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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-ninth Meeting
Montreal, 7–11 December 2026
Item 9(d) of the provisional agenda[1]

PROJECT PROPOSAL: BHUTAN

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

Energy efficiency

• Pilot project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): Integrating energy efficiency into RAC technician training and certification, facilitating the adoption of MEPS and energy labelling, and demonstrating low-GWP commercial refrigeration technologies	UNEP and UNDP	Individual consideration

[1] UNEP/OzL.Pro/ExCom/99/1

Pre-session documents of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol are without prejudice to any decision that the Executive Committee might take following issuance of the document.

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT

Bhutan

PROJECT TITLE	AGENCY
Pilot project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): Integrating energy efficiency into RAC technician training and certification, facilitating the adoption of MEPS and energy labelling, and demonstrating low-GWP commercial refrigeration technologies	UNEP (lead), UNDP

PROJECT OBJECTIVE
This project aims to strengthen energy efficiency in the RAC servicing sector in Bhutan by integrating energy efficiency into technician training and certification, building the institutional and technical foundation for future MEPS and energy labelling, and demonstrating low-GWP commercial refrigeration technologies.

NATIONAL COORDINATING AGENCY	National ozone unit / Department of Energy

ARTICLE 7 DATA (Annex F)	Year: 2025	4.80 mt	10,032 CO_2-eq tonnes

PROJECT DETAILS		
HFC consumption in the RAC sector in 2025 (country programme data)	mt	4.80
	CO_2-eq tonnes	10,032
Project duration	months	36
Grant amount requested from the Multilateral Fund	US $	280,000
Grant amount agreed	US $	250,000
Project support costs for UNEP	US $	15,340
Project support costs for UNDP	US $	11,880
Total cost of project to Multilateral Fund	US $	277,220
Co-financing	US $	36,500
Total project cost, including co-financing	US $	313,720
Energy-efficiency savings to be achieved through the project	kWh/year	19,000
Counterpart funding		Yes
Project monitoring milestones included		Yes
Minimum energy performance standards for relevant applications are established		No
Minimum energy performance standards for relevant applications are enforced		No

SECRETARIAT'S RECOMMENDATION	Individual consideration

PROJECT DESCRIPTION

Summary of the proposal as submitted

1. On behalf of the Government of Bhutan, UNEP as the lead implementing agency has submitted, in line with decision 91/65, a request for the pilot project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): integrating energy efficiency into refrigeration and air-conditioning (RAC) technician training and certification, facilitating the adoption of minimum energy performance standards (MEPS) and energy labelling, and demonstrating commercial refrigeration technologies with low global-warming potential (GWP), at a total cost of US $310,400, consisting of US $130,000, plus agency support costs of US $16,900, for UNEP and US $150,000, plus agency support costs of US $13,500, for UNDP, as originally submitted.[2]

Background

2. Bhutan ratified the Kigali Amendment on 27 September 2019, and stage I of the Kigali HFC implementation plan (KIP) was approved at the 98th meeting,[3] with the country committing to reducing its HFC consumption by 10 per cent of the baseline by 2029. Stage I of the KIP includes activities related to energy efficiency, further discussed in the "Project overview" section below.

Status of implementation of other activities related to energy efficiency

3. At the 95th meeting, funding was approved for additional activities to maintain energy efficiency in the refrigeration servicing sector in line with decision 89/6, including coordination among policy makers on the standards and labelling scheme pertaining to RAC appliances, adapting the United for Efficiency (U4E) product registration system (PRS) prototype for use in Bhutan, training of Government officers and importers on use of the system, and awareness-raising, as well as developing an energy-auditing training curriculum followed by training of trainers.[4] The following is progress of the project as of October 2026:

(a) The national ozone unit (NOU) and Department of Energy (DOE) have been collaborating through discussions and technical exchanges related to implementation of the standards and labelling programme, though a formal memorandum of understanding has not yet been signed;

(b) Update and training of the PRS is progressing following the delay reported to the 98th meeting;[5]

(c) A two-day consultation workshop on appliance energy-efficiency standards and labelling was attended by 30 appliance importers, retailers, Government agencies, and standards bodies; and

(d) The energy-auditing training curriculum was developed and the training-of-trainers programme was implemented; a competency-based training and assessment of RAC trainers and independent assessors took place in September 2026.

