

MALAYSIA HCFC PHASE-OUT MANAGEMENT PLAN (HPMP STAGE III) **2024-2030**





**MALAYSIA HCFC PHASE OUT MANAGEMENT PLAN (HPMP) STAGE III FOR
MEETING THE 2030 COMPLIANCE TARGETS BY PHASING OUT OF HCFCs IN
ACCORDANCE WITH THE ACCELERATED REDUCTION SCHEDULE SET BY THE
MEETING OF PARTIES DECISION XIX/6 OF THE MONTREAL PROTOCOL**

Prepared Jointly by:

DEPARTMENT OF ENVIRONMENT (DOE)
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL SUSTAINABILITY (NRES)
and
UNITED NATIONS DEVELOPMENT PROGRAMME

EXECUTIVE SUMMARY

Malaysia has a proud 35-year history implementing the Montreal Protocol on Substances that Deplete the Ozone Layer. Malaysia successfully eliminated the use of Chlorofluorocarbons (CFCs) by 2010. Building on this milestone, Malaysia had implemented the hydrochlorofluorocarbons (HCFC) Phase Out Management Plan (HPMP) Stage I (2011-2016) and Stage II (2017-2024).

Malaysia has consistently outperformed its targets for ozone depleting substances (ODS) phase out. The country has taken proactive measures to phase out ODS including technology transfer investments, technical assistance, training and capacity building, raising awareness and putting in place effective regulations. However, work remains to protect the ozone layers particularly in addressing the remaining HCFCs.

With HPMP Stage III, Malaysia is again embarking on an ambitious programme to phase out HCFCs. By 2030 Malaysia aims to achieve a full phase out of HCFCs, accepting a small allowance for the servicing 'tail' to 2040.

The global implementation of HPMP works to heal the ozone layer and pushes for improving capabilities towards the identification and adoption of suitable, low global warming potential (GWP) alternatives to the ozone-depleting substances, with co-benefits in climate change mitigation.

HPMP stage III Malaysia was developed through a survey of country stakeholders to develop the strategy based on the current situation of HCFC use in Malaysia. This collaborative approach builds on the work of HPMP stage II and demonstrates the commitment to implement HPMP III in collaboration with key stakeholders in the industry and community.

HPMP Stage III will focus to address two subsector plans, the Refrigeration & Air Conditioning (RAC) Servicing Sector Plan (HCFC-22) and the Chillers Servicing Sector Plan (HCFC-123).

HPMP Stage III will significantly decrease Malaysia's impact on the ozone layer, preserving it and allowing it to recover for future generations. Upon completion, HPMP III will also contribute to Malaysia's climate change mitigation endeavours, reducing cumulative annual (2023-2030) emissions by 8.42 million metric tons of CO₂ equivalent.

UNITED NATIONS DEVELOPMENT PROGRAMME PROJECT DOCUMENT MALAYSIA



Project Title: HCFC Phase-out Management Plan for Malaysia – Stage III (Malaysia HPMP – III)

Start Date : October 2024

End Date : December 2031

Implementing Partner:

Department of Environment, Ministry of
Natural Resources and Environmental
Sustainability (NRES)

Management Arrangements:

National Implementation Assisted Modality
(Country Office Assistance to NIM)

Brief Project Description:

Malaysia acceded to the Vienna Convention and ratified the Montreal Protocol on Substances that Deplete the Ozone Layer in August 1989 and has ratified all the amendments as of October 2020. Malaysia has agreed to meet the 2030 compliance targets by completely phasing-out the Hydrochlorofluorocarbons (HCFCs), in accordance with the accelerated reduction schedule set by the Meeting of the Parties Decision XIX/6.

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) approved Stage III of the HCFC Phase-out Management Plan (HPMP) for Malaysia during the 94th Meeting of its Executive Committee (ExCom), held 27-31 May 2024 in Montreal, Canada with a financing amount of USD15,983 million for the project duration of 7 years. HPMP Stage III will support in phasing out 257.67 ODP tonnes of HCFCs, enabling Malaysia to achieve the Montreal Protocol compliance goal of 100 percent reduction by 2030. This project adopts a portfolio strategy that draws from experiences and lessons learned from Stage I (2011-2016) and Stage II (2017-2024). HPMP Stage III's Servicing Sector Plan builds upon the implementation in previous stages.

The project aims to expand training for technicians in good practices and refrigerant management, particularly focusing on residential and light commercial air conditioners, standalone commercial refrigeration units, and HCFC-123 based chillers, with emphasis on recovery and reuse of HCFC and encouraging improvement of servicing practices, to avoid a transition from HCFCs to high-GWP HFCs. Additionally, HPMP stage III will further strengthen the regulatory and institutional systems by establishing new bans on uses of HCFCs, and expand custom officers, port authorities and national control and compliance officers' capacities to control and manage HCFC in trade, use and continue raising awareness to sustain the HCFC phase-out. Implementing HPMP Stage-III will reduce Malaysia's greenhouse gas emissions by up to 8.42 million tonnes CO₂-eq.

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ACRONYMS AND ABBREVIATION

ATC	Authorised Training Centre
CFC	Chlorofluorocarbon
CSTP	Certification service technical programme
CTC	Carbon tetrachloride
DOE	Department of Environment
ExCom	Executive Committee for the Implementation of the Montreal Protocol
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFO	Hydrofluoroolefin
HFC	Hydrofluorocarbon
HPMP	HCFC Phase Out Management Plan
MACRA	Malaysian Air Conditioning and Refrigeration Association
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MP	Montreal Protocol
NCFCP	National CFC Phase-out Plan
NOU	National Ozone Unit
NRES	Ministry of Natural Resources and Environmental Sustainability
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
OPS	Ozone Protection Section
PMU	Project Monitoring Unit
PSC	Project Steering Committee
PU	Foam Polyurethane Foam
RAC	Refrigeration and air conditioning
RRR	Recovery, recycling and reclaiming
UNDP	United Nations Development Programme
UNEP	United Nation Environment Programme

A photograph of a worker in a light blue shirt, white gloves, and a white face mask working on a complex industrial machine. The machine is covered in numerous cables and hoses. The scene is overlaid with a blue and green gradient. The text 'CHAPTER 1: WHERE WE ARE NOW' is prominently displayed in white, bold, sans-serif font in the center-left area.

CHAPTER 1: WHERE WE ARE NOW

Background

Climate and Demographic

Malaysia is an upper-middle-income country with a population of approximately 34 million (as of 2024) and an area of about 330,803 km². Malaysia's year round hot and humid weather means it has significant demand for refrigeration and air conditioning. Due to climate change, the country is increasingly vulnerable to shifting weather patterns, and changes in rainfall variability and intensity. In recent years, Malaysia has faced heightened climate hazards, including urban flooding and droughts.

The impacts of climate change in Malaysia are broad and profound, affecting various sectors such as water resources, agriculture, forest ecosystems, coastal and marine environments, energy production, and public health. These challenges underscore the need for comprehensive strategies to mitigate and adapt to the evolving climate conditions.

