A7 data reported in chemicals: CP blends converted to chemical components and then treated the same as OS A7 data.

The results are shown in Table A3.8.

Table A3.8: Market share of sectors using HFCs weighted by GWP

% CO2eq	Household Residential Refrigeration	Comm Refrigeration	Residential AC	Comm AC	Industrial & Transport Ref	Foam	Fire Suppression	Solvent	Aerosol	Servicing	Refrigeration Manufacturing Other	Other
China	12.5%	19.6%	12.5%	12.5%	3.6%	1.4%	13.9%	0.1%	1.0%	19.7%	0.8%	2.5%
Top 10	3.1%	4.9%	12.0%	12.0%	0.9%	1.1%	4.5%	0.3%	1.5%	55.7%	0.9%	3.4%
Group 2	3.7%	5.8%	21.3%	21.3%	1.1%	2.0%	3.4%	0.0%	5.3%	33.9%	0.2%	1.8%
Other Countries	0.3%	0.5%	2.0%	2.0%	0.1%	0.4%	1.3%	0.0%	1.0%	88.8%	1.8%	1.8%
LVCs	0.3%	0.5%	0.2%	0.2%	0.1%	0.8%	0.4%	0.0%	0.7%	95.9%	0.4%	0.4%

Note that Mobile Air Conditioning (MAC) data include both servicing and refrigerant charged in new vehicles

Clustered baseline calculations rely on a combination of reported A7 data, CP data, and HCFC data to create estimates where reporting is incomplete. There is inherent uncertainty in baseline estimates for parties that have not reported baselines. Estimates are replaced by reported baseline data when it becomes available.

The methodology described above provides a structured and consistent approach to addressing data gaps in HFC baseline estimates for A5 parties. It ensures alignment with KA reporting requirements while maintaining comparability across parties with varying levels of data availability.

ANNEX 4: METHODOLOGY TO ESTIMATE FUNDING REQUIREMENTS FOR HFC PHASE-DOWN IN THE CONSUMPTION SECTOR

This annex provides information on the estimated funding methodology for the HFC phasedown in the consumption sector. Funding estimates for the production sector are dealt with in detail in Chapter 4.

For HFCs consumption, the assessment considers funding estimates for both Stage I and Stage II KIPs, to reach compliance targets for the 2027-2029 and next two triennia as follows:

- G1 parties: a 10% reduction from baseline by 1 January 2029 and a 30% reduction from baseline by 1 January 2035
- G2 parties: a freeze of production and consumption by 1 January 2028; and a 10% reduction from baseline by 1 January 2032.

The estimate for the HFC phase-down funding requirement for the 2027-2029 triennium and future triennia, 2030-2032 and 2033-2035, is based on A5 parties meeting the relevant G1 or G2 reduction targets.

The estimated funding requirement for the HFC consumption sectors include the following:

- Funding committed for approved KIPs;
- Funding for project preparation costs;
- Funding estimated for new KIPs;
- Funding for EE (ExCom Decision 91/65, 94/60 and 91/65);
- Funding for KIP verification.

A4.1 Sources of Information

The RTF modelling approach consolidates data from the following sources:

- A7 consumption data reported to the OS, current as of January 2026;
- CP data submitted to the MLFS, as of 13 January 2026;
- MLFS provided information on approved KIPs, including agreed reduction from the baseline consumption, funding and tranche schedules, project preparation and verification, and information on EE and status of funding windows;
- ExCom documents and decisions, including cost guidelines, up to and including ExCom-97;
- Classification of LVCs based on HFC baseline consumption;
- BP, used to inform RTF on future requests to IAs for projects to be submitted to MLFS, therefore guiding RTF to forecast potential new funding needed;
- Parties' KA ratification status as of 8 April 2026.

A4.2 HFC Phase-down Funding Methodology for the Consumption Sector

The RTF compliance model methodology calculates funding needs for addressing both 10% reduction from the baseline by 2029 (Stage I KIP) and 30% reduction by 2035 (Stage II KIP) for G1 parties, plus, a freeze by 2028 and a 10% reduction from the baseline by 2032 for G2 parties (Stage I KIP). The Stage I and II total funding estimates were then allocated among the three triennia for the period between 2027 and 2035 covering different compliance targets for G1 and G2 and addressing the diversity of national circumstances and different groups' control targets. Two resource allocation proposals (A and B) are also suggested.

The RTF compliance model to estimate required total funding requirements for both Stage I and II for 3 triennia (9-year period) and also provides a funding range based on **two scenarios.** The model takes into consideration each individual country reduction addressed under a KIP.

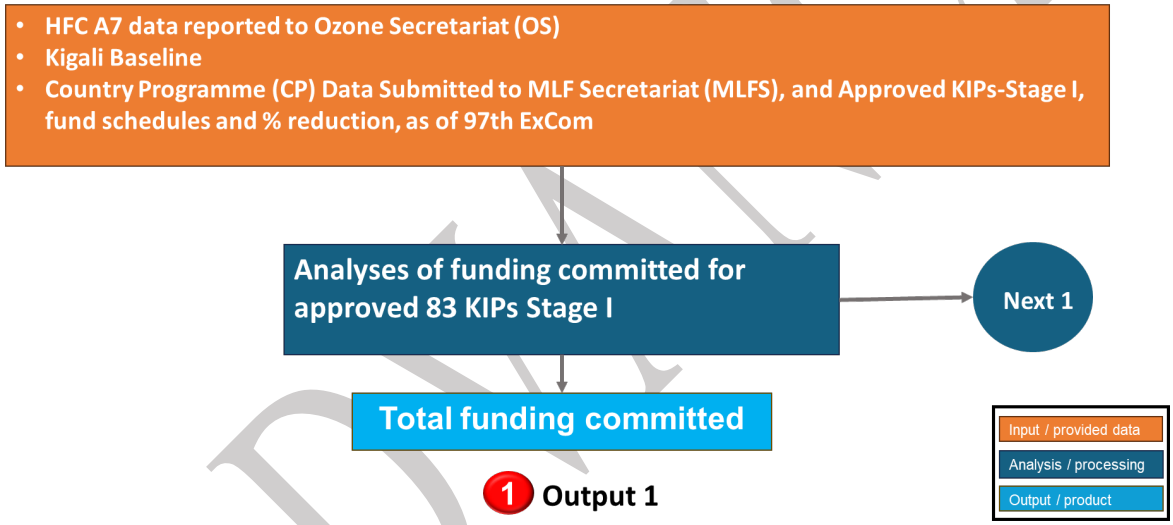
For this assessment, the RTF estimated funding approach grouped parties following their KIPs status according to the steps below:

STEP 1. 83 parties in G1 have approved KIP-Stage I for a 10% reduction from the baseline.

Those parties have different agreed % reductions from the baseline, with some even higher than 30% reduction required by 2035. The model was designed to consider:

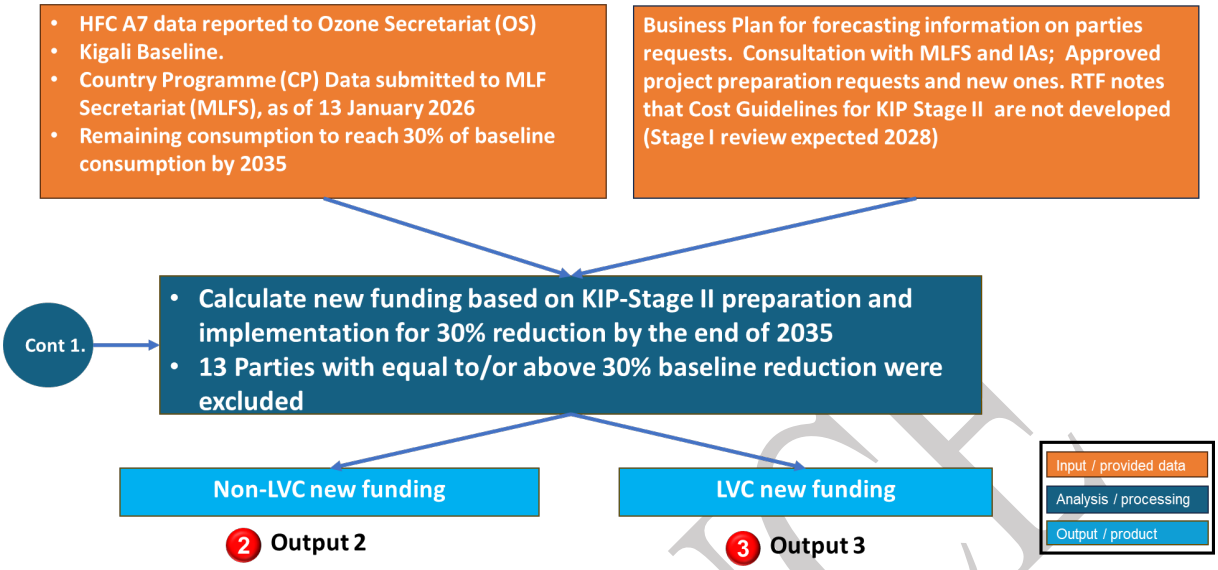
a. The committed funding for all 83 approved Stage I KIPs amounts to **US$ 46.83 million in 2027 to 2029 triennium and US$ 1.94 million in 2030 to 2032 triennium**, as per information received from the MLFS. This methodology step is shown in the Figure A4.1 flow chart below, and the committed funding is presented under **Output 1**.

