UNITED NATIONS

EP

United Nations Environment Programme

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/93/68
6 December 2023

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-third Meeting
Montreal, 15-19 December 2023
Item 9(d) of the provisional agenda[1]

PROJECT PROPOSAL: MALAYSIA

This document consists of the comments and recommendation of the Secretariat on the following project proposal:

Phase-down

- Kigali HFC implementation plan (stage I, first tranche) World Bank

[1] UNEP/OzL.Pro/ExCom/93/1

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

Malaysia

(I) PROJECT TITLE	AGENCY
Kigali HFC implementation plan (stage I)	World Bank (lead)

(II) LATEST ARTICLE 7 DATA (Annex F)	Year: 2022	13,873.41 mt	27,489,898 CO_2-eq tonnes

(III) LATEST ARTICLE 7 DATA BY SUBSTANCE (Annex F) (CO_2-eq tonnes)*			
HFC	**2020**	**2021**	**2022**
HFC-23	208,606	140,985	85,026
HFC-32	1,623,038	1,872,880	2,218,228
HFC-41	0	15	4
HFC-125	130,620	4,620	766,640
HFC-134a	5,222,413	4,571,464	6,818,730
HFC-143a	0	299	643,680
HFC-152a	1,262	788	2,361
HFC-227ea	689,212	963,202	424,155
HFC-236fa	6,945	5,886	9,810
HFC-245fa	0	1,030	4,398
HFC-365mfc	6,347	4,024	746
HFC-43-10mee	122,687	73,397	50,451
R-404A	937,207	561,989	9,893,424
R-407A	107	0	2,142
R-407C	262,239	228,021	214,987
R-407F	93,104	65,151	53,750
R-407H	0	0	135
R-410A	3,632,697	3,760,393	4,399,051
R-417A	4,565	5,806	8,164
R-438A	0	0	335
R-448A	0	0	3,445
R-449A	0	0	0
R-452A	0	0	64
R-507A	1,627,171	1,153,446	1,888,946
R-508B	1,695	30,874	1,225
R-513A	0	0	0
Total	**14,569,917**	**13,444,271**	**27,489,898**

* At the time of finalization of the present document, the Government was revising the country programme data.

(IV) AVERAGE 2020-2022 HFC CONSUMPTION IN SERVICING	3,306.10 mt	5,668,521 CO2-eq tonnes

(V) CONSUMPTION DATA (CO_2-eq tonnes)			
Baseline: average 2020-2022 HFC consumption plus 65% of HCFC baseline	26,703,717	Starting point for sustained aggregate reductions	TBD
CONSUMPTION ELIGIBLE FOR FUNDING			
Already approved	0	Remaining	TBD

(VI) ENDORSED BUSINESS PLAN		2023	2024	2025	Total
World Bank	HFC phase-down (CO_2-eq tonnes)	n/a	n/a	n/a	n/a
	Funding (US $)	1,605,000	0	0	1,605,000

(VI) PROJECT DATA			2023	2024	2025	2026	2027	2028	2029	Total
Consumption (CO_2-eq tonnes)	Montreal Protocol limits		n/a	26,703,716	26,703,716	26,703,716	26,703,716	26,703,716	24,033,345	n/a
	Maximum allowable		n/a	26,703,716	26,703,716	26,703,716	26,703,716	26,703,716	24,033,345	n/a
Amounts requested in principle (US $)	World Bank	Project costs	3,042,912	0	3,246,290	0	2,336,655	0	649,258	9,275,115
		Support costs	213,004	0	227,240	0	163,566	0	45,448	649,258
Amounts recommended in principle (US $)	Total project costs		3,042,912	0	3,246,290	0	2,336,655	0	649,258	9,275,115
	Total support costs		213,004	0	227,240	0	163,566	0	45,448	649,258
	Total funds		3,255,916	0	3,473,530	0	2,500,221	0	694,706	9,924,373

(VIII) Request for approval of funding for the first tranche (2023)		
Implementing agency	**Funds recommended (US $)**	**Support costs (US $)**
World Bank	3,042,912	213,004
Total	3,042,912	213,004

Secretariat's recommendation:	Individual consideration

PROJECT DESCRIPTION

1. On behalf of the Government of Malaysia, the World Bank as the designated implementing agency has submitted a request for stage I of the Kigali HFC implementation plan (KIP), at the amount of US $10,510,235, plus agency support costs of US $735,716, as originally submitted.[2]

2. The implementation of stage I of the KIP will assist Malaysia in meeting the target of 10 per cent reduction from its HFC baseline consumption by 1 January 2029.

3. The first tranche of stage I of the KIP being requested at this meeting amounts to US $3,153,071, plus agency support costs of US $220,715 for World Bank, as originally submitted, for the period of January 2024 to December 2026.

Background

4. Malaysia ratified all the amendments to the Montreal Protocol, including the Kigali Amendment on 21 October 2020. Malaysia has an HCFC consumption baseline of 515.76 ODP tonnes or 7,934.74 metric tonnes (mt) and plans to completely phase out consumption of HCFCs by 1 January 2030.[3]

Status of implementation of the HCFC phase-out management plan

5. Stage I of the HCFC phase-out management plan (HPMP) for Malaysia was originally approved at the 65th meeting[4] and revised at the 75th meeting[5] to meet the 15 per cent reduction from the baseline by 2016, resulting in the phase-out of 111.85 ODP tonnes of HCFCs, at a total cost of US $9,587,470, plus agency support costs.

6. Stage II of the HPMP for Malaysia was approved at the 77th meeting[6] to reduce HCFC consumption by 42.9 per cent from the baseline by 2022, at a total cost of US $6,138,063, plus agency support costs. Stage II of the HPMP will be completed by 31 December 2023, as stipulated in the Agreement between the Government of Malaysia and the Executive Committee. The final progress report will be submitted to the first meeting of 2024.

Status of implementation of HFC-related activities

7. At its 80th meeting, the Executive Committee approved a request from UNIDO for enabling activities for HFC phase-down in the amount of US $250,000, plus agency support costs of US $17,500, to be funded from the additional voluntary contributions of non-Article 5 countries.[7] The enabling activities were implemented from 2017 to 2020 to facilitate and prepare for the HFC phase-down. Activities included a survey of HFC consumption for 2015 to 2018, which helped determine the average consumption and HFC baseline. The final report included recommendations and conclusions that informed the development of the KIP and its preparation, such as the need to prioritize high-GWP HFCs to stay in compliance even in sectors with low baseline consumption (e.g., HFC-23 in the firefighting sector). The enabling activities also supported development of the quota allocation system, and lead to the Government specifying HFCs as "prohibited substances" subject to controls and introducing a new system of HFC tariff codes.

[2] As per the letter of 3 November 2023 from the Department of Environment of Malaysia to the World Bank.
[3] Except for those HCFCs allowed for a servicing tail between 2030 and 2040, where required, consistent with the provisions of the Montreal Protocol.
[4] Decision 65/13
[5] Annex XII of UNEP/OzL.Pro/ExCom/75/85
[6] Decision 77/46
[7] Decision 80/52

Stage I of the Kigali HFC implementation plan

Policy, regulatory and institutional frameworks

8. Two main agencies are responsible for implementing legislative measures for the management and control of controlled substances: the national ozone unit (NOU), part of the Ozone Protection Section/Seksyen Perlindungan Ozon (SPO) within the Department of Environment (DOE), and the Royal Malaysian Customs Department (customs) under the Ministry of Finance.

9. The DOE, under the Ministry of Natural Resources, Environment and Climate Change, is the principal agency managing implementation of the Montreal Protocol and related amendments. Malaysia established the NOU within DOE's air division to act as the national focal point for Montreal Protocol implementation. The SPO has played a lead role in the Government's sustained efforts to phase out controlled substances. The SPO, DOE and the Division of Environmental Management (BPAS) in NRECC serve as the Secretariat to the National Steering Committee (NSC) for the Protection of the Ozone Layer, which provides policy guidance and direction for the implementation of the Montreal Protocol. The NSC is headed by the Secretary General of NRECC and is supported by the Project Steering Committee (PSC) in handling all technical and operational matters of Montreal Protocol projects. The PSC is chaired by the DOE Deputy Director General.

10. Customs collaborates closely with DOE on the enforcement of relevant rules and regulations. Its main responsibility is to control and regulate all of Malaysia's imports and exports. It is also tasked with collecting duties and other taxes from imported and exported goods. The HFC quota system will work in tandem with the HCFC quota system to assist in the transition from HCFCs to lower GWP HFCs.

11. Malaysia has a comprehensive policy and regulatory framework for ODS control. Legislative measures adopted as part of the strategy for CFCs and halons in the 1990s, and the more recent HCFC phase-out, have provided the necessary powers for the relevant control and enforcement agencies to regulate the import and export of controlled substances through a licencing and quota system and require importers, exporters, and relevant industries to report to relevant enforcement authorities. The Environmental Quality Act (EQA) of 1974 gives power to NRECC to develop or amend regulations such as those related to HFCs.

HFC consumption

12. Malaysia only imports HFCs for use in the refrigeration and air-conditioning (RAC) servicing, RAC manufacturing, polyurethane (PU) foam manufacturing, solvent and aerosols, and firefighting sectors. In 2022, Malaysia consumed R-404A (36.0 per cent of total HFC consumption in CO_2-equivalent tonnes), HFC-134a (24.8 per cent), R-410A (16.0 per cent), and other HFCs (23.2 per cent). Table 1 presents the country's HFC consumption as reported under Article 7 to the Ozone Secretariat.