Malaysia and the Montreal Protocol

Malaysia became a party to the Vienna Convention for the Protection of the Ozone Layer and acceded to the Montreal Protocol on Substances that Deplete the Ozone Layer on 29 August 1989. Malaysia is classified as a party operating under Paragraph 1, Article 5 of the Montreal Protocol and thus qualified for technical and financial assistance, including transfer of technology, through the financial mechanism of the Montreal Protocol.

Over this 35-year period, Malaysia has successfully phased out the most destructive ODS and made significant steps towards phasing out hydrochlorofluorocarbons (HCFCs). An Ozone Protection Section was established within the Department of Environment (DOE) in 1996 to implement Malaysia's commitments under the Montreal Protocol.

Table 1.1: Malaysia – Dates of Ratification of Montreal Protocol and Amendments

Agreement/ Amendment	Date of Ratification
Vienna Convention	29 August 1989
Montreal Protocol	29 August 1989
London Amendment	16 June 1993
Copenhagen Amendment	5 August 1993
Montreal Amendment	26 October 2001
Beijing Amendment	26 October 2001
Kigali Amendment	21 October 2020

The Montreal Protocol is the only United Nations environmental agreement that has been ratified by every country in the world to date. It is also one of the most successful multilateral environment agreements. With the parties to the Protocol having phased out 99 per cent of their ozone-depleting substances, they saved an estimated two million people from skin cancer every year (UNEP-Ozone Secretariat, 2022).

The implementation of Montreal Protocol is an evolving practice. The first iteration of the protocol in 1987 phased out five chlorofluorocarbons (CFCs) and three halons. Thirty years later, the treaty now covers about 100 ozone-depleting gases and 18 HFCs through amendments and adjustments in procedures governed by its Meeting of the Parties. The key strength of the Montreal Protocol lies in its capacity to adapt in response to emerging scientific insights.

Malaysia's Country Programme incorporating the National Strategy and Action Plan for controlling the use of Ozone Depleting Substances was approved in 1992. Since then, Malaysia has taken proactive measures such as phase-out activities including technology transfer investments, technical assistance, training and capacity-building, information dissemination and awareness raising and development and implementation of regulations. Malaysia has established a comprehensive regulatory framework for controlling ozone depleting substances (ODS). As a result, Malaysia has consistently followed the provisions of the Montreal Protocol and has exceeded its target.

Malaysia has successfully phased out chlorofluorocarbon (CFCs), the chemicals which most break down the ozone layer. The National CFC Phase-out Plan (NCFCP) addressed the phase out of all consumption of Annex- A Group I substances (mainly CFCs) by 2010. The NCFCP was approved at the 35th Executive Committee (ExCom) for the Implementation of the Montreal Protocol meeting in December 2001. The NCFCP was a performance-based multi-year agreement between Malaysia and the ExCom, which enabled Malaysia to comply with the 2005, 2007 and 2010 control milestones of the Montreal Protocol. By January 2010, Malaysia had successfully phased- out CFC, halon and carbon tetrachloride (CTC).

As part of its obligations to the Montreal Protocol, the Government of Malaysia put in place regulatory controls on the import, production and installation of refrigerators and air conditioners using HCFCs. The latest regulation introduced for this purpose is the Environmental Quality (Refrigerant Management) Regulations 2020. HCFCs are listed in the Second Schedule as controlled substances that are harmful to the environment. The regulation introduces a ban on the manufacture or installation of any HCFC-based air conditioning equipment for use in Malaysia. This new procedure came into force on 1st June 2020.

HCFC Phase-out Management Plan (HPMP)

The use of HCFCs increased substantially from 1990 to 2012, as interim alternatives to CFCs. HCFCs are classified as controlled substances under Annex-C, Group-I of the Montreal Protocol and scheduled for phased-out. The 19th Meeting of the Parties to the Montreal Protocol in September 2007 decided to bring forward the phase out of HCFCs from 2030 to 2020 for developed countries while developing countries are required to phase out in 2030 instead of by 2040. Malaysia's HCFC phase out schedule is as shown in Table 1.2.

Table 1.2: HCFC Phase Our Schedule and Baseline for Malaysia

ARTICLE 5(1) PARTIES: CONSUMPTION - MALAYSIA	
Base Level	Average 2009 to 2010
Freeze	1 January 2013
10% reduction	1 January 2015
35% reduction	1 January 2020
67.5% reduction	1 January 2025
97.5% reduction	1 January 2030 (2.5% allowance of base level for servicing)
100%	1 January 2040

The baseline consumption (average of consumption value for the years 2009 and 2010) of HCFCs for Malaysia is 515.76 ODP tonnes.

HPMP Stage I (2011 -2016)

Stage I of the HPMP, approved in November 2011, was implemented from 2012 to 2016. It achieved the first two consumption reduction targets in 2013 and 2015. Malaysia received US \$9.45 million in grant financing from the Multilateral Fund for the Implementation of the Montreal Protocol (MLF) for funding conversion of polyurethane (PU) foam enterprises and technical assistance activities to reduce HCFC consumption in the AC and refrigeration servicing sectors. According to the agreement between the MLF ExCom and Malaysia, implementation of the HPMP I was to result in a permanent reduction of HCFC consumption by at least 103.02 ODP tonnes (8.42 ODP tonnes of HCFC-22 and 94.6 ODP tonnes of HCFC-141b). By 2015, Malaysia reduced its HCFC consumption by 111.85 ODP tonnes or 8.83 ODP tonnes more than required.

HPMP Stage II (2017-2024)

In 2016, Malaysia secured MLF ExCom approval for Stage II HPMP, with funding of US \$6.14 million. HPMP Stage II aimed to further reduce annual HCFC consumption by 146.24 ODP tonnes. With this additional support, Malaysia committed to reduce HCFC consumption by 42.9 percent of its baseline level by 2022 through complete phaseout of HCFC-141b in the foam manufacturing sectors and of HCFC-22 in the refrigeration and air-conditioner manufacturing sectors. Part of the funding received was allocated for technical assistance activities to strengthen the capacity of service technicians as well as Customs and DOE officials' capacity to monitor HCFC imports and exports and HCFC-containing equipment. The HPMP II Project will conclude in December 2024.

HPMP Stage III (2024 - 2030)

Building on the implementation of the HPMP I (2012-2016) and HPMP II (2017-2024), HPMP Stage III (2024-2030) in Malaysia aims to facilitate the phase-out of 257.67 ODP tonnes of HCFCs, aligning with the Montreal Protocol's goal of achieving 100% reduction by 2030.

HPMP Stage III for Malaysia was earmarked in the 2021-2023 UNDP Business Plan for the Multilateral Fund for the Montreal Protocol and was approved with the funding amount of US \$15.98 million during the 94th Meeting of its Executive Committee (ExCom), held 27-31 May 2024 in Montreal, Canada.

HCFC Data Collection for HPMP Stage III

In designing HPMP III, a national survey was conducted in 2023 with the aim to inform the national strategy and country action plan under HPMP III. The project preparation team prepared a questionnaire and conducted a survey for a sample of entities involved in the HPMP structure in the country.