Figure A4.1 Flowchart for Outputs 1: estimating committed funding for 83 G1 parties for 10% reduction from baseline



b. New funding for KIP-Stage II for 70 parties that have reductions from the baseline below 30% are shown as Output 2 for 29 non-LVC parties and Output 3 for 41 LVC parties in the Figure A4.2 flowchart below.13 parties that have reductions from the baseline equal to or above 30% are not considered for new funding in this 2026 RTF assessment.

Figure A4.2 Flowchart for Outputs 2 and 3: estimating new funding for 29 non-LVC parties and 41 LVC parties to reach 30% reductions of the baseline by 2035

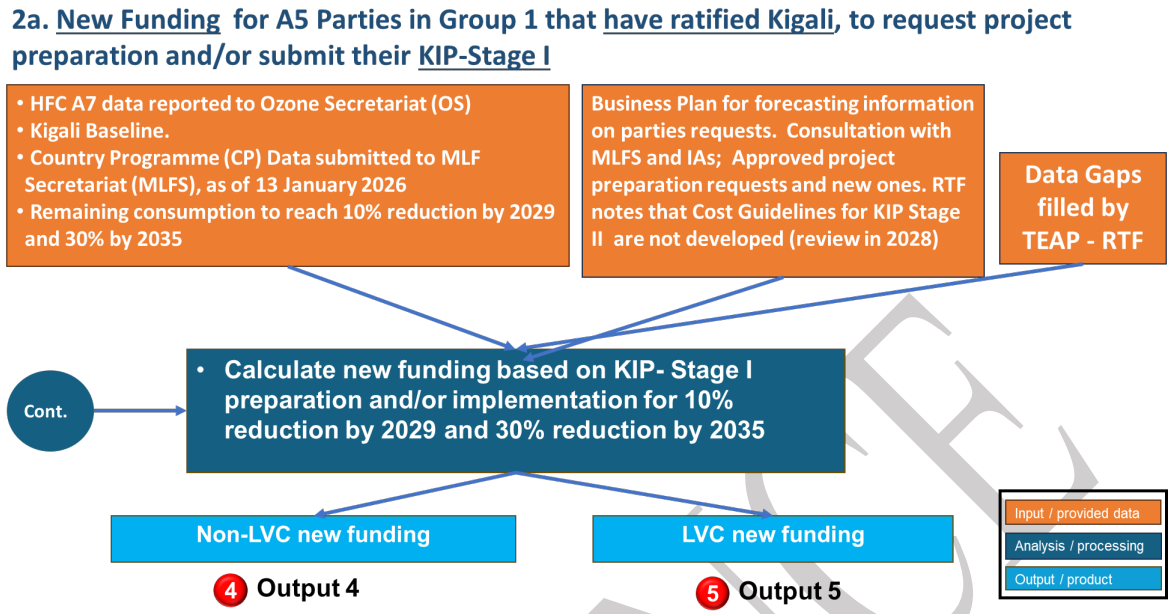


As explained, for this assessment the **RTF calculated funding needs for parties to reach Stage I and Stage II targets for G1, and Stage I target for G2.** For each of the modelling steps explained, RTF presented funding estimates in two Scenarios 1 and 2, and for each scenario (including G1 and G2), the total estimated funding for KIP Stage I and II (G1) and Stage I (G2), was then divided according to two resource allocation proposals A and B, in different triennia, suggested by RTF. That means, the model database was set for each individual party and shows each agreed reduction from the baseline in the previous approved KIP Stage. Any additional funding is then calculated based only on the consumption not yet addressed for that party and required attention so the party can achieve a certain control target.

STEP 2. 42 parties in G1 and G2 without approved KIP-Stage I (as of 97th ExCom), and that ratified KA

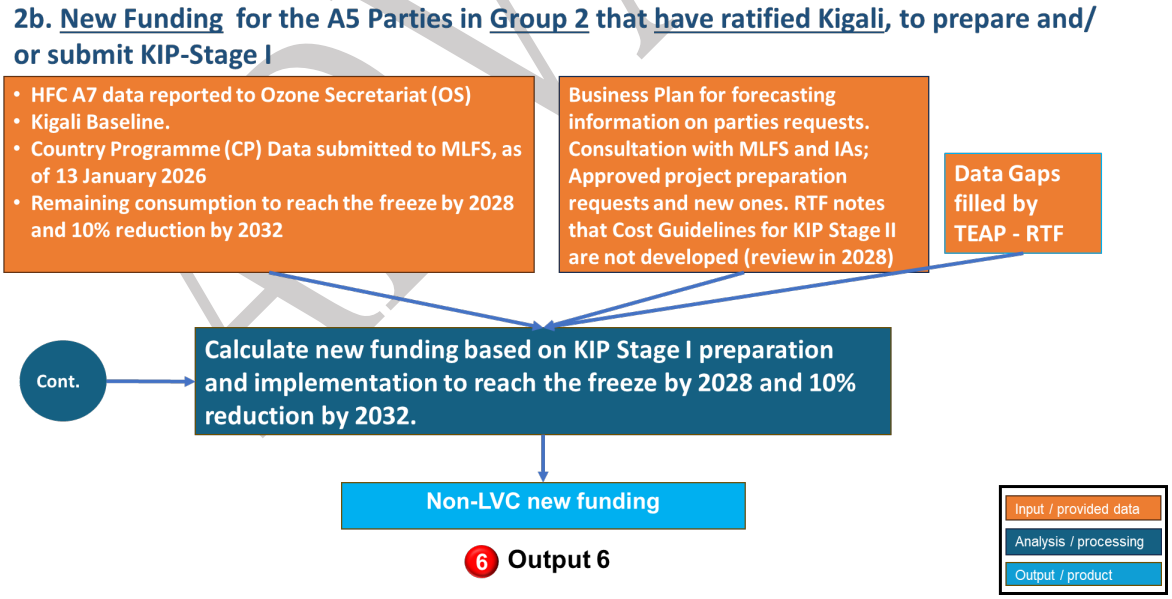
a. G1: New Funding for 36 A5 parties to prepare and/or submit KIP-Stage I and Stage II (10% by 2029; 30% by 2035) (Output 4 for 12 non-LVC parties (including China) and Output 5 for 24 LVC parties) as shown in Figure A4.3 flowchart.

Figure A4.3 Flowchart for Outputs 4 and 5: estimating new funding for G1 parties (12 non-LVC and 24 LVC) to submit KIP-Stage I



b. G2: New funding to six parties (freeze by 2028 and 10% reduction by 2032) (Output 6) as shown in Figure A4.4.