Table 1. HFC consumption in Malaysia (2019–2022 Article 7 data)

HFC	GWP*	2019	2020	2021	2022	Share of HFC consumption in 2022 (%)
mt						
HFC-23	14,800	15.59	14.10	9.53	5.75	0.0
HFC-32	675	1,837.07	2,404.50	2,774.64	3,286.26	23.7
HFC-41	92	0.00	0.00	0.16	0.04	0.0
HFC-125	3,500	2.13	37.32	1.32	219.04	1.6
HFC-134a	1,430	3,216.07	3,652.04	3,196.83	4,768.34	34.4
HFC-143a	4,470	0.05	0.00	0.07	144.00	1.0
HFC-152a	124	1.42	10.18	6.35	19.04	0.1
HFC-227ea	3,220	211.42	214.04	299.13	131.73	0.9
HFC-236fa	9,810	0.50	0.71	0.60	1.00	0.0

HFC	GWP*	2019	2020	2021	2022	Share of HFC consumption in 2022 (%)
HFC-245fa	1,030	0.45	0.00	1.00	4.27	0.0
HFC-365mfc	794	0.00	7.99	5.07	0.94	0.0
HFC-43-10mee	1,640	85.57	74.81	44.75	30.76	0.2
R-404A	3,922	226.17	238.99	143.31	2,522.80	18.2
R-407A	2,107	0.00	0.05	0.00	1.02	0.0
R-407C	1,774	127.89	147.84	128.55	121.20	0.9
R-407F	1,825	56.13	51.03	35.71	29.46	0.2
R-407H	1,495	0.00	0.00	0.00	0.09	0.0
R-410A	2,088	2,010.16	1,740.21	1,801.39	2,107.33	15.2
R-417A	2,346	1.89	1.95	2.48	3.48	0.0
R-438A	2,264	0.00	0.00	0.00	0.15	0.0
R-448A	1,386	0.91	0.00	0.00	2.49	0.0
R-449A	1,396	0.02	0.00	0.00	0.00	0.0
R-452A	2,139	0.23	0.00	0.00	0.03	0.0
R-507A	3,985	203.37	408.32	289.45	474.01	3.4
R-508B	6,808	0.08	0.25	4.54	0.18	0.0
R-513A	629	0.17	0.00	0.00	0.00	0.0
Total (mt)		**7,997.28**	**9,004.32**	**8,744.85**	**13,873.41**	**100.0**
CO_2-eq tonnes						
HFC-23	14,800	230,717	208,606	140,985	85,026	0.3
HFC-32	675	1,240,020	1,623,038	1,872,880	2,218,228	8.1
HFC-41	92	0	0	15	4	0.0
HFC-125	3,500	7,455	130,620	4,620	766,640	2.8
HFC-134a	1,430	4,598,978	5,222,413	4,571,464	6,818,730	24.8
HFC-143a	4,470	224	0	299	643,680	2.3
HFC-152a	124	176	1,262	788	2,361	0.0
HFC-227ea	3,220	680,779	689,212	963,202	424,155	1.5
HFC-236fa	9,810	4,905	6,945	5,886	9,810	0.0
HFC-245fa	1,030	468	0	1,030	4,398	0.0
HFC-365mfc	794	0	6,347	4,024	746	0.0
HFC-43-10mee	1,640	140,327	122,687	73,397	50,451	0.2
R-404A	3,922	886,933	937,207	561,989	9,893,424	36.0
R-407A	2,107	0	107	0	2,142	0.0
R-407C	1,774	226,856	262,239	228,021	214,987	0.8
R-407F	1,825	102,400	93,104	65,151	53,750	0.2
R-407H	1,495	0	0	0	135	0.0
R-410A	2,088	4,196,219	3,632,697	3,760,393	4,399,051	16.0
R-417A	2,346	4,440	4,565	5,806	8,164	0.0
R-438A	2,264	0	0	0	335	0.0
R-448A	1,386	1,257	0	0	3,445	0.0
R-449A	1,396	32	0	0	0	0.0
R-452A	2,139	486	0	0	64	0.0
R-507A	3,985	810,427	1,627,171	1,153,446	1,888,946	6.9
R-508B	6,808	545	1,695	30,874	1,225	0.0
R-513A	629	107	0	0	0	0.0
Total (CO_2-eq tonnes)		**13,133,750**	**14,569,917**	**13,444,271**	**27,489,898**	**100.0**

*Global warming potential, rounded to the nearest whole number.

13. While Malaysia reported consumption of 24 HFCs and HFC blends, its consumption in CO_2-eq tonnes is dominated by six HFCs and HFC blends: HFC-134a, R-410A, HFC-32, R-507A, R-404A, and HFC-227ea. Overall consumption until 2021 was fairly steady with fluctuations likely due to the influence of the COVID-19 pandemic and supply chain disruption, and in 2022 grew considerably given the HCFC phase-out, though this trend varies by substance. Consumption of R-410A and HFC-32 (which

are principally used in residential air-conditioning (AC)) increased steadily between 2020-2022; consumption of HFC-134a (used in mobile and commercial AC, and refrigeration) and R-507A (used in industrial refrigeration and some chillers) first decreased and then increased again; while consumption of HFC-227ea (principally used in firefighting) first increased and then decreased. Consumption of R-404A, as well as that of HFC-125 and HFC-143a, is further discussed in paragraph 63 of the present document.

Country programme implementation report

14. During the course of the review of the stage I proposal, the Government revised the data it had reported under Article 7 of the Montreal Protocol to be in line with the data in table 1 and the detailed surveys undertaken during the course of preparing the stage I KIP proposal. At the time of finalization of the present document, the Government was in the process of revising the HFC sector use and consumption data under its 2020, 2021, and 2022 country programme implementation reports to be consistent with the consumption data reported under Article 7 of the Montreal Protocol for those years, and the sectoral uses identified in the stage I proposal.

HFC distribution by sector

15. Approximately 40 per cent of HFCs in the country are consumed to service RAC equipment, with the remaining 60 per cent consumed in manufacturing RAC equipment and polyurethane (PU) foam, in firefighting, and in solvents and aerosols. In manufacturing, HFCs are mainly consumed in residential AC (portable, split-type) and heat pumps (34.4 per cent in mt), followed by commercial AC and chillers (16.7 per cent), industrial refrigeration (3.1 per cent in mt), and others as shown in table 2. HFCs are consumed at a smaller scale in polyurethane (PU) foam manufacturing and firefighting, though the sectors have experienced growth in recent years. HFCs are also used in solvent and aerosol applications at a very small scale.

Table 2. Estimated sectoral distribution of HFC consumption in Malaysia for 2022 (mt)[8]

Sector	Consumption	Share (%)	Most commonly consumed HFCs
Manufacturing			
Residential AC and heat pumps	4,096.28	34.4	HFC-32, R-407C, R-410A
Commercial AC and chillers[*]	1,992.91	16.7	HFC-134a, R-407C, R-410A, R-417A, R-507A, R-513A
Mobile AC	251.00	2.1	HFC-134a
Commercial refrigeration	201.14	1.7	HFC-134a, R-404A, R-407F, R-448A
Industrial refrigeration	374.02	3.1	R-404A, R-407A, R-449A, R-507A, R-508B
Firefighting[*]	139.24	1.2	HFC-125, HFC-227ea
Foam	5.22	0.0	HFC-245fa, HFC-365mfc, HFC-227ea
Solvent	50.04	0.4	HFC-23, HFC-32, HFC-41, HFC-143a, HFC-152a, HFC-245fa, HFC-365mfc, HFC-43-10mee
Aerosol	49.05	0.4	HFC-125, HFC-134a, HFC-365mfc, R-404A
Total - Manufacturing	**7,158.90**	**60.0**	**-**
Servicing	**4,763.55**	**40.0**	HFC-32, HFC-125a, HFC-134a, HFC-143a, R-404A, R-410A, R-507A, R-407C, others
Other[**]	**1,950.95**	**n/a**	HFC-125, HFC-143a, R-404A
Total - All sectors	**13,873.40**	**100.0**	**-**

[*] Assembly and installation

[**] This category comprises only imports of R-404A, HFC-125 and HFC-143a; while total consumption for these three substances in this category accounts for 14.1 per cent of total consumption in the country for 2022 in metric tonnes, the percentage was not included in the overview given uncertainties in its use, as further explained in paragraphs 63 and 64.

[8] More detailed information on HFC manufacturing consumption is provided in annex I to the present document; and further information on HFC servicing consumption is provided in paragraphs 32 to 34 and table 4 below.

Manufacturing sectors

Residential AC and heat pumps

16. Malaysia is a major manufacturing hub for residential ACs, with seven large manufacturers and several local small- and medium-sized manufacturers that also manufacturer light commercial AC. Manufacturing of AC units (mainly split-type) has been increasing in recent years.

17. Malaysia is also a significant export hub for air-conditioning equipment in the region, particularly for air-cooled split and packaged air-conditioners. Approximately 70 per cent of total manufacturing is for exports to the Association of Southeast Asian Nations (ASEAN), Western Pacific, North America, Latin America, and countries in the Middle East. Most exported AC units are 100 per cent pre-charged with refrigerant. All manufacturing of heat pumps is for the export market, particularly that of the European Union (EU).

18. HFC-32 and R-410A make up the bulk of HFCs used in the manufacturing of small (<6 HP) and larger (>6 HP) split AC and self-contained AC units. Heat pumps use R-410A as the preferred refrigerant, though this has been changing with new fluorinated gas (F-gas) rules in the EU. The choice of refrigerants for split-type AC in Malaysia has shifted from R-407C and R410A to HFC-32 in line with recent trends in the regional market.

Commercial AC and chillers

19. This subsector includes commercial AC such as multi-split variable flow refrigerant (VRF) units, packaged AC units, and air- and water-cooled chillers. Large centrifugal chillers and screw chillers mainly consume HFC-134a, whereas VRF system and small- to medium-capacity chillers using scroll compressors consume R-410A; smaller amounts of HFC blends such as R-407C and R-507A are also used in chillers.

Mobile air-conditioning

20. The Malaysian automotive industry is the third largest in Southeast Asia and includes several major automobile manufacturers, including non-Article-5-owned, with most vehicles manufactured for the domestic market. Malaysia is the first country in Southeast Asia to have established an indigenous car enterprise, Perusahaan Otomobil Nasional Sdn Bhd (PROTON), which began manufacturing cars in the 1980s; a second locally owned automobile manufacturer Perusahaan Otomobil Kedua Sdn Bhd (Perodua) was established in 1993. There are also several contract manufacturers that manufacture vehicles for multinational corporations, including domestic-joint venture and wholly owned subsidiaries. There are approximately 20 vehicle manufacturers, assemblers and distributors in the country.

21. All motor vehicles manufactured in the country are fitted with HFC-134a-based mobile air-conditioning (MAC) units; new vehicles imported from the EU use HFO-1234yf. The country is preparing for the introduction of electric vehicles, which will not have HFC-134a-based MAC. The automotive sector was one of the most impacted by the global COVID-19 pandemic and is expected to recover, resulting in increased consumption of HFC-134a.