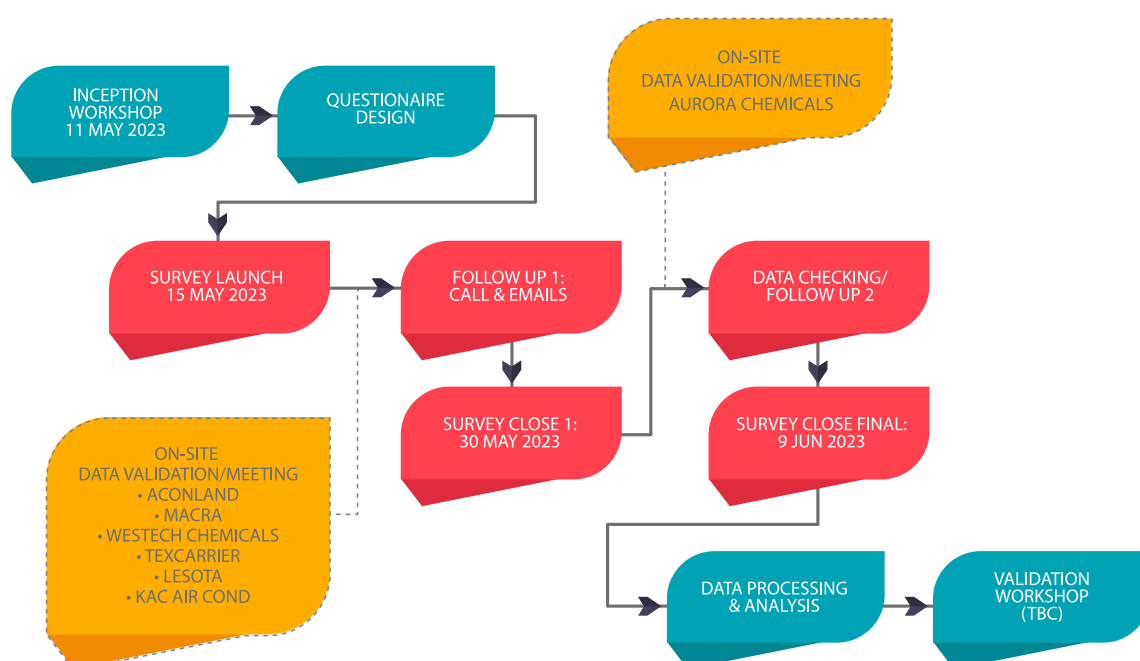
The survey involved engaging in discussions with 13 importers, 215 servicing workshops, 6 reclamation centres, 61 ATCs, and 23 manufacturers of RACs and chillers. The team conducted consultations and data gathering with HCFCs importers and distributors, as well as RAC and Technicians Associations and ATCs to map the profile of the Servicing Sector. These sources constituted the bottom-up (primary) data sources.

Refrigeration and air-conditioning servicing sector data was collected from known service workshops. The data was cross-checked against national level consumption data for bulk HCFCs, collected through the licensing system.

Enterprise-level surveys were used to identify the types and quantities of HCFCs used by manufacturers and end-users, the types of products manufactured with HCFCs, trends in their use and factors influencing trends. The collated survey data, such as licenses issued, imports reported or customs data, was then compared against official data retained by the DOE and the Royal Customs of Malaysia.

Prior to the survey, related data and information on the enterprises were collected and verified to update to the latest information and for preparation of the survey forms. An Inception Workshop was conducted to inform the enterprises of the survey objectives and information required from them. Following the Inception Workshop, the survey forms were emailed to recipients. At the same time, on-site data validation and meetings were also conducted with selected enterprises and Malaysian Air Conditioning and Refrigeration Association (MACRA), while remaining data verification was conducted via phone calls.

Figure 1.1: Survey Methodology



Current Use of HCFCs in Malaysia

There is no production of HCFCs in Malaysia. Local consumption of HCFCs is met through imports. There is also a ban on manufacturing of Refrigeration and Air Conditioning Sector (RAC) equipment with HCFCs and HCFC blowing agent in foam manufacturing sector came into force on 1 June 2020 through the Environmental Quality (Refrigerant Management) Regulations 2020.

The main consumption of HCFCs in Malaysia is HCFC-22, HCFC-123 and a small amount of HCFC-141b. HCFC-22 and HCFC-123 are imported for servicing existing RAC equipment. HCFC-141b is used for flushing during the servicing of RAC Equipment. The export of HCFC in 2022 is confined to HCFC-22 by a single exporter.

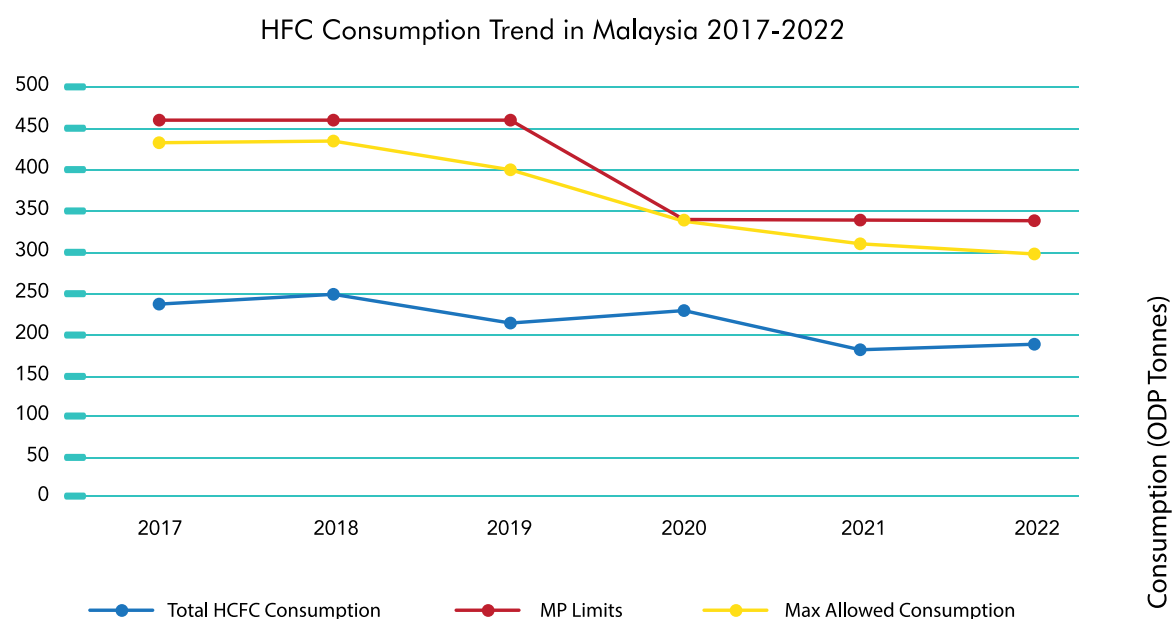
The consumption of HCFCs from 2017 to 2022 is shown in Table 1.3 and Figure 2.2 shows the historical consumption of HCFCs in Malaysia for the same period based on the Country Programme (CP) Data reporting. The overall trend shows consumption of HCFCs has declined since 2017 to 2022 with some fluctuations in year-on-year consumption.

