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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-seventh Meeting
Montreal, 1-5 December 2025
Item 9(d) of the provisional agenda[1]

PROJECT PROPOSAL: GLOBAL

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

Energy efficiency

• Pilot project to improve the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): Demonstration project for digital monitoring and management tools to enhance energy efficiency and reduce emission of greenhouse gases in the cold chain sector in Colombia, Lebanon and Trinidad and Tobago.	UNDP	Individual consideration

[1] UNEP/OzL.Pro/ExCom/97/1

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT

Global

PROJECT TITLE	BILATERAL/IMPLEMENTING AGENCY
Pilot project to improve the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities): Demonstration project for digital monitoring and management tools to enhance energy efficiency and reduce emission of greenhouse gases in the cold chain sector in Colombia, Lebanon and Trinidad and Tobago.	UNDP

PROJECT OBJECTIVE

The objective of this project is to demonstrate how the use of digital solutions in three countries can reduce consumption of HFCs and enhance energy efficiency in the cold chain sector. The global component of this project aims to consolidate the data from different sites for analysis and optimization of a digital platform that could be used by other countries as well, generate knowledge and practical experience for replication in similar applications in other countries in projects funded by the Multilateral Fund.

NATIONAL COORDINATING AGENCY	National Ozone Unit (NOU) of the respective countries

LATEST ARTICLE 7 DATA (Annex F)	**Year:** 2024	Colombia	Lebanon	Trinidad and Tobago
	Metric tonnes (mt)	2,282.45	824.57	1,349.58
	CO_2-eq tonnes	4,647,025	1,573,653	2,967,132

Particular	Non-investment activities		
HFC used by the servicing sector (2024 country programme data)	Colombia	Lebanon	Trinidad and Tobago
(mt)	1,932.16	521.22	1,343.90
(CO_2-eq tonnes)	3,656,574	883,392	2,959,802
Project duration (months):			36
Initial amount requested (US $):			1,404,000
Final project costs (US $):			1,391,000
Requested grant (US $):			680,000
Implementing agency support cost (US $):			47,600
Total cost of project to Multilateral Fund (US $):			727,600
Co-financing (US $):			711,000
Energy-efficiency savings (kWh/year):			239,935
Status of counterpart funding (Y/N):			Y
Project monitoring milestones included (Y/N):			Y
Minimum energy performance standards (MEPS) available for the relevant sector (Y/N):	Colombia: Y	Lebanon: Under development	Trinidad and Tobago: N

SECRETARIAT'S RECOMMENDATION	Individual consideration

PROJECT DESCRIPTION

Background

1. On behalf of the Governments of Colombia, Lebanon and Trinidad and Tobago, UNDP has submitted, in line with decision 91/65, a request for a pilot project to enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities), in the amount of US $1,404,000, plus agency support costs of US $98,280, as originally submitted.[2]

Energy-efficiency pilot project

2. Digital tools help make refrigeration and air-conditioning (RAC) systems run more efficiently. Components such as digital sensors, smart meters, and cloud-based monitoring platforms can track temperatures, pressure, energy use, and run-time patterns. Such components can use this data for early detection of equipment operating problems and help to improve equipment performance. Instead of relying on manual checks or fixed schedules, technicians can use dashboards and alerts to fine-tune equipment performance, schedule timely maintenance, and prevent breakdowns before they happen. All these preventive measures through digital and monitoring tools can result in more energy-efficient performance of equipment.

Policy, regulatory and institutional framework

Colombia

3. Colombia ratified the Kigali Amendment on 25 February 2021. Under stage I of the Kigali HFC implementation plan (KIP), Colombia has committed to reducing HFC consumption by 18.3 per cent of the country's baseline (8,652,982 CO_2-eq tonnes) by 2029, as approved at the 95th meeting.[3] Stage I of the KIP focuses on technology conversions in commercial refrigeration manufacturing, and local assembly and installation sectors. Centralized refrigeration systems are widely used in the commercial subsector in Colombia, and on average, large and medium-sized supermarkets and hypermarkets utilize three centralized refrigeration systems in a facility. These systems are a significant source of refrigerant leakage estimated at 37 per cent per annum which in turn results in higher energy consumption of the equipment.

