



**United Nations
Environment
Programme**

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/82/48
2 November 2018

ORIGINAL: ENGLISH



EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Eighty-second Meeting
Montreal, 3-7 December 2018

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 I, fourth tranche) UNIDO/ UNEP

Refrigeration

- Conversion of the manufacturing of domestic and commercial refrigerators from HFC-134a and R-404A to isobutene (R-600a) and propane (R-290) at Ecasa UNIDO

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

Ecuador

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase-out management plan (Stage I)	UNEP, UNIDO (lead)	65 th	35% by 2020

(II) LATEST ARTICLE 7 DATA (Annex C Group I)	Year: 2017	18.13 (ODP tonnes)
--	------------	--------------------

(III) LATEST COUNTRY PROGRAM SECTORAL DATA (ODP tonnes)						
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Total sector consumption
				Manufacturing	Servicing	
HCFC-22					15.89	15.89
HCFC-123					0.03	0.03
HCFC-124					0.01	0.01
HCFC-141b		2.17				2.17
HCFC-141b in imported pre-blended polyols		12.99				12.99
HCFC-142b		0.02				0.02

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	23.49	Starting point for sustained aggregate reductions:	44.16
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	28.03	Remaining:	16.13

(V) BUSINESS PLAN		2018	2019	2020	Total
UNIDO	ODS phase-out (ODP tonnes)	1.02	0.00	0.65	1.67
	Funding (US \$)	92,987	0	59,125	152,112
UNEP	ODS phase-out (ODP tonnes)	0.30	0.0	0.12	0.42
	Funding (US \$)	28,250	0	11,300	39,550

(VI) PROJECT DATA			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Montreal Protocol consumption limits			n/a	n/a	23.49	23.49	21.14	21.14	21.14	21.14	21.14	15.27	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	23.49	23.49	21.14	21.14	21.14	21.14	21.14	15.27	n/a
Agreed funding (US\$)	UNIDO	Project costs	1,531,940	0	86,500	0	0	86,500	0	518,219	0	55,000	2,278,159
		Support costs	114,896	0	6,488	0	0	6,487	0	36,707	0	4,125	168,703
	UNEP	Project costs	30,000	0	20,000	0	0	30,000	0	25,000	0	10,000	115,000
		Support costs	3,900	0	2,600	0	0	3,900	0	3,250	0	1,300	14,950
Funds approved by ExCom (US\$)	Project costs	1,561,940	0	106,500			116,500		*431,719				2,216,659
	Support costs	118,796	0	9,088			10,387		30,220				168,491
Total funds requested for approval at this meeting (US\$)	Project costs									111,500			111,500
	Support costs									9,737			9,737

*Foam investment project approved at the 81st meeting and subsumed under the Agreement.

Secretariat's recommendation:	Blanket approval
-------------------------------	------------------

PROJECT DESCRIPTION

1. On behalf of the Government of Ecuador, UNIDO as the lead implementing agency has submitted a request for funding for the fourth tranche of stage I of the HCFC phase-out management plan (HPMP), at a total cost of US \$121,237, consisting of US \$86,500, plus agency support costs of US \$6,487 for UNIDO, and US \$25,000, plus agency support costs of US \$3,250 for UNEP.¹ The submission includes a progress report on the implementation of the third tranche, the verification report on HCFC consumption for 2013 to 2017 and the tranche implementation plan for 2018 to 2020.

Report on HCFC consumption

HCFC consumption

2. The Government of Ecuador reported a consumption of 18.13 ODP tonnes of HCFC in 2017, which is 23 per cent below the HCFC baseline for compliance. The 2013-2017 HCFC consumption is shown in Table 1.

Table 1. HCFC consumption in Ecuador (2013-2017 Article 7 data)

HCFC	2013	2014	2015	2016	2017	Baseline
Metric tonnes (mt)						
HCFC-22	346.18	356.97	347.10	310.21	288.95	382.27
HCFC-123	3.36	6.27	1.27	4.43	1.74	9.18
HCFC-124	5.40	0	0.44	0.30	0.54	9.99
HCFC-141b	22.15	14.80	8.70	9.91	19.73	7.84
HCFC-142b	5.58	1.41	0.27	0.18	0.33	18.45
(Sub-total / Total) (mt)	382.67	379.45	357.78	325.03	311.29	427.73
HCFC-141b in imported pre-blended polyols*	95.61	140.72	142.56	181.07	118.09	187.91**
Total (mt)	478.28	520.17	500.34	506.10	429.38	615.64
ODP tonnes						
HCFC-22	19.04	19.63	19.09	17.06	15.89	21.02
HCFC-123	0.07	0.13	0.03	0.09	0.03	0.18
HCFC-124	0.12	0.00	0.01	0.01	0.01	0.22
HCFC-141b	2.44	1.63	0.96	1.09	2.17	0.86
HCFC-142b	0.36	0.09	0.02	0.01	0.02	1.20
(Sub-total / Total) (ODP tonnes)	22.03	21.48	20.10	18.26	18.13	23.49
HCFC-141b in imported pre-blended polyols*	10.52	15.48	15.68	19.92	12.99	20.67**
Total (ODP tonnes)	32.55	36.96	35.78	38.18	31.11	44.16

*Country programme data.