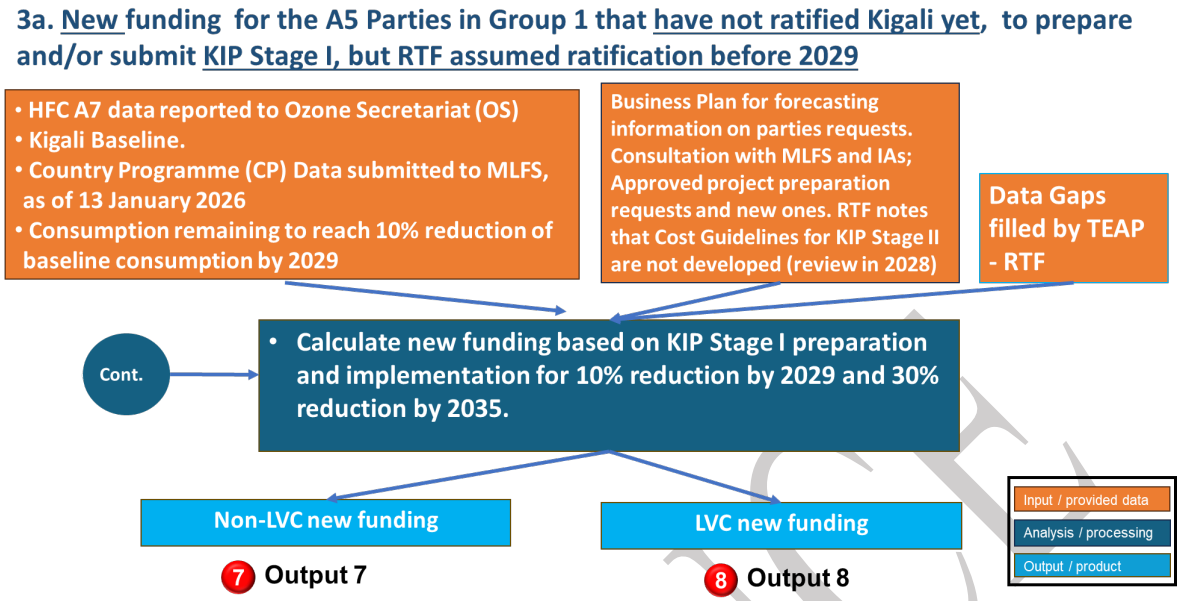
Figure A4.4 Flowchart for Output 6: estimating new funding for G2 parties to submit KIP-Stage I



STEP 3. 19 parties that have not ratified the KA yet (RTF forecasted 100% ratification by 2029)

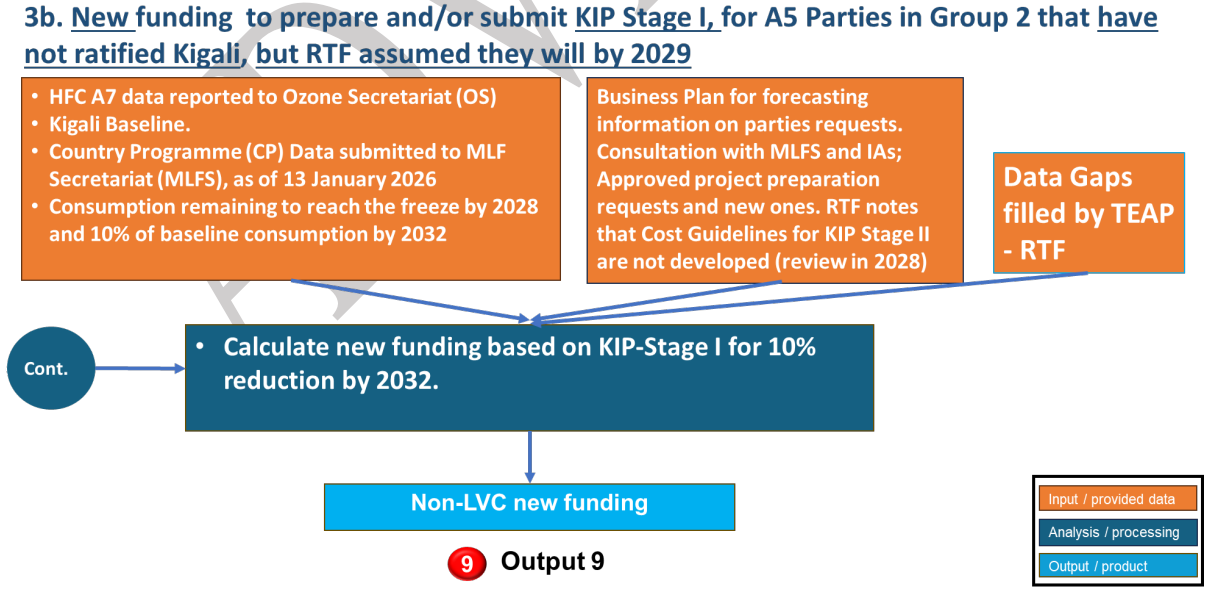
a. G: New funding for 10% reduction by 2029 and 30% by 2035 (16 parties) (Output 7 for 7 non-LVC parties and Output 8 for 6 LVC parties).

Figure A4.5 Flowchart for Outputs 7 and 8: estimating new funding for G1 parties who have not yet ratified KA



b. G2: New funding for the freeze by 2028 and 10% reduction by 2032 for 3 parties that have not ratified Kigali yet. RTF assumed ratification by 2029, as it is critical to access technical and financial support in time to meet compliance targets (Output 9)

Figure A4.6 Flowchart for Output 9: estimating new funding for G2 parties who have not yet ratified KA



For **G2** parties, where baseline years extend to 2024–2026, estimates relied more heavily on trend extrapolation based on available data. Where complete datasets were not available, **the RTF filled the gaps as per methodology detailed in Annex 3** based on reported A7 and GDP growth rates. In order to reflect uncertainty, a range was developed with a low-end value, assuming conservative consumption levels and limited growth, and a high-end value, assuming continuation of recent growth trends. These

assumptions introduce additional uncertainty into the funding estimates, which is reflected in the range presented.

In order to estimate funding requirements for the HFC phasedown to meet the reductions targets in Stage I and Stage II KIPs, discussed in Chapter 3, RTF model organization is summarised in the table below.

Table A4.1: Summary of estimated funding methodology for HFC phase-down

Total: 144 A5 parties	Reduction targets: 10% for Stage I and 30% for Stage II		Output
1.. 83 parties with approved KIPs - all in Group 1	Committed Stage 1 funding for 83 parties in Group 1	33 non-LVC parties (G1)	**1**
		50 LVCs parties (G1)	
	Additional funding required for 70 parties to reach Stage II targets. 13 Parties (out of the 83) that had approved KIP-Stage I with reductions 30% and over were excluded	29 non-LVCs parties (G1)	**2**
		41 LVCs parties (G1)	**3**
2. 42 parties that have ratified but do not have approved KIPs- as of 97th ExCom	**Group1:** Funding required for 36 parties that ratified but without KIPs to reach 2035 schedule targets	11 non-LVCs parties (G1)	**4**
		1 non-LVC party -Highest consumption (G1)	
		24 L VCs parties (G1)	**5**
	Group 2: Funding required for 6 parties that ratified but without KIPs, to reach the freeze and 2032 targets	6 non-LVCs parties **(G2)**	**6**
3. 19 countries assumed will ratify Kigali by 2029	**Group 1**: Funding required for 16 countries have not ratified to reach 10% and 30% targets	7 non-LVCs coutries (G1)	**7**
		9 LVCs countries (G1)	**8**
	Group 2: Funding required for 3 countries have not ratified to reach the freeze and 2032 target	3 non-LVCs countries **(G2)**	**9**

Information on CE thresholds used in the different sections of the model, methodology for filling baseline data gaps, and explanations regarding sector distribution of chemicals utilized, are detailed in separate Annex 3 and in Chapter 3.

The resource allocation proposals A and B described in Chapter 3 are indicated in table below.

Group	KIP Stage	Schedule A (% per triennium)	Schedule B (% per triennium)
G1 parties without KIPs	I	100% - 2027-2029	90% - 2027-2029 10% - 2030-2032
	II	60% - 2030-2032 40% - 2033-2035	60% - 2030-2032 40% - 2033-2035
G1 parties with KIPs	II	60% - 2027-2029 40% - 2030-2032	60% - 2030-2032 40% - 2033-2035
G2 parties without KIPs	I	60% - 2027-2029 40% - 2030-2032	90% - 2030-2032 10% - 2033-2035

For both proposals (A and B), RTF assumed full ratification for G1 and G2 parties by 2029.

The resource allocation proposals are applied to both scenarios. It is important to emphasise that the total funding for the 3 triennia for Stage I plus Stage II, changes depending on the scenario, but the allocation does not affect the total funding. The total funding per scenario only shifts from one triennium to another.