Refrigeration

22. Main manufacturing activities in the refrigeration sector are in the commercial and industrial sectors; transport refrigeration consumes HFCs for servicing only. The majority of domestic refrigerators sold in the country are imported, pre-charged units, with a significant proportion using R-600a (or isobutane) as refrigerant. The manufacture of domestic refrigeration systems in the country is limited, except for chest freezers and beverage/wine chillers where some are still using HFC-134a. Based on

industry consultations, there has been no HFC-134a use in domestic refrigeration manufacturing since 2018, though one non-Article 5-owned enterprise had the manufacturing capacity to do so.

23. HFC-134a and R-404A are the main refrigerants used in the commercial refrigeration subsector, which includes stand-alone refrigeration (chest freezers, counter chillers and freezers, showcases, and upright chillers and freezers); two main local manufacturers include Berjaya Steel and Zun Utara, and a third manufacturer is believed to be making stand-alone units and small refrigeration appliances at a much smaller scale; other enterprises may also manufacture stand-alone commercial equipment, but their consumption is expected to be limited. The subsector also includes large commercial refrigeration equipment, which uses R-404A, R-507A and possibly HFC-134a in commercial display units and centralized refrigeration systems (such as in supermarkets). Malaysia also imports commercial refrigeration systems from countries in the Southeast Asia region. Some are pre-charged with refrigerants and others are charged when installed at sites. Demand in this subsector has fluctuated, but it is likely that use of R-507A is being replaced with HFC-134a, particularly for centralized systems.

24. R-507A has been the main refrigerant in the industrial refrigeration subsector, though its consumption has fluctuated substantially in part due to fluctuating prices of alternatives (i.e., carbon dioxide (CO_2), ammonia) as well as market changes during the pandemic, e.g., challenges in obtaining refrigeration parts and equipment for the alternative ammonia-based systems; periodic stockpiling may also contribute to this. 2022 consumption rose from 2021, indicating that parts of industry may not be moving to alternatives despite availability and global trends. The 2021 consumption shows an increase of R-508B, which may be attributed to stockpiling following an increased demand during the pandemic as an alternative to HFC-23.

Firefighting

25. The fire suppression industry in Malaysia provides fire protection services to the commercial, residential, and industrial sectors, among others, and includes 37 manufacturers, suppliers, and service providers of fire suppression systems and equipment such as sprinkler systems, fire alarms, and fire extinguishers. There are also several local fire suppression enterprises that provide related services to various industries. Since portable fire extinguishers in the country typically use only water, CO_2, foam, dry powder, or wet chemical (potassium), consumption of HFCs in this sector is only known in fixed fire protection systems and is now dominated by HFC-227ea; the sector also consumes small quantities of HFC-23 and HFC-125, as shown in table 3.

Table 3. HFC consumption in firefighting

HFC	2015	2016	2017	2018	2019	2020	2021	2022
HFC-23	11.93	25.05	20.81	59.49	15.44	13.92	9.40	5.68
HFC-125	21.45	34.05	4.76	9.71	2.13	37.32	1.32	1.85
HFC-227ea	294.22	339.10	362.09	447.19	211.40	214.02	299.13	131.71
Total	**327.61**	**398.20**	**387.66**	**516.39**	**228.97**	**265.26**	**309.84**	**139.24**

Polyurethane foam

26. The PU foam sector has experienced steady growth in recent years due to economic development and growth in demand. Malaysia manufactures PU foam mainly for use in the construction, appliance, and cold chain industries. There are seven systems houses that have facilities for blending and customization of formulated polyols in Malaysia and for export to the surrounding region.

27. There are approximately 100 foam manufacturers in the country, most having converted from HCFCs to hydrocarbons with implementation of the HPMP over the last decade. The preferrable HCFC alternative for foam blowing agents has been hydrocarbons (rather than HFCs) due to lower cost. A small amount of HFC-245fa and HFC-365mfc used with HFC-227ea is presently used as a blowing agent in the

manufacturing of spray foam insulation and other applications where hydrocarbon cannot be applied safely. Consumption of HFCs in this sector is expected to grow, notably due to several enterprises that had decided to withdraw from stage II of HPMP to avoid using HFOs, and where hydrocarbon and water-blown technologies are not acceptable for reasons related to safety/costs and quality, respectively. Use of other blowing agents such as methylal and dimethoxymethane was not found.

Solvents

28. Four enterprises were identified to use HFC as solvents, with three of these reporting the use of HFC-4310mee, HFC-152a, HFC-143a, HFC-32, HFC-41 and HFC-23. There are likely more enterprises consuming HFCs in the semiconductor industry, which focuses primarily on the manufacturing of semiconductor devices and electronic components, including microprocessors, memory chips, and sensors. Fluorinated gases and liquids such as HFCs are used for etching circuitry, for cleaning chambers, and as a heat transfer fluid.

29. HFC-4310mee accounts for approximately 80 per cent of HFCs used in the solvent sector since 2019 for use as a solvent carrier in the manufacturing of semiconductors, though HFC-152a use has increased, and in 2022 accounted for approximately 38 per cent of HFCs used in the sector. The remaining HFCs are consumed in small quantities in the sector, including HFC-143a (used as a heat transfer fluid for thermal management of the wafer during etching), and HFC-41, HFC-23 and HFC-32 are also reportedly used in the etching process in the semiconductor industry. HFC-41 was also reported as being used as a solvent to clean and prepare a variety of substrates for bonding with sealants.

30. Reportedly, HFC-245fa is used in the aerospace industry, likely as a working fluid, whereas HFC-365mfc is pre-blended with a HFE-7100 compound for use as a cleaning agent in the production of camera lenses. However, neither were reported through the survey of HFC consumption.

Aerosols

31. HFC applications as aerosols are mostly limited to propellants in the pharmaceutical industry, particularly HFC-134a which is used to manufacture metered dose inhalers (MDIs). Malaysia has a well-developed pharmaceutical industry, with a range of local and international companies including local companies such as Pharmaniaga and Duopharma, as well as international companies such as Pfizer, Novartis, and GlaxoSmithKline. The 2020-222 average HFC-134a consumption in MDI manufacturing was 42.63 mt.

Refrigeration and air-conditioning servicing sector

32. There are approximately 20,000 technicians and 1,380 formal workshops consuming HFCs in Malaysia, as well as informal workshops estimated to be in the thousands. HFCs are used to service residential and commercial air conditioners, chillers, refrigeration equipment (including domestic refrigerators, stand-alone commercial refrigeration units, industrial and large commercial refrigeration equipment, and transport refrigeration) and MAC. As shown in table 4, HFC-32, HFC-134a, R-407C, R-404A, R-410A, and R-507A represented the majority (94 per cent) of total HFCs used for servicing in 2022. HFC-134a is used across many sectors, including domestic and commercial refrigeration, mobile AC, and chillers. HFC-32 is used to service residential AC equipment, and R-410A is used to service both residential and commercial AC; commercial AC and chillers are also serviced with HFC-134a, R-507A, and other blends. R-404A and R-507A are used in the servicing of commercial and industrial refrigeration equipment, and R-407C is used to service the public railway and bus AC in the country. R-407F is a drop-in replacement for R-404A and R-507A, likely used to service commercial refrigeration systems.

Table 4. HFC consumption in servicing in Malaysia from 2019 to 2022

HFC	2019	2020	2021	2022
		mt		
HFC-32	24.00	360.45	484.73	610.60
HFC-125a	-	-	-	140.00
HFC-134a	1,550.53	1,719.87	1,402.86	2,398.94
HFC-143a	-	-	-	140.00
R-404A	63.83	18.68	34.67	506.49
R-407A	-	0.03	-	0.51
R-407C	53.06	69.50	55.92	54.15
R-407F	28.06	25.52	17.86	15.96
R-407H	-	-	-	0.09
R-410A	289.49	388.76	469.09	736.02
R-417A	0.95	0.97	1.24	1.74
R-438A	-	-	-	0.07
R-448A	0.45	-	-	2.49
R-452A	0.11	-	-	0.02
R-507A	-	9.36	92.87	156.39
R-508B	0.04	0.13	2.27	0.09
R-513A	0.09	-	-	-
Total (mt)	**2,010.61**	**2,593.26**	**2,561.50**	**4,763.55**
Total (CO_2-eq tonnes)	**3,236,757**	**3,797,829**	**3,968,681**	**9,239,053**

33. The stationary RAC servicing sector is made up of a diverse range of establishments that provide maintenance services for all types of RAC systems. There are approximately 380 formal service workshops associated with RAC equipment and appliance manufacturers across the country, which are either owned by the manufacturer or franchises. There is also a large informal servicing sector in the country, with workshops estimated to be in the thousands. Approximately 80 per cent of an estimated 10,000 active servicing technicians have learned in the field rather than through formal technician training. There are also estimated to be over 10,000 MAC technicians working in both formal and informal service workshops.

34. Malaysia's public transportation sector consumes HFCs, mainly R-407C, to service rail cars and buses of the light rapid transit system, commuter rail and bus rapid transit of the Land Public Transportation Agency (APAD). All trains are equipped with R-407C AC, which are charged during installation; each AC unit contains a charge size of 5.8 kg, and units are inspected twice per year. In case of failure, the refrigerant is recovered, stored in receiving tanks, and sent to other contractors for proper disposal. Public transportation systems in the country are serviced by a certified contractor; for example, Rapid Rail Sdn Bhd services the Kejang line train system, which operates under APAD. This line serves the Kuala Lumpur metro area and is equipped with 58 trains and a total 232 coaches; each train has four coaches and each coach is equipped with two R-407C package AC units, with coaches supplied by manufacturers in Germany and Korea and estimated to have an operating life of 30 years, and each AC unit an expected service life of 10 years. There is an estimated 2.7 mt (4,789 CO_2-eq tonnes) of R-407C installed in the Kejang network.