4. Further, a voluntary standards and labelling programme was developed by the DOE and officially launched on 1 June 2026, with support from the South Asia Regional Energy Partnership (SAREP), the World Wildlife Fund of Bhutan (WWF-Bhutan), and the Asian Development Bank (ADB). The voluntary programme comprises three components: voluntary participation providing appliance import studies,

[2] As per the letter of 24 August 2026 from the Ministry of Finance of Bhutan to UNEP.
[3] Decision 98/43
[4] Decision 95/34
[5] Decision 98/7

energy-performance thresholds, testing and verification, stakeholder consultation, product prioritization, and design of an energy label; the registration of prioritized products through a DOE portal, under development, where importers will register their products to qualify as star-rated; and the monitoring, enforcement, and publication of these products to encourage market uptake. The programme currently covers domestic refrigerators, storage water heaters, and LED lamps; air conditioners and reversible heat pumps were also identified as priorities and are undergoing market studies for their inclusion. The DOE has also signed a memorandum of understanding (MOU) with India's Bureau of Energy Efficiency (BEE) to draw on its energy-efficiency standards and star-labelling database.

Policy, regulatory and institutional framework

5. The DOE, under the Ministry of Energy and Natural Resources, is the lead national authority for energy efficiency and for Bhutan's standards and labelling programme. The Bhutan Standards Bureau (BSB) is the national standards body and works in collaboration with the DOE and SAREP on this programme. The NOU, located within the Ministry of Energy and Natural Resources, coordinates implementation of the Montreal Protocol and Kigali Amendment activities and will act as the national implementing counterpart for this project. The Department of Workforce Planning and Skills Development, under the Ministry of Education and Skills Development, is responsible for the national RAC technician training curriculum and certification system, delivered through the Technical Training Institute in Thimphu. The Technical and Vocational Education and Training (TVET) authority updates the national curriculums every three years or as needed; certifications include inter alia the Bhutan Qualification Framework (BQF) Certificate 2, which covers domestic RAC; BQF Certificate 3, which covers commercial heating, ventilation and air-conditioning (HVAC); and a diploma in HVAC technology. TVET also introduced a system for the Recognition of Prior Learning (RPL) in 2022 to assess the skills of technicians lacking formal training and certification.

6. The Procurement Rules and Regulations 2025 provides the framework governing public procurement procedures and is supported by standard bidding documents, standard request-for-quotation documents, procurement guidelines, and the national Electronic Government Procurement (e-GP) system. Bhutan is currently in the process of implementing the Sustainable Procurement Guidelines, which have been submitted to the Cabinet for approval. Once approved, the guidelines will be rolled out in a phased approach, focusing first on the construction and transport sectors; they are expected to serve as a bridge between the Procurement Rules and Regulations 2025 and the practical implementation of sustainable procurement in Bhutan, supporting the incorporation of environmental, economic, and social considerations, such as promoting energy efficiency and environmental performance and applying appropriate life-cycle costing approaches, into procurement decisions.

7. Bhutan does not yet have mandatory MEPS or a mandatory energy-labelling regime for RAC appliances. The National Energy Efficiency and Conservation Policy and Energy Efficiency Roadmap (2019), together with the National Energy Policy (2025), provide the policy framework for demand-side energy management and the national standards and labelling programme. In June 2026, the DOE, with support from SAREP, WWF-Bhutan and ADB, launched a voluntary standards and labelling programme covering domestic refrigerators, storage water heaters and LED lamps. Air conditioners and reversible heat pumps are currently under market study for possible future inclusion, while commercial refrigeration equipment is not yet covered. For the further development of the programme, the DOE plans to consider elements of India's energy-efficiency standards and information from the local adaptation of the U4E PRS system developed with the assistance of the project approved under decision 89/6 at the 95th meeting.

HFC consumption and sector background

8. The HFC consumption baseline for Bhutan has been established at 13,105 CO_2-equivalent (CO_2-eq) tonnes. The Government reported a consumption of 10,032 CO_2-eq tonnes of HFCs in 2025, which is 23 per cent below the country's HFC baseline for compliance. The 2021–2025 HFC consumption is shown in table 1.

Table 1. 2021–2025 HFC consumption in Bhutan (Article 7 data)

Substances	2021	2022	2023	2024	2025
Metric tonnes (mt)					
All HFCs	4.36	4.77	1.49	5.36	4.80
HFC-134a	0.87	0.93	0.32	0.38	0.11
R-404A	0.54	0.63	0.10	0.50	0.20
CO_2-eq tonnes					
All HFCs	7,941	8,667	2,388	6,391	10,032
HFC-134a	1,244	1,330	458	543	157
R-404A	2,118	2,471	392	1,957	793