ANNEX 5: LIST OF PARTIES FUNDED AS LVC UNDER THE HCFC PHASE-OUT AND HFC PHASE-DOWN

Countries Funded as LVCs under HCFC Phase-out – 94							
1	Albania	25	Democratic Republic of the Congo	49	Liberia	73	Saint Kitts and Nevis
2	Angola	26	Djibouti	50	Madagascar	74	Saint Lucia
3	Antigua and Barbuda	27	Dominica	51	Malawi	75	Saint Vincent and the Grenadines
4	Armenia	28	Ecuador	52	Maldives	76	Samoa
5	Bahamas	29	El Salvador	53	Mali	77	Sao Tome and Principe
6	Barbados	30	Equatorial Guinea	54	Marshall Islands	78	Serbia
7	Belize	31	Eritrea	55	Mauritius	79	Seychelles
8	Benin	32	Eswatini	56	Micronesia (Federated States of)	80	Sierra Leone
9	Bhutan	33	Ethiopia	57	Mongolia	81	Solomon Islands
10	Bolivia (Plurinational State of)	34	Fiji	58	Montenegro	82	South Sudan
11	Bosnia and Herzegovina	35	Gabon	59	Mozambique	83	Sri Lanka
12	Botswana	36	Gambia	60	Myanmar	84	Suriname
13	Brunei Darussalam	37	Georgia	61	Namibia	85	Timor-Leste
14	Burkina Faso	38	Grenada	62	Nauru	86	Togo
15	Burundi	39	Guatemala	63	Nepal	87	Tonga
16	Cambodia	40	Guinea Bissau	64	Nicaragua	88	Turkmenistan
17	Cabo Verde	41	Guyana	65	Niger	89	Tuvalu
18	Central African Republic	42	Haiti	66	Niue	90	Uganda
19	Chad	43	Honduras	67	North Macedonia	91	United Republic of Tanzania
20	Comoros	44	Jamaica	68	Palau	92	Vanuatu
21	Congo	45	Kiribati	69	Papua New Guinea	93	Zambia
22	Cook Islands	46	Kyrgyzstan	70	Paraguay	94	Zimbabwe
23	Costa Rica	47	Lao People's Democratic Republic	71	Republic of Moldova		
24	Cuba	48	Lesotho	72	Rwanda		

Countries Funded as LVCs under HFC Phase-down – 84							
1	Albania	22	Dominica	43	Malawi	64	Rwanda
2	Antigua and Barbuda	23	El Salvador	44	Maldives	65	Saint Kitts and Nevis
3	Armenia	24	Equatorial Guinea	45	Mali	66	Saint Lucia
4	Bahamas	25	Eritrea	46	Marshall Islands	67	Saint Vincent and the Grenadines
5	Barbados	26	Eswatini	47	Mauritius	68	Samoa
6	Belize	27	Ethiopia	48	Micronesia (Federated States of)	69	Sao Tome and Principe
7	Benin	28	Fiji	49	Mongolia	70	Serbia
8	Bhutan	29	Gambia	50	Montenegro	71	Seychelles
9	Bolivia (Plurinational State of)	30	Georgia	51	Mozambique	72	Sierra Leone
10	Botswana	31	Ghana	52	Myanmar	73	Solomon Islands
11	Brunei Darussalam	32	Grenada	53	Namibia	74	South Sudan
12	Burkina Faso	33	Guinea Bissau	54	Nauru	75	Suriname
13	Burundi	34	Guyana	55	Nepal	76	Timor-Leste
14	Cabo Verde	35	Haiti	56	Nicaragua	77	Tonga
15	Central African Republic	36	Jamaica	57	Niger	78	Turkmenistan
16	Comoros	37	Kenya	58	Niue	79	Tuvalu
17	Congo	38	Kiribati	59	North Macedonia	80	Uganda
18	Cook Islands	39	Kyrgyzstan	60	Palau	81	United Republic of Tanzania
19	Cuba	40	Lao People's Democratic Republic	61	Papua New Guinea	82	Vanuatu
20	Democratic People's Republic of Korea	41	Lesotho	62	Paraguay	83	Zambia
21	Djibouti	42	Liberia	63	Republic of Moldova	84	Zimbabwe

ANNEX 6: LIST OF PARTIES PENDING RATIFICATION OF THE KIGALI AMENDMENT (as of 8 April 2026)

Countries	Cluster by Consumption Level	Group
Yemen	Other Non-LVC	1
Democratic Republic of the Congo	Other Non-LVC	1
Libya	Other Non-LVC	1
Madagascar	Other Non-LVC	1
Algeria	Other Non-LVC	1
Sudan	Other Non-LVC	1
Afghanistan	Other Non-LVC	1
Myanmar	LVC	1
Jamaica	LVC	1
Equatorial Guinea	LVC	1
South Sudan	LVC	1
Guyana	LVC	1
Suriname	LVC	1
Antigua and Barbuda	LVC	1
Dominica	LVC	1
Timor-Leste	LVC	1
Iran (Islamic Republic of)	Other Non-LVC	2
Iraq	Other Non-LVC	2
Qatar	Other Non-LVC	2

ANNEX 7: RELEVANT EXCOM DECISIONS ON INSTITUTIONAL STRENGTHENING AND STANDARD ACTIVITIES

Table A7.1: Summary of ExCom decisions related to IS

ExCom	Date	Funding level	Criteria	Conditions
7th	June 1992	Initial funding	Initial rules	
19th	May 1996	Maintained funding at initial level, first approval for three years and renewal for two years		Conditional upon a report of progress and an articulated plan of future actions
35th	December 2001	Increase of 30% higher than the historically agreed level	Implement the new strategic framework agreed, and provide increased support for critical areas such as public awareness	
43rd	July 2004	To supplement the lower ranges of annual funding levels for IS for very low-volume-consuming countries and low volume consuming countries up to a threshold level of US $30,000 per year		The increase would be provided on the condition that: i) the relevant country duly assigned a full-time officer to manage the ozone unit; and ii) a national licensing system controlling ODS imports was in place
61st	July 2010	To maintain funding for IS support at current levels, and	Taking into account decisions 59/17 and 59/47(b) that allowed A5 parties to submit their IS projects as stand-alone projects or within their HCFC HPMP	To renew IS projects for the full two-year period from the 61st meeting
74th	May 2015	Increase of 28% of historic levels, with a minimum funding level of US $42,500		To address the challenges related to phase-out of HCFCs in line with the objectives of decision XIX/6 and the transition to alternatives that minimize environmental impacts
91st	December 2022	Increased in funding for all IS projects and renewals at a level 38% higher than that agreed at the 74th meeting, with a minimum level of funding of US $60,000 per year	New format for terminal reports and new requests, and corresponding performance indicators	Extend the duration of IS renewal implementation phases from two to three years for IS renewal proposals submitted from the 92nd meeting onwards
			MLF Secretariat to prepare a report on the review of the use of the revised format	No later than the second meeting in 2028
			Further review of IS projects including funding levels	*No later than the second meeting in 2029

*The RTF has considered that this new revision agreed by the 91st ExCom Meeting, will not affect the estimations for this triennium but might affect estimations for the subsequent triennia, depending on the final decisions expected to be taken by the end of 2029.

