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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-eighth Meeting
Montreal, 22–26 June 2026
Items 8(c) and (d) of the provisional agenda¹

PROJECT PROPOSALS: ECUADOR

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

Phase-out

- HCFC phase-out management plan (stage II, third tranche) UNIDO Blanket approval

Phase-down

- Kigali HFC implementation plan (stage I, second tranche) UNIDO Individual consideration
including a plan for the complete elimination of HFCs
contained in imported pre-blended polyols in the
polyurethane foam sector

Energy efficiency

- Pilot demonstration project to replace an R-507A-based UNIDO Individual consideration
centralized refrigeration system with an ammonia-based
recirculated system at a shrimp processing enterprise
(decision 91/65)

¹ UNEP/OzL.Pro/ExCom/98/1

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

Ecuador

PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase-out plan (stage II)	UNIDO (lead)	86 th	100% phase-out by 2030

ARTICLE 7 DATA (Annex C, Group I)	Year: 2025	6.81 ODP tonnes
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COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)							Year: 2025
Substance	Aerosol	Foam	Firefighting	Refrigeration		Solvent	Total sector consumption
				Manufacturing	Servicing		
HCFC-22					6.81		6.81

CONSUMPTION DATA (ODP tonnes)			
2009–2010 baseline:	23.49	Starting point for sustained aggregate reductions:	44.16
CONSUMPTION ELIGIBLE FOR FUNDING			
Already approved:	44.16	Remaining:	0.00

ENDORSED BUSINESS PLAN		2026	2027	2028	Total
UNIDO	ODS phase-out (ODP tonnes)	0.00	3.02	0.00	3.02
	Funding (US \$)	0	273,385	0	273,385

PROJECT DATA		2020	2021-2022	2023*	2024	2025	2026**	2027	2028-2029	2030	Total
Consumption (ODP tonnes)	Montreal Protocol limits	15.27	15.27	15.27	15.27	7.63	7.63	7.63	7.63	0	n/a
	Maximum allowable	15.27	15.27	15.27	15.27	7.63	7.63	7.63	7.63	0	n/a
Amounts approved in principle for UNIDO (US \$)	Project costs	292,750	0	527,250	0	0	0	255,500	0	214,500	1,290,000
	Support costs	20,493	0	36,908	0	0	0	17,885	0	15,015	90,301
Funds approved by ExCom (US \$)	Project costs	292,750	0	527,250	0	0		0	0	0	820,000
	Support costs	20,493	0	36,908	0	0		0	0	0	57,401
Total funds recommended for approval at this meeting (US \$)	Project costs						255,500				255,500
	Support costs						17,885				17,885

* Funding for 2023 includes US \$120,000, plus agency support costs of US \$8,401, for additional activities to maintain energy efficiency (decision 89/6)

** The third tranche request was advanced from 2027 to 2026

Secretariat's recommendation:	Blanket approval
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PROJECT DESCRIPTION

1. On behalf of the Government of Ecuador, UNIDO as the designated implementing agency has submitted a request for funding for the third tranche of stage II of the HCFC phase-out management plan (HPMP), in the amount of US \$255,500, plus agency support costs of US \$17,885.² The submission includes a progress report on the implementation of the second tranche and the tranche implementation plan for 2026 to 2029.

Report on HCFC consumption

2. The Government of Ecuador reported a consumption of 6.81 ODP tonnes of HCFCs in 2025, which is 71 per cent below the country's HCFC baseline for compliance. The 2021–2025 HCFC consumption is shown in table 1.

Table 1. HCFC consumption in 2021–2025 in Ecuador (Article 7 data)

HCFC	2021	2022	2023	2024	2025	Baseline
Metric tonnes (mt)						
HCFC-22	****185.22	166.28	164.33	138.15	123.89	382.27
HCFC-124	0.27	0.0	0.0	0.0	0.0	9.99
HCFC-142b	0.16	0.0	0.0	0.0	0.0	18.45
Total (mt)	185.65	166.28	164.33	138.15	123.89	*427.73
HCFC-141b in imported pre-blended polyols**	67.08	1.51	0.0	0.0	0.0	***187.91
ODP tonnes						
HCFC-22	****10.19	9.15	9.04	7.60	6.81	21.02
HCFC-124	0.01	0.0	0.0	0.0	0.0	0.22
HCFC-142b	0.01	0.0	0.0	0.0	0.0	1.20
Total (ODP tonnes)	10.21	9.15	9.04	7.60	6.81	*23.49
HCFC-141b in imported pre-blended polyols**	7.38	0.17	0.0	0.0	0.0	***20.67

* Including 9.18 mt (0.18 ODP tonne) of HCFC-123 and 7.84 mt (0.86 ODP tonne) of HCFC-141b

** CP data

*** Starting point established in the Agreement with the Executive Committee.

**** Consumption was verified at 10.17 ODP tonnes (document UNEP/OzL.Pro/ExCom/93/52). The Article 7 data is being corrected.

3. HCFCs are only consumed for the maintenance of refrigeration and air-conditioning (RAC) equipment originally designed to operate with HCFC-22, including commercial refrigeration equipment, residential and light commercial air-conditioning (AC) units, and large refrigeration systems in the industrial fishing sector. All HCFCs other than HCFC-22 have been phased out.

4. The consistently declining HCFC consumption reflects the implementation of HPMP activities in the country, including regulatory controls, licensing and quota system, and continued technical assistance to the RAC sector; the progressive retirement of HCFC-based equipment; and market transition to alternative refrigerants such as HFCs.

5. In the foam sector, the consumption of HCFC-141b contained in imported pre-blended polyols has been eliminated. Imports have ceased as a result of national regulatory measures and the transition of the sector to alternative blowing agents such as HFC-365mfc/227ea blends and HFC-245fa.

² As per the letter of 28 March 2026 from the Ministry of Production, Foreign Trade and Investments of Ecuador to UNIDO.

Country programme implementation report

6. The HCFC consumption data provided by the Government of Ecuador in its country programme (CP) implementation report for 2025 is consistent with the data reported under Article 7 of the Montreal Protocol.

Progress report on implementation of second tranche of stage II of the HCFC phase-out management plan

Legal framework

7. The import of pre-blended polyols containing HCFCs is currently banned in Ecuador. Initially, they were regulated under a prior import licensing system through tariff code 3907.20.30.10, pursuant to COMEX Resolution No. 009-2022. Subsequently, COMEX Resolution No. 001-2024, adopted on 26 January 2024 and entered into force on 30 January 2024, amended the national trade control framework by removing those products from the import licensing regime and including them in the national list of prohibited imports. Specifically, tariff code 3907.29.30.10 corresponding to “polyether polyols derived from propylene oxide containing HCFCs” was incorporated into the list of prohibited imports. The following activities were implemented during the reporting period:

- (a) *Technical assistance to strengthening traffic control for ozone-depleting substances (ODSs):* Training on HCFC import control and prevention of illegal trade was held for 105 officers (including 27 women) of the National Customs Service of Ecuador (SENAE); training on the licensing system, tariff classification and reporting tools for controlled substances was held for 105 importers and customs brokers (including 79 women); information material was developed for importers to support improved reporting and monitoring; and preventive maintenance was carried out on portable gas identifiers used by SENAE; and
- (b) *Adoption and implementation of guidelines for alternative refrigerants:* Risk assessment guidelines for RAC servicing practices using hydrocarbon (HC) were finalized, with 2,200 copies printed and distributed to five vocational training institutions; technical and financial assistance was provided to support the development and adaptation works for the Centro de Perfeccionamiento en el Uso de Refrigerantes at the Escuela Politécnica Nacional (EPN).

Refrigeration servicing sector

8. The following activities were implemented during the reporting period:

- (a) *Application of good practices in the use of HCs and other alternative refrigerants:* Sixteen students (including four women) from technical schools across the country participated in a Refrigeration Summer School programme focused on good refrigeration practices and the safe use of refrigerants with low global-warming potential (GWP); a national technical agenda was developed on ammonia (NH₃) refrigeration systems, including seminars, technical discussions and knowledge-sharing events aimed at strengthening technical capacities in industrial refrigeration applications, chillers and condensers, using NH₃; 20 basic toolkits for good practices in HC-based RAC systems were procured and are pending delivery to selected technicians in the second half of 2026;
- (b) *Strengthening of the training programme on good maintenance practices:* A manual of good refrigeration practices was updated in line with the national labour competency standard for RAC technicians (printing and distribution planned in 2026); practical training guides were developed based on the existing modules used at the EPN; two didactic laboratory modules were delivered for the Universidad Técnica de Manabí; a proposal for an inter-institutional

cooperation agreement with the Ministry of Education, Sports and Culture has been developed; several technical and vocational training institutions received consumables (refrigerants, brazing material, filters, copper tubing and other laboratory supplies) and additional educational and technical material; service agreement was signed with one technical school to strengthen the training programmes for RAC technicians; and a variety of training activities on good RAC servicing practices and the safe handling of HC, refrigerant recovery, domestic refrigeration equipment repair and servicing practices, psychrometry, brazing and welding, practical laboratory exercises on refrigerant handling, recovery, installation and servicing procedures were attended by 651 participants (77 women);

- (c) *Strengthening of the technician certification system:* In December 2024, a new national occupational competency profile with a validity period of five years was officially adopted, establishing two competency-based certification schemes: “Operation of NH₃ Refrigeration Systems” and “Good Practices in the Installation and Maintenance of RAC Systems.” Technical assistance was provided to training institutions to become authorized certification bodies, including EPN, Instituto Superior Tecnológico Universitario Luis Arboleda Martínez (ITSULAM), Servicio Ecuatoriano de Capacitación Profesional and others; 145 technicians were certified; a webinar was held for 37 participants to present the occupational competency profiles and certification schemes, promote the adoption of the certification system, and raise awareness among RAC sector stakeholders; and an online training course on good refrigeration practices was developed and attended by 121 participants. The course is currently hosted on the EPN e-learning platform and is being adapted for implementation at Escuela Superior Politécnica del Litoral (ESPOL), with completion expected by mid-2026. An additional 131 technicians (four women) participated in technical courses and seminars on good servicing practices, refrigerant recovery and preparation for labour competency certification in the RAC sector at ESPOL (252 participants trained but not certified);
- (d) *Strengthening of the refrigerant recovery, reclaim and recycling (RRR) network:* A management and operational model for the ESPOL refrigerant reclaim centre was developed and is now used as a reference nationally. One reclaiming machine was delivered to ITSULAM, a locally manufactured unit was provided to a waste electrical and electronic equipment (WEEE) management enterprise, and ESPOL received eight 50 lb recovery cylinders and a refrigerant scale. The national ozone unit (NOU) established cooperation with a cement enterprise for no-cost destruction of recovered refrigerants and provided technical assistance to HAZWAT, an operator capable of destroying controlled substances; training workshops on refrigerant recovery from end-of-life equipment held at ESPOL and EPN reached 111 WEEE operators (including eight women); manuals for recovery and reclaim machines were translated and designed; four WEEE enterprises acquired equipment for refrigerant recovery; and two study tours were conducted: one to Colombia for 12 representatives (five women) to strengthen technical capacities across the refrigerant lifecycle, and another to Chile for two representatives focused on end-of-life refrigerant management. A desk study completed in November 2024 analyzed challenges and opportunities in managing insulating foams from heat-exchange equipment and proposed policy and technology options for future work; a pilot project at an authorized WEEE enterprise dismantled 100 end-of-life refrigerators, recovering 24.2 kg of HFC-134a, 1.11 kg of R-12, 9.5 kg of compressor oil, and 887 kg of polyurethane foam (16.7 per cent of total equipment weight). The pilot also revealed traceability gaps, as 31 per cent of units lacked identification plates or serial numbers, underscoring the need for stronger monitoring of end-of-life refrigeration equipment;