Table 1.3: HCFCs Consumption in Malaysia 2017-2022 From CP Data Report

HCFCs Consumption from CP Data Reports 2017-2022						
	2017	2018	2019	2020	2021	2022
in MT						
HCFC-22	3,213.59	3,606.22	3,238.86	3,679.24	3,020.88	3,370.10
HCFC-141b	528.79	441.60	323.49	235.13	135.22	9.00
HCFC-123	36.68	64.58	21.79	9.82	27.06	36.69
HCFC-225	1.95	1.93	0.59	0.05	0	0
HCFC-142b	0	0	0	0	0	0
Total	3,781.01	4,114.33	3,584.73	3,924.24	3,183.17	3,415.78
in ODP tonnes						
HCFC-22	176.75	198.34	178.14	202.35	166.15	185.36
HCFC-141b	58.17	48.58	35.58	25.86	14.87	0.99
HCFC-123	0.73	1.29	0.44	0.20	0.54	0.73
HCFC-225	0.14	0.14	0.04	0	0	0
HCFC-142b	0	0	0	0	0	0
Total	235.79	248.35	214.20	228.41	181.56	187.08
MP limits	464.18	464.18	464.18	335.24	335.24	335.24
MAC*	438.40	438.40	400.00	335.24	309.46	294.63

Note: MAC*: Maximum Allowable Consumption

Figure 1.2: HCFC Consumption Trend in Malaysia 2017-2022



Note: Chart plotted based on CP data in Table 1.3.

The HPMP III Project implementation period will be from 2024 to 2030 with a funding of US \$15,983,465 from the Multilateral Fund for the Implementation of the Montreal Protocol (MLF), agency support cost of US \$1,118,843 and in-kind cost sharing from the Government of Malaysia of US \$300,000. The project will be managed by the United Nations Development Programme (UNDP). The project will target specific actions for the RAC servicing sector plan and the chilling servicing sector plan that will be targeted at the activities reflected in Table 1.4.

Table 1.4: Agreed cost of stage III of the HPMP for Malaysia

Activity	Agreed (US \$)	Phase-out (Mt)	CE (US \$/kg)
Policies and regulations	170,000	3,606.22	4.80
Customs capacity-building	618,300		
Technician capacity-building	6,447,460		
Equipment procurement for 64 ATCs and 1 COE	4,166,294		
Equipment for RAC technicians	2,298,909		
Technical assistance for RRR	355,750		
Technical assistance for HCFC-123-based chillers	145,252		
Awareness-raising	625,000	0.00	n/a
Project implementation and monitoring	1,156,500		
Subtotal	15,983,465	3,088.95	5.17
Additional reduction from remaining consumption eligible for funding	n/a	1,622.51	n/a
Total	15,983,465	4,711.46	3.39





CHAPTER 2:

DEVELOPMENT CHALLENGES

Montreal Protocol's Global Development Challenges

In 1987, evidence collected by the USA's National Oceanic and Atmospheric Administration confirmed that CFCs and other chemicals were depleting Earth's ozone layer. Members of UN agreed on the 1987 Montreal Protocol to control the production and consumption of ozone-depleting chemicals. Since then, 197 countries and the European Union have ratified the binding treaty, and CFC levels have steadily declined in the atmosphere.

Ozone depletion increases the amounts of ultraviolet (UV) radiation that reaches Earth, leading to more cases of skin cancer, cataracts, and impaired immune systems. Since 1990, the risk of developing melanoma, the most dangerous skin cancer, has more than doubled. UV radiation can also damage sensitive crops, such as soybeans, reducing crop yields. Some scientists suggest that marine phytoplankton, the base of the ocean food chain, are already under stress from UV radiation, which could adversely affect food supplies from the oceans.

HPMP Stage III plays an important part in helping countries phase out HCFCs. Implementation will face significant global development challenges, including technical and financial constraints to developing and deploying cost-effective, environmentally friendly alternatives to HCFCs. Substantial support is needed to help developing regions adopt new technologies and transition smoothly. Capacity building is crucial as many centres lack the technical expertise and institutional strength required for effective management of the phase-out. Providing targeted training and technical assistance can help develop the necessary capabilities to meet their commitments.

Malaysia has taken proactive measures including technology transfer investments, technical assistance, training and capacity-building, information dissemination and raising awareness. Malaysia has established a comprehensive regulatory framework for controlling ODS.

The remaining consumption of HCFCs is attributed to RAC servicing, including chillers. HPMP Stage-III focuses on effectively addressing phase out of HCFCs in the RAC servicing sector (HCFC-22) and chillers servicing sector (HCFC-123), building upon Stages I and II.

RAC Servicing Sector

The RAC sector consumes a significant amount of HCFCs, particularly HCFC-22. New HCFC-based manufacturing and the manufacturing, assembly, and import of HCFC-based air conditioning units is banned. Demand for HCFC-22 persists in the servicing sector, including in residential, light commercial, small chillers, and commercial refrigeration applications. While a natural decline in equipment usage is anticipated due to environmental regulations and climate conditions, intensive maintenance activities is leading to extended equipment lifespan, contributing to sustained demand for HCFC-22.

The servicing sector in Malaysia is supported by a network of Authorized Training Centres (ATCs). These ATCs, accredited by the DOE, are responsible for delivering training programs and certification schemes for technicians in the servicing sector. However, there are discrepancies in training capacities among ATCs, with variations in infrastructure, resources, and quality of training equipment. Despite efforts to strengthen capacities through physical assistance and training programs under HPMP Stages I and II, challenges persist in ensuring standardized training delivery and certification across all ATCs.

A more coordinated and comprehensive approach is needed to enhance the physical capacities of ATCs in Malaysia supporting technicians to deliver effective maintenance practices and support the sustained phase-out of HCFCs in the servicing sector. Improved infrastructure and resources at ATCs will ensure standardized and high-quality training, contributing to long-term sustainability in HCFC phase-out efforts.

The current situation highlights the need for coordinated efforts to address barriers in the RAC servicing sector. These barriers include the lack of proper physical infrastructure in training centres, technicians' need for updated knowledge and tools for emerging technologies, and the necessity to align servicing certification schemes with the National Certification Scheme. Additionally, there is a requirement to expand the reach of ATCs to include informal technicians and improve the capacity and coverage of reclamation services. These barriers hinder the effective implementation of training programs, certification schemes, and reclamation initiatives, thereby impeding progress towards HCFC phase-out goals in Malaysia.

Chillers Servicing Sector

Transitioning to more sustainable options in the chiller service sector is challenging due to the absence of economically viable low global warming potential (GWP) alternatives and exemptions for certain equipment like HCFC-123 chillers in sensitive applications. Large capacity chillers are generally found in central air conditioning systems in setting such as commercial buildings and industrial applications. Furthermore, the landscape for HCFC-123 alternatives lacks clarity, and retrofit options depends mainly on high-GWP hydrofluorocarbons (HFCs), leading to serious environmental concerns. The widespread adoption of alternative refrigerants like R-717 (Ammonia) and Hydrofluoroolefins (HFO) based chillers faces technical and financial challenges. While these alternatives offer potential benefits in terms of efficiency and environmental impact, concerns about safety, compatibility with existing systems, and upfront costs hinder their uptake. A lack of detailed information on installed capacity and market demands for alternatives, coupled with insufficient knowledge sharing inhibits effective phase-out management in the sector. Addressing these barriers is important for facilitating a smooth transition to environmentally friendly and sustainable practices in the servicing sector.