Table A7.2 Summary of ExCom decisions related to CAP

ExCom Meeting	Date	Objective	Criteria	Conditions
35th	December 2001	Initial decision, establishment of a consolidated compliance support mechanism	Consolidated UNEP's networking, training and information clearance mechanism	UNEP's single compliance support programme for parties operating under A5 of the MP
36th	March 2022	First CAP operational structure and budget	Included regional teams to assist A5s	Operationalization of CAP
38th	November 2002	Scope of services	Defined CAP services	Provide policy guidance, customs training and information clearing house support
41st	December 2003	Requested detailed reporting on activities and results	Emphasis on parties at risk of non-compliance	Programme oversight
43rd	July 2004	Approved CAP budget Mention	Strengthen regional networks of NOOs	Strengthen regional cooperation
45th	~~April 2005~~	CFC and halons phase-out deadlines	To prioritize support to parties approaching CFC and halon phase-out deadlines	
47th & 50th	November 2005 November 2006	-New rules on CAP, budget management and flexibility -Financial reporting	UNEP to relocate funds across CAP budget lines	-Maintaining transparency -Clarification for reporting expenditures and reallocations
53rd & 56th	November 2007& November 2008	Requested detailed reporting on CAP activities	Prioritization of CAP funding between budget lines	A comprehensive list of compliance assistance activities included in budget proposals
57th	April 2009	Approved CAP work programme	Emphasizing support for parties at risk of non-compliance	Compliance risk management
65th	November 2011	Approved CAP work programme	Prioritizing assistance for HPMPs	HPMPs
75th	November 2015	Approved budget	Reinforce support to parties implementing HPMPs	Strengthening compliance assistance

77th	December 2016	Approved Budget	Requested a review of CAP organizational structure and regional operations	Reviewing CAP organizational effectiveness
79th	July 2017	Considered the results of the CAP structure review	Improved effectiveness	Provided guidance on strengthening regional support
82nd	~~December 2018~~	Approved the CAP budget		Reiterated reporting requirements on activities and expenditures
84th	~~December 2019~~	Approved budget	Requested detailed reporting	Transparency and accountability
86th	~~2020-2021~~	Approved budget and continued CAP operations		On expenditures, staff posts and expenditures
90th	~~June 2022~~	Approved budget	Emphasizing support for KA preparation HFC phase-down	KA preparation
93rd	December 2023	-Approved the terms of reference for an evaluation of CAP	Additional support for preparing KIPs	External evaluation of CAP
95th	December 2024	–Desk study for the evaluation of CAP - Approved the CAP budget	Requested detailed reporting	On expenditures, staff posts and expenditures
97th	December 2025	–Approved the CAP budget	Requested detailed reporting	On expenditures, staff posts and expenditures

ANNEX 8: DECISIONS RELATED TO ENHANCING REGIONAL ATMOSPHERIC MONITORING

A8.1 Decision XXX/3: Unexpected emissions of CFC-11

At their MOP-30 in 2018, the parties adopted "Decision XXX/3: Unexpected emissions of trichlorofluoromethane (CFC-11)", which requested, *inter alia*:

> *[The] Scientific Assessment Panel to provide to the Parties a summary report on the unexpected increase of CFC-11 emissions, which would supplement the information in the quadrennial assessment, including additional information regarding atmospheric monitoring and modelling, including underlying assumptions, with respect to such emissions; a preliminary summary report should be provided to the Open-ended Working Group at its forty-first meeting, a further update to the Thirty-First Meeting of the Parties and a final report to the Thirty-Second Meeting of the Parties;*
>
> *"…the [TEAP] to provide the parties with information on potential sources of emissions of CFC-11 and related controlled substances from potential production and uses, as well as from banks, that may have resulted in emissions of CFC-11 in unexpected quantities in the relevant regions; a preliminary report should be provided to the Open-ended Working Group at its forty-first meeting and a final report to the Thirty-First Meeting of the Parties;*

In response to Decision XXX/3, TEAP produced a preliminary report in May and a final report in September, "Decision XXX/3 Task Force Report on Unexpected Emissions of CFC-11."[108, 109] TEAP considered potential sources of CFC-11 and related controlled substances as well as its historical use in various sectors and applications. The final report concluded that "[based] on modelling of CFC-11 production, usage, emissions and comparison against atmospheric-derived emissions, it is unlikely that past production and historic usage can account for the unexpected CFC-11 emissions, including from existing foam banks." It attributed the unexpected emissions to stem from a "resumption of newly produced CFC-11 in closed-cell foams."

In response to Decision XXX/3, SAP produced a report released by the World Meteorological Organization (WMO) in 2021, "Report on the Unexpected Emissions of CFC-11."[110] The report addressed: current and past observations of CFC-11 atmospheric abundances, information on the CFC-11 global and regional emission increase and subsequent decrease, changes derived for emissions of CFC-12 and carbon tetrachloride (CCl_4), estimates of CFC-11 banks (CFC-11 that has been produced but has not yet been emitted), scenarios of future emissions and atmospheric concentrations, and the impact on the stratospheric ozone layer of the anomalous enhancement in CFC-11 emissions. Drawing on concentration enhancements measured in pollution plumes from source regions, the report attributed a large proportion of the increase in unexpected global CFC-11 emissions during 2014-2017 to Eastern China; these emissions decreased substantially between 2014-2017 and 2019. Because the increased CFC-11 emissions significantly elevated only for a brief period (2014-2019), the "anticipated recovery [measured as a return to 1980 levels] from stratospheric ozone depletion will not be substantially delayed…only 0.4-1.3 years globally and by 0.5-3.1 years for the Antarctic ozone hole."

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[108] UNEP, *Decision XXX/3 TEAP Task Force Report on Unexpected Emissions of CFC-11*, May 2019. https://ozone.unep.org/sites/default/files/2020-07/TEAP_Task_Force_Dec_XXX-3_on_Unexpected_CFC-11_Emissions_May_2019.pdf

[109] UNEP, *Decision XXX/3 TEAP Task Force Report on Unexpected Emissions of CFC-11 – Final Report*, September 2019. https://ozone.unep.org/system/files/documents/TEAP-TF-DecXXX-3-unexpected_CFC11_emissions-september2019.pdf

[110] WMO. (2019). *Report on the Unexpected Emissions of CFC-11* (WMO No. 1268). Geneva, Switzerland. https://ozone.unep.org/system/files/documents/SAP-2021-report-on-the-unexpected-emissions-of-CFC-11-1268_en.pdf

A8.2 Decision XXXI/3: Unexpected emissions of CFC-11 and institutional processes to be enhanced to strengthen the effective implementation and enforcement of the Montreal Protocol

At MOP-31 in 2019, parties adopted "Decision XXXI/3: Unexpected emissions of CFC-11 and institutional processes to be enhanced to strengthen the effective implementation and enforcement of the Montreal Protocol", which requested, *inter alia*:

> *[The TEAP] to provide the parties with an update to the information provided pursuant to paragraph 2 of decision XXX/3, and to provide a report thereon to the Thirty-Second Meeting of the Parties, including any new compelling information that becomes available, as well as providing information on the following:*
>
> 1. *An analysis of CFC-11 banks by geographic location and by market sector;*
> 2. *Linkages between the level of production of anhydrous hydrogen fluoride and carbon tetrachloride and unexpected emissions of CFC-11;*
> 3. *The types of CFC-11 products, the disposition of any such products, and opportunities and methods to detect such products and potentially recover the associated CFC-11;*
> 4. *Identification of possible drivers of illegal production of and trade in CFC-11, such as the availability of technically and economically feasible alternatives to CFC-11 and HCFC-141b and their sustained effectiveness;*
>
> *[The SAP] to work with the Ozone Research Managers at their meeting in 2020 to identify gaps in the global coverage of atmospheric monitoring of controlled substances and to provide options on ways to enhance such monitoring, as well as exploring options for informing the parties of preliminary information indicating unexpected emissions of controlled substances, for the consideration of the Thirty-Second Meeting of the Parties to the Montreal Protocol and the Conference of Parties to the Vienna Convention at its twelfth meeting, in 2020;*

In response to Decision XXXI/3, TEAP produced its report "Decision XXXI/3 TEAP Task Force Report on Unexpected Emissions of CFC-11."[111] TEAP refined its global and regional inventory-based modelling of CFC-11 production, usage, and a comparison of resulting emissions against derived CFC-11 emissions from atmospheric observations. It confirmed the findings of TEAP's 2019 final report on CFC-11 that the difference between the inventory-based modelling estimated of expected CFC-11 emissions and those derived from atmospheric observations is indicative of unreported CFC-11 production and use, and emissions from CFC-11 banks alone cannot explain the unexpected increase in emissions 2013-2018. A new conclusion is that unreported CFC-11 production would seem to have been already occurring in the period 2007-2012, and this is necessary to explain the difference between the inventory-based expected emissions and the derived CFC-11 emission during this earlier period.