- (e) *Pilot projects for conversion to alternative refrigerants and technical assistance for large end users:* A pilot project at the Banco de Alimentos de Quito optimized two cold rooms previously using HCFC-22 and R-507 through system resizing, retrofitting to R-438A and conversion to propane (HC-290), along with performance monitoring, safety assessments, and electrical upgrades; the intervention delivered 35–42 per cent energy savings and prevented the release of 4 kg (6.5 CO₂-equivalent (CO₂-eq) tonnes) of HCFC-22; results were shared with the Global Food Banking Network, prompting interest from member organizations seeking support to replicate similar conversions. A second pilot at La Fabril S.A. converted a 30 TR industrial water chiller from HCFC-22 to propane, including safety risk assessments, replacement of components suitable for flammable refrigerants, and technical training; the converted system achieved ~20 per cent electricity savings and up to 30 per cent performance improvement, and avoided 25 kg (45 CO₂-eq tonnes) of HCFC-22 emissions; the enterprise is now evaluating broader replacement of HCFC-based equipment with HC systems. Both pilots incorporated comprehensive safety evaluations with institutional occupational health teams, ensured compliance with safety standards, and included capacity-building for technical personnel. System performance continues to be monitored to track stability, efficiency and safety; the pilots demonstrate strong replication potential in their respective sectors. Additional technical interventions at the Quito Wholesale Market improved the performance and energy efficiency of refrigeration equipment in small commercial food-preservation facilities; activities included servicing and optimizing three systems in the meat and dairy sections by replacing door seals and hinges, improving evaporator drainage, sealing air leaks, installing temperature controllers, maintaining condensing units, and upgrading electrical connections, to enhance the reliability and performance for perishable food storage; and
- (f) *Public awareness activities:* The certification programme for labor competencies was disseminated at all workshops held for RAC technicians and trainers under the second tranche. The country's national obligations as part of the Montreal Protocol have been confirmed in the three annual import quota communication meetings. Information related to the activities under stage II of the HPMP was disseminated via the Ministry of Production, Foreign Trade and Investments of Ecuador (MPCEI)'s social media and press releases. Regular visits to refrigerant retailers and servicing workshops, customs facilities, and end users were carried out, and several awareness workshops were organized both on-site and online to promote HCFC phase-out commitments and alternatives refrigerants.

Project implementation and monitoring

9. Through the inter-institutional cooperation agreement between MPCEI and Vice-ministry of Production and Industries through the Directorate of Environmental and Technology Reconversion, UNIDO established technical and financial links among the main involved sectors. The NOU and UNIDO have been monitoring activities, reporting on progress and working with stakeholders to phase out HCFCs. Of the US \$26,000 approved for project management and monitoring under the second tranche, US \$22,905 was disbursed for project staff and consultants (US \$10,000) and domestic travel, meetings and workshops (US \$12,905).

Activities to maintain energy efficiency

10. The following additional activities to maintain energy efficiency were implemented since 2023:

- (a) *Strengthening the capacity of importers and customs agents:* A draft guide was prepared for importers and customs agents on conformity-assessment procedures, energy-efficiency labelling and minimum energy performance standards for RAC equipment, effective use of risk analysis tools and practical examples to prevent counterfeiting, piracy and false marking

of origin; two awareness-building events were held for industry leaders and key stakeholders to discuss opportunities for improving energy efficiency in RAC systems and foster dialogue with the private sector; and training was delivered to six professionals from the Instituto de Investigación Geológico y Energético, an institution responsible for conducting energy audits in the industrial sector;

- (b) *Capacity-building and additional training on energy efficiency in the refrigeration servicing sector:* The procurement of eight toolkits³ for vocational training institutes and basic schools to support the training of technicians in determining RAC systems' performance and energy efficiency was completed by UNIDO in 2025; the toolkits are expected to arrive in Ecuador by mid-2026. A technical visit to the Galápagos Islands assessed the refrigeration and electrical systems of fish-processing facilities to identify issues related to energy efficiency and develop technical recommendations to correct the power factor and reduce energy penalties, and a data-logging system was developed to facilitate continuous monitoring, performance analysis and predictive maintenance for RAC equipment. Technical training on energy efficiency in refrigeration systems was held in Cuenca for 18 participants (including three women); technical assistance was provided to the Diakonía Food Bank by carrying out an assessment and improving the energy performance of refrigeration chambers and AC systems, delivering training on energy efficiency and carbon footprint reduction to 10 staff members (five women) and providing follow-up recommendations and guidance on energy-efficient integration of newly installed cooling equipment; training on energy efficiency in buildings, with emphasis on AC systems, natural ventilation and sustainable architecture, was held in Quito for 150 participants (including 30 women); and
- (c) *Awareness and outreach activities to promote energy efficiency:* Awareness materials on energy efficiency in the RAC sector were also disseminated through infographics, digital publications and dedicated content on the institutional website, contributing to broader outreach and public awareness of the importance of energy-efficient RAC technologies; NOU staff participated in an industry event in Brazil dedicated to strengthening policy design and implementation capacities related to energy efficiency in emerging economies; four internal auditor training sessions on ISO 50001 Energy Management Systems were attended by 120 participants; and awareness-raising material on energy efficiency in the RAC sector was disseminated in the form of infographics, digital publications and websites.

Level of fund disbursement

11. As of May 2026, of the US \$820,000 approved so far, US \$669,092 (82 per cent) had been disbursed, as shown in table 2. The balance of US \$150,908 will be disbursed in the third tranche.

Table 2. Financial report of stage II of the HPMP for Ecuador (US \$)

Funding tranche	Funds approved	Funds disbursed	Disb. rate (%)	Fund balance
First	292,750	292,750	100	0
Second	527,250	376,342	71	150,908
Total	820,000	669,092	82	150,908

³ Including a three-phase power quality analyzer, power meter clamps, thermometers, anemometer, pipeline pressure measuring instruments, and thermal imaging cameras.

Implementation plan for the third tranche of stage II of the HCFC phase-out management plan

12. The following activities will be implemented by UNIDO between July 2026 and December 2029:

- (a) *Technical assistance for the strengthening of ODS traffic control and guidelines for alternative refrigerants* (US \$20,500, plus funds from previous tranche): Conduct at least one training course for customs officers and stakeholders, develop at least one online course for the customs, and support the development of risk profiles to prevent illegal trade in controlled substances (US \$12,000); adopt and implement safety standards/guidelines for alternative refrigerants, and design and develop guidelines for RAC system conversions, including printed manuals (US \$8,500);
- (b) *Strengthening of training programmes on good maintenance practices for RAC systems* (US \$35,000 plus funds from previous tranche): Update the training programme for RAC technicians, implement the online training course in at least three institutions, and conduct three training courses for female technicians (US \$15,000); and conduct three training courses on the safe use of HCs and other alternatives for 90 RAC technicians (US \$20,000);
- (c) *Strengthening of the certification scheme for RAC technicians* (US \$30,000): Carry out at least two awareness campaigns to promote the technician certification scheme; design and develop a registration and licensing system based on ID cards; and certify at least 100 RAC technicians in approved labour competency standards;
- (d) *Strengthening of the refrigerant RRR network* (US \$40,000): Monitor the operation of the existing refrigerant reclaim centres; and train 70 technicians on good refrigerant recovery and reclaim practices;
- (e) *Pilot conversion projects and technical assistance for large end users* (US \$100,000): Implement at least three pilot projects on conversions to low-GWP refrigerants; and hold four information meetings or training workshops in different subsectors to share lessons learned, promote best practices and raise awareness;
- (f) *Public awareness to promote HCFC phase-out* (US \$10,000 plus funds from previous tranche): Conduct an awareness campaign for end users to promote environmentally responsible refrigerant use and adoption of energy-efficient, low-GWP technologies, and a campaign for technicians to promote good servicing practices and proper refrigerant handling to reduce emissions;
- (g) *Activities to maintain energy efficiency in the refrigeration servicing sector* (funds from previous tranche): Conduct four training workshops for 90 importers, customs and trade officials on the monitoring, labelling, and inspection of products using low-GWP refrigerants and their energy-efficiency classification; organize four training workshops for 80 trainers and technicians on procedures to limit energy-efficiency depreciation during the servicing, maintenance, and installation of RAC equipment, distribute 3,000 copies of two infographics on reading energy-efficiency labels, ODP and GWP values of refrigerants, related costs, and environmental benefits; and
- (h) *Project monitoring and implementation* (US \$20,000 plus funds from previous tranche): Follow up on all activities; monitor the purchase of equipment, materials, and tools; ensure that contracts for services comply with relevant rules and regulations; report on project implementation and timelines and troubleshoot any problems that may emerge.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Early submission

13. As per the Agreement between the Government of Ecuador and the Executive Committee, the third tranche of stage II of the HPMP was due at the 100th meeting in 2027. Given the substantive progress and level of tranche disbursement achieved so far, upon consultation with the Secretariat, UNIDO has submitted the present request to the 98th meeting, i.e., in advance of the scheduled date, to align it with the Kigali HFC implementation plan (KIP) tranche submission at the same meeting and thus lessen the administrative burden of the Government and the implementing agency. The Secretariat has reviewed and recommended approval of the tranche based on the level of progress and of disbursement achieved (71 per cent), noting that postponing the approval of this tranche could disrupt the momentum of implementation and that after the approval of all projects and activities programmed in the business plan for this year, there would be sufficient funds for the approval of this tranche.

Progress report on implementation of the second tranche of stage II of HCFC phase-out management plan

Legal framework

14. The Government of Ecuador has issued HCFC import quotas for 2026 at 6.11 ODP tonnes, which is lower than the Montreal Protocol control targets.

Refrigeration servicing sector

15. The procurement of 80 recovery cylinders and 40 recovery machines experienced delays due to procurement processes; the equipment is expected to arrive in Ecuador in the last quarter of 2026. Despite this delay, progress has been achieved through developing a collaboration with four WEEE management companies (Reciclaelectronics, Recitec, Recygreen and Recynter) and holding trainings. To maximize efficiency in the use of resources and optimize the available budgets, several activities were integrated and coordinated between Quito and Guayaquil, including training sessions focused on refrigerant recovery practices from end-of-life RAC and WEEE equipment.

16. UNIDO informed the Secretariat that the NOU had established an informal cooperation arrangement with a cement kiln enterprise UNACEM for the environmentally sound destruction (incineration) of recovered refrigerants at no cost. So far, 392.56 kg of refrigerants have been managed through the national recovery network, of which 273.82 kg were destroyed through co-processing in cement kilns at UNACEM, while 118.74 kg were reclaimed.

17. The Secretariat enquired about the online customs training course; UNIDO explained that it was still being developed, because an institutional agreement with SENAE to formally integrate the course into the official customs training system was still pending. Course content and structure are being prepared in coordination with SENAE. The implementation of training activities for customs officers, brokers, and importers has faced operational challenges resulting from recent institutional restructuring processes and state optimization measures, which have reduced the availability of customs personnel and other related stakeholders. To date, a cumulative total of 330 participants have been trained, compared to the overall target of 800 established for the stage. In order to maintain momentum and accommodate personnel challenges, training has been relocated from Quito to regions.

18. The Secretariat also enquired about budgetary changes, and UNIDO confirmed that no substantial budgetary modifications had been made to the originally approved plan. During project implementation, minor adjustments between certain activities were required in order to address operational needs and adapt

to institutional changes that arose during implementation. These reallocations were carried out in accordance with the flexibility allowed under the project framework and, in all cases, remained below the 20 per cent threshold established by the Executive Committee.

Gender policy implementation

19. In line with decisions 84/92(d) and 90/48(c), UNIDO plans to increase the participation of women in the RAC sector by creating a favourable environment, improving women's employment opportunities and working conditions, and strengthening the technical capacities of female technicians through training courses and provision of toolkits. The project collects sex-disaggregated data and qualitative information to analyse and track gender issues; its outcomes, output, and activities are designed to meet the different needs and priorities of women and men; it ensures that both women and men can provide input, access and participate in project activities; offers a balanced recruitment of project personnel and representation in project boards and steering committees; and its monitoring and evaluation component requires specific reporting on women's participation and progress made to address them. During the implementation of the first tranche, a number of activities, including the training of technicians on good practices, the certification of technicians in labor competencies, the "Zero Leaks" programme and the promotion of alternative substances in the RAC sector, were led by local and international female consultants.