CHAPTER 3:

THE PLAN TO PHASE OUT HCFCs

Overarching Strategy

HPMP Phase 3 will focus on the servicing sector, where over 98% of remaining HCFC use occurs. The large number of individual cooling units using HCFCs in Malaysia mean that phase out requires adequate numbers of trained technicians who can facilitate the transition away from HCFCs.

Stage III strategy guiding principles

- Country-driven reflecting the national context, priorities, and national policies.
- Develop and demonstrate strengthened and proactive partnership between the Government and industry.
- Take a balanced approach to ensure the phase-out of HCFCs while avoiding as much as possible the transition to high GWP HFCs in the servicing sector.
- Put a strong emphasis on recovery and reuse of HCFCs and encouraging improvement of servicing practices across the board.
- Draw upon lessons learnt and integrate and build upon existing infrastructures established under stages I and II.
- Dynamic and open for revisions and adaptation as necessary in response to evolving situations.
- Incorporate gender responsive actions and indicators into the planned activities.

Stage III is the last phase of HPMP, to be implemented from 2024 to 2030. HPMP Stage III will see the phase out of 257.67 ODP tonnes of HCFCs. Malaysia needs to achieve the 2025 and 2030 compliance targets for phasing out HCFCs as per the accelerated schedule of the Montreal Protocol. The outcomes summary for HPMP III is listed below and the Theory of Change of HPMP III is presented in **Annex A**.

Stage III Outcomes summary

- Enhance infrastructure and technical capacities in the servicing sector.
- Expand training and certification schemes of technicians, in a gender sensitive manner, to improve national capacities and avoid jobs losses in transition.
- Expand training for servicing technicians, promoting harmonization of national certification schemes, and strengthening Authorized Training Centres (ATCs).
- Support a national strategy for managing existing chillers and prohibiting new HCFC-123-based chillers, ensuring a smooth transition to alternative technologies.
- Promote low-GWP alternatives through capacity building workshops.
- Enhances enforcement efforts by delivering extensive training to customs and port authority officers.
- Improve circularity of refrigerants through recovery and reclaim processes.
- Fosters innovation and sustainability within the industry by offering guidance on alternative technologies, thereby facilitating the shift towards environmentally friendly options.
- Continue gender inclusive raising awareness.
- Estimate future servicing needs considering the future servicing tail allowance (2030-2040).

The Refrigeration and Air Conditioning (RAC) servicing sector (including chillers) accounts for all the remaining consumption of HCFCs in Malaysia. Therefore, the focus of HPMP strategy is to effectively address these sectors building on the work of stage I and stage II.

Stage III proposes two subsector plans, which detailed scope, budget and activities targets are in the following sections of this document.

RAC Servicing Sector Plan (HCFC-22)

HPMP Stages I and II eliminated the manufacture of HCFCs, and the import and manufacture of new HCFC equipment. Stage III focusing on the RAC servicing sector, where HCFCs remain, with HCFC-22 accounts for 95% of HCFC consumption in Malaysia.

The key success factor for Stage III lines on capacity building of servicing sector technicians as a critical means to improve capacities, reduce leakages and elevate the quality of services in general in the RAC Servicing Sector.

Key actions in the RAC Servicing Sector Plan (HCFC-22)

- Expand training on Good Practices and Refrigerant Management to 10,000 technicians.
- Promote the harmonization of the National Certification under the Skills Training Programme and Montreal Protocol-related Technician Certification Schemes.
- Continue strengthening the 64 Authorized Training Centres by delivering fit-for-purpose RAC Trainer Units and improve basic training tooling of new 23 ATCs accredited by the NOU since Stage II.
- Assist the Government to continue improving the Regulatory and Institutional systems by establishing new bans on use of HCFCs, expand DOE, Custom Officers, Port Authorities and National Control and Compliance Officers capacities to control and manage HCFCs use.
- Continue raising awareness to support sustaining the HCFCs phase-out.

Barriers to be addressed in the RAC Servicing Sector

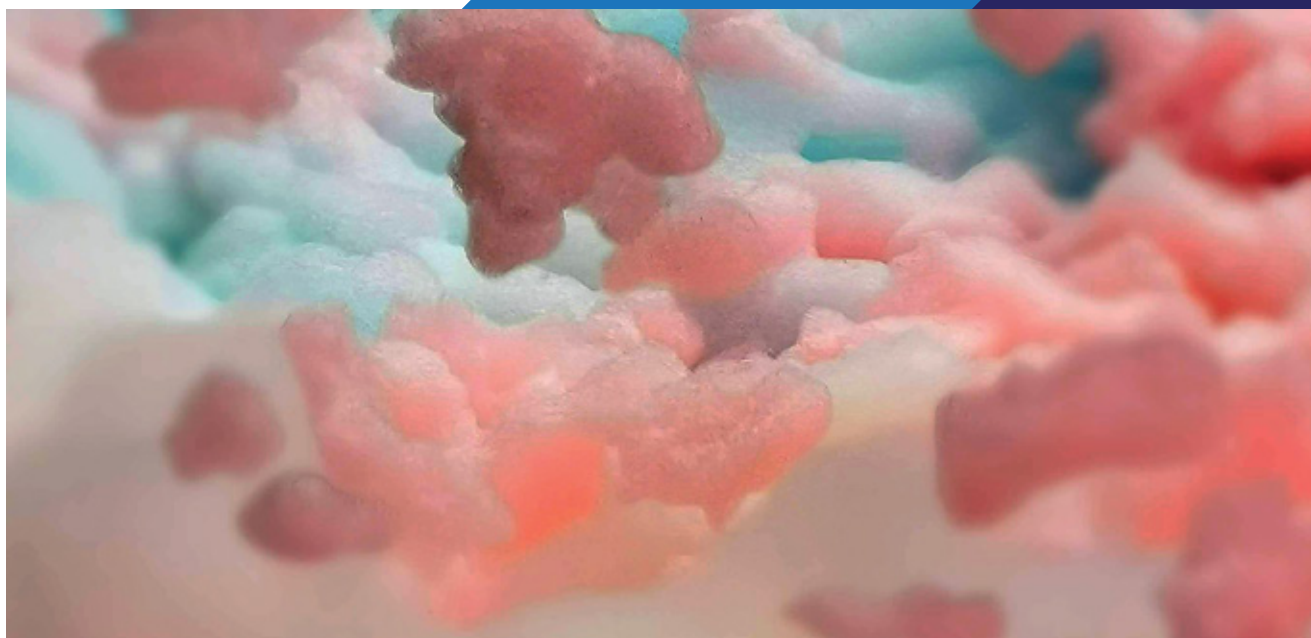
- Lack or limited proper physical structure to deliver comprehensive training in training centres.
- Additional needs for technicians to improve the knowledge of new/emerging technologies and good service practices.
- Lack of tools for good service practices to be used by technicians.
- Need to align National Vocational System and the RAC Servicing Certification Scheme.
- Need to be abreast of regional needs and enlarge the base of ATCs to reach informal technicians, deliver training and promote certification.
- Lack of proper physical structure and human capacity at the reclaim centres to offer the reclamation services to the public and to upscale reclamation activities, and limited reach of current reclamation network in the country.