Phase-down strategy for stage I of the Kigali HFC implementation plan

Overarching strategy

35. In line with the flexibility provided to Article 5 countries to select their own strategies and priorities in sectors and technologies, the Government of Malaysia's strategic vision for the KIP is to harmonize actions required for meeting Kigali Amendment obligations and national commitments for CO_2 emission reductions with actions that promote and sustain economic growth and development of Malaysia's key industrial sectors. In line with that vision, Malaysia's strategy was shaped by the following overarching principles:

(a) Consumption reduction steps will be implemented in a sustainable manner to accommodate normal economic growth of non-prioritized HFCs;

(b) High-GWP HFCs, especially with growth potential and available alternatives, will be targeted, and emissions from the highest HFC polluters will be reduced;

(c) Conversions will be targeted in sectors where viable, lower GWP alternatives are available and where the global market is rapidly shifting to these low-GWP alternatives;

(d) Average GWP of HFCs consumed will be lowered year-on-year;

(e) Subsequent conversions will be avoided as long as possible;

(f) Phasedown will be prioritized for industry that export to non-Article 5 country markets; and

(g) Early retirement of existing equipment will be minimized by providing a sufficient consumption tail for servicing sectors.

36. Based on those principles, stage I will entail a combination of interventions to manage and control HFCs that are used in fire suppression systems; in domestic, stand-alone commercial and transport refrigeration; and in MAC and the servicing sector**.** Those activities will be supported by six bans:

(a) By 1 January 2026: a ban on the installation of new HFC-23- and HFC-125-based fire suppression systems; and

(b) By 1 January 2029: a ban on the manufacture and import of HFC-based stand-alone commercial refrigeration equipment; a ban on the manufacture of HFC-based domestic refrigeration; a ban on the manufacture and import of HFC-134a-, R-452A-, and R-404A-based components for refrigerated transport; ban on new installations of R-407C-based chillers; a ban on the manufacture and import of R-407C-based split AC and heat pumps.

37. Later stages will address other sectors, including residential AC where HFC-32 will be the refrigerant of choice until the market is ready for lower-GWP alternatives. By 2045 and beyond, almost all remaining HFCs consumed in all sectors are expected to be phased out except for the aerosol sector (HFC-134a) and the servicing sector (HFC-32).

38. Malaysia is proposing four stages for the KIP implementation. Stage I is proposed to be implemented simultaneously with the HPMP until 2030. Stage II is expected to cover a period of six years (from 2029 to 2035), stage III is expected to cover a period of five years (from 2035 to 2040), and stage IV is expected to cover a period of five years until 2045.

Established HFC baseline and proposed reductions

39. The Government of Malaysia reported its Article 7 data for 2020-2022. By adding 65 per cent of the HCFC baseline (in CO_2-eq tonnes) to the average HFC consumption in 2020-2022, the established HFC baseline is 26,703,717 CO_2-eq tonnes, as shown in table 5.

Table 5. HFC baseline for Malaysia (CO_2-eq tonnes)

Baseline calculation	2020	2021	2022
HFC annual consumption	14,569,917	13,444,271	27,489,898
HFC average consumption 2020-2022			18,501,362
HCFC baseline (65%)			8,202,355
HFC baseline			**26,703,717**

40. While the country's 2022 consumption was above the HFC baseline, as further explained in paragraphs 63 and 64 of the present document, the Government considered that consumption anomalous. The activities proposed under stage I would ensure the country remained in compliance with its Montreal Protocol HFC consumption targets for the duration of the stage.

Proposed activities

41. Stage I includes three investment projects: a pilot project at one enterprise manufacturing automobiles to convert MAC units in a new vehicle model from HFC-134a to HFO-1234yf, and the conversion of two small- and medium-sized enterprises (SMEs)[9] manufacturing stand-alone commercial refrigeration equipment to R-290 and R-600a. Non-investment activities include strengthening the servicing sector for MAC, and commercial and domestic refrigeration; and technical assistance, including in transport refrigeration servicing, MAC servicing in public transport, strengthening recovery and recycling, customs capacity-building, and other technical assistance activities; and project monitoring and coordination.

Legal framework

42. Malaysia has an enforceable HFC licensing system in place and is developing their quota system to include HFC import quotas.

43. Stage I of the KIP proposes policy and regulation changes to control HFC import and consumption, including through the reduction of import quotas, revision of public procurement policies, and preparation of six manufacturing, import, and installation bans across sectors. The Government will also amend, following consultations with relevant stakeholders, the country's 2020 environmental quality regulations on refrigerant management to control the consumption of HFC refrigerants.

44. The HFC quota system will work in tandem with the HCFC quota system to assist in the transition from HCFCs to lower GWP HFCs, rather than proportionally distribute quotas to all importers regardless of HFC. The quotas will be distributed to importers based on their 2020-2022 average consumption six months prior to the year of control, with the exception of any HFCs chosen for accelerated phase-down, with priority to importers of lower GWP HFCs.

45. Stage I includes a focus on the fire suppression sector given the high GWP of some of the agents used sector. The country will ban the installation of new fire suppression systems based on HFC-23 and HFC-125 by 31 December 2026, and reduce the quota for those substances to allow for servicing of existing systems. Given the prevalence of HFC-227ea in the country, and the planned end in production of a currently available alternative, HFC-227ea will see a more gradual phasedown that will be supported by quota reductions.

[9] The Government defines SMEs in the manufacturing sector as enterprises with sales turnover not exceeding 50 million Malaysian Ringgit or up to 200 full-time employees.

Pilot project in MAC manufacturing (PROTON)

46. A pilot project at the enterprise PROTON, a 100 per cent Article 5 owned automobile manufacturer, will promote the conversion from HFC-134a in one car model to HFO-1234yf, which will be launched in 2027. Through the pilot project, the MAC manufacturing sector will be prewarned of the eventual and inevitable phaseout of HFC-134a-based MACs in new automobiles and the need to align new model development with new MAC systems; in addition, the MAC manufacturing sector and supply chain will be sensitized about the costs, challenges and opportunities of transitioning away from HFC-134a.

47. The overall transition to HFO-1234yf at PROTON will happen gradually depending on the car model, market segment, launching schedule of newly redesigned model, price of HFO-1234yf after patents are released (expected in the mid-2020s), and government policy. Accordingly, the pilot project will not fully convert PROTON's manufacturing to HFO-1234yf; rather, one of the two enterprise's two assembly lines will be converted to allow the manufacturing with HFO-1234yf and one of the eight models the enterprise manufactures will be converted to HFO-1234yf; the enterprise's remaining models will continue to be manufactured with HFC-134a-based MACs during stage I, both on the enterprise's second line and the converted line, which will have the capacity to assemble MACs with both HFO-1234yf and HFC-134a.

48. Investments required include development of a new design with MAC component suppliers; research and development, and performance testing of new MAC system; new refrigerant charging equipment;[10] refrigerant storage and transfer, including an explosion proof transfer pump, piping, ventilation, gas detection, alarm and safety system; and 10 training workshops for 250 line operators. In addition, 25 out of PROTON's 250 authorized service workshops will be provided tools (i.e., vacuum pump, charging machine, manifold gauges) that can handle HFO-1234yf. PROTON will prepare an environmental management plan and develop standard operating procedures (SOPs) to handle a flammable refrigerant; this element will be co-financed by the enterprise. The incremental capital costs (ICCs) of the pilot project are US $1,386,065, as summarized in table 6.

Table 6. ICCs for the pilot MAC manufacturing project at PROTON

Description	Total cost (US $)
Investment component for assembly line	
HFO-charging equipment (two online, one offline)	492,000
Refrigerant supply (piping, civil construction of new refrigerant room)	25,100
Ventilation and plant safety	49,300
Research, development and performance testing	450,000
Training at PROTON plant	11,500
Subtotal for assembly line	***1,027,900***
Investment component for authorized workshop	
Tools (vacuum pump, charging machine, manifold gauges)	130,000
Training at servicing centre	11,250
Subtotal for authorized workshop	***141,250***
Contingencies	116,915
Environmental management plan and SOPs to handle a flammable refrigerant	100,000
Total	**1,386,065**

49. As HFO-1234yf is mildly flammable, PROTON needs to adjust the placement of the compressor and condenser and reroute hose and pipe connections between MAC system components to avoid hot surfaces in the engine compartment. The difference in price for the compressor, evaporator, condenser, and hose and pipe connection per MAC is US $13.40. The current price of HFO-1234yf is US $80/kg and that of HFC-134a is US $6/kg. The car model selected by PROTON has a refrigerant charge of 0.9 kg/unit, resulting in incremental operating costs (IOCs) of US $81.68/unit. To estimate the total IOCs for

[10] The manufacturing line has three HFC-134a charging machines, one of which is offline in case a vehicle's MAC was not appropriately charged on the assembly line.

transitioning to HFO-1234yf MAC system, PROTON estimated it would manufacture 8,000 units per year of the selected model in 2027, resulting in the phase-down of 7.2 mt of HFC-134a and IOCs of US $653,440.

Conversion of the commercial refrigeration manufacturing enterprise Zun Utara

50. Zun Utara uses HFC-134a and R-404A to manufacture 21 models of chest and upright freezers on two manufacturing lines. The enterprise will convert its manufacturing to R-290, resulting in the phase-out of 6.46 mt (9,239 CO2e tonnes) of HFC-134a and 0.11 mt (425 CO2e tonnes) of R-404A.

51. The enterprise has three charging machines that need to be replaced with R-290 charging units, one of which the enterprise would co-finance. As a blowtorch is used during the installation of compressors and condensers to each freezer cabinet, and the refrigerant charging area is close to that area, the enterprise intends to build an extension to separate the charging area from the open flame source; the enterprise would co-finance that building extension. In addition, hydrocarbon leak detectors and safety measures, including ventilation, explosion proof electrical and grounding, monitoring and a safety panel, as well as changes to the refrigerant storage and piping are necessary. The 21 freezer models manufactured by the enterprise will need to be redesigned and tested; workers will participate in safety training; and technical support will be provided and a plant safety audit undertaken, resulting in ICCs of US $363,000, of which US $237,000 were requested from the Multilateral Fund, as summarized in table 7. The enterprise was not requesting IOCs, which it estimated at US $382,527 based on the higher price of an R-290 compressor, and the difference in price and refrigerant charge between HFC-134a, R-404A and R-290.

Table 7. ICCs for the conversion at Zun Utara

Component	Cost (US $)	Requested grant (US $)	Co-financing (US $)
Refrigerant charging machine (3)	180,000	120,000	60,000
Refrigerant storage and distribution, safety measures	96,000	47,000	49,000
Technical assistance, product design, testing, and training	54,000	49,000	5,000
Contingency	33,000	21,600	11,400
Total	**363,000**	**237,600**	**125,400**

Conversion of the commercial refrigeration manufacturing enterprise Berjaya Steel

52. Berjaya Steel uses HFC-134a and R-404A to manufacture 48 models of display chillers, upright chillers and freezers, counter chillers and freezers, and other stand-alone commercial refrigeration equipment. The enterprise will convert its manufacturing process to R-600a and R-290, resulting in the phase out of 3.83 mt of HFC-134a (5,472 CO_2e tonnes) and 5.09 mt of R-404A (19,976 CO_2e tonnes).