Sustainability of the HCFC phase-out and assessment of risks

20. To ensure long-term sustainability of the HCFC phase-out, the application of the HCFC import licensing and quota system by the NOU will be complemented by continuous improvements, and the online licensing system has been updated to improve monitoring, traceability and reporting of controlled substances, reinforcing the country's capacity to manage HCFC consumption in the long term. The enforcement of the ban on imports of pure HCFC-141b (January 2020) and the restriction on imports of polyols premixed with HCFC-141b for foaming applications (January 2023) will ensure the sustained phase-out of this substance.

21. Training programmes on good servicing practices, refrigerant recovery and the safe handling of low-GWP alternatives have been progressively institutionalized through national vocational training institutes and technical education centres. This institutionalization ensures that training activities can continue beyond the completion of the HPMP. Furthermore, the strengthening of technician certification schemes and the expansion of refrigerant RRR networks contribute to maintaining HCFC reductions achieved through the HPMP. The Government of Ecuador is committed to continuing the formulation and introduction of new norms and standards for the safe handling of alternative refrigerants, as well as raising public awareness on HCFC phase-out to facilitate transition to low-GWP technologies.

Conclusion

22. The Government of Ecuador continues to comply with the targets determined under the Montreal Protocol and stated in its Agreement with the Executive Committee. An extensive set of activities has been implemented to strengthen national capacity to control trade in HCFCs, adopt technical standards on refrigeration, train 210 customs agents and brokers, certify 145 technicians, procure toolkits and equipment for technicians and training institutes, and promote refrigerant containment and leakage reduction among large end users. The overall disbursement rate stands at 82 per cent of the approved funding. The activities to maintain energy efficiency in the refrigeration servicing sector are also progressing well. The third tranche of stage II was only due at the 100th meeting of the Executive Committee, in 2027; however, given the level of progress and disbursement achieved so far, the Secretariat considers the approval of the third tranche at the present meeting conducive to ensuring continued implementation of the phase-out activities, especially since it aligns with the submission of the KIP tranche and thus helps avoid the administrative burden for the Government and UNIDO. The Secretariat recommends blanket approval for the tranche since there are adequate funds in the current triennium.

RECOMMENDATION

23. The Fund Secretariat recommends that the Executive Committee note the progress report on the implementation of the second tranche of stage II of the HCFC phase-out management plan (HPMP) for Ecuador, and further recommends blanket approval of the third tranche of stage II of the HPMP and the corresponding 2026–2029 tranche implementation plan for Ecuador at the funding level shown in the table below.

	Project title	Project funding (US \$)	Support costs (US \$)	Implementing agency
(a)	HCFC phase-out management plan (stage II, third tranche)	255,500	17,885	UNIDO

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

Ecuador

PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
Kigali HFC implementation plan (stage I)	UNIDO (lead)	93 rd	14.1% phase-out by 2029

ARTICLE 7 DATA (Annex F)	Year: 2025	1,238.20 mt	2,730,306 CO ₂ -eq tonnes
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COUNTRY PROGRAMME SECTORAL DATA (CO ₂ -eq tonnes)								Year:	2025
Substance	Aerosol	Foam	Fire-fighting	Air-conditioning (AC) and refrigeration				Solvent	Other
				Manufacturing			Servicing		
				Refrigeration	AC	Other			
HFCs				115,073			2,615,874		
HFCs in imported pre-blended polyols*		91,536							

*Average consumption of HFCs contained in imported pre-blended polyols in 2022–2024: 96,263 CO₂-eq tonnes

CONSUMPTION DATA (CO ₂ -eq tonnes)			
HFC baseline:	3,179,294	Starting point for sustained aggregate reductions:	n/a
CONSUMPTION ELIGIBLE FOR FUNDING			
Already approved:	449,126	Remaining:	n/a

ENDORSED BUSINESS PLAN		2026	2027	2028	Total
UNIDO	HFC phase-down (mt)	64.95	0.0	0.0	64.95
	Funding (US \$)	389,923	0	0	389,923

PROJECT DATA		2022*	2023	2024	2025	2026	2027	2028	2029	Total
Montreal Protocol consumption limits (CO ₂ -eq tonnes)		n/a	n/a	3,179,294	3,179,294	3,179,294	3,179,294	3,179,294	2,861,265	n/a
Maximum allowable consumption (CO ₂ -eq tonnes)		n/a	n/a	3,179,294	3,083,915	2,991,398	2,901,656	2,814,606	2,730,168	n/a
Reduction from baseline (%)		n/a	n/a	0.0	3.0	5.9	8.7	11.5	14.1	n/a
Amounts approved in principle for UNIDO (US \$)	Project costs	267,885	292,600	0	0	364,414	0	0	72,930	997,829
	Support costs	18,752	20,482	0	0	25,509	0	0	5,105	69,848
Funds approved by ExCom (US \$)	Project costs	267,885	292,600	0	0		0	0	0	560,485
	Support costs	18,752	20,482	0	0		0	0	0	39,234
Funds recommended for approval at this meeting (US \$)	Project costs					**789,364				**789,364
	Support costs					**55,255				**55,255

* Funding for the conversion of a commercial and domestic refrigerator manufacturing line at the enterprise Induglob (decision 91/59)

** Tranche recommended for approval at the present meeting, including US \$424,950, plus agency support costs of US \$29,746, for the project to phase out HFCs contained in imported pre-blended polyols in the polyurethane foam sector.

Secretariat's recommendation	Individual consideration
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PROJECT DESCRIPTION

24. On behalf of the Government of Ecuador, UNIDO as the designated implementing agency has submitted requests for funding for the second tranche of stage I of the Kigali HFC implementation plan (KIP), in the amount of US \$364,414, plus agency support costs of US \$25,509, and for a plan for the complete elimination of HFCs contained in imported pre-blended polyols in the polyurethane (PU) foam sector in line with decision 96/52, in the amount of US \$959,812, plus agency support costs of US \$67,187, as originally submitted.⁴ The submission includes a progress report on the implementation of the first tranche of the KIP, a verification report on HFC consumption for 2024 and 2025, and the tranche implementation plan for 2026 to 2028.

Report on HFC consumption

25. The Government of Ecuador reported a consumption of 2,730,306 CO₂-equivalent (CO₂-eq) tonnes of HFCs in 2025, which is 14.1 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 and HFC baseline for Ecuador (Article 7 data)

HFCs	GWP	2021	2022	2023	2024	2025
Metric tonnes (mt)						
HFC-23	14,800	0.0	1.72	0.0	0.0	0.01
HFC-32	675	0.0	0.0	1.41	14.88	1.58
HFC-125	3,500	2.11	0.97	2.29	0.07	0.09
HFC-134a	1,430	427.17	707.22	627.32	470.67	611.76
HFC-152a	124	1.78	3.67	1.75	0.00	4.25
HFC-227ea	3,220	0.01	0.16	0.02	0.04	0.0
R-404A	3,921.6	82.11	260.75	118.25	91.06	81.86
R-407C	1,773.85	17.70	17.95	29.84	14.30	22.78
R-410A	2,087.5	159.10	282.71	346.81	193.09	257.18
R-417A	2,346	27.23	11.75	39.15	36.69	38.02
R-422D	2,728.95	5.44	6.91	2.15	4.85	6.39
R-507A	3,985	137.16	301.20	229.72	109.77	212.34
Other*		0.75	2.66	0.56	2.46	1.84
Total (mt)		860.56	1,597.67	1,399.28	937.88	1,238.10
In imported pre-blended polyols**		0.0	104.68	109.06	80.37	88.87
CO₂-eq tonnes						
HFC-23	14,800	0	25,441	0	0	118
HFC-32	675	0	0	948	10,042	1,063
HFC-125	3,500	7,389	3,390	8,015	242	329
HFC-134a	1,430	610,854	1,011,330	897,066	673,059	874,812
HFC-152a	124	221	455	217	0	526
HFC-227ea	3,220	47	506	74	121	0
R-404A	3,921.6	322,003	1,022,562	463,745	357,099	321,035
R-407C	1,773.85	31,402	31,840	52,932	25,374	40,405
R-410A	2,087.5	332,127	590,157	723,972	403,065	536,861
R-417A	2,346	63,889	27,571	91,841	86,075	89,200
R-422D	2,728.95	14,848	18,849	5,859	13,239	17,424
R-507A	3,985	546,588	1,200,272	915,426	437,444	846,187

⁴ As per the letters of 12 and 28 March 2026 from the Ministry of Production, Foreign Trade and Investments of Ecuador to UNIDO.

HFCs	GWP	2021	2022	2023	2024	2025
Other*		1,760	5,581	991	4,583	2,346
Total (CO₂-eq tonnes)		1,931,128	3,937,954	3,161,086	2,010,343	2,730,306
In imported pre-blended polyols**		0	100,893	105,114	82,781	91,536
HFC baseline calculation (CO₂-eq tonnes)						
HFC average consumption in 2020–2022					2,693,743	
HCFC baseline (65%)					485,551	
HFC baseline					3,179,294	
Average consumption of HFCs in imported pre-blended polyols in 2022–2024					96,263	

* Including HFC-245fa, R-407A, R-407F, R-422A, R-437A, R-438A, R-449A, R-452A, R-454B and R-508B. The Ozone Secretariat reporting system does not allow differentiation between R-507A and R-507C; therefore, both have been reported as a single substance (R-507A).

** Including HFC-245fa, HFC-365mfc and HFC-227ea

26. Due to the impact of the COVID-19 pandemic, the national consumption of HFCs had temporarily dipped to 860.5 metric tonnes (mt) in 2021, increasing again to 1,597.7 mt in 2022 and outgrowing its pre-pandemic levels during market recovery. The largest growth in consumption, compared to the pandemic and pre-pandemic years, was recorded for R-507A and R-404A. Because of those substances' high global-warming potential (GWP), this increase had a major impact on the country's 2022 consumption measured in CO₂-eq tonnes. There is an overall downward trend after recovery from the pandemic, and the fluctuations reflect short-term supply and demand adjustments rather than structural changes in the market.

Consumption in the polyurethane foam sector

27. A comprehensive sector-wide survey conducted during the preparation of the PU foam sector plan identified an average annual consumption of 98.04 mt (96,263 CO₂-eq tonnes) of HFCs contained in imported pre-blended polyols in the 2022–2024 period. All polyol systems used in Ecuador are imported from Colombia or China; no domestic formulation capacity exists. The survey revealed that HFCs contained in imported pre-blended polyols had not been fully disaggregated in previous reporting under Article 7 of the Montreal Protocol or consistently reflected in the country programme (CP) data as distinct from other types of HFC consumption. The consumption of HFCs contained in imported pre-blended polyols in Ecuador over the 2022–2025 period is presented in table 1.

Country programme implementation report

28. The HFC consumption data provided by the Government of Ecuador in its CP implementation report for 2025 is largely consistent with the data reported under Article 7 of the Montreal Protocol. Small discrepancies are attributed to differences in decimal rounding; characteristics of the Ozone Secretariat's platform, including limitations in differentiating between certain substances (e.g., R-507A and R-507C); restrictions in reporting specific applications, such as HFC-227ea in imported pre-blended polyols; and automatic deduction of destruction volumes. Some discrepancies were also due to clerical data entry errors. In the case of R-407C and R-410A, the differences were related to imprecise customs classification records identified during the verification process.

29. The CP dataset includes HFC-152a (445.37 CO₂-eq tonnes), which was reported as feedstock/process agent use for glass manufacturing and was therefore excluded from the Article 7 controlled consumption calculation and the verification totals. HFC-245fa contained in imported pre-blended polyols was reported separately and not considered controlled consumption under the Montreal Protocol.