9. Bhutan's 2025 HFC consumption is dominated by R-410A (approximately 86.8 per cent in mt), followed by R-404A (4.2 per cent), HFC-32 (2.7 per cent), HFC-134a (2.3 per cent), R-449A (2.1 per cent) and R-407C (1.9 per cent), with HFC-32 emerging as the principal transitional refrigerant in newly imported air-conditioning (AC) equipment. By number of units, the national RAC stock is dominated by domestic refrigeration (56.5 per cent), followed by residential AC (15.9 per cent), mobile air-conditioning (MAC) (15.4 per cent), and stand-alone commercial refrigeration (10.2 per cent); however, measured by estimated HFC use in CO_2-eq tonnes, consumption is concentrated in residential AC (40.5 per cent) and industrial refrigeration and cold storage (21.4 per cent), followed by commercial AC (13.6 per cent) and MAC (11.5 per cent).[6] Stand-alone commercial refrigeration currently accounts for a smaller share of consumption (approximately 2.6 per cent of estimated HFC use in CO_2-eq tonnes) but is expected to grow rapidly following new national food-safety requirements for refrigerated meat and fish display and storage.

Project overview

Project objectives and coordination with stage I of the Kigali HFC implementation plan

10. The pilot project aims to strengthen the technical, institutional, and market foundation needed to sustain and enhance energy efficiency across the RAC servicing sector, by integrating energy-efficiency competencies into the national technician training and certification system, building the institutional and technical foundation for future MEPS and energy labelling, and demonstrating energy-efficient, low-GWP technologies in the commercial refrigeration sector.

11. The proposed activities are designed to complement Bhutan's other ongoing HFC- and energy-efficiency-related projects, addressing gaps while avoiding duplication. For example, the project approved under decision 89/6 includes early-stage implementation of the national standards and labelling scheme and adaptation of the PRS, whereas the pilot project would strengthen the regulatory framework to support future mandatory MEPS development, and stage I of the KIP includes a study on the feasibility of an early ban on the import of HFC-based stand-alone commercial refrigeration equipment, with the pilot project demonstrating energy-efficient, low-GWP commercial refrigeration technology that would be needed to support such a ban.

Project beneficiary

12. The demonstration of R-290 display refrigeration for meat retailers would benefit approximately 12-15 meat and fish retailers and supermarkets currently using R-404A-based display refrigeration cabinets, which would be replaced with factory-sealed, pre-charged R-290 display units followed by at least 12 months of monitoring. The project will also promote the uptake of R-290 display refrigeration among meat and fish retailers responding to the recently updated requirements of the Bhutan Food and Drug Authority to install appropriate refrigerated display and storage equipment; this change will require an estimated 300 additional

[6] Paragraph 10 and table 4 of document UNEP/OzL.Pro/ExCom/98/25.

shops to install refrigeration, which may increase demand for HFC-134a and R-404A in commercial refrigeration. One representative 293-litre hard-top chest freezer model available in the regional market has an estimated annual electricity consumption of approximately 975 kWh; stand-alone commercial refrigeration units typically contain approximately 0.2-0.5 kg of refrigerant per unit.

13. The demonstration of energy-efficient R-290 monoblocs would benefit approximately four operators of small-scale cold rooms (below 20 kW cooling capacity) in food warehouses, hotels, or hospitals that are currently relying on R-404A or HFC-134a systems, which will be replaced with factory-sealed, pre-charged R-290 monobloc systems followed by at least 12 months of monitoring.

14. The proposed demonstration projects are expected to complement the study to assess the feasibility of an early ban on the import of HFC-based stand-alone commercial refrigeration equipment planned under stage I of the KIP, aiming to build confidence among end users, importers, and policymakers by showcasing how R-290-based systems perform under the ambient temperatures and altitudes specific to Bhutan. The findings are also expected to inform future procurement specifications, market-engagement measures, and the design of future KIP interventions.

15. In-kind co-finance from beneficiaries included providing the operating environment necessary for the demonstrations, including access to the sites and existing equipment, staff time, electricity during operation, routine operational support, and monitoring support.

Proposed activities as submitted

16. The proposed activities and costs for the implementation of the project are shown in table 2.

Table 2. Proposed project activities and their costs for Bhutan

Project components and activities	Cost (US $)
Integrating energy-efficiency competencies into the technician training and certification system (UNEP)	
Integration of energy efficiency into TVET curricula and certification framework	***30,000***
Review and update of the competency standards and related training materials, certification assessment criteria, and practical testing methodology and procedures, including for RPL	25,000
One workshop with at least 10 trainers and assessors (at least two women) to discuss and practice the teaching methods and assessment criteria in the updated materials	5,000
Energy-efficiency training of refrigeration technicians	***15,000***
At least three energy-efficiency-focused technician training courses (outside of regular TVET courses, including outside Thimphu) for a total of at least 30 technicians (at least three women), including pre- and post-training assessments	15,000
Strengthening and facilitating adoption of MEPS and energy labels for RAC equipment (UNEP)	
Strengthening institutional coordination and technical readiness for RAC MEPS and energy labels	***30,000***
Training of Government authorities (NOU, DOE, and BSB) on energy-efficiency policy development, standards and labelling programmes, and MEPS implementation	10,500
Establishment of a multi-stakeholder coordination mechanism (NOU, DOE, BSB, customs, and other stakeholders) through at least three coordination meetings and consultations, including at least two with private-sector stakeholders, reaching at least 75 participants	4,500
Report reviewing international and regional MEPS and labelling frameworks, and a Government-validated roadmap and implementation plan for mandatory MEPS and energy labelling for domestic refrigerators, air conditioners, and reversible heat pumps	15,000