4. Regulatory energy efficiency standards are not available for centralized refrigeration systems in large cold chain infrastructures given their nature of customized design. However, Colombia's national supermarket strategy includes the establishment and implementation of specific minimum energy performance standards (MEPS) for installed systems. MEPS for stand-alone equipment is applicable when used in supermarkets.

Lebanon

5. Lebanon ratified the Kigali Amendment on 5 February 2020. Under stage I of the KIP, Lebanon has committed to reducing HFC consumption by 15 per cent of the country's baseline (2,556,533 CO_2-eq tonnes) by 2029 and 40 per cent by 2032, as approved at the 96th meeting.[4] The use of R-404A as a refrigerant in the commercial refrigeration subsector accounts for 33 per cent of the total HFC consumption in 2024.[5] Commercial refrigeration units are used in corner stores, restaurants and small and large supermarkets.

[2] As per the letters dated between 19 and 22 August 2025 from the relevant ministry of the Governments of Colombia, Lebanon, and Trinidad and Tobago to UNDP.
[3] Decision 95/61
[4] Decision 96/42
[5] 2024 CP data for Lebanon

6. In Lebanon, the implementation of MEPS for RAC equipment is progressing as part of the country's broader transition towards sustainable and energy-efficient cooling. Recent sector assessments indicate that MEPS for key product categories, such as split air conditioners, heat pumps, and domestic refrigerators, are still under development and have not yet been formally enacted through a binding legal framework. Although voluntary standards exist, including the 2011 Lebanese Energy Efficient Heating, Ventilation, and Air-Conditioning (HVAC) Equipment Standard, these have not yet been adopted as mandatory measures through a governmental decree with defined enforcement mechanisms.

7. Lebanon is currently updating its National Cooling Plan, which will integrate the introduction of mandatory MEPS and labelling standards across the RAC sector. The Ministry of Environment, through the national ozone unit (NOU), is actively engaged in this process as a core member of the national HVAC Committee, working in close coordination with LIBNOR (the Lebanese Standards Institution) and other relevant national entities. This collaboration aims to establish the legal and institutional framework necessary for the adoption and enforcement of MEPS in Lebanon, thereby promoting the uptake of high-efficiency, low-global-warming-potential (GWP) technologies consistent with the objectives of the Montreal Protocol and its Kigali Amendment.

8. By leveraging modern technology like digital tools to detect and prevent refrigerant leaks, tracking system efficiency, and providing data-driven insights, this project could help relevant stakeholders in Lebanon to monitor the energy efficiency data, increase the capacity of local companies for a more resilient and sustainable cold chain system.

Trinidad and Tobago

9. Trinidad and Tobago ratified the Kigali Amendment on 17 November 2017. Under stage I of the KIP, Trinidad and Tobago has committed to reducing HFC consumption by 10 per cent of the country's baseline (5,681,787 CO_2-eq tonnes) by 2029, as approved at the 93rd meeting.[6] It is estimated that the residential and commercial cooling sector accounts for approximately 17 per cent of total energy use in Trinidad and Tobago.

10. According to the country's National Cooling Action Plan, there is a lack of reliable and clear information of RAC energy performance in Trinidad and Tobago. Insufficient information and data make it difficult for regulators, service technicians and consumers to make decisions on how to reduce emissions and save energy in the cooling sector. Reduction of consumption demands in the servicing sector is critical for achieving the compliance targets of the Montreal Protocol as set by the country.

11. Currently, there are no MEPS for the RAC sector in Trinidad and Tobago. However, the development of MEPS is currently under consideration by the Government.