Verification report

30. The verification report confirmed that the Government was implementing a licensing and quota system for HFC imports and exports and that the total consumption of HFCs reported under Article 7 of the Montreal Protocol for 2024 and 2025 was correct (as shown in table 1 above). The verification concluded that Ecuador complied with the HFC consumption targets for 2024 and 2025. The report included several recommendations, discussed in paragraph 51.

Progress report on the implementation of the first tranche of stage I of the Kigali HFC implementation plan*Conversion project at Induglob*

31. At its 91st meeting, the Executive Committee approved the conversion project for one commercial and domestic refrigerator manufacturing line at the enterprise Induglob (formerly Indurama) from the use of HFC-134a to propane (R-290) and isobutane (R-600a). The project, incorporated into stage I of the KIP for Ecuador in line with decision 93/61(b)(i.), was completed on 25 March 2025 and its final report was submitted to the Secretariat on 28 April 2025, confirming the complete elimination of HFCs from the enterprise's production processes in favour of R-600a and R-290 and the resulting phase-out of 10.42 mt (14,901 CO₂-eq tonnes) of HFC-134a. The project proved that conversions of this nature were not only achievable but also cost-effective and scalable, and demonstrated that it could be replicated in other countries and regions, particularly among small and medium-sized manufacturers operating under similar technical and market conditions.

Legal framework

32. The national online licensing system was upgraded in 2024, expanding its functionality to control HFCs, pre-blended polyols and low-GWP alternatives with a new module for the registration and monitoring of air-conditioning (AC) equipment linked to extended producer responsibility targets currently being tested. The planned delivery of two refrigerant identifiers for customs offices has experienced delays due to the limited global availability, and delivery of a refrigerant reference standard for the customs' laboratory is ongoing. Meetings were held with 20 customs and private sector representatives (including five women) to discuss the prevention of illegal trade in HFCs and strengthen awareness of import control mechanisms; a study on risk management and tariff codifications is ongoing; and several awareness-raising and communication activities on HFC control measures have been developed and implemented for relevant government institutions and stakeholders, including development of informational materials and technical presentations and organization of coordination meetings.

Refrigeration servicing sector

33. The following activities were implemented under the first tranche:

- (a) *Technician training, certification, and capacity-building*: Collaboration agreements for the strengthening and updating of technician training and certification programmes were prepared for two technical universities, and a cooperation framework was prepared with the Ministry of Education, Sports and Culture to support technical training for refrigeration and air-conditioning (RAC) at public learning institutions; a training manual on good practices in RAC servicing was finalized; a manual for mobile air-conditioning (MAC) servicing technicians was prepared and is currently under review; the planned training of 30 instructors and 60 technicians on the safe use of flammable refrigerants in the RAC and MAC sectors is scheduled for the first half of 2026; an additional training-of-trainers on the safe use and application of alternative refrigerants was held for 23 instructors from universities, technical institutes and training centres; two technical seminars on the safe handling of flammable refrigerants were attended by 154 servicing technicians and sector

stakeholders; tools and equipment for training on the safe handling of flammable refrigerants in the RAC and MAC sectors were procured for three technical universities, with delivery expected by the end of 2026; a study tour to a RAC training centre in Bogotá, Colombia, was held for 11 trainers and national ozone unit (NOU) staff, focusing on the installation and servicing of AC systems, servicing of domestic and commercial refrigeration equipment, refrigerant recovery and recycling practices, energy-efficiency considerations, and the fundamentals of transcritical carbon dioxide (CO₂) refrigeration systems;

- (b) *Refrigerant recovery and reclaiming scheme:* Two mobile refrigerant reclamation units, planned to be acquired for a large end user, were instead deployed at a technical university in support of training activities; as of February 2026, 689 kg of HFC-134a and 113.3 kg of R-410A had been reclaimed using this equipment; and
- (c) *Public awareness:* Communication materials covering refrigerant recovery, good refrigeration practices and energy efficiency were developed to support workshops, technical seminars, training activities and awareness initiatives organized by the NOU, and outreach videos were produced and disseminated through official NOU communication channels to raise awareness among technicians, industry stakeholders and the public.

Pilot project to enhance energy efficiency (decision 91/65)

34. At its 93rd meeting, the Executive Committee approved a US \$190,000 pilot project for Ecuador (plus US \$17,100 in agency support costs for UNIDO) to enhance energy efficiency in replacement technologies during the HFC phase-down, noting the Government's commitment to meet the conditions listed in decision 91/65(b)(iv)b.–d., to operationally complete the project by 31 December 2026, and to submit a final report within six months of completion (decision 93/80). Early results show progress in enabling energy-efficiency integration in the RAC sector. A May 2025 study tour to Mexico familiarized national authorities with the implementation of minimum energy performance standards (MEPS), testing methods, and market-transformation approaches, supported by exchanges with institutions, manufacturers, and laboratories. A feasibility assessment for a national RAC testing laboratory found immediate establishment premature but provided a foundation for future planning. Capacity-building is advancing, with training modules and refrigeration simulators procured for 2026 to support curriculum updates and technician guidance. Outreach materials on MEPS and energy labelling have been developed; the remaining activities are underway, including the strengthening of MEPS for condensing units and targeted training for agroindustry users and technicians. Overall, the project has improved institutional coordination, technical capacity, and market awareness while laying the groundwork for regulatory improvements and future investment in energy-efficient RAC technologies.

Project implementation and monitoring

35. Under the project management component, three consultants were hired to assist the NOU in the coordination of activities, technical monitoring, and integration of gender considerations into project implementation; three annual project reports were issued; and ten coordination meetings were held with stakeholders. The US \$26,100 approved for project monitoring activities under the first tranche was fully disbursed for project staff and consultants (US \$25,012) and coordination meetings (US \$1,088).

Level of fund disbursement

36. As of April 2026, of the US \$560,485 approved so far (US \$267,885 for the conversion at Induglob and US \$292,600 for the first tranche of the KIP), US \$543,813 (97 per cent) had been disbursed (US \$265,687 (99 per cent) for Induglob and US \$278,126 (95 per cent) for the first tranche). UNIDO returned the unused balance of US \$213 from the completed Induglob conversion project to the Multilateral

Fund in December 2025, and the balance of US \$14,474 for the first tranche will be disbursed in 2026. The details of fund disbursement are presented in table 2.

Table 2. Fund disbursement for stage I of the KIP in Ecuador (UNIDO)

Project	Funds approved (US \$)	Funds disbursed		Balance (US \$)
		US \$	%	
Conversion project at Induglob	267,885	265,687	99	*2,198
KIP stage I, first tranche	292,600	278,126	95	14,474
Total	560,485	543,813	97	16,672

* Including US \$213 returned and US \$1,970 obligated pending financial completion of the project.

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

37. The following activities will be implemented by UNIDO between July 2026 and December 2028:

- (a) *Policies and regulations to reduce HFC supply and demand:* Support for the automation and operational strengthening of the HFC quota and licensing system; organization of capacity-building workshops for customs officers and agents and procurement of refrigerant identifiers and laboratory equipment to strengthen enforcement capacity; and awareness-raising activities targeting public institutions and key stakeholders to promote compliance with HFC control measures (US \$34,000 plus funds from previous tranche);
- (b) *Technician training, certification and capacity building:* Training of at least 600 RAC and MAC technicians in the safe handling and application of flammable refrigerants (US \$64,000) and provision of 44 servicing toolkits⁵ to workshop technicians who successfully complete the training programme (US \$127,214) (total of US \$191,214);
- (c) *Refrigerant recovery and reclaiming scheme:* Continued development of the refrigerant lifecycle management system through the establishment of an upgraded reclaiming centre⁶ and deployment of a mobile reclaiming unit to provide recovery and reclamation services to large end users (US \$100,000);
- (d) *Public awareness:* Dissemination of information on the Kigali Amendment and good refrigeration practices through design and development of communication materials and multimedia products such as infographics, videos, and outreach materials addressing refrigerant management, energy efficiency and the safe handling of alternative refrigerants (US \$6,000);
- (e) *Project to phase out HFCs contained in imported pre-blended polyols in the PU foam sector:* The project is described in detail in paragraphs 38 to 50 of the present document; and
- (f) *Project monitoring and management:* Engagement of a national consultant to facilitate coordination between the NOU, national stakeholders and UNIDO (US \$16,500); engagement of a technical expert to guide project implementation (US \$11,000); engagement of a specialist to support the empowerment of women across project activities (US \$4,400); and organization of coordination meetings for project stakeholders (US \$1,300) (total of US \$33,200).

⁵ Including inter alia vacuum and charging kits for HCs, portable nitrogen blowing equipment, welding kits, leak detector spray, portable air blowers, and leak detectors for RAC technicians; and recovery and recycling units for HFC-134a and associated consumables (oil, hoses, valves, filters, cylinders) for MAC technicians.

⁶ Equipped with, inter alia, a refrigerant reclaim unit with associated consumables and cylinders of several capacities, drying system for refrigeration cylinders, vacuum pumps, recovery units, 1,000 lb storage tanks, electronic leak detectors, pollution detector kits, and advanced refrigerant identifiers.

Project to phase out HFCs contained in imported pre-blended polyols in the polyurethane foam sector

Background

38. The import of polyols premixed with HCFC-141b for foaming applications has been restricted since 6 January 2023. Under Ecuador's HCFC phase-out management plan (HPMP), the starting point for aggregate reductions in the consumption of pure HCFC-141b was 0.86 ODP tonnes, and 20.67 ODP tonnes for HCFC-141b contained in imported pre-blended polyols. Stage I of the HPMP included two investment projects in the foam sector:

- (a) A conversion project at Induglob to replace 14.96 ODP tonnes of HCFC-141b contained in imported pre-blended polyols with cyclopentane in the manufacturing of PU foam panels at Ecuador's largest domestic refrigeration manufacturer, approved at the 65th meeting in the amount of US \$1,331,440, plus agency support costs, and successfully completed (see paragraph 31 above); and
- (b) An umbrella project to phase out the remaining consumption of 5.71 ODP tonnes of HCFC-141b contained in imported pre-blended polyols in the manufacturing of PU foam by other enterprises and replace it with HFO-1233zd(E), cyclopentane or water, approved at the 81st meeting in the amount of US \$431,719, plus agency support costs. One domestic refrigeration enterprise (Ecasa) completed the conversion of the foam insulation of panels to pre-blended hydrocarbon (HC) systems. The remaining foam enterprises completed their testing of HFO, CO₂, pre-blended HC and water-based technologies with positive results; however, they were not able to complete conversions as no alternatives for the spray sector were available at that time in the Ecuadorian market, other than those based on HFC-227ea and HFC-365mfc. The project was subsequently cancelled and US \$114,550 was returned to the Fund at the 91st meeting. At the time of submission of the second tranche of stage II at the 93rd meeting (in 2023), UNIDO had expected to reuptake work in the spray foam application sector under stage II of the KIP.⁷

Project objective

39. The present project proposes an umbrella, sector-wide conversion to HFO-based pre-blended polyol systems across all applications, including discontinuous panels, spray foam and insulation products. The selection of HFO technology is based on its commercial maturity, low GWP, compatibility with existing equipment, and suitability for markets dominated by small and medium-sized enterprises (SMEs) with limited safety infrastructure. The conversion, to be implemented over a four-year period, includes formula development, clustered validation trials, full enterprise conversion, and adoption of regulatory measures prohibiting the import and/or use of HFC-containing polyols upon project completion. The elimination of 62.55 mt of HFCs will result in a sustained annual reduction of approximately 61,650 CO₂-eq tonnes.

40. All but one of the 24 identified PU foam manufacturers are SMEs established before 1 January 2020. The applicable cost-effectiveness threshold for the PU foam sector is US \$9.00/kg, with flexibility provisions for SMEs. Consistent with the precedent established at the 81st meeting under the HPMP, this proposal applies a cost-effectiveness level of US \$9.79/kg. Applied to the eligible consumption of 98.04 mt, the total funding request amounts to US \$959,812, plus agency support costs. In line with decision 96/52, this quantity will be treated separately from the national starting point for sustained aggregate reductions.