Project components and activities	Cost (US $)
Market assessment and evidence-based development for energy-efficient and low-GWP RAC technologies	***15,000***
Market and energy-efficiency baseline study of air conditioners and reversible heat pumps in Bhutan, estimating potential energy and emissions savings and identifying priority products for future policy action	15,000
Awareness-raising and compliance support for the implementation of the standards and labelling programme and future mandatory enforcement	***40,000***
Development of awareness and outreach materials on energy-efficient and low-GWP RAC technologies for households, businesses, importers, distributors, and retailers	10,000
At least four awareness and stakeholder consultations on the benefits of energy-efficient, low-GWP RAC technologies and the standards and labelling programme	6,000
Development of a market-surveillance checklist, standard operating procedures (SOPs), and guidelines for verification of registered and labelled products for customs	10,000
Two training sessions for clearing and forwarding agents, customs officers, and retailers on equipment data and handling discrepancies, with at least 100 participants (at least 25 women)	10,000
Establishment of a reporting and feedback mechanism between customs authorities and the DOE to support market surveillance of registered and labelled products	4,000
Demonstration of energy-efficient and low-GWP commercial refrigeration equipment (UNDP)	
Demonstration of R-290 display refrigeration for meat retailers	***61,500***
Assessment of candidate meat and fish retail sites to confirm which existing R-404A cabinets are suitable for replacement, size and specify the R-290 display units needed, and set a baseline energy and temperature monitoring plan before installation	3,500
Procurement and delivery of between 12 and 15 factory-sealed R-290 commercial display refrigeration units for meat/fish retailers, to replace existing R-404A-based cabinets	45,000
Procurement of monitoring equipment and support to technicians and suppliers on installation, commissioning, and data collection	4,000
Performance monitoring, verification, and analysis for at least 12 months	4,000
Preparation and dissemination of a comparative case-study report on energy performance, food-safety performance, reliability and lifecycle/operating costs, together with procurement and policy recommendations for wider uptake	5,000
Demonstration of energy-efficient R-290 monoblocs for small-scale cold rooms	***88,500***
Assessment of candidate cold rooms to confirm which existing R-404A/HFC-134a systems are suitable for replacement, size the R-290 monobloc capacity via cooling-load calculations, and set a baseline energy and temperature monitoring plan before installation	3,500
Procurement and delivery of approximately four R-290 monobloc refrigeration systems for existing small-scale cold rooms, to replace existing R-404A/HFC-134a systems	66,000
Procurement of monitoring equipment and support to technicians and suppliers on installation, commissioning, and data collection	4,000
Performance monitoring, verification, and analysis for at least 12 months	10,000
Preparation and dissemination of a comparative case-study report on energy performance, food-safety performance, reliability and lifecycle/operating costs, together with procurement and policy recommendations for wider uptake	5,000
Subtotal for UNEP	**130,000**
Subtotal for UNDP	**150,000**
Total	**280,000**

Cost of the pilot project as submitted

17. At a total cost of US $280,000, plus agency support costs, as initially submitted, the project is expected to be completed within 36 months from approval, between January 2027 and December 2029. In-kind co-financing was proposed by the beneficiaries of demonstration project.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

18. The Secretariat has reviewed the project proposal in light of decisions 89/6, 91/65 and 95/87 and taking account activities implemented under stage I of the country's KIP.

Eligibility under decisions 89/6, 91/65, and 95/87

19. The project meets the eligibility criteria of decision 95/87(d) since it has been submitted prior to the 100th meeting of the Executive Committee and, in line with decision 91/65, the Government of Bhutan has confirmed that the NOU would coordinate with the DOE, BSB and other relevant institutions to facilitate consideration of refrigerant transition when developing energy-efficiency standards; that if Bhutan were to mobilize funding from sources other than the Multilateral Fund for energy-efficiency components when phasing down HFCs, the project would not result in the duplication of activities among those funded by the Multilateral Fund and those funded from other sources; the information on project progress, results and key learning would be made available, as appropriate; the date of completion of the project would be set as no more than 36 months after the date of approval by the Executive Committee; and a detailed project report would be submitted to the Executive Committee within six months of the date of completion of the project.