Servicing Sector Action Plan

HPMP Phase 3 will focus on the servicing sector, where over 98% of remaining HCFC use occurs. The large number of individual cooling units using HCFCs in Malaysia mean that phase out requires adequate numbers of trained technicians who can facilitate the transition away from HCFCs.

Table 3.1 – Expected Results, and Outputs for Servicing Sector

Component	Outputs	Expected Results
AC-R Servicing Sector Plan	Customs Officers and Enforcement Officers Capacity Building	6 (six) coordination meetings and eight (8) bilateral meetings held between NOU, subnational DOEs, Customs Office, and Port Authority
		350 Enforcement officers of DOE trained on monitoring and import control of HCFCs and their alternatives
		One (1) ODS Imports Risk Profile Manual developed and mapping of illicit trade risks
		One (1) Online training module developed
		Nine (9) training sessions for Customs and Port Authority officers
		Five (5) laboratory personnel trained on the new lab equipment
		50 enforcement officers trained for ODS sampling
		Two (2) Laboratories strengthened for accurate Refrigerants and Blowing Agents Identification
	Regulatory Framework Improved	ODS Phase-out Legislation/Policies Compendium Developed
		Ban on the use of new HCFC-123 chillers for sensitive sectors as of 31 December 2027
		Ban on HCFC 141b for all uses as of 31 December 2025
	Awareness Raised to sustain Phase-out	5 Awareness Campaigns on HCFC bans/phase-out
		5 End-User Awareness Campaign on ODS-free products
		5 Capacity Building on low GWP alternative RAC technologies
		5 refrigerant RRR Awareness Campaigns
	Equipment Procured and distributed to improve national physical structures for training and refrigerant management	Basic Training and Assessment equipment for 64 Training Centres
		10 toolkits each for 23 new ATCs (since Stage II)
		15 flushing kits for one (1) COE
		Good service practices tools to 2000 technicians
	Good Practices Training Expansion and Harmonization of National Certification Scheme	Training Manuals and Occupational Safety Guidelines updated
		350 Master Trainers re-refreshed in the CTSP
		10,000 technicians trained in good servicing practices
		Harmonization of policy and syllabus for National Certification and CSTP
		350 Master Trainers trained under the harmonized program
	Technical Assistance for AC-R	500 technicians certified under the harmonized certification program
		International Coordinator Technical Advisor
		National Expert on AC application
	Improved refrigerant RRR System	National Expert on Refrigeration application
		Guidelines and SOPs for RRR Activities (harmonized approach)
		TA on improved business models
		45 personnel trained on Improved Reclamation Practices



Chillers Servicing Sector Plan (HCFC-123)

Transitioning to more sustainable options in the chiller service sector is challenging for several reasons. Among others, this is due to the absence of economically viable low global warming potential (GWP) alternatives. Equipment has a long lifespan, up to 20 years, far beyond Malaysia allowance to import HCFC-123 for servicing in 2030. The condition of HCFC-123 chillers is largely unknown. There are also issues with the alternative technologies; HFCs are restricted under the Kigali Amendment, HFOs have high costs, and HCs are flammable. While these alternatives offer potential benefits in terms of efficiency and environmental impact, concerns about safety, compatibility with existing systems, and upfront costs hinder their uptake.

The Chiller Servicing Sector Plan will assist NOU to map the installed capacity of HCFC-123 chillers in the country and support a national strategy to manage remaining chillers and establish bans on new installation of HCFC-123 based chillers.

There is a lack of affordable and cost effective low-GWP alternatives that can meet restrictions in use of flammable refrigerants in certain urban/priority setting, as well as the high efficiency of HCFC-123 chillers. Given the very low ODP values of HCFC-123, this equipment is exempted from the 2020 Ban for the use in "sensitive application".

The project survey identified few new installations of HCFC-123 chiller that occurred in 2021 from equipment procured in 2019/2020, with a total of 11 chillers installed (provided by two Manufacturers), followed by an additional 6 chillers in 2022. The installation process in 2021, added to the servicing sector needs for maintenance of previous installed based, resulted in the consumption of 9,377 kg of HCFC-123, while in 2022, the consumption amounted to 5,370 kg.

Table 3.2 – Expected Results and Outputs for Chiller Servicing Sector

Component	Outputs	Expected Results
Chillers Servicing Sector Plan	Technical Assistance for HCFC-123 based Chillers delivered	Installed capacity of HCFC-123 Chillers mapped
		Needs of Chillers servicing sector assessed
		Assess alternatives landscape for HCFC-123 free Chillers
		National Strategy for Chillers Sector / Future Demands
		Conduct stakeholders' consultations / awareness
		Comprehensive SOPs for best practices in the servicing of HCFC-123-based chillers

HCFC-123 alternatives landscape and market demands

Retrofit options depend on the specific refrigerant for which the chiller was originally designed for, and it is recommended that the manufacturers of the equipment be consulted in any retrofit program. For retrofit/revamp options, only high GWP HFCs are readily available in Malaysia and retrofitting practices may not immediately bring additional benefits (such as improved energy efficiency or reduced servicing demand, depending on the age of the baseline chiller). Thus, retrofit potential should be indeed considered in a case-by-case scenario.

In terms of new equipment, R-717 (Ammonia) is a feasible and available option for industrial applications with notably comparative advantages in terms of application, servicing, and efficiency. HC-based units are not used in Malaysia and the market penetration is virtually inexistent. Currently, the most common and fully commercially available refrigerants for new chillers (and replacement of HCFCs-based

chillers) are high-GWP HFCs (particularly HFC-134a for positive displacement units).

Consultations with main suppliers demonstrated a long-term willingness to shift high-GWPs HFCs chillers to HFO-based ones (HFO-1233zd(E)), since this refrigerant brings environmental benefits (GWP=1), improved energy efficiency of the system, and has the potential to reduce the operational costs (being an A1 refrigerant that could replace oil-based compressor by Magnetic Bearing Chillers). However, its phase-in costs are 25-40 per cent higher than those of the HFC-based chillers and there are technical barriers to be addressed to allow a large-scale penetration of this technology.