Enterprise background, phase-out activities and associated costs

41. The list of enterprises included for conversion in this project, the applications they produce and average HFC consumption are presented in table 3.

⁷ Paragraph 16 of document UNEP/OzL.Pro/ExCom/93/52

Table 3. PU foam enterprises eligible for funding in Ecuador, as submitted

#	Enterprise	Application	Average HFC consumption (mt)
1	ALME	Spray foam	0.79
2	Car Bus	Spray foam	0.68
3	Cepolfi Industrial C.A.	Spray foam	0.40
4	Ecuapoliuretanos	Discontinuous panel and spray foam	17.08
5	Fibras Picosan	Discontinuous panel and spray foam	0.91
6	Furgometal	Spray foam	6.54
7	Grupo MM Refrigeración S.A.	Discontinuous panel	2.64
8	Impertop	Spray foam	1.25
9	Indeltro	Spray foam	5.72
10	Industrias Metálicas Terán	Water heaters	0.25
11	Industrias Verton	Discontinuous panel and spray foam	5.14
12	Kubiec S.A.	Spray foam	9.25
13	Macosa	Spray foam	0.51
14	Mafrico S.A.	Discontinuous panel	28.73
15	Master Metal	Spray foam	0.62
16	Metal Trucks	Spray foam	0.45
17	Novacero	Discontinuous panel and spray foam	9.69
18	Plásticos Rival	Pore in place	1.90
19	Plastimet	Spray foam	4.08
20	Sats	Spray foam	1.42
	Total		98.04

42. All eligible enterprises will transition to pre-blended polyol systems based on HFO-1233zd(E), a technology selected due to its commercial maturity at international level, compatibility with existing foam processing equipment, low GWP, suitability for such applications as discontinuous panel, spray foam and other insulation options, and reduced flammability risk compared to systems based on HCs. The use of a single technological pathway will simplify implementation, facilitate supplier coordination and reduce long-term regulatory uncertainty.

43. The exclusive selection of HFO-based systems reflects lessons learned from the HPMP implementation, when HC-based systems were technically validated in selected panel applications; however, sustained sector-wide conversion was not achieved due to supply instability, availability constraints and safety-related investment requirements, particularly for SMEs.

44. With regard to the availability of HFO-based technology, the sector-wide survey conducted for the preparation of the present proposal confirmed that HFO-1233zd(E) was commercially available to the Ecuadorian market through established international supply chains, and that pre-blended HFO-based polyol systems could be supplied upon confirmed demand. Furthermore, the current generation of HFO-based pre-blended polyol systems have undergone technical improvements compared to earlier formulations evaluated during the HPMP implementation period. Suppliers have optimized foam stability, cell structure control and processing performance, addressing technical challenges encountered during the initial trials.

45. Under the proposed implementation framework, reformulation trials will be conducted in coordination with enterprises and material suppliers to validate these updated formulations under local production conditions. Where required, formulation fine-tuning will be carried out jointly with suppliers to ensure stable industrial-scale implementation.

Incremental costs

46. The incremental capital costs (ICCs) of the project include: procurement of three units of HFO integration equipment for two enterprises (Mafrico and Novacero) (US \$240,000); 24 sets of portable

thermal conductivity (K-factor) measurement equipment (US \$288,000); reformulation trials (two rounds for each enterprise) (US \$144,000); 50 practical and theoretical workshops on the safe handling of low-GWP alternatives for beneficiary enterprises (US \$150,000); preparation and implementation of regulatory updates, including banning the import and use of HFCs in the PU foam sector (US \$30,000); and hiring of one national (US \$70,000) and one international technical expert (US \$37,812) to carry out sector-wide supervision and specialized oversight and provide guidance in the reformulation phase.

47. Project implementation will be carried out under the overall supervision and technical coordination of UNIDO and in close cooperation with the NOU. Structured engagement with importers and distribution enterprises will be undertaken to align supply chains with low-GWP HFO formulations and to ensure the progressive replacement of HFC-containing polyols. Monitoring arrangements will include the annual verification of import volumes of pre-blended polyols through the national licensing system, combined with enterprise-level validation of product performance using K-factor measurement equipment. Periodic technical missions and progress reporting will be conducted to ensure that conversion milestones are achieved within the agreed timeframe.

48. No incremental operating costs (IOCs) have been requested for this project.

49. The total cost of the PU foam sector conversion amounts to US \$959,812, with a cost-effectiveness of US \$9.79/kg, as originally submitted, as shown in table 4. The project will be implemented in 48 months.

Table 4. ICCs of the conversion of 24 enterprises in the PU foam sector in Ecuador, as submitted

Component	Unitary cost (US \$)	Total cost (US \$)
HFO integration equipment – Mafrico S.A. (2 units) and Novacero (1)	80,000	240,000
Thermal conductivity measurement equipment (24 sets)	12,000	288,000
Reformulation trials (2 rounds per enterprise)	3,000	144,000
Practical and theoretical workshops (50)	3,000	150,000
Regulatory update and ban enforcement preparation	-	30,000
National PU foam technical expert (4 years)	-	70,000
International PU foam technical expert (missions over 4 years)	-	37,812
Total	-	959,812

50. In accordance with decision 96/52(a)(iv), the Government of Ecuador commits to banning the imports and/or the use of HFCs, both pure and contained in pre-blended polyols, by the time the final foam manufacturing plant had been converted to a non-HFC technology.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Report on HFC consumption and verification

51. The verification report recommended that the Government continue strengthening and consolidating the Ozone Ecuador Application (OEA) as the central platform for the management and monitoring of HFC quotas, licensing and consumption data in order to establish robust backup, recovery and data redundancy mechanisms to further strengthen the integrity, traceability and long-term security of historical records associated with the implementation of the Kigali Amendment. Other recommendations included strengthening the institutional arrangements related to the authorization and approval of import and export licenses for controlled substances by establishing an operational backup mechanism within MPCEI; advancing the digitalization and automation of licensing and verification procedures, particularly by reducing the manual entry of information into the OEA; continued strengthening of the review and verification of tariff classifications applicable to HFC substances and blends during both the licensing and

customs clearance processes; monitoring the allocation and utilization of quotas reserved for occasional or new importers to ensure that the total assigned volumes remain fully consistent with the established limits; continued strengthening technical training, awareness and coordination activities for importers, customs officers, customs brokers and other relevant stakeholders regarding tariff classification, identification and reporting obligations applicable to HFC substances and blends under the Kigali Amendment; and updating and progressively aligning the applicable COMEX resolutions and national quota allocation instruments with the HFC consumption limits. UNIDO indicated that those recommendations would be taken into account during the implementation of the second tranche; it was agreed that progress in the implementation of the recommendations would be reported as part of the tranche implementation report.

Progress report on the implementation of the first tranche of stage I of the Kigali HFC implementation plan

Legal framework

52. The Government of Ecuador has issued HFC import quotas for 2026 in accordance with the Montreal Protocol control targets.

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

53. The Secretariat enquired about the number of toolkits to be procured for RAC and MAC servicing technicians as well as the servicing tools procured for the training institutions. UNIDO confirmed that 44 toolkits would be procured and distributed to RAC and MAC servicing technicians under the second tranche, and that the RAC and MAC servicing tools and equipment for three training institutions corresponded to comprehensive professional sets designed for the safe handling of toxic and flammable refrigerants, including recovery units, vacuum pumps, instrumentation, brazing equipment and safety devices. The toolkit cost per institution is approximately US \$52,300. UNIDO further clarified that the kits were not basic toolsets, but fully equipped units that included HC-compatible equipment, leak detectors, safety devices, and complete servicing tools to ensure safe and effective operation in line with current technical requirements.

54. In response to the Secretariat's questions on the refrigerant recovery and reclaiming scheme, UNIDO clarified that the reported "regenerated" quantities of HFC-134a and R-410A referred to the volume of refrigerant recovered from equipment and then reclaimed with the use of reclaiming units. In this context, "reclaimed" means that refrigerant was cleaned to reduce contaminants and improve its suitability for reuse. The quality of reclaimed refrigerants is verified with refrigerant identifiers. The successfully reclaimed refrigerants are returned to the customer or service user who requested the service, for reuse in their own equipment. They are therefore not sold on the market as reclaimed refrigerant. Mixed or contaminated refrigerants that cannot be suitably reclaimed are sent for destruction to a cement kiln facility.

Project to phase out HFCs contained in imported pre-blended polyols in the polyurethane foam sector

Issues related to selected technologies

55. The Secretariat held multiple discussions with UNIDO regarding the selection of HFO-1233zd(E) noting the delays and cancelation of other PU foam projects in the region due to the low accessibility of HFOs at competitive prices, and considering that the project approved at the 81st meeting, based on assurances of technology availability, could not be fully completed due to the lack of available technologies. UNIDO explained that HFO-based systems had reached a higher level of commercial maturity at the international level, with increased production capacity, broader supplier availability, particularly from systems houses in Latin America and Asia, and improved technical performance across a wider range of applications, including discontinuous panels and spray foam. UNIDO further explained that supply conditions had improved and HFO systems were now commercially available through established regional suppliers, and that the risk of reverting to HFCs was thus considered limited and would be mitigated through

technical validation, supplier engagement and, most importantly, regulatory measures. Given that all polyol systems are imported and there is no domestic formulation, this measure will effectively prevent the reintroduction of HFC-based systems, ensuring a sustained and irreversible phase-out.

Incremental costs

56. Following the eligibility analysis of enterprises included in the umbrella project, three beneficiaries (Mafrico S.A., Industrias Verton, and Grupo MM Refrigeración S.A.) were removed, since they had previously received funding for transitioning their discontinuous foam panel manufacturing processes to low-GWP technologies.

57. Since previous transitions from HCFC-141b and HFC-245fa to HFO-1233zd(E) required no modification to equipment, the HFO integration equipment cost was removed; the thermal conductivity measurement equipment cost was also removed because it is considered basic equipment for operating foam manufacturing and thus is not an incremental cost in the transition to HFOs. The cost for reformulation trials was adjusted to reflect the number of eligible enterprises, and practical and theoretical workshops costs were adjusted to one workshop per eligible enterprise using a lower cost per unit. The costs for the regulatory update and ban enforcement preparation was removed because it should be covered under institutional strengthening, while the costs for national and international PU foam technical experts were combined into technical assistance for SMEs and project management costs. Due to the prior experience of the foam sector project in Ecuador, it was agreed that a robust monitoring programme would be put in place to confirm the complete conversion of all enterprises.

58. During the discussion, it was acknowledged that while local availability of HFO-based polyols had improved, their price remained higher than that of HFC-based polyols. Taking into consideration prices provided by UNIDO, the IOCs for eligible enterprises, based only on the eligible portion of the consumption (62.55 mt), were calculated at US \$3.00/kg for a typical formulation,⁸ as per the cost guidelines for stage I of the KIPs (decision 95/86 (a), (b), and (d)(ii)).

59. On the basis of the above, the total cost of the project amounts to US \$424,950, to phase out 62.55 mt of HFCs contained in imported pre-blended polyols, with a cost-effectiveness of US \$6.79/kg. Taking into consideration that the consumption eligible for funding is 62.55 mt, the theoretical maximum level of funding at US \$12.60/kg is US \$788,130. The funds requested by enterprises and technical assistance were adjusted accordingly, as shown in table 5.

Table 5. Agreed incremental costs for the conversion of 21 PU foam enterprises in Ecuador

Component	Cost (US \$)	
	As requested	As agreed
HFO integration equipment – Mafrico S.A. (2 units) and Novacero (1)	240,000	0
Thermal conductivity measurement equipment (24 sets)	288,000	0
Reformulation trials (2 rounds per enterprise)	144,000	126,000
Practical and theoretical workshops (50)	150,000	27,300
Regulatory update and ban enforcement preparation	30,000	0
National PU foam technical expert (4 years)	70,000	0
International PU foam technical expert (missions over 4 years)	37,812	0
Technical assistance for SMEs and project management costs	0	84,000
Subtotal ICCs	959,812	237,300
IOCs	0	187,650
Total	959,812	424,950
Eligible consumption	98.04	62.55
Cost-effectiveness (US \$/kg)	9.79	6.79

⁸ The price difference for the blowing agent was approximately US \$3.50/kg.