Status of implementation of additional activities for energy efficiency (under decision 89/6)

20. UNEP confirmed that the additional activities to maintain energy efficiency in the refrigeration servicing sector approved in line with decision 89/6 will be completed by December 2027 in line with the extension granted through decision 98/7.

21. Several of the activities proposed under the present project, in particular the market assessment and evidence base development for energy-efficient and low-GWP RAC equipment, would benefit from the implementation of the PRS developed under the project approved under decision 89/6. UNEP clarified that the PRS had not yet been integrated with Bhutan's national Electronic Customs Management System (eCMS), which is managed by the Department of Revenue and Customs, as this integration was not foreseen during the initial design of the project approved under decision 89/6. Moreover, the Government had decided to expand the scope of the system beyond the original concept focused on domestic RAC equipment to cover six appliance categories under the national standards and labelling programme, including commercial refrigeration equipment. This broader scope has increased development requirements and associated costs and will be entirely co-financed by the Government since it adds appliances (e.g., storage water heaters) not relevant for the Montreal Protocol. Further to consultations with UNEP, it was agreed to replace the activity related to market assessment with technical assistance to integrate the eCMS in the PRS.

22. It was agreed that rather than an MOU between the NOU and the DOE as had been planned under the project approved under decision 89/6, the present project would include an MOU between the NOU, DOE, and customs to enable the completion and implementation of the PRS, in line with the additional Government co-financing required for the expanded scope of the system and arrangements for its joint development and operation, including the integration of the eCMS in the system.

Technical and cost-related issues

Integrating energy-efficiency competencies into the technician training and certification system

23. Regarding the development of training material, the Secretariat inquired how this activity would be coordinated with the training curriculum on energy auditing developed under the project approved under decision 89/6 and under the KIP. UNEP clarified that the curriculum development under the KIP focuses on updating national competency standards and curricula on refrigerant transition, safety and good servicing

practices, the present project would integrate energy-efficiency competencies into the standards, curricula, assessment criteria and practical testing methodologies, which was different from the curriculum on energy auditing. Upon further discussion, UNEP agreed to align the activities within a single curriculum and certification revision process and reducing the budget for this activity to US $25,000.

24. The Secretariat noted that stage I of the KIP includes good servicing practices training for 45 technicians, while separate energy efficiency training for 30 technicians was originally proposed under the present project. In order to integrate those trainings, UNEP agreed to add energy efficiency training for the 45 technicians alongside their good servicing practices training, at a cost of US $4,500. The separate training activity was revised to cover energy auditing for at least 30 technicians, engineers and building managers through at least three courses, including at least three women and pre- and post-training assessments, with its cost reduced from US $15,000 to US $6,000.

Strengthening and facilitating adoption of MEPS and energy labels for RAC equipment

25. The Secretariat noted Bhutan's small, import-dependent RAC market and sought to better understand how the strengthened institutional coordination and improved technical readiness for RAC MEPS and energy labels under this component would improve the energy efficiency of RAC equipment in the country. UNEP highlighted the importance of the activity in the absence of mandatory MEPS for RAC equipment and limited national capacity for their development, implementation and enforcement. Capacity building for government institutions, together with expert support to provide technical recommendations and a roadmap, would support Bhutan's transition from the voluntary programme to mandatory MEPS and energy labelling.

26. Accordingly, the Secretariat and UNEP had detailed discussions on the Government's planned timeline for introducing MEPS for RAC equipment. In line with the Government's prioritization of MEPS for domestic refrigerators, the Government committed to implementing mandatory MEPS for domestic refrigerators by 31 December 2029. The Government considered additional time was needed to implement MEPS for residential AC units, which the Government would undertake concurrently with the present project with the support of funding from ADB. For commercial refrigeration, the Government considered MEPS premature given the developing market, limited performance data and the need to first build institutional experience with registration, verification, market surveillance and enforcement. In the meantime, the project will use the updates to the Government Sustainable Procurement Guidelines and the PRS, and the R-290 demonstrations implemented under the project to generate market and performance data and promote energy-efficient, low-GWP equipment, providing a basis for considering commercial refrigeration MEPS at a later stage.

27. Following further discussion and taking account of the proposed demonstrations and the current status of MEPS for commercial refrigeration, the activities under this component were rationalized. The proposed MEPS and labelling framework review and roadmap, and the market and energy-efficiency baseline study for air conditioners and reversible heat pumps, were removed. To create an enabling environment for replication of the demonstrations, two activities were added: (i) integration of energy-efficient standalone commercial refrigeration equipment and monobloc refrigeration units into Government Sustainable Procurement Guidelines, and training and awareness raising on the implementation of those guidelines (US $17,500); and (ii) integration of the PRS with the eCMS, including commercial refrigeration and monobloc refrigeration equipment (US $30,000).