53. The enterprise has four manufacturing lines, and three charging machines: two for HFC-134a and one for R-404A. The three charging machines need to be replaced to be able to charge with hydrocarbon refrigerant; as the enterprise was in the process of converting two of its manufacturing lines that share an HFC-134a charging machine, it will finance that conversion, including by procuring the hydrocarbon refrigerant charging machine. Safety measures including ventilation, hydrocarbon gas detectors, explosion proof electrical and grounding, monitoring and a safety panel will be requested for the enterprise's other manufacturing lines, as well as changes to the refrigerant storage and piping are necessary. The 48 models manufactured by the enterprise will need to be redesigned and tested; workers will participate in safety training; and technical support will be provided and a plant safety audit undertaken, resulting in ICCs of US $332,400, of which US $224,950 were requested from the Multilateral Fund, as summarized in table 8. The enterprise was not requesting IOCs, which it estimated at US $406,432 based on the higher price of a hydrocarbon compressor, and the difference in price and refrigerant charge between HFC-134a, R-404A and hydrocarbon refrigerant.

Table 8. ICCs for the conversion at Berjaya Steel

Component	Cost (US $)	Requested grant (US $)	Co-financing (US $)
Refrigerant charging machine (3)	180,000	120,000	60,000
Refrigerant storage and distribution, safety measures	51,000	26,000	25,000
Technical assistance, product design, testing, and training	71,400	58,500	11,400
Contingency	30,240	20,450	9,640
Total	**332,640**	**224,950**	**106,040**

Refrigeration and air-conditioning servicing sector

54. Strengthening of RAC sectors servicing HFC-based RAC equipment and vehicles (US $6,127,280), including:

(a) MAC servicing:

(i) Training and assessment (US $1,108,000): Development of standardized MAC servicing training modules (US $60,000), revision of occupational standards and training curriculum to include good MAC servicing practices (US $15,000), organization of five train-the-trainers workshops to train 100 trainers and 126 workshops to train 2,376 technicians on good servicing and installation practices (US $529,000), and testing and certification of 2,376 technicians (US $504,000);

(ii) Equipment procurement (US $2,388,000): Procurement of 160 training equipment kits for 20 of the 64 authorized training centres (ATCs) in Malaysia (eight per ATC) (US $1,200,000) and procurement of 2,376 servicing tools for training workshops (US $1,188,000);

(b) Commercial and domestic refrigeration servicing:

(i) Training and assessment (US $989,000): Development of standardized training modules for servicing commercial and domestic refrigeration equipment (US $60,000) and electronics repair, needed to repair or replace the controls needed for refrigeration equipment using energy efficient inverter compressors (US $35,000); revision of occupational standards and training curriculum to include good servicing practices in servicing commercial and domestic refrigeration, including the safe handling of flammable refrigerants (US $15,000); three train-the-trainers workshops to train 60 trainers and 108 workshops to train 2,000 technicians on the safe handling of flammable refrigerants, leak reduction, and recovery and recycling (US $447,000); and testing and certification of 2,000 technicians (US $432,000);

(ii) Equipment procurement (US $1,449,200): Procurement of 108 equipment sets[11] for 12 ATCs (nine per ATC) (US $615,600); 24 electronic repair tools[12] for three ATCs (eight per ATC) (US $14,400); 2,000 servicing tools[13] for technicians who have completed technician training (US $720,000); and 200 servicing

[11] Includes leak detector/simple refrigerant identifiers for hydrocarbons, recovery machine and cylinder, weigh scale, two-stage vacuum pumps, brazing kit, ohmmeter, and anemometer.
[12] Including a toolkit for inverter checks and a digital clamp multimeter.
[13] Choice of a micron, manifold gauge, or anemometer.

toolkits[14] for electronic repair for technicians who have completed the additional training (US $99,200);

(c) Transport refrigeration servicing (US $28,080): Support to the six enterprises to transition the assembly of new refrigerated trucks to use low-GWP refrigerants, including a training workshop (US $15,000) and dissemination of six basic tool sets (US $13,080);

(d) MAC servicing in public transport (US $100,000): Support to the public transport sector through the development of a refrigerant management plan for the phase-out of R-407C (US $25,000), four workshops to train approximately 80 Land Public Transport Agency (APAD) train servicing contractors on the phase-out plan (US $60,000), and a study to determine equipment and infrastructure needs in rail transport systems for stage II of the KIP (US $15,000); and

(e) Recovery and recycling (US $65,000): Strengthen the 2020 regulation managing refrigerants, including recovery and recycling requirements, by amending it to include HFCs, conducting a study tour of countries already enforcing regulations through refrigerant tracking (US $40,000), and determining the feasibility of implementing this system in Malaysia through a study (US $25,000).

Technical assistance

55. Technical assistance will be provided in the amount of US $1,025,400, and include:

(a) Energy efficiency in commercial refrigeration: Conduct a market survey of stand-alone commercial refrigeration equipment to determine its energy efficiency as it relates to the type and amount of refrigerant used; determine needs for commercial refrigeration to participate in voluntary energy performance labelling, and determine the feasibility for the development of a mandatory energy performance standard (US $75,000);

(b) Impact assessments: Four studies to support the development of the seven proposed bans, assessing the technical feasibility, availability, costs, and benefits of alternative technologies and evaluating their environmental, economic, and social impacts (US $200,000);

(c) Feasibility studies (US $235,000): A study on the feasibility of enhancing green public procurement and increasing the number of product options based on low-GWP HFCs and HFC alternatives (US $50,000) and on the feasibility of implementing mandatory MAC testing and related measures to improve fuel efficiency of passenger vehicles (US $185,000); and

(d) Customs capacity-building (US $180,400): Three workshops to train 75 customs officers on the monitoring and import control of HFCs and their alternatives, and update customs training curricula to include HFC-related information (e.g., updated Harmonized System (HS) codes and quota system) (US $30,000); provision of 16 refrigerant identifiers (US $96,000) and five annual calibrations (US $4,400); and develop standard operating procedures and guidelines on HFC policies, and upgrade customs' online system to allow for managing import quotas (US $50,000); and

(e) Industry capacity-building (US $335,000): Provide support through workshops to commercial refrigeration manufacturers not otherwise participating in the project,

[14] Each will receive an electronics toolkit for inverter checks and a digital clamp multimeter.

including advice on technical and safety information of HFCs and alternatives (US $85,000); provide sector-specific training and information workshops related to the phase-down and the upcoming bans in fire-suppression, stand-alone commercial refrigeration, domestic refrigeration, and certain chillers, split AC and heat pumps, and fire suppression systems (US $115,000); study tours on the consumption and manufacturing of alternative technologies in challenging sectors, with travel to both Article 5 and non-Article-5 countries (US $120,000); and technical working group meetings on HFO-1234yf developments in the MAC sector (US $15,000).

Project implementation, coordination and monitoring

56. The project management unit (PMU) will work in cooperation with the NOU to cover the financial, operational, and technical implementation of the project, including verification of consumption, in the amount of US $955,500.

Gender policy implementation

57. An important part of Malaysia's KIP strategy is to make continued efforts to mainstream gender to the extent possible, noting that the industry and sectors in the project traditionally have low female representation. This is particularly the case for technicians in the servicing sector. In contrast, gender balance is more common in terms of ownership of small- and medium-sized enterprises and in management offices. However, under the training and certification programme through ATCs, more than 800 female technicians have been certified, and the Government plans to support this further through public awareness and through the training institutions. Gender representation under KIP activities will be tracked and monitored, and women's participation in all activities encouraged. In the servicing sector, training of female instructors is planned. Public awareness material on HCFC phase-out and HFC phase-down and Viet Nam's obligations will portray the required actions of society and industry in a gender-balanced manner.

Total cost of stage I of the Kigali HFC implementation plan

58. The budget for stage I has been established at US $10,510,235. The cost of activities in the refrigeration servicing sector are established in line with decision 92/37. In the absence of cost funding guidelines, the funding requested for activities in the manufacturing sector is the best available estimate for each activity based on Malaysia's experience in implementing similar activities.

59. The proposed activities and costs for stage I of the KIP are summarized in table 9.

Table 9. Stage I of the KIP for Malaysia, as submitted

Sector	Phase-out (mt)	Phase-out (CO_2-eq tonnes)	Cost (US $)	Requested grant (US $)	CE (US $/kg)
Investment projects					
PROTON (MAC)	7.20	10,296	2,039,505	1,939,505	269.38
Zun Utara (commercial refrigeration)	6.57	9,664	690,527	237,600	36.16
Berjaya Steel (commercial refrigeration)	8.92	25,448	750,072	224,950	25.22
Non-investment activities					
Servicing	1,201.45	1,928,529	6,127,280	6,127,280	5.10
Technical and policy assistance	225.57	582,107	1,025,400	1,025,400	4.55
Project management	n/a	n/a	955,500	955,500	n/a
Total	**1,449.71**	**2,556,044**	**11,588,284**	**10,510,235**	**7.25**

Coordination of activities in the servicing sector under HCFC phase-out and HFC phase-down plans

60. Stage I of the KIP will be implemented in four tranches. The schedule of HFC phase-down and of the KIP tranches is presented in annex II to the present document. Stage III of the HPMP is expected to be submitted to the 94th meeting.