60. In addition to the 62.55 mt of HFCs contained in imported pre-blended polyols eligible for funding, as shown in table 4, the sector is also consuming 35.48 mt not eligible for funding. This consumption will also be phased out during stage I of the KIP. The cost-effectiveness, including all tonnage being phased out in stage I, is US \$4.33/kg.

Impact on the climate

61. The conversion of the PU foam manufacturing enterprises in Ecuador would prevent the emission into the atmosphere of approximately 96,263 CO₂-eq tonnes of HFCs per year, as shown in table 6.

Table 6. Impact on the climate of the PU foam project in Ecuador

Year	Substance	GWP	Consumption in pre-blended polyols	
			mt	CO ₂ -eq tonnes
Before conversion				
2022	HFC-365mfc/227ea	963.82	104.68	100,893
2023	HFC-365mfc/227ea	963.82	109.06	105,114
2024	HFC-245fa	1,030	80.37	82,781
2022–2024 average			98.04	96,263
After conversion				
	HFO-1233zd(E)	0	34.40	0
	Impact			96,263

Gender policy implementation

62. In line with decisions 84/92(d) and 90/48(c) of the Executive Committee, the implementation of the KIP in Ecuador takes into consideration the gender policy of the Multilateral Fund. During the reporting period, disaggregated data on capacity-building and training activities related to the RAC sector have been systematically collected, allowing the NOU and implementing partners to monitor participation trends and identify opportunities to further encourage the involvement of women. Efforts have been made to ensure that the role of women in the RAC sector is visible and appropriately represented in the preparation of training material, presentations, and communication products developed under the KIP. Educational and outreach materials present inclusive examples and imagery, highlighting the contributions of both women and men in technical and managerial roles within the sector. Efforts have also been made to promote balanced participation and involvement of female professionals and students in stakeholder consultations, meetings, workshops, and dialogues organized under the project, and to disseminate information on training and professional development opportunities within the RAC sector.

Updated Agreement

63. In view of the inclusion of the PU foam sector plan and the accordingly revised funding level, the Agreement between the Government of Ecuador and the Executive Committee for stage I of the KIP has been updated. Specifically, paragraph 2 and Appendices 1-A and 2-A have been revised, and paragraph 17 has been added to indicate that the updated Agreement supersedes that reached at the 97th meeting by decision 97/17(l), as contained in annex I to the present document. The full updated Agreement will be appended to the final report of the 98th meeting.

Sustainability of the HFC phase-out and assessment of risks

64. The long-term sustainability of the HFC phase-down in Ecuador is supported by a combination of regulatory measures, institutional strengthening and capacity-building activities implemented under the KIP. Ecuador has an established and operational licensing system for HFC imports, implemented through an electronic platform managed by the Ministry of Production, Foreign Trade and Investments in coordination with the National Customs Service, enabling the continuous monitoring of imports and improving the

traceability of controlled substances. Training programmes on good servicing practices, safe handling of low-GWP alternatives and refrigerant recovery and management, are being incorporated into the curricula of technical institutes, vocational training centres and universities to ensure that the knowledge and technical capacities developed during project implementation will continue beyond the duration of the project. The strengthening of the refrigerant recovery, recycling and reclaim network also contributes to long-term sustainability of the HFC phase-down, as the partnerships established with waste management operators, training institutions and private sector stakeholders support the recovery and environmentally sound management of refrigerants at the end of equipment life, reducing emissions and facilitating lifecycle management.

65. Despite these advances, some risks to the sustainability of the HFC phase-down remain. One of the main challenges is the continued presence of a large installed base of equipment operating with high-GWP refrigerants, particularly in the commercial RAC sectors. The relatively long operational lifetime of this equipment may slow down transition toward low-GWP alternatives. This risk is being mitigated through the continued training of technicians, awareness activities targeting end users, and demonstration projects showcasing the technical and economic feasibility of alternative technologies. Another potential risk is the limited capacity of the servicing sector to safely handle HCs and other mildly flammable refrigerants. To address this risk, the KIP includes specialized training activities, technical guidelines, and strengthening of the technician certification system based on labour competencies. Finally, potential risks associated with illegal trade or misclassification of refrigerants are being mitigated through continuous collaboration with customs authorities, training of customs officers, and development of technical tools to improve refrigerant identification and the monitoring of imports. These combined measures will ensure that Ecuador maintains sustained progress in the implementation of the HFC phase-down under the Kigali Amendment.

Conclusion

66. The 2025 consumption of 2,730,306 CO₂-eq tonnes is 14.1 per cent below the Montreal Protocol consumption limit of 3,179,294 CO₂-eq tonnes and 11.5 per cent below the maximum allowable consumption of 3,083,915 CO₂-eq tonnes stated in the Agreement. The verification report confirmed that the Government was implementing a licensing and quota system for HFC imports and exports and that Ecuador complied with the HFC consumption targets for 2024 and 2025. Activities completed during the first tranche of stage I include the upgrading of the online HFC licensing system, customs training, development of agreements with training institutions, procurement of tools and equipment for RAC and MAC training institutions, and awareness activities. The disbursement rate for the first tranche is 95 per cent. Activities planned for the second tranche include continued training and provision of equipment to RAC and MAC servicing technicians and further development of the refrigerant recovery and reclamation scheme as well as a plan to completely eliminate the use of HFCs in the PU foam sector.

RECOMMENDATION

67. The Executive Committee may wish to consider:

(a) Noting:

- (i) The progress report on the implementation of the first tranche of stage I of the Kigali HFC implementation plan (KIP) for Ecuador;
- (ii) That stage I of the KIP included funding for the plan for the complete elimination of HFCs contained in imported pre-blended polyols in the polyurethane foam sector (foam sector plan), in the amount of US \$424,950, plus agency support costs of US \$29,746, for UNIDO;

- (iii) The commitment of the Government of Ecuador to ban the imports and/or use of HFCs, both pure and contained in pre-blended polyols, by the time the final foam manufacturing plant has been converted to a non-HFC technology and no later than 1 January 2030;
 - (iv) That the Fund Secretariat has updated the Agreement between the Government of Ecuador and the Executive Committee for stage I of the KIP, as contained in annex I to the present document, specifically: paragraph 2 and Appendices 1-A and 2-A, based on the inclusion of the foam sector plan and the accordingly revised funding level, and paragraph 17 that has been added to indicate that this updated Agreement supersedes that reached at the 97th meeting;
 - (v) That 96,263 CO₂-equivalent tonnes of HFCs contained in imported pre-blended polyols will be deducted from the starting point for sustained aggregate reductions in HFC consumption that will be established on the basis of guidance provided by the Executive Committee; and
- (b) Approving the second tranche of stage I of the KIP for Ecuador and the corresponding 2026–2028 tranche implementation plan, in the amount of US \$789,364, plus agency support costs of US \$55,255, for UNIDO, on the understanding that UNIDO will include, as part of the progress report on the implementation of the second tranche of the KIP, an update on progress in implementing the recommendations contained in the verification report submitted to the 98th meeting.

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT**Ecuador**

PROJECT TITLE	AGENCY
Pilot demonstration project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of the HFC phase-down (non-investment activities) through replacing an R-507A-based centralized refrigeration system with an ammonia-based recirculated system at a shrimp processing enterprise in Ecuador (decision 91/65)	UNIDO (lead)

PROJECT OBJECTIVE
This demonstration project aims to eliminate the use of R-507A in the targeted installation, reduce direct CO ₂ -equivalent (CO ₂ -eq) emissions associated with leakage, enhance energy efficiency, strengthen national technical capacity for the design and operation of ammonia (NH ₃)-based systems, and provide a replicable model for other industrial refrigeration users. The expected results include the installation and commissioning of an NH ₃ -based system, quantified reductions in refrigerant consumption and emissions, verified assessment of energy performance before and after conversion, and dissemination of results among stakeholders to support replication.

NATIONAL COORDINATING AGENCY	Ministry of Production, Foreign Trade and Investments
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ARTICLE 7 DATA (Annex F)	Year: 2025	1,238.20 mt	2,730,306 CO ₂ -eq tonnes
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PROJECT DETAILS		
HFC consumption in the refrigeration servicing sector (2025 country programme data)	mt	1,209.29
	CO ₂ -eq tonnes	2,615,862
Project duration	months	36
Grant amount requested from the Multilateral Fund	US \$	492,000
Grant amount agreed	US \$	449,600
Project support costs for UNIDO	US \$	31,472
Total cost of project to Multilateral Fund	US \$	481,072
Co-financing	US \$	1,403,743
Total project cost, including co-financing	US \$	1,853,343
Energy-efficiency savings to be achieved through the project	kWh/year	1,321,374
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
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PROJECT DESCRIPTION

Summary of the proposal as submitted

68. On behalf of the Government of Ecuador, UNIDO as the designated implementing agency has submitted, in line with decision 91/65, a pilot demonstration project to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down (non-investment activities) through replacing an R-507A-based centralized refrigeration system with an ammonia (NH₃/R-717)-based recirculated system at a shrimp processing enterprise, in the amount of US \$492,000, plus agency support costs of US \$34,440, as originally submitted.⁹

Background

69. Ecuador ratified the Kigali Amendment on 22 January 2018, and stage I of the Kigali HFC implementation plan (KIP) was approved at the 93rd meeting,¹⁰ with the country committing to reducing its HFC consumption by 14 per cent of the baseline by 2029, including interim reduction steps starting in 2025. At its 91st meeting, the Executive Committee approved an investment project to convert the manufacturing of domestic and commercial refrigerators from HFC-134a to R-600a and R-290 at an enterprise Induglob. This project has been noted in the KIP Agreement, and the associated HFC reductions are part of the 14 per cent reduction of the HFC baseline by 2029. While the project did not include an energy efficiency component, calculations reported by the enterprise have shown a 4 per cent improvement in the energy efficiency of R-600a-based domestic refrigerators manufactured at the converted line. 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

70. As part of the enabling activities for HFC phase-down, Ecuador’s national ozone unit (NOU) has strengthened its partnership with the Ministry of Energy and Non-Renewable Natural Resources by identifying links between HFC phase-down and energy efficiency.

71. At the 93rd meeting, as part of the second tranche stage II of the HCFC phase-out management plan (HPMP), additional activities to maintain energy efficiency in the refrigeration servicing sector were approved in line with decision 89/6, including strengthening the capacity of importers and customs agents, capacity-building and additional training on energy efficiency in the refrigeration and air-conditioning (RAC) servicing sector, and awareness and outreach activities.¹¹

72. The pilot project to enhance energy efficiency in replacement technologies during the HFC phase-down in Ecuador, approved at the 93rd meeting, is discussed in detail in paragraph 34 of the present document.

73. Ecuador’s national initiatives aimed at improving energy performance across sectors include the RENOVA Programme (replacement of inefficient domestic refrigerators with higher-efficiency units to reduce residential electricity consumption), Energy Labelling Programme (mandatory labelling to guide consumer choices and promote efficient equipment), Industrial Energy Management Promotion (encouraging ISO 50001-based energy management systems at large electricity consumers), public sector energy-efficiency audits and improvement plans for public infrastructure, and various incentive mechanisms recognizing verified energy savings and related certifications.

⁹ As per the letter of 12 March 2026 from the Ministry of Production, Foreign Trade and Investments of Ecuador to UNIDO.