In response to Decision XXXI/3, SAP and experts in atmospheric monitoring of controlled substance prepared a white paper for the 11th Meeting of the Ozone Research Managers (ORM-11), "Closing the gaps in top-down regional emissions quantification: needs and action plan".[112] The paper noted that the "recent finding of unexpected atmospheric emissions of…[CFC-11] has made it imperative to expand ways to find, quantify, and attribute emissions of substances controlled under the Montreal

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[111] UNEP, *Decision XXXI/3 TEAP Task Force Report on Unexpected Emissions of Trichlorofluoromethane (CFC-11)*, May 2021. https://ozone.unep.org/system/files/documents/Final_TEAP-DecisionXXXI-3-TF-Unexpected-Emissions-of-CFC-11-may2021.pdf

[112] Annex to Note by the Secretariat: UNEP/OzL/Conv.ResMgr/11/4/Rev.1. https://ozone.unep.org/system/files/documents/ORM11-4-Rev-1E.pdf

Protocol…to enable the parties to take actions, at country, regional, and international levels to assure compliance, and safeguard the ozone layer and mitigate climate change." The paper lays out an approach to build on the existing observational network and enhance regional atmospheric monitoring at key locations to close existing data gaps. The paper considered a range of issues associated with expanding these networks, including "essential criteria for establishing new measurement stations and flask sampling locations to optimize the quantification of emissions." It provided some initial considerations on cost as well as recommendations for initial activities including pilot projects.

A8.3 Decision XXXIII/4: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol

At MOP-33 in 2021, parties adopted "Decision XXXIII/4: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol" which requested:

> *[The] Ozone Secretariat, in consultation with relevant experts from the [SAP], the [TEAP] and the [ORM], to provide the following information to the parties at the forty-fifth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol, to be held in 2023, and to report on the progress of work at the forty-fourth meeting of the Open-ended Working Group:*
>
> 1. *Options for the regional monitoring of atmospheric concentrations of substances controlled by the Montreal Protocol, based on the existing information provided by the [SAP] and the [ORM], and the challenges for operationalizing relevant recommendations;*
> 2. *The identification of suitable locations for possible high-frequency measurements and flask sampling for regions not, or not sufficiently, covered by existing atmospheric monitoring, with a view to strengthening monitoring capacity and networks;*
> 3. *Options for possible means of establishing new monitoring capacity and related costs, taking into account existing monitoring infrastructure."*

At OEWG-44 in 2022, the OS presented a progress report[113] in response to decision XXXIII/4. The OS's report included information on the implementation of the pilot project developed by the OS in 2021 and funded by the EU on the regional quantification of emissions of controlled substances.[114] This pilot project was developed based on the white paper[115] prepared by the SAP in 2020 in cooperation with atmospheric monitoring experts and discussed and endorsed by the ORM. The purpose of the project is to identify the regions where emissions are likely to occur, the locations of potential observation stations, the protocols for measurements and analyses that best provide the required information; to assess the capabilities of the locations and types of measurements for installing one or more stations; and to initiate new measurements at those stations. The implementation of the pilot project is managed by the OS and overseen by a steering committee established in November 2021.

The report noted a virtual discussion forum was held in March 2022 and focused on understanding emission sources, the future evolution of controlled substances and other compounds important to the MP, observational systems and techniques, and the siting and development of new stations to improve regional coverage. The best way to carry out measurements, i.e., by flask sample collection and

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[113] UNEP/OzL.Pro.WG.1/44/2/Add.1, paras. 5–10.

[114] https://ozone.unep.org/eu-funded-project-regional-quantification-emissions-substances-controlled-under-montreal-protocol

[115] Annex to Note by the Secretariat: UNEP/OzL/Conv.ResMgr/11/4/Rev.1. https://ozone.unep.org/system/files/documents/ORM11-4-Rev-1E.pdf

analyses in one or two central analytical facilities or by installing automated high-frequency in-situ measuring instruments, was discussed. Work was also expected to conclude shortly on the identification of suitable locations for carrying out measurements. The Secretariat provided an update on these activities in an addendum to its note[116] at MOP-34 in November 2022.

At OEWG-45 in 2023, the OS in its response to Decision XXXIII/4[117] reported that due to the cost and focused campaigns required for long-term aircraft measurements, the best strategy to fill data gaps in regional atmospheric monitoring is to locate ground stations approximately 100 and 1,000 km downstream from the emission source regions to optimize cost, emissions modelling, and longer-term continuity. Vast regions in Eastern Europe; western, southern and central Asia; all of South America; portions of North America; large parts of South-East Asia; Australia and New Zealand; and most of Africa are not monitored.

Under the EU-funded pilot project, the steering committee decided to establish a flask-sampling site on Bhola Island, Bangladesh. The measurement programme was done with experts on flask sampling and data analysis from the University of Bristol working closely with experts from the University of Dhaka. These measurements and the experience gained informed considerations for other locations.

A8.4 Decision XXXV/14: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer

At MOP-35 in 2023, parties adopted "Decision XXXV/14: Enhancing the global and regional atmospheric monitoring of substances controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer" which requested the OS, in consultation with the MLFS and relevant experts from the ORM, SAP, and TEAP "to provide the following information to the parties at the 46th OEWG in 2024:

1. *An update of the information provided under decision XXXIII/4, including refining, to the extent possible, the cost estimates associated with enhancing atmospheric monitoring presented in the decision XXXIII/4 report, and providing a list of potential monitoring station locations;*

Options for sustainable funding to establish new regional monitoring capacities, including an assessment of their advantages and disadvantages, of potential implementation options, and a description of the administrative processes required to operationalize any potential funding options considered, taking into account the discussion at the Thirty-Fifth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer.

At OEWG-46 in 2024, the OS provided its response to Decision XXXV/14 in an addendum to its note.[118] Information related to the request for sustainable funding options was contained in annexes to that addendum: Annex V prepared by the MLFS on support from the MLF[119] and Annex VI prepared

[116] UNEP/OzL.Pro.34/2/Add.1.

[117] UNEP/OzL.Pro.WG.1/45/2/Add.2, paras. 24-37. https://ozone.unep.org/system/files/documents/OEWG-45-2-Add-2E.pdf

[118] UNEP/OzL.Pro.WG.1/46/2/Add.1, paras. 41-76. https://ozone.unep.org/system/files/documents/Annex_VI_to_46-2-Add-1.pdf

[119] UNEP/OzL.Pro.WG.1/46/2/Add.1, Annex V. https://ozone.unep.org/system/files/documents/Annex_V_to_the_addendum.pdf

by a financial expert under contract to the OS on utilizing the existing trust funds of the Vienna Convention and the MP.[120]

In February 2024, the OS and the steering committee of the EU-funded pilot project held an online workshop[121] in order to better understand the costs involved in setting up a new station for monitoring controlled substances. According to the workshop outcomes, the cost of setting up an in-situ high-frequency measurement station was estimated at between US$ 456,000 and US$ 1,245,000, while the cost of setting up a low-frequency flask sampling station with central chemical analysis would be between US$ 50,000 and US$ 1,245,000. The cost estimates were presented as a range of likely values, as they were highly dependent on existing infrastructure, site location and other variables/choices. These figures did not include staffing costs (which are highly variable); the cost of initial site selection experiments (i.e., Observing System Simulation Experiments, OSSEs); the cost of data interpretation; overhead costs charged by any operational research establishment; the cost of travel by scientific personnel; or publication costs.

On the basis of the costs estimated in the workshop, an attempt was made to estimate the average cost (capital and operating) of establishing and maintaining a monitoring site for a period of 5 years, for a step-by-step approach and for a programmatic approach. This costing model shows that total costs between the assumed 5-year low-cost and high-cost scenarios lie in the ranges of US$ 1.4 million to US$ 2.5 million for high-frequency monitoring; US$ 2 million to US $4 million for daily flask sampling; and US$ 1 million to US$ 2 million for weekly flask sampling.

A programmatic approach would entail working with multiple potential sites in a coordinated manner, covering site identification, data monitoring and analysis, capacity-building for the different sites and dissemination of results. While such an approach may appear significantly more expensive because of the number of sites being established, there are likely to be economies of scale in terms of development of training material, bundling of training activities and, potentially, procurement costs. There would also be flexibility to move funds between sites depending on actual needs for each site. The following four scenarios were considered depending on the number of additional monitoring stations, frequency of sampling, and use of pre-existing infrastructure: 1) low-cost modest expansion; 2) high-cost modest expansion; 3) low-cost aggressive expansion; 4) high-cost aggressive expansion. The analysis showed that, for the above scenarios, the lowest-cost scenario (modest expansion, assuming existing local infrastructure) would require about US$ 9 million to execute, and the highest-cost scenario (aggressive expansion, assuming all new construction) would require about US$ 32 million.