Implementation plan for the first tranche of stage I of the Kigali HFC implementation plan

61. The first funding tranche of stage I of the KIP, in the total amount of US $3,153,071, will be implemented between January 2024 and December 2026. The allocated funding will focus on organization of the project and project implementation, such as staffing the PMU, and technical assistance activities related to the quota system. Training curricula will be developed, and first training workshops will take place starting with customs officers and technician trainers. Funding will be allocated by sector as follows:

(a) Stand-alone commercial refrigeration manufacturing (US $619,276): Release first two payments to the two enterprises, Zun Utara and Berjaya, to begin their conversion from the consumption of HFC-134a and R-404A to R-290 and R-600a;

(b) Servicing (US $1,873,795):

(i) MAC servicing: Development of standardized MAC servicing training modules, revision of occupational standards and training curriculum to include good MAC servicing practices, and start of train-the-trainers workshops; and begin tools and equipment procurement for ATCs and training workshops;

(ii) Commercial and domestic refrigeration servicing: Development of standardized training modules for servicing commercial and domestic refrigeration equipment and electronics repair for energy-efficient equipment, revision of occupational standards and training curriculum to include good servicing practices in servicing commercial and domestic refrigeration, and start of train-the-trainers workshops on the safe handling of flammable refrigerants, leak reduction, and recovery and recycling; and begin tool and equipment procurement for ATCs and technicians;

(iii) MAC servicing in public transport: Begin development of the refrigerant management plan for the phase-out of R-407C;

(c) Technical assistance (US $345,000):

(i) Customs capacity-building: Update customs training curricula to include HFC-related information (e.g., updated HS codes and quota system); begin training of customs officers on the monitoring and import control of HFCs and their alternatives; and upgrade customs' online system to allow for managing import quotas; and

(d) Project coordination, monitoring, and 2024 consumption verification (US $315,000).

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

62. The Secretariat reviewed stage I of the KIP for Malaysia in light of the existing policies and guidelines of the Multilateral Fund, including decisions 91/38[15] and 92/37,[16] stage II of the HPMP, and the 2023-2025 business plan of the Multilateral Fund.

HFC consumption levels

63. Relative to 2021, consumption in 2022 increased by 59 per cent in metric tonnes, and more than doubled in CO_2-eq tonnes. The Government and the World Bank carefully examined that increase in preparing the KIP. In particular, the submission helpfully noted that imports of R-404A, HFC-125 and HFC-143a in 2022 increased considerably; the Government considered part of that growth may be due to stockpiling including because of the entrance of two new importers that imported those substances. Accordingly, the Government considered the majority of the 2022 consumption of those substances as anomalous and requested the World Bank to exclude that consumption from the analyses and projections used to inform the development of the KIP strategy. In addition, the two importers and the presumed stocks will be carefully monitored by DOE.

64. The Secretariat notes with appreciation the diligent work of the Government and the World Bank to proactively identify possible stockpiling in the country. Notwithstanding the commendable work done to understand such possible stockpiling, it was not yet possible to quantify such stockpiling with confidence. The Secretariat further acknowledges the distortions caused by the COVID-19 pandemic during at least two of the baseline years increases the complexity faced by Article 5 countries in characterizing their HFC consumption and trends. Given the careful monitoring by DOE of the two importers and the presumed stocks, it was agreed that the World Bank would include as part of the next tranche report detailed information that would inform whether and the extent to which the imports of R-404A, HFC-125, and HFC-143a in 2022 were due to stockpiling, noting that the next tranche request would be submitted in 2026 and that the availability of data on longer-term HFC consumption trends will allow more clarity on the issue.

Overarching strategy

Exports to non-Article 5 countries and non-Article 5 ownership of manufacturing enterprises

65. Malaysia's strategy is shaped by a number of principles, including inter alia that the phase-down will be prioritized for industry that export to non-Article 5 country markets. Given that RAC manufacturing in the country is dominated by large, multinational export-oriented manufacturers, Malaysia expects to realize reductions in HFC consumption from the export of heat pump and self-contained, small split-type AC equipment, noting also that the non-trade provisions of the Kigali Amendment would hit a country like Malaysia hard with its large AC export market.[17]

66. While surveyed data collected during the course of the KIP preparation covered manufacturing for both domestic and export markets, detailed export information categorized by Article 5 and non-Article 5 countries was not collected. However, the following preliminary information could be provided:

[15] In the absence of the cost guidelines for HFC phase-down, to consider HFC individual investment projects and stage I of KIPs on a case-by-case basis, without setting a precedent for the cost guidelines or any future HFC individual investment projects and stage I of KIPs.

[16] Level and modalities of funding for HFC phase-down in the refrigeration servicing sector.

[17] Under the enabling activity for the country, the World Bank had estimated that non-ratification of the Kigali Amendment would be approximately five times more costly than the estimated cost of ratification.

(a) For the AC manufacturing sector, while Malaysia exports most of its ACs to India, Viet Nam and Indonesia, it was estimated that approximately 30 per cent of portable ACs, 36 per cent of residential ACs, and 31 per cent of multi-split AC and chillers are exported to non-Article 5 countries; for heat pumps, it was estimated that all HFC-32-based heat pumps are destined to the EU market and that 90 per cent of R-410A-based heat pumps are for other non-Article 5 countries. It was estimated that the non-Article 5-owned enterprises accounted for between 61 and 66 per cent of AC manufacturing between 2019 and 2021;

(b) There is one large, non-Article 5 owned enterprise that manufactures domestic refrigerators in Malaysia. While the enterprise had the capacity to manufacture with HFC-134a, it currently only manufactures with R-600a; consumption of HFC-134a by the enterprise is only to service its equipment;

(c) Cars manufactured in Malaysia are primarily for the Malaysian and ASEAN[18] markets. Approximately 61 per cent of automobile manufacturing is locally-owned and 24 per cent non-Article 5-owned; the remaining percentage includes enterprises that have both Article 5 and non-Article 5-owned ownership; and

(d) In the foam sector, there are seven systems houses (BASF, Colorex, Cosmo, Dow, Maskimi, PPT, and Oriken) that have facilities for blending and customization of formulated polyols in Malaysia and for export to the region; one systems house may also export to a non-Article 5 country in the region.

Starting point for sustained reductions in HFC consumption

67. The Executive Committee is still considering the methodology for calculating the starting point for sustained reductions in HFC consumption. Noting that a significant proportion of Malaysia's HFC consumption was associated with non-Article-5-owned enterprises or with equipment exported to non-Article 5 countries, the Secretariat was not clear whether and how the Executive Committee may wish to consider such ownership and exports in its consideration of the country's starting point or when determining the reductions in remaining eligible HFC consumption for the country.[19] The Secretariat recommends that the Executive Committee consider this issue once it has agreed on a methodology for the starting point, and once additional information is available on the non-Article 5 ownership and non-Article 5 exports in the country.

68. During its discussions with the World Bank on the matter, the Secretariat emphasized that while there was insufficient information available at the present meeting to determine what additional reductions would be made based on non-Article-5-ownership of manufacturing enterprises or with equipment exported to non-Article 5 countries, that additional reductions from the country's remaining HFC consumption eligible for funding would at some point be taken, that such reductions could be significant given the preliminary information available, and that the Government should be cognizant of such future reductions in considering the scope of its stage I KIP.

69. The Government emphasized that while it understood that it could only seek funding for eligible consumption, the starting point determination should follow the same methodology for all Article 5 countries; that any deduction of HFC consumption eligible for funding in relation to non-Article 5 ownership and non-Article 5 exports should be considered as part of the review of each stage of the KIP; and that this issue should be delinked from the establishment of a country's starting point.

[18] Includes Singapore.

[19] For example, paragraph 10(d)(i) of document UNEP/OzL.Pro/ExCom/92/46.

Policy, regulatory and institutional frameworks

HFC licensing and quota system

70. Decision 87/50(g) requests the bilateral and implementing agencies, when submitting stage I of the KIPs, to include confirmation that the country has an established and enforceable national system of licensing and quotas for monitoring HFC imports/exports in place, consistent with decision 63/17. The World Bank confirmed that the Government has such a system.

71. Malaysia chose to deploy a quota system whereby, rather than proportionally distribute quotas to importers regardless of the HFC, it will use the HCFC component of the HFC baseline to accommodate the transition from HCFCs to lower-GWP HFCs. In particular, quotas will be in CO_2-eq tonnes and will be distributed to importers based on their 2020-2022 average consumption six months prior to the year of control except for HFCs chosen for accelerated phasedown (including HFC-23, HFC-125, HFC-227ea; R-407C, R-452A, R-404A, R-410A, and others). Another round of quotas would be distributed later in the year made up of most of the HCFC component of the baseline, first to importers of lower-GWP HFCs and then other importers if necessary; the remaining buffer would be available to the Government to address unexpected needs.

Technical and cost-related issues

Pilot project in MAC manufacturing

72. The Secretariat and the World Bank discussed the rationale for the project, noting that the proposed reductions associated with the project would contribute less than 1 per cent of the expected reductions in HFC consumption under stage I; the proposed IOCs are estimated based on 2022 prices while components and refrigerant were only expected to be procured in 2027, by which time prices may have changed, including due to the expected release of application patents on HFO-1234yf; large multinational automobile manufacturers had decided HFO-1234yf can be used as a global replacement refrigerant to HFC-134a in MAC systems, and several such manufacturers were active in the country, though those manufacturers had not yet converted their in-country manufacturing; PROTON's 2022 automobile manufacturing accounted for a minority of new vehicles in the country and the converted model would account for minority of PROTON's automobile manufacturing; and the sustainability of the use of HFO-1234yf to service vehicles of the converted model was a concern given the large difference in price between HFC-134a and HFO-1234yf.

73. The World Bank emphasized the importance of the project to the Government, including because the Government planned significant reductions in HFC-134a consumption in the subsequent stage of the KIP: initiation of work in the MAC manufacturing sector would send an important signal to automobile manufacturers, particularly given the lead time manufacturers need to develop a new model. While multinational automobile manufacturers may have access to HFO-1234yf technology (e.g., model designs, component specifications, assembly line changes and changes to SOPs, etc.), local manufacturers did not, and it was important not to leave those manufacturers behind. Moreover, the project would help establish the necessary supply chain for future conversions, including by helping link local manufacturers with suppliers of HFO-1234yf technology and components, and would be a significant confidence-building measure for the sector.

74. On that basis, the Secretariat and the World Bank had detailed discussions on the project costs. During a project to convert a manufacturing enterprise, typically the manufacturing capacity of the enterprise is converted, and the enterprise ceases to manufacture equipment based on the phased out technology and only manufactures equipment based on the agreed technology. The proposed pilot project is fundamentally different: while one assembly line would be fully converted, the enterprise would only convert part of its manufacturing to HFO-1234yf, which complicates the consideration of eligible costs for

the project. Accordingly, the Secretariat proposed two options: under the first option, PROTON would only convert sufficient capacity of the assembly line to enable the enterprise to manufacture the planned number of HFO-1234yf-based vehicles (i.e., rather than three charging modules, only one would be procured; reducing the training to be provided to a smaller number of line operators, reducing the assistance provided to authorized servicing workshops); alternatively, under the second option, the assembly line would be fully converted (i.e., three HFO-1234yf modules would be procured, training and assistance to the servicing workshops would be considered as submitted, noting that such funding would be considered under the servicing sector), on the understanding that PROTON would only be eligible for further funding from the Multilateral Fund for the phase-down of HFCs to convert the existing equipment on its second assembly line, and for eligible IOCs.