¹⁰ Decision 93/61

¹¹ Decision 93/36(a)(iv)

Policy, regulatory and institutional framework

74. The institutional responsibilities related to energy efficiency in Ecuador are distributed among the Ministry of Energy and Mines (MEM), lead authority on national energy policy and coordinator of energy-efficiency strategies; the Ecuadorian Standardization Service (INEN), responsible for the development, adoption, and enforcement of technical regulations and standards, including MEPS and labelling schemes; the Ministry of Production, Foreign Trade and Investments, host of the NOU and overseer of Montreal Protocol implementation, including refrigerant licensing and quota systems; the Customs Authority, enforcing control over imported substances and regulated equipment; and the Electricity Regulation and Control Agency, which supervises the electricity market regulations and tariff structures relevant to industrial electricity consumption.

75. The National Energy Efficiency System, set out in the Organic Law on Energy Efficiency adopted in 2019, mandates rational and sustainable use of energy across public and private sectors by promoting highly efficient technologies, energy management systems and performance-based standards. The National Energy Efficiency Plan for 2016–2035 aims to reduce electricity consumption and associated greenhouse gas emissions, especially with regard to RAC applications, which account for a significant share of electricity demand across the residential, commercial and industrial sectors.

76. The MEM has developed 11 standards to promote energy efficiency and 23 technical regulations to ensure the commercialization of energy-efficient domestic and industrial equipment, including technical standard No. 2495 on energy-efficiency requirements for air conditioners (2015); technical regulation No. 35 on energy-efficiency reporting, test methods and labelling in domestic refrigeration (2020); and technical standard No. 2511 on the requirements for energy efficiency in refrigeration chambers installed in motor vehicles.

77. The NOU will serve as the national coordinating authority, overseeing project implementation, ensuring alignment with the HFC licensing and quota system, facilitating regulatory coordination, and reporting progress. The MEM will guide integration with national energy-efficiency policies, while the National Customs Service will enforce the HFC import quota system and ensure that project-driven reductions in R-507A consumption are reflected in national controls. Environmental authorities will ensure compliance with industrial and safety regulations governing NH₃-based systems.

78. The shrimp-processing plant will serve as the host enterprise, providing baseline data, supporting installation and commissioning, and integrating the NH₃-based system into its operations. Industrial refrigeration engineering firms will handle system design, equipment supply, installation, commissioning, and performance verification. Local service providers will participate in technical exchanges and training to strengthen national capacity in NH₃ system maintenance and safety management.

79. UNIDO, as the implementing agency, will provide technical oversight, support procurement, supervise implementation, monitor performance, and report on results. Training institutions strengthened under the HPMP and KIP will contribute to project capacity-building and incorporate lessons from the demonstration into national curricula to support the safe operation of NH₃-based industrial refrigeration systems. Industry associations in the shrimp-processing sector will help disseminate results and promote replication across similar facilities, expanding the project's sector-wide impact.

Minimum energy performance standards

80. Ecuador has mandatory MEPS and labelling for domestic refrigeration and small air-conditioning (AC) equipment, and minimum energy performance requirements exist for certain components of large applications in the commercial and industrial refrigeration sectors, such as electric motors used in compressors and liquid recirculation pumps or motor-driven fans incorporated in evaporative condensers and air coolers; however, system-level performance standards have not yet been put in place for those sectors.

HFC consumption and sector background

81. The HFC consumption baseline for Ecuador has been established at 3,179,294 CO₂-equivalent (CO₂-eq) tonnes. As reported in Article 7 data, total HFC use in 2025 was 2,730,306 CO₂-eq tonnes, which is 14.1 per cent below the baseline. Table 1 presents HFC consumption in the country in 2021–2025.

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

Substances	2021	2022	2023	2024	2025
Metric tonnes					
All HFCs	861.65	1,597.67	1,399.50	937.88	1,238.20
R-507A	137.16	301.20	229.72	109.77	212.39
CO₂-eq tonnes					
All HFCs	1,931,128	3,937,954	3,161,086	2,010,343	2,730,306
R-507A	546,588	1,200,272	915,426	437,444	846,390

82. Following a temporary dip due to the COVID-19 pandemic, Ecuador's 2022 HFC consumption peaked at 3,937,954 CO₂-eq tonnes due to market recovery. Since then, consumption of both R-507A and all HFCs combined has been fluctuating but remained below both Montreal Protocol controls and the maximum allowable consumption of Annex F substances as per Ecuador's Agreement with the Executive Committee.

83. Industrial refrigeration is Ecuador's second-largest HFC-consuming subsector, using nearly one quarter of national servicing-sector HFCs, mainly R-507A, R-404A, and HFC-134a. Shrimp processing is one of the country's leading export industries, relying on low-temperature systems and freezing tunnels operating at –35°C to –40°C, with large refrigerant charges and long operating hours. These facilities are among the most energy- and emission-intensive industrial refrigeration users. Refrigerant blends with high global-warming potential (GWP) remain common in centralized and semi-centralized systems, and recent export-driven expansion has increased installations. Without industrial refrigeration performance standards, high-charge HFC-based systems continue to dominate both new and existing plants.

Project overview

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

84. The pilot demonstration project, implemented in coordination with stage I of the country's KIP, aims to replace a centralized high-charge R-507A-based system serving five blast freezing (–40°C) tunnels at Empacreci, a shrimp-processing enterprise in Guayaquil, with a recirculated system based on low-temperature NH₃. By eliminating the use of R-507A from the targeted installation, the project will reduce direct CO₂-eq emissions associated with leakage, enhance energy efficiency, strengthen national technical capacity for NH₃-based system design and operation, and provide a replicable model for other industrial refrigeration users.

85. The earlier pilot project, approved by decision 93/80, included a draft proposal to introduce or improve energy-efficiency labelling and MEPS for condensing units, as well as activities to promote those measures in commercial and industrial RAC systems in order to create conditions for a transition to more energy-efficient large RAC systems in Ecuador's commercial refrigeration sector.¹² This project aims to further expand the regulatory network pertaining to energy efficiency through developing a proposal for MEPS for centralized refrigeration systems, including technical assessment of current technologies,

¹² Paragraphs 82, 103 and 110 and table 7 of document UNEP/OzL.Pro/ExCom/93/52. The additional activities related to energy efficiency implemented under the country's HPMP in line with decision 89/6 focus on developing national capacities to strengthen the energy efficiency of stand-alone RAC appliances for which MEPS had already been developed and would only need to be updated.

benchmarking against international best practices, and identification of minimum performance thresholds for high-efficiency and low-GWP solutions, with particular attention given to centralized NH₃ and low-GWP systems used in food processing, cold storage, and export-oriented industries.

86. Technical and vocational training institutions strengthened under the HPMP and KIP will support capacity-building activities associated with the project. These institutions will integrate lessons learned from the demonstration into the national training curricula, contributing to the safe handling and operation of NH₃-based industrial refrigeration systems. Industry associations representing the shrimp-processing sector will facilitate dissemination of results and promote replication among similar facilities, thereby enhancing the broader sectoral impact of the intervention.

Project beneficiary

87. The beneficiary enterprise of the project is Empacreci, a leading Ecuadorian aquaculture shrimp processor and exporter, based in Durán, Ecuador. The processing plant is located in Guayaquil, Ecuador's largest city and main port. It specializes in the processing, freezing, and storage of shrimp products destined for international markets in compliance with strict quality, traceability, and cold-chain integrity requirements. The production process relies on freezing tunnels to ensure rapid product stabilization and preservation of quality standards required for export. In 2022, Empacreci was the fifth largest shrimp exporters, exporting over 78 million pounds of shrimp every year, with an estimated annual consumption of R-507A at approximately 0.9 metric tonnes or 3,527 CO₂-eq tonnes.

88. The demonstration project proposes to replace the R-507-based system with a centralized low-temperature (-40°C) recirculated system (pumped recirculation/overfeed) based on NH₃. The new system will be installed in a dedicated machinery room and will distribute liquid NH₃ to evaporators through a low-temperature separator and controlled liquid recirculation, ensuring stable operation under high-load industrial conditions. The installation includes an industrial screw compressor rack, evaporative condensers, liquid receivers, and extensive copper piping distribution to evaporators located inside each blast tunnel. Beyond refrigerant substitution, the installation integrates optimized system architecture, modular compressor capacity control, continuous performance monitoring through SCADA¹³ and structured energy performance verification. The system is designed specifically for low-temperature freezing applications under continuous industrial load conditions and tropical ambient temperatures typical of Guayaquil. The installation will ensure full compatibility with the existing brine distribution system at the facility.

89. The beneficiary will self-finance the full NH₃ equipment package (US \$1,403,743), contributing 74 per cent of total project cost.

Proposed activities as submitted

90. The following activities and costs were proposed for the implementation of the project:

- (a) Commissioning, supply and installation of an NH₃-based refrigeration system, including low-temperature compressors, separator, condensers, liquid receiver, evaporators, valve stations, electrical and control systems, safety devices, and engineering and supervision services (US \$1,403,743); and associated mechanical works (US \$432,000) (total of US \$1,835,743);
- (b) Engagement of technical experts to provide guidance and support in the commissioning and installation of new refrigeration systems, review designs, ensure compliance with best practices, train staff on new system operation and maintenance, assist in regulatory

¹³ Supervisory Control and Data Acquisition (SCADA) is a system of software and hardware elements that allows organizations to control and monitor industrial processes by directly interfacing with plant-floor machinery and viewing real-time data.

compliance and certification processes, monitor progress and prepare technical reports (US \$20,000);

- (c) Baseline energy audits carried out to establish pre-installation energy usage, post-installation energy assessments to measure efficiency gains, comparative analysis of energy data to assess overall system performance, preparation of reports detailing energy savings and recommendations for optimization, data logging, verification analysis and dissemination of findings to stakeholders to support wider adoption (US \$10,000); and
- (d) Development of a draft proposal for MEPS for centralized industrial refrigeration systems, including technical assessment of currently used technologies, benchmarking against international best practices, identification of minimum performance thresholds, stakeholder consultations, and technical workshops with industry representatives, engineering firms, government authorities, and energy regulators to ensure feasibility and sectoral buy-in (US \$30,000).

Cost of the pilot project as submitted

91. Out of a total cost of US \$1,895,743, plus agency support costs, as initially submitted, US \$492,000 has been requested from the Multilateral Fund, and US \$1,403,743 (74 per cent of total project cost) will be provided through co-financing by the beneficiary for the commissioning, supply and installation of all components of an NH₃-based refrigeration system. The project is expected to be completed within 36 months from approval, between July 2026 and June 2029. The cost breakdown of the project is presented in table 2.

Table 2. Project activities, total budget and cost breakdown by source, as submitted

Item		Project cost (US \$)		
		Total	MLF grant	Co-financing
Component 1: Equipment and installation process	NH ₃ equipment and controls	1,403,743	0	1,403,743
	Mechanical installations	432,000	432,000	0
	Subtotal Component 1	1,835,743	432,000	1,403,743
Component 2: Technical assistance	Consultants and experts on energy efficiency	20,000	20,000	0
	Assessment of energy gains	10,000	10,000	0
	Development of a draft proposal for MEPS for condensing units and centralized systems	30,000	30,000	0
	Subtotal Component 2	60,000	60,000	0
Total		1,895,743	492,000	1,403,743

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

92. 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

93. This proposal meets the eligibility criteria of decision 95/87(d), since it has been submitted prior to the 100th meeting of the Executive Committee, and the activities proposed are in line with the criteria of decision 91/65(b)(i)d., since they are part of a project in the servicing sector and were not previously funded. In line with decision 91/65(b)(iv), the Government of Ecuador has confirmed that the NOU would coordinate with the MEM and the INEN to facilitate consideration of refrigerant transition when developing energy-efficiency standards; that if Ecuador 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.

Minimum energy performance standards

94. Despite having established standards for domestic refrigeration and small-capacity AC equipment, Ecuador does not currently have system-level MEPS for large-capacity commercial and industrial refrigeration systems. In the absence of system-level MEPS for centralized industrial refrigeration, the project will apply internationally recognized energy performance measurement methodologies to ensure robust documentation of efficiency gains and to support the future development of system-level performance benchmarks in the country.