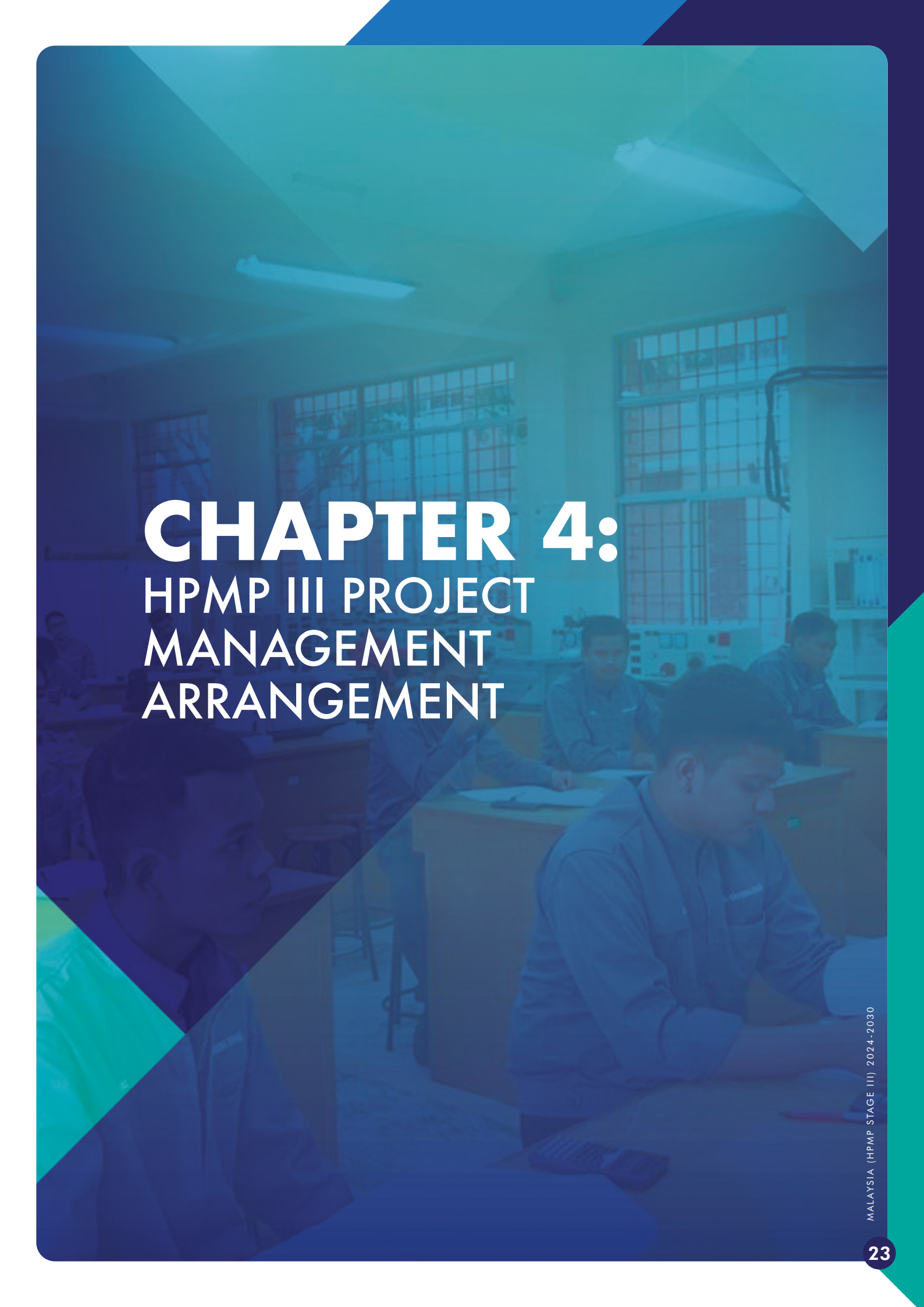
As per discussion with suppliers, it is found that there are currently 400 HCFC-123 chillers still in operation in Malaysia. As per survey, following is the consumption in chillers:

Table 3.3 – Estimated demand for Large-sized Chillers Alternatives Market in Malaysia (2022)

Refrigerant Demand	Demand (Kg)
R-123	36,609
R-134a	869,028
R-407C	55,914
R-410A	13,120
R-417A	1,237
R-507A	3,290

Barriers to be addressed in the Chiller Servicing Sector

- Lack of detailed information/mapping of chillers installed capacity utilizing HCFC-123 and lack of tools to better understand future market needs.
- Lack of capacities of installers and end-users to assess their long-term needs to understand country's future servicing needs.
- Lack of knowledge sharing and awareness to communicate and build capacities for effective means of "managing" phase out in the sector.



CHAPTER 4:

HPMP III PROJECT MANAGEMENT ARRANGEMENT

Institutional Arrangements

HPMP III will be implemented following UNDP's National Implementation Assisted Modality (Country Office Assistance to NIM), as per the Standard Basic Assistance Agreement between UNDP and the Government of Malaysia. Under this framework, specific financial, procurement and human resources rules and execution regulations, as well as gender and environmental and social screening policies and standards of UNDP will be observed. Adherence to policies and regulations will be assured through the Project Monitoring Unit (PMU). DOE will act as the Implementing Partner (IP) to the project.

DOE as Implementing Partner

The Government of Malaysia, through DOE will act as IP to the project. The IP shall:

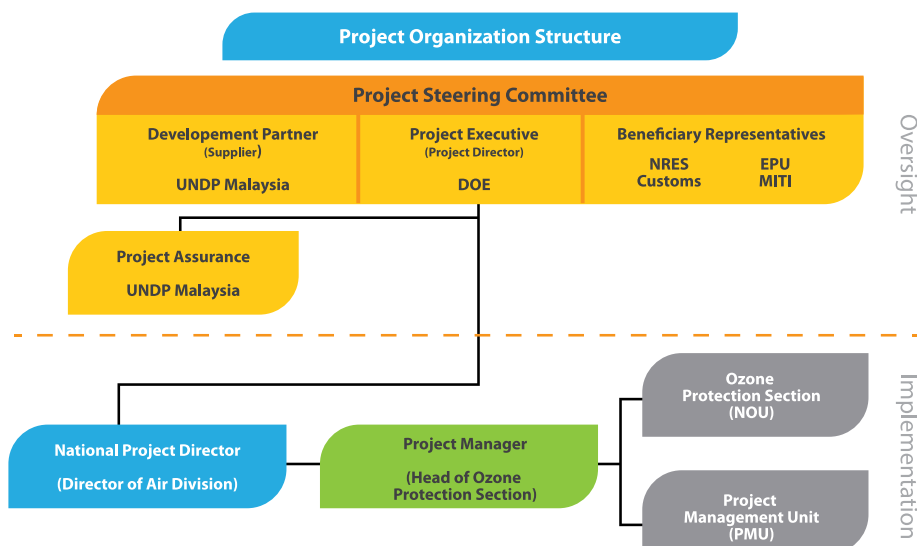
- (a) conduct project and programme-related activities in a manner consistent with the UNDP Social and Environmental Standards.
- (b) implement any management or mitigation plan prepared for the project or programme to comply with such standards.
- (c) engage in a constructive and timely manner to address any concerns and complaints raised through the Accountability Mechanism.

A Project Steering Committee (PSC or Project Board) will be established. This multi-stakeholder board will serve to review performance based on established monitoring and evaluation metrics and high-level implementation issues to ensure quality delivery of results. The Project Board, being the most senior, dedicated oversight body for a UNDP 'Development Project' (defined in the Project Policy Management (PPM) as an instrument where UNDP "delivers outputs where UNDP has accountability for design, oversight and quality assurance of the entire project") will follow the specific Terms of Reference (TORs).

Project Management Structure

Project management and coordination is an important element of HPMP III to ensure timely and systematic implementation of the project. The framework that was developed during HPMP I and II will be primarily used to manage and monitor project's implementation, with changes as and when necessary to respond to evolving needs.

The Department of Environment (DOE) through its Ozone Protection Section (OPS) under the National Ozone Unit (NOU) will coordinate the project implementation. The NOU will oversee the overall coordination and undertake the day-to-day implementation supervision and management of the project. The Ministry of Natural Resources and Environmental Sustainability (NRES) will support the project in terms of providing overarching policy guidance and direction whereas UNDP will be responsible for project and financial management as well as to provide for technical and policy support to the project.