75. The Government wished to proceed with second option and PROTON agreed it would only be eligible for further funding from the Multilateral Fund for the phase-down of HFCs to convert the existing equipment on its second assembly line, and for eligible IOCs. On that basis, the following adjustments to the project ICCs were agreed:

(a) Automotive factories require specialized charging equipment that inter alia use a programmable logic controller based on the factory's needs. The funding request was therefore based on a quote from a (specialized) equipment supplier; accordingly, those costs were agreed as submitted on the understanding that no contingencies would be requested. The cost of the ventilation and safety system were agreed at US $43,400 in line with similar previous projects, and the costs for research, development and testing were agreed at US $75,000 given that model development (and testing such models) is a regular part of the automotive business cycle, resulting in agreed costs of US $647,000 for the assembly line component; and

(b) Assistance to the authorized workshops was agreed as submitted on the understanding that this assistance is considered as part of the activities under the servicing sector, resulting in additional reductions of 27.70 mt or 45,550 CO_2e tonnes from the country's remaining HFC consumption eligible for funding.

76. In general, no IOCs had been approved for other projects in the MAC sector previously funded by the Multilateral Fund, noting that funding for projects related to conversions in the manufacturing of heat exchangers and compressors had been provided. The exception for this practice was for enterprises that charge refrigerant to the MAC system, since those costs are borne by the car manufacturers.[20] In line with that practice, a recently submitted project for the conversion of the manufacturing of MAC units from HFC-134a to HFO-1234yf at Kerman Motor Company Limited[21] only requested IOCs on the basis of the difference in price of HFC-134a and HFO-1234yf and did not request funding based on a difference cost of compressor, evaporator, condenser, and pipe and hose connection. Moreover, it was not clear why the price of an HFO-1234yf compressor, evaporator, condenser, and a pipe and hose connection would differ from that of components suitable for use with HFC-134a. For example, recent research has suggested that since the working pressure of HFO-1234yf is lower than that of HFC-134a, the thickness of the piping system can be reduced, resulting in a lower price and higher proficiency.[22] Finally, the Secretariat noted that previously the Executive Committee had approved funding for the conversion of compressors and heat exchangers in the context of MAC projects. Were the Executive Committee to continue this practice for HFCs, funding that conversion and funding those components as part of PROTON's IOCs would constitute double-counting.

[20] Paragraph 7 of document UNEP/OzL.Pro/ExCom/36/6, Report on the desk study on MAC projects
[21] UNEP/OzL.Pro/ExCom/81/39
[22] Daviran et. al (2017), Applied Thermal Engineering, http://dx.doi.org/10.1016/j.applthermaleng.2016.09.034

77. Based on the above, it was agreed that IOCs for the project would be determined exclusively on the difference in price between HFO-1234yf and HFC-134a. In addition, PROTON would incur the cost associated with the higher price of refrigerant in 2027; at that time, the price difference was likely to be smaller than presently estimated, particularly given the expected release of patents; however, it was uncertain by how much the price difference between the refrigerants would change. Given this uncertainty, the Secretariat proposed on an exceptional basis, and without setting a precedent, that PROTON and the Executive Committee share the risk associated with the uncertain IOCs by equally splitting the estimated IOCs based on the current price difference, resulting in agreed IOCs of US $33.30/unit. Finally, the Secretariat modeled likely sales of the model that would be converted based on information on PROTON's automobile sales between 2020 and 2022,[23] and proposed IOCs based on sales of 9,000 vehicles, resulting in a phase-out of 8.1 mt of HFC-134a and agreed IOCs of US $299,700. If the enterprise's manufacturing of HFO-1234yf-based vehicles was lower than 9,000, the associated IOCs would be returned. In addition, it was agreed that exports to non-Article 5 countries and Singapore, if any, would not count toward the 9,000 vehicles to be manufactured with HFO-1234yf, in line with decision 23/14.

Conversion of Zun Utara and Berjaya Steel

78. Both enterprises are SMEs converting to hydrocarbon refrigerants. The proposed costs are in line with similar precedent projects except for the price of the hydrocarbon charging machine, which the Secretariat and the World Bank discussed in detail. Subsequent to those discussions, it was agreed to use the price consistent with similar precedent projects (US $37,000/charging machine) on the understanding that US $12,500 would be provided to Berjaya Steel for additional safety measures given the safety features that were included in the originally requested charging machine, resulting in agreed costs of US $187,000 and US $186,850 for Zun Utara and Berjaya Steel. Both Zun Utara and Berjaya Steel export less than 5 per cent of the commercial refrigeration equipment the enterprises manufactured to non-Article 5 countries. At its 15th meeting, the Executive Committee endorsed guidelines to apply in projects which benefit enterprises that export part of their production to non-Article 5 countries.[24] In line with those guidelines, no adjustment to the funding for the enterprises was made. The World Bank confirmed that other enterprises that manufactured HFC-based stand-alone commercial refrigeration equipment and that declined to participate in the project would phase-out their HFC consumption without assistance from the Multilateral Fund, in line with the 1 January 2029 ban.

Non-investment activities

79. The Secretariat and the World Bank had detailed discussions on the activities and costs, resulting in the following agreed adjustments:

(a) MAC servicing: Noting the large number of trainings and assessments planned for MAC technicians, rationalization of the associated costs, and increasing the number of MAC technicians to be trained (from 2,376 to 2,540 technicians), and adjusting the cost of the development of a training module based on other, similar projects, resulting in agreed costs of US $1,037,000 for MAC training and assessment; costs for the MAC servicing equipment were adjusted based on the price of a machine capable of recovering and recycling both HFC-134a and HFO-1234yf, and increasing the number of tools to be procured for trained technicians to 2,540, resulting in agreed costs of US $2,326,000 for MAC equipment procurement;

(b) Commercial and domestic refrigeration servicing: Noting the large number of trainings and assessments planned for technicians, rationalization of the associated costs, and increasing the number of commercial and domestic refrigeration technicians to be trained from 2,000

[23] Information considered confidential.
[24] Paragraphs 146 and 147 of document UNEP/OzL.Pro/ExCom/15/45.

to 2,200, resulting in agreed costs of US $974,600 for training and assessment; and increasing the number of tools to be procured for technicians to 2,200, resulting in agreed costs of US $1,521,400 for equipment procurement; and

(c) Technical assistance: removing the energy efficiency project in commercial refrigeration, which was not eligible under the KIP, noting that the Secretariat encouraged the World Bank to submit the project under decision 91/65,[25] rationalizing the costs for study tours, and increasing the funding associated with training and information workshops for sectors with upcoming bans, resulting in agreed costs of US $995,400 for industry capacity-building.

80. At its 92nd meeting, the Executive Committee agreed on funding at a level of up to US $5.10/kg. for countries with consumption above 360 mt in servicing (decision 92/37(b)(iii)). In order to calculate the reductions from the country's remaining HFC consumption eligible for funding associated with the above non-investment activities, the Secretariat used the methodology for converting US $/kg to US $/$CO_2$-eq tonnes in the servicing sector described in annex I of document 92/46.[26] The average HFC consumption in Malaysia's servicing sector during the baseline years was 3,306.10 mt or 5,668,521 CO_2-eq tonnes, resulting in a cost-effectiveness in the servicing sector for Malaysia of US $2.97/$CO_2$-eq tonnes.

81. Accordingly, the reductions from the country's HFC consumption eligible for funding associated with the non-investment activities (US $7,047,480) and the assistance to PROTON's authorized dealers (US $141,250) will result in reductions of 2,323,799 CO_2-eq tonnes from the country's remaining HFC consumption eligible for funding. In addition, implementation of the six bans will result in additional phase-down of 77.90 mt or 392,958 CO_2-eq tonnes from the country's remaining HFC consumption eligible for funding, based on the average 2020-2022 consumption in the subsectors, and after accounting for the phase-out at the assisted enterprises (Berjaya Steel and Zun Utara) and reductions achieved through technical assistance.

82. In line with other projects, the PMU costs were agreed at US $765,835. Funding for the first tranche was adjusted to US $3,042,912 based on the revised costs of the investment activities and adjustments to the servicing sector and PMU costs.

83. The total cost for stage I of the KIP for the country is US $9,275,115 and would result in reductions of 2,763,452 CO_2-eq tonnes from the country's remaining HFC consumption eligible for funding, as summarized in table 10.

Table 10. Agreed cost of activities to be implemented in stage I of the KIP for Malaysia

Sector	Phase-out (mt)	Phase-out (CO_2-eq tonnes)	Cost (US $)	CE (US $/kg)
Investment projects				
PROTON (MAC)	8.10	11,583	946,700	116.88
PROTON (authorized dealers)	27.70	45,660	141,250	5.10
Zun Utara (commercial refrigeration)	6.57	9,664	187,000	28.46
Berjaya Steel (commercial refrigeration)	8.92	25,448	186,850	20.95
Non-investment activities				
Servicing	1,186.68	1,956,370	6,052,080	5.10
Technical and policy assistance	195.18	321,769	995,400	5.10
Implementation of bans	77.90	392,958	0	n/a
Project management	n/a	n/a	765,835	n/a
Total	**1,511.04**	**2,763,452**	**9,275,115**	**6.14**

[25] See paragraphs 12-16 of document UNEP/OzL.Pro/ExCom/93/38.

[26] Paper on the starting point for sustained aggregate reductions based on discussions at the 91st meeting in the contact group on the cost guidelines for the phase-down of HFCs (decision 91/64(a)).

Impact on the climate

84. The Secretariat was in the process of updating the Multilateral Fund Climate Impact Indicator (MCII). As that revision is not yet complete, the Secretariat is presenting the annual reductions in CO_2-eq tonnes associated with the conversions in the RAC manufacturing sector in table 11. The Secretariat has not estimated the climate benefits associated with any energy efficiency benefits in this calculation.