Annex V of the addendum was produced by the MLFS to describe how the MLF could be used to support the establishment of new regional atmospheric monitoring capacities. The paper notes that the "establishing regional atmospheric monitoring stations would both help build scientific capacity in A5 countries and enable their compliance with the Montreal Protocol control measures…[and, therefore,] the Meeting of the Parties to the Montreal Protocol could consider using the Multilateral Fund to provide assistance to establish regional atmospheric monitoring stations in Article 5 countries." Following a decision by parties, the ExCom could approve guidelines for preparing proposals by those A5 parties interested in establishing a regional monitoring station. The sites would be guided by information developed by the OS. Funding could follow established processes under the MLF for disbursing funding through agencies based on decisions by the ExCom. Given the novelty in using the

[120] UNEP/OzL.Pro.WG.1/46/2/Add.1, Annex VI. https://ozone.unep.org/system/files/documents/Annex_VI_to_46-2-Add-1.pdf

[121] "Outcomes of the Workshop on Costs of Atmospheric Monitoring of Gases Controlled under the Montreal Protocol," 23 February 2024. https://ozone.unep.org/system/files/documents/Monitoring_Costs_Workshop_Outcomes.pdf

MLF to support establishing regional atmospheric monitoring station, some time may be needed to adjust the established processes.

Annex VI of the addendum considers utilizing the existing trust funds of the Vienna Convention and the MP, namely:

- The Trust Fund for the Vienna Convention,
- The Trust Fund for the MP,
- The General Trust Fund for Financing Activities on Research and Systems Observations relevant to the Vienna Convention, and
- The MLF.

The main advantage identified in using these existing funds would be that they are operational with well-established policies and procedures, including auditing and reporting. A challenge would be the need to reconcile the budgeting periods of the trust funds with the duration of projects and programmes to be funded. The paper notes that "for projects and programmes to be sustainable and produce useful datasets, the desirable duration would be at least five years."

ANNEX 9. PROJECT PREPARATION FOR KIPS AND COST DETAILS

Table A9.1: Project preparation cost for KIP Stage I (in alphabetical order – source MLFS)

Country	Group	Ratified KA	Project preparation for KIP Stage I (US$)	KIP PRP in 2026-2028 Business Plan
Afghanistan	1	No	190,000	Yes
Algeria	1	No	190,000	Yes
Antigua and Barbuda	1	No	100,000	
Central African Republic	1	Yes	170,000	
China	1	Yes	case by case	
Democratic People's Republic of Korea	1	Yes	190,000	
Democratic Republic of the Congo	1	No	190,000	
Djibouti	1	Yes	100,000	Yes
Dominica	1	No	100,000	
Equatorial Guinea	1	No	170,000	Yes
Guyana	1	No	130,000	Yes
Haiti	1	Yes	130,000	
India	2	Yes	230,000	Yes
Iran (Islamic Republic of)	2	No	220,000	Yes
Iraq	2	No	220,000	Yes
Jamaica	1	No	170,000	
Libya	1	No	220,000	Yes
Madagascar	1	No	170,000	Yes
Mauritania	1	Yes	190,000	Yes
Myanmar	1	No	130,000	Yes
Nepal	1	Yes	130,000	Yes
Qatar	2	No	190,000	Yes
Saint Kitts and Nevis	1	Yes	100,000	
Saudi Arabia	2	Yes	230,000	Yes
South Sudan	1	No	130,000	Yes
Sudan	1	No	190,000	Yes
Suriname	1	No	130,000	Yes
Timor-Leste	1	No	100,000	Yes
Yemen	1	No	220,000	
Total (less China)			**US $4,630,000**	
Total including 9.6% support costs			**US $5,074,480**	

Table A9.2: Project preparation cost for KIP Stage II (by order of consumption – RTF calculations)

Country	Level	Ratified	Current control measure KIP Stage I	Eligible for Stage II	Prep cost US $
Mexico	Top 10	Yes	10% of Baseline by 2029	Yes	230,000
Thailand	Top 10	Yes		Yes	220,000
Brazil	Top 10	Yes		Yes	230,000

Country	Level	Ratified	Current control measure KIP Stage I	Eligible for Stage II	Prep cost US $
Nigeria	Top 10	Yes	10.1% of Baseline by 2029	Yes	220,000
Türkiye	Top 10	Yes	14.4% of Baseline by 2029	Yes	220,000
Malaysia	Top 10	Yes	10% of Baseline by 2029	Yes	220,000
Indonesia	Top 10	Yes		Yes	220,000
Argentina	Top 10	Yes		Yes	230,000
Viet Nam	Top 10	Yes	10% of Baseline by 2029	Yes	230,000
Côte d'Ivoire	Other	Yes		Yes	220,000
Syrian Arab Republic	Other	Yes		Yes	220,000
South Africa	Other	Yes	14.6% of Baseline by 2029	Yes	220,000
Philippines	Other	Yes		Yes	220,000
Venezuela (Bolivarian Rep)	Other	Yes		Yes	220,000
Colombia	Other	Yes	18.3% of Baseline by 2029	Yes	220,000
Bangladesh	Other	Yes		Yes	220,000
Chile	Other	Yes	10% of Baseline by 2029	Yes	220,000
Trinidad and Tobago	Other	Yes	10% of Baseline by 2029	Yes	220,000
Dominican Republic	Other	Yes	10% of Baseline by 2029	Yes	220,000
Angola	Other	Yes	10% of Baseline by 2030	Yes	180,000
Chad	Other	Yes	10% of Baseline by 2029	Yes	180,000
Serbia	Other	Yes	10% of Baseline by 2029	Yes	180,000
Senegal	Other	Yes	20.5% of Baseline by 2029	Yes	180,000
Ecuador	Other	Yes	14% of Baseline by 2029	Yes	180,000
Panama	Other	Yes	10% of Baseline by 2029	Yes	180,000
Guinea	Other	Yes	17.3% of Baseline by 2029	Yes	180,000
Peru	Other	Yes	10% of Baseline by 2029	Yes	180,000
Benin	Other	Yes	10% of Baseline by 2029	Yes	180,000
Tunisia	Other	Yes	23.8% of Baseline by 2030	Yes	180,000
Gabon	Other	Yes		Yes	180,000
Paraguay	Other	Yes	10% of Baseline by 2029	Yes	180,000
Togo	Other	Yes	15% of Baseline by 2029	Yes	180,000
Honduras	Other	Yes	15.5% of Baseline by 2029	Yes	180,000
Sri Lanka	Other	Yes	10% of Baseline by 2029	Yes	180,000
Cambodia	Other	Yes	10% of Baseline by 2029	Yes	180,000
Costa Rica	Other	Yes	10% of Baseline by 2029	Yes	180,000
Guatemala	Other	Yes	15.9% of Baseline by 2029	Yes	180,000
Bosnia and Herzegovina	Other	Yes	10% of Baseline by 2029	Yes	180,000
Mali	LVC	Yes		Yes	130,000
Kenya	LVC	Yes		Yes	130,000
Somalia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
El Salvador	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Albania	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Cuba	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Uruguay	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Zambia	LVC	Yes		Yes	130,000
North Macedonia	LVC	Yes	18.7% of Baseline by 2029	Yes	130,000