<u>HFC consumption and sector background</u>

12. Table 1 presents the HFC consumption in Colombia, Lebanon and Trinidad and Tobago.

[6] Decision 93/74

Table 1. Consumption of HFCs in Colombia, Lebanon and Trinidad and Tobago (2020–2024 Article 7 data)

HFC consumption	2020	2021	2022	2023	2024
Metric tonnes (mt)					
Colombia	2,423.16	2,492.15	4,168.48	2,936.32	2,282.45
Lebanon	940.70	863.70	803.93	792.48	824.57
Trinidad and Tobago	1,965.92	2,271.47	2,038.93	2,168.58	1,349.58
CO_2-eq tonnes					
Colombia	5,064,307	5,086,999	9,242,759	6,206,292	4,647,025
Lebanon	1,743,012	1,604,665	1,532,493	1,518,706	1,573,653
Trinidad and Tobago	4,425,345	5,201,433	4,597,414	4,967,441	2,967,132

13. It is estimated that Colombia has more than 2,160 operational centralized refrigeration systems, approximately 94 per cent of which use HFCs. As reported in the KIP for Colombia, in 2023 the commercial refrigeration subsector is the most diverse in refrigerants and technology, reporting the use of eight different refrigerants, with R-507A (48.1 per cent), R-404A (34.5 per cent) and HFC-134a (12.3 per cent) being the most commonly used in stand-alone units, condensing units and ice machines.

14. In Lebanon, the three main types of cooling equipment used for commercial refrigeration are centralized systems, condensing units, and stand-alone systems. As reported in the KIP for Lebanon, in 2023 the main HFCs consumed in the commercial refrigeration subsector are R-404A (80.8 per cent), R-407C (13.1 per cent) and R-507A (5.6 per cent).

15. In Trinidad and Tobago, in 2022 the main refrigerants consumed in centralized systems, comprised of cold rooms and storage, are R-134a (48.8 per cent), R-404A (20.1 per cent) and R-507C (11.0 per cent). This sector experiences high levels of service demands and high leakage rates, and alternative technologies in the sector are not yet widely available in the country. The non-centralized commercial refrigeration systems consume HFC-134a (63.4 per cent), R-407C (26.5 per cent) and R-507C (10.1 per cent), and industrial refrigeration systems consume R-404A exclusively.

16. Most of these systems, referred to above in the three countries, lack digital monitoring and management tools.

Project objectives

17. The objective of this project is to demonstrate how the use of digital solutions in the three countries can reduce consumption of HFCs and therefore emissions, and enhance energy efficiency in the cold chain sector, in line with their national strategies and their plans for the implementation of the Kigali Amendment. The project has a national component for the three countries that relates to assessment, installation of digital equipment infrastructure, monitoring and training, and a global component that relates to data analysis and intelligent equipment to perform maintenance support as explained in paragraph 2 above.

18. Through the national component, the project will record data of refrigerant usage and energy consumption before and after the conversion or retrofits, use the information along with capital and operational costs to assess economic feasibility, and develop a digital platform for replication of digital solutions in a cost-effective manner. The project will provide a technical solution for customized cold chain applications that do not have robust standard, monitoring, testing, and reporting tools for energy efficiency. It will demonstrate a modern way of maintenance practices such as use of real-time data for corrective actions and data analysis for predictive maintenance, moving from a traditional corrective approach to a preventive and predictive approach, with the help of the digital tools.

19. The global component of this project aims to consolidate the data from the different sites for analysis and optimization of the digital platform for adaptation in different contexts and generate knowledge and practical experience for replication in similar applications in other countries for other projects funded by the Multilateral Fund.

Technology

20. The project proposes to use the Internet of Things (IoT) and cloud-based information and communication technology (ICT) infrastructure for collecting and analysing performance data of the different RAC equipment from installed smart sensors will be used to collect data on different technical parameters such as temperature, pressure, compressor speed and others. The collected data will also cover ambient conditions such as temperature and humidity levels, and this data will be used for additional analysis of cooling performance and energy efficiency under different weather conditions.

21. Data analytics tools are proposed to be developed to carry out performance analysis based on historic and real-time data and assess the need for corrective actions for optimizing performance, operations and maintenance. Both data storage and applications are typically cloud-based, providing access worldwide and from a wide range of devices, including computers, tablets, and mobile phones. Open and scalable digital infrastructure will ensure long-term flexibility and avoid proprietary constraints, allowing the digital tools to be adapted to fit different local circumstances.