Project Steering Committee (PSC)

A Project Steering Committee will be established. This multi-stakeholder committee will serve to review performance based on established monitoring and evaluation metrics and high-level implementation issues to ensure quality delivery of results.

The PSC is the dedicated oversight body for a UNDP 'Development Project' (defined in the Project Policy Management (PPM) as an instrument where UNDP "delivers outputs where UNDP has accountability for design, oversight and quality assurance of the entire project") will follow the specific Terms of Reference (TORs). The composition of the PSC must include individuals assigned to the following three roles:

- **Project Executive:** This is an individual who represents ownership of the project and chairs (or co-chairs) the PSC. The Executive usually is the senior national counterpart for nationally implemented projects (typically from the same entity as the Implementing Partner-IP). For this project, two individuals will co-share the PSC (DOE and UNDP). If the project executive co-chairs the PSC with representatives of another category, it typically does so with a development partner representative. The Project Executive is the Deputy Director General (Operation) of the DOE.
- **Beneficiary Representative(s):** Individuals or groups representing the interests of those groups of stakeholders who will ultimately benefit from the project. Their primary function within the board is to ensure the realization of project results from the perspective of project beneficiaries. Often representatives from civil society, industry associations, or other government entities benefiting from the project can fulfil this role. There can be multiple beneficiary representatives in a PSC. The Beneficiary representatives are NRES, Ministry of Economy, Royal Malaysia Customs Department (Customs), Ministry of Investment Trade and Industry (MITI).
- **Development Partner(s):** Individuals or groups representing the interests of the parties concerned that provide funding, strategic guidance and/or technical expertise to the project. The Development Partner is the UNDP Resident Representative.

Project Monitoring Unit (PMU)

A well-functioning project implementation and monitoring structure is a critical part of this overarching strategy as it allows additional human capacities to be added to the DOE structure.

Therefore, the structure established for the PMU under stage II will be continued under stage III to retain expertise in the technical and implementation areas, as well as to assure a smooth transition between projects. PMU will consist of a dedicated team of a Manager, Assistants and Experts to assure the project is timely implemented following the Rules and Regulations of the MLF and the Implementing Agencies (IAs), reporting systems are in place and Independent Verifications and Audits are facilitated.

The PMU cost is estimated at US \$1,681,000 for eight (8) years of project execution, and it will continue to be facilitated by UNDP and placed within the structure of DOE, reporting directly to the National Ozone Officer (NOO). It will ensure close coordination of activities and proper reporting lines and deployment of joint activities. The PMU will be responsible to carry out the following activities:

Carry on the relevant execution follow ups through physical on-site visits.

Manage the implementation of projects, technical assistance and other activities.

Organize missions, meetings and technical visits to project partners, stakeholders and beneficiaries.

Prepare periodic reports and reports to the NSC and PSC.

Prepare technical documentation and organize of meetings for evaluation.

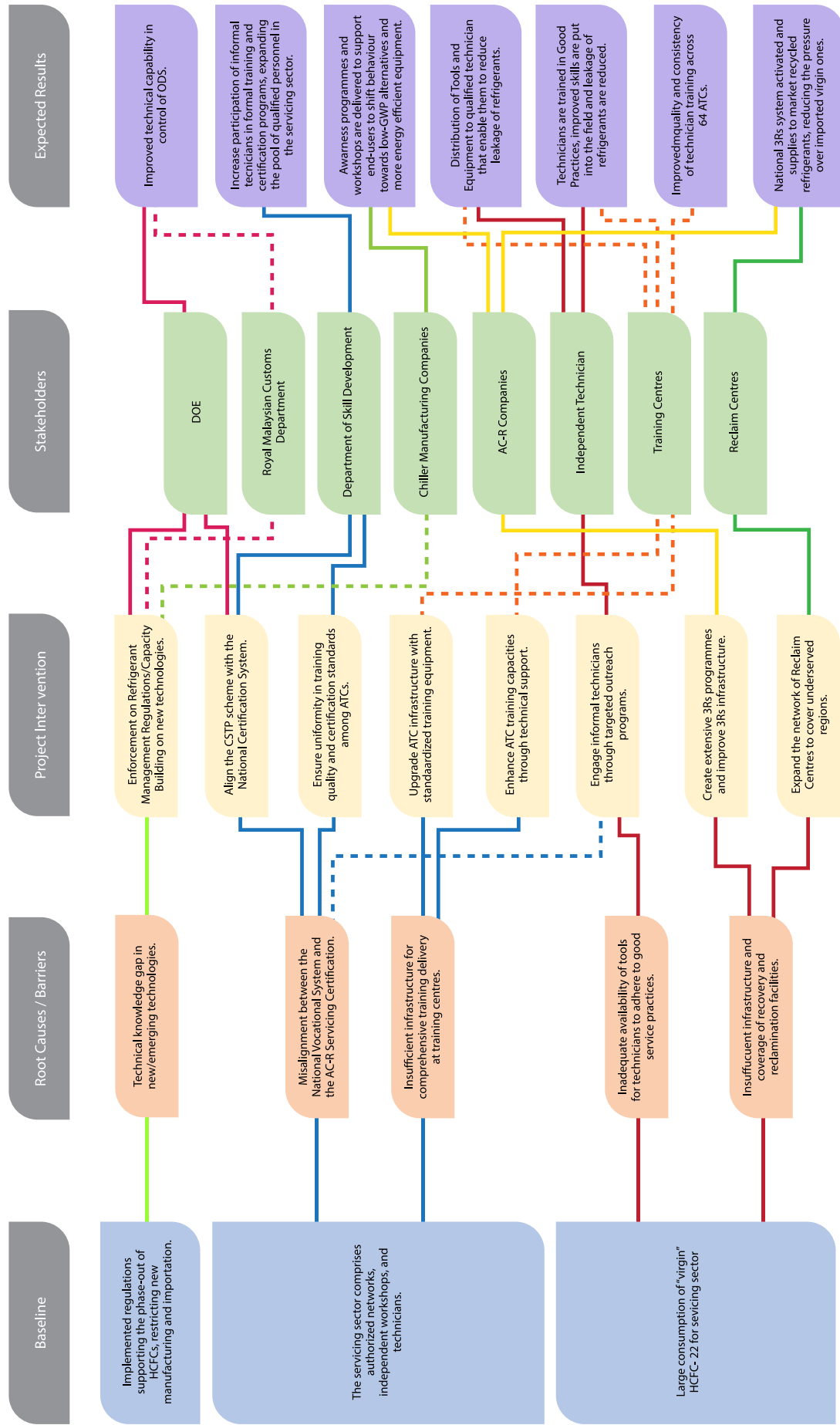
Make recommendations to the DOE and UNDP regarding implementation performance, achievement of milestones, field verification of enterprises and endorsement of disbursements.

Carry on the day-to-day administration of the HPMP activities (managerial and operational).

Budget and financial control of approved funds.

Prepare annual budget reviews pursuant to DOE's rules and regulations.

ANNEX A: Theory of Change of HPMP III



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