28. The awareness activities being implemented under the project approved under decision 89/6 focused on supporting the launch of the voluntary standards and labelling programme through consumer awareness, retailer engagement and outreach. To avoid duplication, awareness activities under the present project were streamlined by removing general awareness activities and refocusing the activities on implementation and compliance measures, resulting in an adjusted cost of US $20,000.

Demonstration project on energy-efficient and low-GWP equipment in the commercial refrigeration sector

29. The Secretariat sought to better understand the barriers to the wider adoption of R-290 technology in commercial refrigeration in the country. For stand-alone display cabinets, while R-290 technology is already used in a few other commercial refrigeration equipment applications, the key barrier is the limited use of meat-display refrigeration in Bhutan. With new requirements for refrigerated meat display expected to increase demand, the project will demonstrate R-290 meat-display cabinets under actual retail conditions, replacing R-404A units and assessing their energy performance, operating costs, reliability and servicing needs. This will avoid growth of high-GWP HFC-based equipment and support the adoption of energy-efficient, low-GWP technology for this growing application. Regarding the demonstration of monoblocks, no existing R-290 monoblock installations have been identified through the KIP baseline assessment. The monoblock activity therefore addresses an application where operational experience with R-290 remains limited.

30. The project will generate comparative data on energy use, performance, reliability, servicing and lifecycle costs. Linked directly to stage I of the KIP, the demonstrations will support the assessment of restrictions on HFC-based stand-alone commercial refrigeration equipment and inform future MEPS, procurement and KIP interventions. Scalability will be supported through performance and cost evidence, procurement guidance, stakeholder dissemination, and alignment with the evolving regulatory framework. The demonstration will also complement the KIP stage I assessment of possible restrictions on HFC-based stand-alone commercial refrigeration equipment and, where appropriate, inform national procurement guidance to promote energy-efficient, low-GWP technologies.

31. Noting that no co-financing had been proposed for the demonstration activities, the Secretariat discussed with UNEP the need for beneficiary contributions. Following further discussion, it was agreed that beneficiaries would provide 40 per cent co-financing for the R-290 commercial display refrigeration units, including installation, commissioning and operational costs. For the monobloc units, the equipment cost was rationalized based on the required size and the number of units increased from four to five, with beneficiaries providing approximately 25 per cent co-financing, including support for installation and commissioning. Beneficiaries would also provide access to sites and existing equipment, staff time, electricity, operational support and participation in monitoring. UNEP further confirmed that replaced equipment would be rendered unusable to prevent reuse, while existing R-404A and HFC-134a refrigerants would be recovered and managed in accordance with Bhutan's procedures, without venting.

32. Regarding selection of beneficiaries, demonstration sites will be identified during implementation based on agreed technical and operational criteria, including the condition and refrigerant type of existing equipment, suitability for replacement, operating patterns, accessibility for monitoring, and the opportunity to generate evidence across different climatic and operating conditions.

33. To strengthen performance monitoring and support continued use of the equipment, the budget was increased to procure two portable devices for monitoring performance and energy efficiency: one for the display refrigeration demonstration and one for the monobloc demonstration. Upon completion of the project, the devices will be provided to TVET training centres to enable further testing, as well as training and awareness raising. As R-290 monobloc technology is new to the country, training for 20 technicians on servicing R-290 monobloc units was also included.

Cost of the pilot project as agreed

34. The agreed cost of the pilot project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down by integrating energy efficiency into RAC technician training and certification, facilitating the adoption of MEPS and energy labelling, and demonstrating low-GWP commercial refrigeration technologies in Bhutan amounts to US $250,000, as

shown in table 3. The estimated co-financing that will be provided by the beneficiaries, including for the procurement of the equipment, is US $36,500.