Beneficiaries

Colombia

22. Three locally owned supermarkets and hypermarkets will be selected to represent various altitude and weather conditions present in the country.[7] Each beneficiary needs to meet specific criteria including the use of centralized refrigeration systems with a facility size greater than 1,200 square meters, cooling capacity of 100 kW and an installation date older than six years ago. A local service provider will serve as the executing partner for support and local handholding for the projects during the implementation period.

Lebanon

23. Al-Tawfeer Supermarket has been identified as a suitable beneficiary for the project due to its significant potential for energy savings and replication across similar settings. Al-Tawfeer has 38 branches in Lebanon with additional expansion plans. The selected beneficiary site includes one R404A-based central refrigeration system (45kW), one R404A-based central freezing system (20kW), and seven ice cream freezers (0.3kW).

Trinidad and Tobago

24. In Trinidad and Tobago, NAMDEVCO, a government-owned cold chain facility specialized in receiving, processing, storage, and delivery of locally grown agricultural commodities was identified as a suitable beneficiary. The data collected during the preparation phase provides a clear baseline of the installations' current condition, their alignment with project criteria, and their potential for successful integration into the initiative. The selected beneficiary site includes two cold chambers both using R-404A refrigerant and operating at temperatures of -23°C to -29°C.

[7] One beneficiary in each location cold area (2,000-3,000 altitude meters), temperate area (1,000-2,000 altitude meters), and warm area (below 1,000 altitude meters). The temperature variations in three locations would provide information on the impact of ambient temperature on the performance of the equipment.

Global RAC intelligence platform

25. The data collected from the selected beneficiaries in the three countries will provide different scenarios that will allow the pilot facility to test, optimize, train and analyse results. This will lead to the establishment of a global RAC intelligence platform with a data lake,[8] where replication factors will be identified for similar cooling systems through digital systems and artificial intelligence (AI) for reduction of emissions and energy saving.[9] Designing and deploying the RAC intelligence platform will support the pilot project to expand beyond the selected sites and enable scalability and replication either for the same sector or similar sectors. The platform will be operationalized through a dedicated technical team and consultants to ensure robust deployment and alignment with the pilot site requirements for a two-year period; and maintaining platform hosting will enable continuous data collection and performance monitoring across the pilot sites for five years post-completion. This phase will reinforce replicability and foster South-South cooperation through shared insights and best practices.

Proposed activities

26. The proposed activities are described below, and the cost breakdown is summarized in table 2 (as initially submitted):

(a) *Energy audit for baseline establishment*: Performance measurement of key components including the compressor rack, the condenser unit, the display cases, and the system-wide controls; conduct energy consumption tests and leakage identification used for calculating the baseline of the direct and indirect impacts of the refrigeration circuit;

(b) *Retrofit plan development and digitalization concept design*: Recruit an international consultant to identify and evaluate digital tools and technologies including smart meters, sensors, data gateways, and monitoring platforms; develop a methodology for monitoring energy consumption and refrigerant flow/leakage; define requirements for supervisory control and data acquisition (SCADA) systems; support the selection of suppliers and installers with an awareness of adaptations or innovations tailored to local contexts; guide the installation of energy-efficient equipment, IoT sensors, and monitoring systems; collect and analyse data to evaluate performance and make iterative improvements;

(c) *Hardware and installation*: Purchase and installation of a set of smart meters, sensors and set traductors,[10] data gateway and IoT devices;[11] supervisory control and data acquisition through the cloud IoT platform and dashboard for centralized monitoring, energy analytics, alarms, and hosting; installation and commissioning of the above-mentioned meters, sensors and other components; and collecting data using the system;

(d) *Technical support, monitoring and coordination*: Installation and technical setup of pilot components such as smart meters, sensors, data gateways, and monitoring platforms, ensuring proper integration and functionality; develop and deliver training modules for RAC technicians focused on digital solutions and IoT technologies relevant to the sector; organize workshops to promote the benefits of RAC digitalization and foster stakeholder engagement; establish baselines of existing equipment, and conduct ongoing monitoring of equipment performance, ambient conditions, and system operations to assess impacts