Technical and cost-related issues

Technology selection and calculation of costs

95. UNIDO explained that continued use of HFC systems and other low-GWP options were assessed, but NH₃-based technology was selected because of its zero-GWP, superior thermodynamic performance at low temperatures (-40°C) which is particularly important for industrial freezing applications, higher energy efficiency compared to equivalent HFC systems, proven reliability in large-capacity industrial food processing facilities, long equipment lifespan, and lower lifetime operating costs despite higher initial capital expenditure. NH₃-based technology adoption in Ecuador has been limited by higher upfront costs, safety requirements, and the need for specialized technical skills. The project addresses these barriers by supporting installation, enabling a structured transition, and generating practical experience to facilitate broader replication in the sector. Beyond refrigerant substitution, the installation integrates optimized system architecture, modular compressor capacity control, continuous performance monitoring, and structured energy-performance verification.

96. The enterprise will finance the full cost of the NH₃ equipment and controls (US \$1,403,743), which represents the core technological investment and demonstrates ownership and commitment to adopt a zero-GWP solution. To avoid fragmented procurement of an integrated industrial system and to ensure full compatibility with the existing process and operational requirements, equipment selection and supply will be managed and financed by the enterprise and no funds are being requested for the equipment package. Instead, the costs of mechanical installation and safety-driven works required to implement the NH₃ solution under industrial conditions, including piping and accessories, mechanical assembly, insulation and electric cabling, are requested in the proposal along with technical assistance.

97. The Secretariat enquired about comparative costs and UNIDO estimated that replacing the system with another R-507A-based system would cost approximately US \$800,000 compared to the cost of an NH₃-based system (US \$1.8 million). The Secretariat inquired about the division of costs since typically the Multilateral Fund pays for equipment; UNIDO explained that, given the complexity of the project, allocating Multilateral Fund resources to installation helps avoid fragmenting of procurement of an integrated package, which is critical to guarantee system compatibility, performance, and safety. UNIDO further explained that experience from other projects had shown that splitting procurement, with some components financed separately, could create technical and operational challenges, particularly in large industrial systems. Unlike modular or standalone equipment, this project involves a highly integrated system, where compressors, piping, controls, and safety elements must function as a single engineered solution.

98. Upon discussion of the cost elements, it was agreed to reduce the funds covered by the Multilateral Fund for component 1 of the demonstration project from US \$432,000 to US \$399,600. A reduction of US \$32,400 was applied to the overall cost of mechanical installations, noting that in the event of cost overruns during installation, the enterprise will cover any additional costs beyond the approved project budget and will not require additional funding from the Multilateral Fund. In addition, the budget for the development of a draft proposal for MEPS for condensing units and centralized systems (component 2) was reduced by US \$10,000, on the understanding that this activity would find efficiencies during the KIP and HPMP implementation. The level of funding agreed upon will help ensure that the beneficiary is motivated to participate and actively promote the adoption of this technology. It will also support the proper design and engineering of the project, leading to improved performance, fewer technical issues, and greater confidence in the technology's reliability and long-term viability.

Selection of beneficiary

99. UNIDO explained that the beneficiary was selected due to their strong ownership and commitment to the transition to low-GWP alternatives to HFCs. The enterprise was evaluating options to upgrade its refrigeration system in response to operational and efficiency considerations. In the absence of the project, the most likely pathway would have been a like-for-like replacement based on conventional HFC technology. The proposed project enables an accelerated transition to a zero-GWP NH₃-based system, aligned with energy performance objectives and national Kigali Amendment commitments.

Monitoring

100. The funding recommended includes baseline energy audits to establish pre-installation energy usage, perform post-installation energy assessments to measure efficiency gains, analyze and compare energy data to assess overall system performance, prepare reports detailing energy savings and recommendations for optimization, and share findings with stakeholders to support wider adoption for replication. In addition, the beneficiary has committed to implementing a structured preventive maintenance programme covering compressors, condensers, evaporators, control systems, and safety components, including gas detection and ventilation systems. The system will operate under continuous monitoring of key performance parameters (pressures, temperatures, load factors, and electricity consumption), allowing early detection of inefficiencies and preventive corrective actions.

Cost of the pilot project as agreed

101. The agreed cost of the pilot project to replace an R-507A-based centralized refrigeration system with an NH₃-based recirculated system at a shrimp processing plant in Ecuador amounts to US \$1,853,343, including a Multilateral Fund grant of US \$449,600 and co-funding by the beneficiary of US \$1,403,743, as shown in table 3.

Table 3. Project activities, total budget and cost breakdown by source, as agreed

Item		Project cost (US \$)		
		Total	MLF grant	Co-financing
Component 1: Equipment and installation process	NH ₃ equipment and controls	1,403,743	0	1,403,743
	Mechanical installations	399,600	399,600	0
	Subtotal Component 1	1,803,343	399,600	1,403,743
Component 2: Technical assistance	Consultants and experts on energy efficiency	20,000	20,000	0
	Assessment of energy gains	10,000	10,000	0
	Development of a draft proposal for MEPS for condensing units and centralized systems	20,000	20,000	0
	Subtotal Component 2	50,000	50,000	0
Total		1,853,343	449,600	1,403,743

Energy-efficiency enhancements and estimated savings

102. Based on the proposal's operational parameters, the baseline system consumes about 7.3 GWh of electricity annually (600–610 MWh per month), costing an estimated US \$55,000–65,000 per month at typical industrial tariffs. With the NH₃-based system and the expected coefficient of performance (COP) improvement from 1.35 to 1.65, annual consumption is projected to fall to roughly 5.9 GWh (490–500 MWh per month), reducing monthly electricity costs to about US \$45,000–55,000. The difference between the baseline technology and the NH₃-based system using the average cooling load, COP, and annual electricity use amounts to 1,321,374 kWh/year of avoided emissions. This represents estimated savings of US \$10,000–12,000 per month, or US \$120,000–140,000 per year. These values align with the proposal's indicative performance gains and will be confirmed through measurement and verification under Component 2.

Sustainability, replicability and assessment of risks

103. Potential risks to the sustainability of the project results include delays in equipment manufacturing or delivery, integration challenges between the new NH₃-based system and existing infrastructure, safety risks associated with NH₃ handling, cost overruns during installation, exchange rate fluctuations affecting equipment imports, temporary production interruption during installation, insufficient technical capacity for the operation of an NH₃-based system, accidental NH₃ release and delays in performance verification activities. The overall risk level of the project is considered moderate, given the technical maturity of NH₃-based systems and the financial commitment of the participating enterprise.

104. The risks will be mitigated through early procurement planning, relevant contractual clauses, use of fixed-price contracts in US dollars where feasible, internal financial oversight, detailed engineering design, involvement of experienced industrial refrigeration experts, phased commissioning and installation schedules coordinated with the production process, inclusion of buffer periods in the implementation schedule, assured compliance with international safety standards, installation of gas detection and ventilation systems, employment of industrial-grade containment systems and pressure-relief valves, provision of operator training and emergency response protocols, implementation of a preventive maintenance programme, continuous monitoring, targeted technical supervision, and early installation of data-logging systems.

105. The project's results are expected to be highly replicable across Ecuador's seafood processing sector. Technical findings, including system design parameters, commissioning procedures, safety architecture, and measured energy performance, will be compiled in a final report for dissemination to industrial refrigeration stakeholders. Nationwide, an estimated 25 shrimp-processing plants operate with refrigeration systems of similar scale, and roughly 50 additional agro-industrial facilities use centralized systems with comparable temperature and operating profiles. Given their reliance on R-507A and R-404A, continuous operation, and low-temperature freezing needs, these facilities present strong replication potential. The project will therefore generate practical experience directly applicable to a substantial share of Ecuador's industrial refrigeration market.

RECOMMENDATION

106. The Executive Committee may wish to consider:

- (a) Approving the project to replace an R-507A-based centralized refrigeration system with an ammonia-based recirculated system at a shrimp processing enterprise in Ecuador, in the amount of US \$449,600, plus agency support costs of US \$31,472 for UNIDO;

(b) Noting:

- (i) That the Government of Ecuador has committed to the conditions referred to in decision 91/65(b)(iv)b. to d.;
- (ii) That the Government of Ecuador, upon completion of the project, will develop minimum energy performance standards for centralized industrial refrigeration systems, which will include technical specifications, performance metrics including coefficient-of-performance benchmarks at defined operating conditions, compliance pathways, and implementation recommendations; and
- (iii) That the project will be operationally completed no later than 30 June 2029, and a detailed project report will be submitted to the Executive Committee within six months of the date of completion, including a detailed description of activities undertaken to disseminate the results of the technology demonstration and to promote the adoption of the selected energy-efficient alternative technologies.

Annex I

TEXT TO BE INCLUDED IN THE UPDATED AGREEMENT BETWEEN THE GOVERNMENT OF ECUADOR AND THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE REDUCTION IN CONSUMPTION OF HYDROFLUOROCARBONS IN ACCORDANCE WITH STAGE I OF THE KIGALI HFC IMPLEMENTATION PLAN

2. [...] and in respect to any consumption of Annex F substances that exceeds the levels defined in rows 4.1.3 and 4.2.3 (remaining consumption eligible for funding).

9. [...] The Country agrees to evaluations, which might be carried out **under the evaluation work programme** of the Multilateral Fund or the evaluation programme of the Lead IA taking part in this Agreement.

17. This updated Agreement supersedes the Agreement reached between the Government of Ecuador and the Executive Committee at the 97th meeting of the Executive Committee.

APPENDIX 1-A: THE SUBSTANCES

Substances	Starting point for aggregate reductions in consumption (CO ₂ -eq tonnes)
HFCs	To be determined (TBD)
HFCs contained in imported pre-blended polyols	96,263

APPENDIX 2-A: THE TARGETS, AND FUNDING

Row	Particulars		2022*	2023	2024	2025	2026	2027	2028	2029	Total
1.1	Montreal Protocol reduction schedule of Annex F substances	%	n/a	n/a	freeze	freeze	freeze	freeze	freeze	10	n/a
		CO ₂ -eq tonnes	n/a	n/a	3,179,294	3,179,294	3,179,294	3,179,294	3,179,294	2,861,365	n/a
1.2	Maximum allowable total consumption of Annex F substances	Reduction in %	n/a	n/a	0.0	3.0	5.9	8.7	11.5	14.1	n/a
		CO ₂ -eq tonnes	n/a	n/a	3,179,294	3,083,915	2,991,398	2,901,656	2,814,606	2,730,168	n/a
2.1	Lead IA (UNIDO) agreed funding (US \$)		267,885	292,600	0	0	789,364	0	0	72,930	1,422,779
2.2	Support costs for Lead IA (US \$)		18,752	20,482	0	0	55,255	0	0	5,105	99,594
3.1	Total agreed funding (US \$)		267,885	292,600	0	0	789,364	0	0	72,930	1,422,779
3.2	Total support costs (US \$)		18,752	20,482	0	0	55,255	0	0	5,105	99,594
3.3	Total agreed costs (US \$)		286,637	313,082	0	0	844,619	0	0	78,035	1,522,373
4.1.1	Deduction of HFCs under this Agreement (CO ₂ -eq tonnes)										434,225
4.1.2	Deduction of HFCs from previously approved projects (CO ₂ -eq tonnes)										14,901
4.1.3	Remaining eligible consumption for HFCs (CO ₂ -eq tonnes)										TBD
4.2.1	Deduction of HFCs contained in imported pre-blended polyols under this Agreement (CO ₂ -eq tonnes)										96,263
4.2.2	Deduction of HFCs contained in imported pre-blended polyols from previously approved projects (CO ₂ -eq tonnes)										0
4.2.3	Remaining eligible consumption for HFCs contained in imported pre-blended polyols (CO ₂ -eq tonnes)										0

* Conversion of one commercial and domestic refrigerator manufacturing line at the enterprise Induglob, approved by decision 91/59 to phase out 14,901 CO₂-eq tonnes (10.42 mt) of HFC-134a.