Table 3. Activities and costs of the project, as agreed

Project components and activities	Cost (US $)	
	Submitted	Agreed
Support development of energy-efficiency competencies (UNEP)		
Integration of energy efficiency into TVET curricula and certification framework	***30,000***	***25,000***
Review and update of the competency standards and related training materials, certification assessment criteria, and practical testing methodology and procedures, including for RPL	25,000	20,000
One workshop with at least 10 trainers and assessors (at least two women) to discuss and practice the teaching methods and assessment criteria in the updated materials	5,000	5,000
Energy-efficiency training of refrigeration technicians, engineers, and building managers	***15,000***	***10,500***
Augment technician training under stage I of the KIP for 45 technicians to include energy efficiency, including pre- and post-training assessments	0	4,500
At least three training courses to train at least 30 technicians, **engineers, and building managers on energy auditing** (at least three women), including pre- and post-training assessments	15,000	6,000
Strengthening and facilitating adoption of MEPS, energy labels and public procurement for RAC equipment (UNEP)		
Strengthening institutional coordination and technical readiness for RAC MEPS and energy labels	***30,000***	***62,500***
Training for NOU, DOE, and BSB on energy-efficiency policy development, standards and labelling programmes, and MEPS implementation	10,500	10,500
Establishment of a multi-stakeholder coordination mechanism through at least three coordination meetings, including at least two with private-sector stakeholders, reaching at least 75 participants	4,500	4,500
Review of international and regional MEPS and labelling frameworks, and a roadmap and implementation plan for mandatory MEPS and energy labelling for domestic refrigerators, air conditioners and reversible heat pumps	15,000	0
Integration of energy-efficient stand-alone commercial refrigeration equipment and monobloc refrigeration units into Government Sustainable Procurement Guidelines	0	17,500
Integration of PRS with eCMS, with the addition of commercial refrigeration and monobloc refrigeration equipment co-financed by the Government	0	30,000
Market assessment and evidence-based development for energy-efficient and low-GWP RAC technologies	***15,000***	***0***
Market and energy-efficiency baseline study of air conditioners and reversible heat pumps in Bhutan, estimating potential energy and emissions savings and identifying priority products for future policy action	15,000	0
Compliance support for the implementation of the standards and labelling programme and future mandatory enforcement	***40,000***	***20,000***
Awareness and outreach materials on energy-efficient and low-GWP RAC technologies for households, businesses, importers, distributors, and retailers	10,000	0
Awareness and stakeholder consultations on the benefits of energy-efficient, low-GWP RAC technologies and the standards and labelling programme	6,000	0
Development of a market-surveillance checklist, SOPs, and guidelines for verification of registered and labelled products for customs	10,000	8,000

Project components and activities	Cost (US $)	
	Submitted	Agreed
Two training sessions for clearing and forwarding agents, customs officers, and retailers on equipment data and handling discrepancies, with at least 100 participants (at least 25 women)	10,000	10,000
Reporting and feedback mechanism **including an MOU between customs authorities, DOE, and NOU** to support market surveillance of registered and labelled products	4,000	2,000
Demonstration of energy-efficient and low-GWP commercial refrigeration equipment (UNDP)		
Demonstration of R-290 display refrigeration for meat retailers	***61,500***	***61,500***
Assessment of sites to identify R-404A cabinets for replacement, selection of R-290 display units, and baseline energy and temperature monitoring plan	3,500	2,000
Procurement and delivery of **15** factory-sealed R-290 commercial display refrigeration units for meat/fish retailers, to replace existing R-404A-based cabinets **(40 per cent co-finance from beneficiary)**	45,000	36,000
Procurement of **one portable** monitoring device to monitor performance and energy efficiency	4,000	11,000
Baseline assessment and at least 12 months of performance monitoring; followed by a comparative analysis on energy consumption, temperature performance, reliability and lifecycle/operating costs	4,000	7,500
Preparation and dissemination of demonstration results, case studies, and procurement and policy recommendations for wider uptake	5,000	5,000
Demonstration of energy-efficient R-290 monoblocs for small-scale cold rooms	***88,500***	***70,500***
Assessment of candidate cold rooms to identify R-404A/HFC-134a systems for replacement, capacity of R-290 monobloc replacement units, and energy and temperature monitoring plan	3,500	2,000
Procurement and delivery of **five** R-290 monobloc refrigeration systems to replace existing small-scale R-404A/HFC-134a cold rooms **(25 per cent co-finance from beneficiary)**	66,000	37,500
Procurement of **one portable** monitoring device to monitor performance and energy efficiency	4,000	11,000
Training of 20 technicians on servicing R-290 monobloc units	0	5,000
Baseline assessment and at least 12 months of performance monitoring; followed by a comparative analysis on energy consumption, temperature performance, reliability and lifecycle/operating costs	10,000	10,000
Preparation and dissemination of demonstration results, case studies, and procurement and policy recommendations for wider uptake	5,000	5,000
Subtotal for UNEP	**130,000**	**118,000**
Subtotal for UNDP	**150,000**	**132,000**
Total	**280,000**	**250,000**

Energy-efficiency enhancements and estimated savings

35. Replacing 15 R-404A display refrigerators with R-290 units is estimated to save approximately 7,500 kWh/year, based on annual electricity consumption of 2,600 kWh per R-404A unit and 2,100 kWh per R-290 unit, a saving of 500 kWh per unit. UNEP also reported an input-power comparison of approximately 7.12 kW for an R-404A unit and 5.75 kW for an R-290 unit, representing a reduction of about 19.2 per cent. This input-power comparison is distinct from annual energy consumption, which depends on operating hours and load profiles. Actual annual savings will be assessed through the baseline measurements and performance monitoring.