Table 11. Annual reduction in CO2-eq tonnes in RAC manufacturing activities

Subsector	HFC consumption		Consumption of alternatives		Reduction
	mt	CO_2-eq tonnes	mt	CO_2-eq tonnes	CO_2-eq tonnes
PROTON (MAC)	8.10	11,583	8.10	32	11,551
Zun Utara (commercial refrigeration)	6.57	9,664	3.29	10	9,654
Berjaya Steel (commercial refrigeration)	8.92	25,448	4.46	13	25,435
Total	**23.59**	**46,695**	**15.85**	**56**	**46,639**

85. In addition to the benefits from the manufacturing conversions, the activities in the servicing sector, regulatory and policy assistance, and TA are expected to also reduce refrigerant emissions into the atmosphere, resulting in climate benefits. A calculation of the impact on the climate of the activities in the KIP indicates that by 2029, Malaysia will have reduced its emissions by approximately 2,670,371 CO_2-eq tonnes of HFCs, calculated as the difference between baseline HFC consumption and the target proposed to be achieved by 2030.

Sustainability of the HFC phase-down and assessment of risks

86. The World Bank and the Secretariat discussed concerns related to the servicing of the vehicles fitted with an HFO-1234yf MAC unit given the price differential between HFC-134a (US $6/kg) and HFO-1234yf (US $80/kg) and noting that the converted model would only represent a small proportion of the country's automobile market. The expiration of patents is likely lead to a reduction in the price of HFO-1234yf; conversely, the implementation of Malaysia's quota system could limit the supply of HFC-134a and thus lead to an increase in price. The assistance provided to PROTON's authorized workshops would help ensure that those vehicles were only serviced with HFO-1234yf. In addition, PROTON will consider offering an extended warranty to vehicles equipped with an HFO-1234yf MAC, thus helping ensure the use of the authorized workshops.

87. Following the implementation of the enabling activities, the Government undertook a series of consultations with the fire suppression industry that resulted in industry agreeing to voluntary cease installing new HFC-23-based fire suppression systems. As shown in table 3, this changed the trajectory of HFC consumption in the firefighting sector[27] and validated the enabling activities recommendations, including that compliance with the Kigali Amendment is manageable and more affordable if Malaysia targets the elimination of high-GWP HFCs early. To ensure the sustainability of those reductions, the Government will ban new HFC-23-based, as well HFC-125-based, new fire suppression systems by 1 January 2026.

88. Regarding the planned bans on the specified RAC equipment by 1 January 2029, the Secretariat inquired whether the Government had considered establishing an earlier ban for certain applications where non-HFC technology was already well-accepted by the market, such as for stand-alone commercial refrigeration equipment and domestic refrigerators, while noting the time required for the regulatory and administrative processed to establish bans. Such earlier bans would reduce the introduction of additional

[27] In 2018, HFC-23 consumption in the sector had reached 59.49 mt; by 2019, consumption of HFC-23 had decreased to 5.68 mt.

HFC-based equipment that would need subsequent servicing. The World Bank emphasized that each ban would be implemented after undertaking a policy impact assessment and stakeholder consultations, which included enterprises that were not receiving assistance from the Multilateral Fund. Should those assessments and consultations reveal that an earlier ban was possible, the Government would consider advancing the timeline for the ban.

89. The stage I of the KIP will include controls in sectors whose use of controlled substances was addressed more than a decade ago in the context of the CFC and halon phaseout. To mitigate this risk, technical assistance activities were included in the KIP to keep sectors engaged and informed about alternatives and international practices, including through workshops for manufacturers and systems providers, technical working groups embedded in respective associations, and study tours. Regulators will be invited to participate in technical assistance activities. The MAC manufacturing pilot project will help inform the sector of alternatives' and component cost and supply, and technical feasibility in the Malaysian context.

90. The implementation of the quota allocation system is an important component of the KIP and will ensure the reductions in HFC consumption are achieved. The system developed by the Government is innovative, will encourage the uptake of lower-GWP alternatives, and help sustain the HFC phase-down. In particular, by allocating an initial set of quotas based on average HFC consumption, and retaining a buffer will help ensure that quotas associated with that buffer can be carefully released to ensure the country's consumption remains within the specified targets. The training for customs officers, procurement of refrigerant identifiers, and technical assistance to develop an online tool for importers to better understand and manage their imports against annual quotas, will help ensure the effective implementation and enforcement of the quota system.

Co-financing

91. Owners in the manufacturing conversion project are expected to co-finance the portions of the project that will not be covered by the KIP project funding.

2023-2025 business plan of the Multilateral Fund

92. The World Bank is requesting US $9,275,115, plus agency support costs, for the implementation of stage I of the KIP for Malaysia. The total value of US $6,729,446, including agency support costs, requested for the period of 2023–2025, is US $5,124,446 above the amount in the business plan.

Draft Agreement

93. A draft Agreement between the Government of Malaysia and the Executive Committee for stage I of the KIP has not been prepared as the Agreement template is still under consideration by the Executive Committee.

94. If the Executive Committee so wishes, the funds for stage I of the KIP for Malaysia could be approved in principle, and funds for the first tranche could be approved on the understanding that the Agreement would be prepared and presented at a future meeting, before the submission of the second tranche, and once the Agreement template has been approved.

RECOMMENDATION

95. The Executive Committee may wish to consider:

(a) Approving, in principle, stage I of the Kigali HFC implementation plan (KIP) for Malaysia for the period 2024-2029 to reduce HFC consumption by 10 per cent of the country's

baseline in 2029 in the amount of US $9,275,115, plus agency support costs of US $649,258 for World Bank, as reflected in the schedule contained in annex II of the present document;

(b) Noting:

(i) That the Government of Malaysia will establish its starting point for sustained aggregate reductions in HFC consumption based on guidance provided by the Executive Committee;

(ii) That, once the cost guidelines for HFC phase-down are agreed by the Executive Committee, the reductions from the country's remaining HFC consumption eligibility for funding will be determined in line with these guidelines;

(iii) That the reductions from the country's remaining HFC consumption eligible for funding referred to in subparagraph (b)(ii) above will be deducted from the starting point referred to in subparagraph (b)(i);

(iv) The commitment of the Government to:

a. Ban the installation of new HFC-23- and HFC-125-based fire suppression systems by 1 January 2026;

b. Ban by 1 January 2029 the manufacturing and import of the following equipment: HFC-based stand-alone commercial refrigeration equipment; HFC-based domestic refrigeration; HFC-134a-, R-452A-, and R-404A-based components for refrigerated transport; and R-407C-based split AC and heat pumps;

c. Ban by 1 January 2029 new installations of R-407C-based chillers;

(v) That the automobile manufacturing enterprise PROTON would only be eligible for further funding from the Multilateral Fund for the phase-down of HFCs to convert the existing equipment on its second assembly line not assisted under stage I, and for eligible incremental operating costs;

(c) Approving the first tranche of stage I of the KIP for Malaysia, and the corresponding tranche implementation plan, in the amount of US $3,042,912, plus agency support costs of US $213,004, for World Bank; and

(d) Requesting the Government of Malaysia, World Bank and the Secretariat to finalize the draft Agreement between the Government of Malaysia and the Executive Committee for the reduction in consumption of HFCs, including the information contained in the annex referred to in subparagraph (a) above, and to submit it to a future meeting once the KIP Agreement template has been approved by the Executive Committee.

Annex I

HFC USE IN THE REFRIGERATION AND AIR-CONDITIONING MANUFACTURING SUBSECTORS IN 2022

Sector	HFC-32	HFC-134a	HFC-227ea	R-404A	R-410A	R-507A	Other	Total	Share of total (%)
mt									
Commercial refrigeration	0	97.15	0.00	90.49	0.00	0.00	13.50	201.14	2.8
Industrial refrigeration	0	0	0.00	56.97	0.00	316.45	0.60	374.02	5.2
Residential AC	2,675.78	0	0.00	0.00	1,358.73	0.00	61.77	4,096.28	57.2
Mobile AC	0	251	0.00	0.00	0.00	0.00	0.00	251.00	3.5
Commercial AC /chillers	0	1,972.20	0.00	0.00	12.58	1.18	6.95	1,992.91	27.8
PU foam	0	0	0.01	0.00	0.00	0.00	5.21	5.22	0.1
Aerosol	0	49.05	0.00	0.00	0.00	0.00	0.00	49.05	0.7
Firefighting	0	0	131.71	0.00	0.00	0.00	7.53	139.24	1.9
Solvent	0.03	0	0.00	0.00	0.00	0.00	49.97	50.04	0.7
Total (mt)	**2,675.81**	**2,369.40**	**131.72**	**147.46**	**1,371.31**	**317.63**	**277.25**	**7,158.90**	**100**
Total (tCO_2-eq)	**1,806,168**	**3,388,242**	**424,155**	**578,279**	**2,862,610**	**1,265,756**	**247,701**	**10,572,910**	**100**

Annex II

SCHEDULE OF HFC PHASE-DOWN AND HCFC PHASE-OUT COMMITMENTS AND FUNDING TRANCHES UNDER THE KIGALI HFC IMPLEMENTATION PLAN AND THE HCFC PHASE-OUT MANAGEMENT PLAN FOR MALAYSIA

Kigali HFC implementation plan (stage I)

Row	Particulars	2023	2024	2025	2026	2027	2028	2029	Total
1.1	Montreal Protocol reduction schedule of Annex F substances (CO_2-eq tonnes)	n/a	26,703,716	26,703,716	26,703,716	26,703,716	26,703,716	24,033,345	n/a
1.2	Maximum allowable total consumption of Annex F substances (CO_2-eq tonnes)	n/a	26,703,716	26,703,716	26,703,716	26,703,716	26,703,716	24,033,345	n/a
2.1	Lead IA (World Bank) agreed funding (US $)	3,042,912	0	3,246,290	0	2,336,655	0	649,258	9,275,115
2.2	Support costs for Lead IA (US $)	213,004	0	227,240	0	163,566	0	45,448	649,258
3.1	Total agreed funding (US $)	3,042,912	0	3,246,290	0	2,336,655	0	649,258	9,275,115
3.2	Total support costs (US $)	213,004	0	227,240	0	163,566	0	45,448	649,258
3.3	Total agreed costs (US $)	3,255,916	0	3,473,530	0	2,500,221	0	694,706	9,924,373