[8] A data lake is a centralized repository that stores vast amounts of raw data in its native format, including structured, semi-structured, and unstructured data, until it is needed.
[9] Using machine learning, AI supported platforms can monitor performance in real-time, detect anomalies, enable predictive maintenance, and dynamically optimize operations based on comprehensive data analysis.
[10] Set of sensors include temperature probe, humidity and temperature sensor, pressure transducer, door contact, vibration sensor, current sensor, energy meter, and gas/refrigerant leak sensor.
[11] Devices include Wi-Fi/ethernet, LoRa/LoRaWAN module, cellular 4G modem, antenna and cabling.

on energy efficiency and refrigerant emissions; provide technical oversight during design and commissioning; and analyse collected data to refine strategies and demonstrate measurable outcomes; and

(e) *Global RAC intelligence platform*: Establish an international software team comprising of an architect to outline the structure of the intelligence platform,[12] a software architect, UI specialist, frontend developer, backend developer and/or full stack developer to develop the intelligence platform;[13] and ICT specialist to support the integration[14] to the five locations.

Table 2: Activities and total project budget as submitted

Activities	Cost breakdown (US $)			
	Colombia	**Lebanon**	**Trinidad and Tobago**	**Total**
Energy audit to establish baseline				
Conduct energy audit at the selected beneficiary site	60,000	20,000	15,000	**95,000**
Retrofit plan and digitalization concept design				
Design of retrofit plan, development of architecture and technical and functional requirements	45,000	20,000	20,000	**85,000**
Energy consumption tests and identification of leakage	45,000	15,000	15,000	**75,000**
Supervisory control and data acquisition or monitoring platform	45,000	15,000	15,000	**75,000**
National consultant in charge of technical monitoring during design, installation, commissioning and data evaluation of pilot	120,000	35,000	40,000	**195,000**
Hardware and installation				
Set of smart meters and sensors and set traductors	90,000	30,000	30,000	**150,000**
Data gateway and IoT devices	60,000	20,000	20,000	**100,000**
Installation, commissioning, collecting and analyzing the data	90,000	30,000	30,000	**150,000**
Technical support, monitoring and coordination				
Technical assistance	45,000	15,000	15,000	**75,000**
Project management unit	48,000	16,000	16,000	**80,000**
Total national component	***648,000***	***216,000***	***216,000***	***1,080,000***
Global RAC intelligence platform				
Architecture and development of the intelligence platform including integration to pilot projects				**225,000**
Five years of hosting and continuous data collection and monitoring of the pilot projects and other replication sites				**75,000**
Project management unit (for global component)				**24,000**
Total global component				***324,000***
TOTAL PROJECT COST				**1,404,000**

[12] Structure includes inter alia hosting technology, communication setup, features, cloud services to apply, user access management structure, support structure, and preparation of development program and documentation.
[13] Development includes inter alia planning, requirements analysis, design, coding, testing, deployment, operating and maintenance finalization.
[14] Integration includes inter alia local ICT infrastructure setup, commissioning, performance testing, operation and maintenance.

Co-financing

27. UNDP, through its corporate funding window with financial support from the Governments of Denmark and Luxembourg, is supporting Lebanon and Trinidad and Tobago to advance digital solutions for energy efficiency in the cold chain sector. The funding window focuses on piloting digital monitoring and management tools to optimize energy use, reduce greenhouse gas emissions, and enhance maintenance practices in cold chain systems. It includes conducting energy audits, installing and testing digital solutions, and building the capacity of RAC professionals, particularly women, on digital technologies.

28. The projects under the UNDP corporate funding window include a grant of US $198,000 for Lebanon and US $198,000 for Trinidad Tobago for development of communication materials for raising end-user awareness of the benefits of using digital technologies in energy efficiency and performance improvement; practical training on identified digital tools and IoT technologies; a country-wide survey on levels of digital automation and its effectiveness in Lebanon, and a survey of digital technologies within the tertiary education sector, with a focus on strengthening the curriculum regarding energy efficiency in Trinidad and Tobago.