36. Based on the comparative assessment, installation of five R-290 monoblock systems is estimated to save approximately 11,500–11,900 kWh of electricity annually compared with equivalent R-404A systems. Final savings will depend on the climatic conditions and operating characteristics of the selected demonstration sites.

Sustainability, replicability and assessment of risks

37. The Secretariat considers Bhutan's staged approach to the implementation of mandatory MEPS for RAC equipment prudent, with domestic refrigerators being targeted first, followed by residential AC units and then commercial refrigeration equipment. The commitment of the Government to implement mandatory MEPS for domestic refrigerators by 31 December 2029 will help build experience in implementing and enforcing MEPS, thereby enabling the implementation of subsequent MEPS for residential AC and commercial refrigeration equipment.

38. While MEPS for commercial refrigeration equipment will not be implemented under the project, the inclusion of R-290-based stand-alone commercial refrigeration equipment and monoblock refrigeration systems into the Government's Sustainable Procurement Guidelines, as well as the energy efficiency gains, lower electricity and maintenance costs and improved reliability and performance, expected to be demonstrated and disseminated under the project will help enable the long-term market introduction of R-290, energy efficient commercial refrigeration equipment. This is particularly relevant given the expected growth of meat and fish commercial refrigeration display units in line with Bhutan's newly implemented food safety standards.

39. The assistance provided under the project for compliance capacity building, including the development of guidance for customs; training for clearing and forwarding agents, customs officers, and retailers; and the development of a reporting and feedback mechanism, including an MOU between customs authorities, DOE, and the NOU, will enable the implementation and enforcement of MEPS once those are implemented. The linking of the PRS with the eCMS will enable the country to better understand and track the type and energy efficiency of equipment being imported into the country, thus building the necessary knowledgebase for continued MEPS upgrading and enforcement. Integrating energy-efficiency competencies into Bhutan's national RAC technician training and certification system will enable the long-term energy efficient operation of RAC equipment in the country. The provision of high-quality portable devices to monitor RAC equipment performance and energy efficiency will not only enable the implementation of the present project but also build long-term capacity as those monitoring devices will be provided to TVET training centres upon completion of the project.

40. Key risks to implementation and sustainability include technical capacity constraints for servicing and performance monitoring, and the upfront costs and beneficiary contributions required for wider uptake. Delays in completing the PRS and its integration with the eCMS, or in introducing mandatory MEPS, could also constrain the enabling environment for replication. These risks would be mitigated through technician training on R-290 monobloc servicing, supplier or refrigeration-expert support for installation and commissioning, provision of monitoring equipment, and selection of demonstration sites against agreed technical and operational criteria. An MOU among the NOU, DOE and customs would support joint development and operation of the PRS, while alignment with stage I of the KIP would help coordinate training and refrigerant-transition measures. Demonstration results would provide evidence of performance and operating-cost benefits to inform end-user decisions, which would be complemented by Government Sustainable Procurement Guidelines, although wider market uptake would remain dependent on affordability and progress with the regulatory framework.

RECOMMENDATION

41. The Executive Committee may wish to consider:

(a) Approving the pilot project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): Integrating energy efficiency into refrigeration and air-conditioning technician training and certification, facilitating the adoption of minimum energy performance standards (MEPS) and energy labelling, and demonstrating low-global-warming-potential commercial refrigeration technologies in Bhutan, in the amount of US $277,220, consisting of US $118,000, plus agency support costs of US $15,340, for UNEP, and US $132,000, plus agency support costs of US $11,880, for UNDP;

(b) Noting:

(i) That the Government of Bhutan has committed to the conditions referred to in decision 91/65(b)(iv)b. to (b)(iv)d.;

(ii) That the Government of Bhutan would establish MEPS for domestic refrigerators by 31 December 2029, was developing MEPS for residential air-conditioning units, and would integrate standalone commercial refrigeration equipment and monobloc refrigeration units into the Government's Sustainable Procurement Guidelines; and

(iii) That the project will be operationally completed no later than 31 December 2029 and a detailed project report will be submitted to the Executive Committee within six months of the date of completion of the project, including a detailed description of the activities undertaken to disseminate the results of the technology demonstrations and to promote the adoption of the selected energy-efficient alternative technologies.