Country	Level	Ratified	Current control measure KIP Stage I	Eligible for Stage II	Prep cost US $
Mozambique	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Georgia	LVC	Yes	22.5% of Baseline by 2029	Yes	130,000
Bolivia (Plurinational State)	LVC	Yes	15% of Baseline by 2029	Yes	130,000
Belize	LVC	Yes		Yes	130,000
Mauritius	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Nicaragua	LVC	Yes		Yes	130,000
Guinea Bissau	LVC	Yes	17.5% of Baseline by 2029	Yes	130,000
Namibia	LVC	Yes		Yes	130,000
Republic of Moldova	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Botswana	LVC	Yes	15% of Baseline by 2029	Yes	130,000
Turkmenistan	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Brunei Darussalam	LVC	Yes		Yes	130,000
Maldives	LVC	Yes		Yes	130,000
Papua New Guinea	LVC	Yes		Yes	130,000
Kyrgyzstan	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Armenia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Lao People Democratic Rep	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Fiji	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Ethiopia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Sierra Leone	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Rwanda	LVC	Yes	25% of Baseline by 2029	Yes	130,000
Barbados	LVC	Yes		Yes	130,000
United Republic of Tanzania	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Gambia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Burundi	LVC	Yes		Yes	130,000
Bahamas	LVC	Yes		Yes	130,000
Seychelles	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Eritrea	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Sao Tome and Principe	LVC	Yes		Yes	130,000
Montenegro	LVC	Yes	19.4% of Baseline by 2029	Yes	130,000
Tuvalu	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Cabo Verde	LVC	Yes		Yes	130,000
Saint Lucia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Eswatini	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Uganda	LVC	Yes		Yes	130,000
Mongolia	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Grenada	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Comoros	LVC	Yes		Yes	130,000
Vanuatu	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Bhutan	LVC	Yes		Yes	130,000
Samoa	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Marshall Islands	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Tonga	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Palau	LVC	Yes	10% of Baseline by 2029	Yes	130,000

Country	Level	Ratified	Current control measure KIP Stage I	Eligible for Stage II	Prep cost US $
Micronesia (Fed States)	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Kiribati	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Cook Islands	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Nauru	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Niue	LVC	Yes	10% of Baseline by 2029	Yes	130,000
Total				Yes	**15,660,000**
Total with ASC @ 9.6%				Yes	**17,163,360**

Annex 10: INDICATIVE COSTS FOR EOL ODS/HFC MANAGEMENT[122] [123]

Process	Capital Expenditure (CAPEX)	Operational Expenditure (OPEX)			
	Equipment, Infrastructure, and Installation costs	Laboratory Testing and Operational costs	Centralized Handling, Storage and other Logistics costs	Training costs	Compliance costs
Leak prevention	- Hand-held leak detectors (US$ 400/unit) Automatic leak detectors (not hand-held) (depends on size of coverage required, not possible to provide indicative price)	-	-	- Continuous technician training on leak prevention and detection, recovery, and recycling can be combined. Indicative cost, US $250 – 400 per technician. - Awareness campaigns can be consolidated for LRM activities. Programmes vary in cost starting at US$10,000	- Putting policies in place. Indicative cost starts at US $15,000 - Recordkeeping by operators. Cost borne by end users. Cost of awareness campaigns and workshops start at US $15,000/Workshop - Monitoring and tracking. - Capacity building cost of NOUs. Indicative cost starts at US $25,000
Leak Detection	- Hand-held leak detectors (US$ 400/unit) - Automatic leak detectors (not hand-held) (depends on size of coverage required, not possible to provide indicative price)	-	-	-	- Reporting and recordkeeping

[122] UNEP, TEAP Decision XXXV/11 Task Force Report on Lifecycle Refrigerant Management," May 2024.

[123] Prices presented in this table were not obtained from a detailed market survey; they are estimates based on expert information.

Recovery	- Recovery cylinders and/or bulk containers (below US$100 for the smallest cylinder, prices depend on sources, volume, presence of valves, transport and registering costs) - Recovery equipment (US$ 300- 1000/unit for very basic recovery equipment, US$ 30K-40K for more complex equipment that can do faster recoveries) - Refrigerant identifiers (US$ 5,000/unit)	- Cost for contracting out GC analysis (US$500) - Incremental technician time - Technician financial incentive	- Incremental handling equipment - Storage for economies of scale for onward return/treatment/ destruction - Incremental costs associate with handling mildly flammable or flammable refrigerants - Transport for treatment or destruction - Indicative costs vary from US$5 – 15/kg	-Technician training/awarenes -Training for new operations/staff	- Emission ban enforcement - Tracking/ recordkeeping - Reporting and recordkeeping
Recycling	- Recovery and recycling machine (US$ from 1200 onward, prices depending on capacity) - Bespoke[124] recycling equipment	- Moisture, high boiling residue, and other impurities removal and testing[125]	- If applicable, operation and maintenance costs for the testing facility or laboratories	-	- Reporting and recordkeeping
Reclamation (single component refrigerants)	- Refrigerant identifiers (US$ 5,000/unit) - Gas Chromatography (GC) equipment (US$ 45K to 50K) - Additional lab infrastructure (e.g., fume cupboards, lab balances)	- Cost per GC analysis (US$ 500) - Incremental staffing costs - Incremental laboratory operational costs (e.g., sample and reagent bottles, calibration standards, etc.)	- Operation and maintenance costs for the testing facility or laboratories - Incremental handling equipment (e.g., forklifts, trolleys etc.) – will vary by facility size - Storage for	- Employment and training of operators of reclamation equipment (which is more extensive than typical technician training)	- Inventory management (paper or electronic) - Where applicable, facility permitting and individual licensing/certification - Reporting and recordkeeping

[124] Bespoke equipment refers to custom-made equipment that is not commercially available.

[125] Producing larger volumes of recycled refrigerants will need access to moisture and oil removal and testing equipment.

	- Reclamation equipment to remove moisture, high boiling residue and other impurities		recovered refrigerants pending reclamation - Appropriate cylinder fleet for returning reclaimed refrigerant to the market - Where applicable, costs associated with providing third party certification (e.g., AHRI- 700, ISO 90001, ISO 17025) - Storage of non-reclaimable/contaminated refrigerants for destruction	- Indicative cost US$500 – 750/operator	
Reclamation (multi-component refrigerants)	- - Refrigerant identifiers (US$ 5,000/unit, may not yet available to identify the composition for all types of blends) - Gas Chromatography (GC) equipment (US$ 45K to 50K) - Additional lab infrastructure (e.g., fume cupboards, lab balances) - Reclamation equipment to remove moisture, high boiling residue and other impurities	- Cost per GC analysis (US$ 500) - Incremental staffing costs - Incremental laboratory operational costs (e.g., sample and reagent bottles, calibration standards, etc.)	- Operation and maintenance costs for the testing facility or laboratories - Incremental handling equipment (e.g., forklifts, trolleys etc.) – will vary by facility size - Storage for recovered refrigerants pending reclamation - Appropriate cylinder fleet for returning reclaimed refrigerant to the market - Where applicable, costs associated with providing third party certification (e.g., AHRI- 700, ISO 90001, ISO 17025) - Storage of non-reclaimable/contaminated refrigerants for destruction	- Employment and training of operators of reclamation equipment (which is more extensive than typical technician training) Indicative cost US$500 – 750/operator	- Inventory management (paper or electronic) - Where applicable, facility permitting and individual licensing/certification - Reporting and recordkeeping

Destruction	- Existing facility: Retrofitting existing hazardous waste facilities i.e. rotary kilns, cement kilns) with approved refrigerant destruction technologies co-disposing EOL ODS/HFCs (US$50,000 – 100,000) - New dedicated facility: Design, fabrication, installation, commissioning costs for approved destruction technologies (e.g., plasma arc etc.) – costs will vary depending on location, scale, and technology type. References costs: >3 million US$ for a small rotary kiln and >.4.2 US$ for a commercial scale plasma - arc facility (COPA (2023)	- Commercial hazardous waste chemical destruction using lowest-cost incineration technology US $2-3/kg, assuming economies of scale are potentially achievable if contracted with established qualified facility - Low volume costs in commercial rotary kilns may be US$6-8/kg. - Cement kiln destruction estimated at US$ 8/kg. - Commercial scale plasma arc estimated at US$8/kg while small scale plasma arc at US$20+/kg References (COPA (2023), UNEP (2019)	- Operation and maintenance costs for destruction facilities in accordance with the MP handbook - Costs associated with achieving optimal operating efficiencies (may include quality testing of material prior to destruction) - Storage of non-reclaimable/contaminated refrigerants pending destruction	- Employment and training for new operations/staff (new facility) - Training of operators on lower cost destruction technologies has a similar indicative cost to RRR operators at US $500 –750/operator	- Permitting, and if applicable, periodic recertification[41] - Inventory management - Facility performance qualification - Testing of waste streams, air/effluent discharge etc. to meet local environmental regulations - Reporting and record keeping