Total cost of the pilot project

29. The project is expected to be completed in 36 months after approval, between January 2026 and December 2028 for a total cost of US $1,404,000, as initially submitted.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

30. The Secretariat has reviewed the project proposal in light of the activities described under decisions 89/6 and 91/65 as well as those being implemented under stage I of the KIP in the three countries.

Eligibility under decision 91/65

31. The pilot project intends to enhance energy efficiency in the context of HFC phase-down in the identified refrigeration applications at the end-users' sites and assist in better servicing and maintenance practices of the equipment. UNDP confirmed that for the three countries, the energy efficiency authorities in the respective countries will be supporting the project implementation under the supervision of the NOUs. Other stakeholders involved in the project would include energy efficiency standards authorities, industry representatives and associations.

32. In line with decision 91/65(b)(iv), the Governments of Colombia, Lebanon, and Trinidad and Tobago have confirmed that if their respective Government 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.

Relationship to HFC phase-down and the Kigali HFC implementation plan

33. On the relationship with the KIP activities in the three countries, UNDP explained that the pilot project will be implemented in coordination with the activities under stage I of each country's KIP. Tailor-made curriculum and awareness materials were developed with co-finance support explained in

paragraphs 27 and 28 above and will be used for training and outreach activities for adopting the digital tools. Training will be conducted throughout the project in collaboration between the equipment supplier and IT systems developer focusing on energy-efficient performance and improved operations and maintenance of equipment. The training materials will be used along with other KIP-related training activities for capacity building of service technicians and installers of equipment, to help disseminate the benefits of digital tools in the cooling sector for relevant stakeholders, as well as practical training for installation, operations and maintenance of equipment.

Promoting adoption of digital technologies in the market

34. Noting that digitalization tools can result in more energy-efficient performance of commercial refrigeration equipment, and faster adoption of such technologies need to be promoted with possible policy and regulatory interventions, the Secretariat had consultations with UNDP on how this project will impact energy-efficient performance of equipment and enhancement of standards. UNDP explained that based on the experiences gained through this project, the three countries would develop national guidelines on best practices and use of digital tools to improve energy efficiency in different commercial refrigeration applications (or in the retail sector). Digital tools can also provide a deeper understanding on energy performance standards of equipment and help improve other programmes like labelling programmes for commercial refrigeration equipment/end users.

35. Furthermore, UNDP explained that the evolution of IoT and cloud-based ICT infrastructure will help catalyze a transformative shift in cooling through the integration of AI, Edge Computing, and Advanced Analytics. This initiative envisions a “strategic leap” toward smart, sustainable, and adaptable digital tools, emphasizing predictive, data-driven maintenance powered by real-time monitoring, AI diagnostics, and automated energy and emissions optimization.

Technical and cost-related issues

Choice of locations for the demonstration project

36. The Secretariat had detailed consultations with UNDP on the number of locations chosen in Colombia for the demonstration of digital tools used for reducing emissions and ensuring energy-efficient performance of equipment through timely servicing and maintenance. UNDP explained that the three locations were chosen for demonstrating the digital tools primarily based on the type of equipment, the kind of end users and the weather conditions, to help showcase the performance results of the implementation of digital tools by different types of users operating under different ambient conditions.

Choice of technology providers

37. On the choice of technology providers, UNDP explained that during implementation, the specific technology providers will be selected through an open competitive procurement process as per UNDP’s rules and regulations; and prices are based on a survey undertaken during the project preparation on the technology costs of similar equipment. UNDP also explained that a “data lake” is proposed to be created to generate data analytics in applications and analysed by AI and visualization tools. On scaling up adoption of this technology, based on the experiences gained from this project, UNDP aims to expand the accessibility of the platform to other relevant projects and programmes for adoption of energy efficiency technologies and best practices, as well as to explore developing similar platforms for other cooling systems.

Energy audit and real-time data collection

38. On the need for an energy audit and retrofit plans, UNDP explained that it is important to understand the energy consumption levels in the refrigeration, air-conditioning and heat pump (RACHP)

equipment, to uncover potential areas of intervention to improve cooling performance and energy consumption and to develop a plan for implementing those interventions.

39. On the ongoing monitoring of the digital tools for ensuring that real-time data is made available, UNDP explained that technical support would be provided including capacity building for the staff supporting the RACHP equipment in the different locations, and that technical personnel would undertake spot assessments on a periodic basis to check the performance of the equipment.

Use of equipment with flammable low-GWP refrigerants

40. UNDP explained that this demonstration project is in the context of HFC phase-down and hence, beneficiary sites using HFC refrigerants were chosen. The digital monitoring tools can be used with low-GWP refrigerants and equipment using drop-in alternatives. UNDP also explained that training, including safety aspects during installation and operations of the tools, will facilitate safe operations and maintenance practices while using the digital monitoring tools.

Adoption of the technology and scalability

41. On adoption of the technologies by consumers, UNDP explained that through this demonstration project and the online data collected, the impact of good quality servicing and maintenance in terms of energy savings and savings in costs through avoided leakage of equipment, mainly HFCs, would be disseminated to end users of commercial refrigeration equipment, and to the importers and sellers of such equipment. The information will also be shared on different fora including UNDP's communication platforms, through training activities for the service sector and installers of equipment, and other regional and global technology transfer meetings that relate to energy efficiency in RACHP equipment. This will help greater adoption.

Project costs

42. The Secretariat had detailed discussions on the project costs with UNDP taking into consideration the number of locations for equipment installation and the need for different activities outlined in the original proposal. Based on the discussions, the following was agreed:

(a) The cost for the energy audit was revised from US $95,000 to US $65,000 and the retrofit planning/digital infrastructure architecture development was revised from US $85,000 to US $55,000 based on efforts needed for technical experts for undertaking these activities;

(b) Costs of hardware such as smart meters for monitoring energy consumption, temperature and humidity measurement devices, current sensors and digital and IoT devices for data capture, transmission, supervisory control, and a monitoring platform including cloud-based systems was reduced from US $550,000 to US $330,000;

(c) Technical support, monitoring and training support activities that relate to on-site assistance for monitoring performance of the digital tools and infrastructure, to oversee the installation of the components such as smart meters, sensors, data gateways, and monitoring platforms, ensuring proper integration and functionality; training and capacity building of technicians and other relevant personnel; and awareness and knowledge sharing and monitoring and data collection was reduced from US $270,000 to US $80,000 mainly taking into consideration levels of technical support and training needed for implementation of the infrastructure;

(d) Data lake architecture design and integration with pilot sites that includes designing the architecture for data collection and analysis, development of software and tools for data analysis, preventive and predictive maintenance from US $324,000 to US $150,000 based on possible use of IT solutions sold by the service providers; and

(e) The cost for project management unit costs was removed.

43. Table 3 below presents the summary of the project proposal as submitted and the final agreed costs based on consultations with UNDP.

Table 3: Summary of activities and costs as submitted and as agreed

Activities	As submitted (US $)				As agreed (US $)			
	Colombia	Lebanon	Trinidad and Tobago	Total	Colombia	Lebanon	Trinidad and Tobago	Total
Energy audit	60,000	20,000	15,000	**95,000**	35,000	15,000	15,000	**65,000**
Retrofit plan and digitalization concept design	45,000	20,000	20,000	**85,000**	25,000	15,000	15,000	**55,000**
Hardware and installation	330,000	110,000	110,000	**550,000**	198,000	66,000	66,000	**330,000**
Technical support, monitoring and coordination	165,000	50,000	55,000	**270,000**	40,000	20,000	20,000	**80,000**
Project management unit	48,000	16,000	16,000	**80,000**	0	0	0	**0**
Total national component	**648,000**	**216,000**	**216,000**	**1,080,000**	**298,000**	**116,000**	**116,000**	**530,000**
Global: Data lake architecture design and integration with pilot sites				**324,000**				**150,000**
Total project cost				**1,404,000**				**680,000**

Co-financing

44. Regarding the co-financing for Lebanon and Trinidad and Tobago, UNDP explained that through its corporate funding window, with financial support from the Governments of Denmark and Luxembourg, the advancement of digital solutions for energy efficiency in the cold chain sector is supported in line with the UNDP digital transformation strategy, as outlined in paragraph 27 above. These funds will co-finance some of the related activities under the pilot project including the development of training materials for technicians, end-users and enterprises installing RAC equipment in both countries, and awareness and outreach materials to ensure a better understanding of the technical and operational aspects of the digital tools as well as the benefits of energy efficient equipment.

45. Further, UNDP also explained that the beneficiaries of the project in Colombia, Lebanon and Trinidad and Tobago are expected to provide co-financing amounting to US $140,000, US $50,000 and US $50,000, respectively for conducting an energy audit, designing a retrofit plan and digitalization architecture, and providing technical support for monitoring, reporting and training activities. Through the funds available under the global digital transformation strategy of UNDP,[15] the agency is expected to provide US $75,000 for cloud infrastructure, networking and data analytics for a period of five years after completion of the project initiation phase.

[15] https://digitalstrategy.undp.org/

Energy-efficiency improvements and preliminary estimate of electricity savings

46. In response to the Secretariat's enquiry regarding the estimated energy efficiency improvements and electricity savings, UNDP provided a preliminary analysis for the selected locations in the three countries including emission reductions resulting from both retrofit to low-GWP alternatives and leakage reductions. The summary of the impact is presented in table 5.

Table 5: Estimates of direct and indirect emission impact from the project

	Direct impact of refrigerant emission reduction (CO_2-eq tonnes)	Indirect impact through energy saving (kWh/year)	Duration of impact calculation (years)	Total impact over five years	
				Direct emission reduction (CO_2-eq tonnes)	Indirect energy savings (kWh)
Colombia	439	104,390	5	2,195	521,950
Lebanon	609	102,970	5	3,045	514,850
Trinadad Tobago	78	32,575	5	390	162,875
Total	**1,126**	**239,935**		**5,630**	**1,199,675**

Sustainability, replicability and assessment of risks

47. The Secretariat notes that affordability of this technology, availability and ease of use (i.e. simplicity and reliability) are key factors that will promote the adoption of this technology, as driven by market factors. On sustainability, UNDP explained that the implementation of the digital infrastructure and analysis of the data collected from these systems will lead to a deeper understanding of the benefits and the return on investment from establishing this infrastructure. The technology choice needs to reflect the user specifications (e.g., cold storage in supermarkets) and requires easy installation and operation of equipment. Furthermore, as this technology continues to develop, the cost of the hardware as well as software is expected to come down, reducing the cost barrier of adopting the digital technologies by the different enterprises. Potential risks include limited technical capacity of end users, particularly in implementing the technologies, and are proposed to be mitigated by an international expert to support the optimal design and deployment of the digital monitoring and management tools, as well as providing training support to the end users and their service personnel. To promote and sustain adoption of the technologies, a guideline document including training materials will be developed based on the experience from this project to be used in the three countries, and other countries across the world, for improving energy efficiency through the use of digital technologies and tools.

RECOMMENDATION

48. The Executive Committee may wish to consider 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): Demonstration project for digital monitoring and management tools to enhance energy efficiency and reduce emission of greenhouse gases in the cold chain sector in Colombia, Lebanon and Trinidad and Tobago, in the amount of US $680,000 plus agency support costs of US $47,600 for UNDP, noting:

(a) That the Governments of Colombia, Lebanon and Trinidad and Tobago have committed to the conditions referred to in decision 91/65(b)(iv)b. to b(iv)d.;

(b) That the Governments of Colombia, Lebanon and Trinidad and Tobago would develop energy-efficiency guidelines for commercial refrigeration applications for improving energy efficiency in the retail sector upon the completion of the project; and

(c) That the project would be operationally completed no later than 31 December 2028 and a detailed project report would be submitted to the Executive Committee within six months of the date of completion of the project.