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

3. The decrease in HCFC-22 consumption is due to the activities implemented under the HPMP (training of technicians and promotion of alternatives), the availability of new alternatives being introduced in the market, and an economic slowdown in the country. The increase in HCFC-141b consumption in 2017 is due to its increased use for flushing refrigeration circuits during servicing.

Country programme (CP) implementation report

4. The Government of Ecuador reported HCFC sector consumption data under the 2017 CP implementation report that is consistent with the data reported under Article 7 of the Montreal Protocol.

¹ As per the letter of 19 September 2018 from the Ministry of Industries and Productivity of Ecuador to UNIDO.

Verification report

5. The verification report confirmed that the Government is implementing a licensing and quota system for HCFC imports and exports, that the total HCFC consumption in 2017 was 18.13 ODP tonnes, and that HCFC consumption between 2013 and 2017 was below the Montreal Protocol targets and the maximum allowable consumption levels in the Agreement between the Government and the Executive Committee. The verification concluded that the licensing and quota system applied by the National Ozone Unit (NOU) and the National Customs Service of Ecuador (SENAE) ensures full compliance with the Montreal Protocol targets.

Progress report on the implementation of the third tranche of the HPMP

Legal framework

6. The country has put in place a ban on the manufacturing and import of HCFC-based air conditioners as of December 2018, and a ban on the manufacturing and import of domestic refrigeration equipment using HCFCs in thermal insulation and HCFCs and HFCs as refrigerants as of March 2019. The Government is currently preparing, starting from 1 January 2020, a ban on the import of pure HCFC-141b, and an enforcement of the commitment not to issue any import quota for HCFC-141b contained in pre-blended polyols, except for a maximum of 0.86 ODP tonnes (7.78 metric tonnes) for spray foam for 2020 and 2021 (decision 81/47(c)(i)).

7. The NOU attended a regional workshop on ODS identification and the prevention of illegal trade in Mexico in August 2017; 140 customs officers were trained on ODS regulation, customs codes application for HCFCs and HFCs and prevention of ODS illegal trade; three refrigerant identifiers were delivered to SENAE, and training on their use was provided to six officers from the Customs Laboratory.

8. As per the agreement signed in May 2018, the Ministry of Industries and Productivity (MIPRO) will provide training to SENAE on a systematic basis on ODS regulations, Montreal Protocol and prevention of ODS illegal trade; both institutions are obliged to report findings and exchange information. SENAE's online platform, shared with MIPRO, now alerts ports of entry regarding mandatory inspection of HCFCs and HFCs. Import of HFCs has also been controlled through licenses (without quota) and importers must submit quarterly report on the quantities of HFCs imported.

Polyurethane (PU) foam manufacturing sector

9. Induglob (formerly Indurama) converted to cyclopentane prior to the implementation of the third tranche, phasing out 136 mt (14.96 ODP tonnes) of HCFC-141b contained in imported pre-blended polyols. The launch of the investment project for the remaining eligible PU foam enterprises to phase out 44.10 mt (4.85 ODP tonnes) of HCFC-141b contained in imported pre-blended polyols approved at the 81st meeting² is planned for October 2018.

Refrigeration servicing sector

10. Training on good practices and HCFC alternatives was provided to 25 trainers in the SECAP (Servicio Ecuatoriano de Capacitación Profesional) centres and to 322 refrigeration technicians nationwide; a pilot zero-leak project has commenced with the "Supermaxi" supermarket (indicators and logbooks have been set up); and the management plan for the development of a refrigerant reclamation centre has been prepared.

² Approved at the total cost of US \$431,719 (decision 81/47).

11. As part of the activities to support the Government initiative to declare the Galapagos Islands free of ODS before 2020, 21 refrigeration technicians were trained and tools were provided for good refrigeration practices.

Project implementation and monitoring

12. The implementation of the HPMP is coordinated by the NOU placed within MIPRO.

Level of fund disbursement

13. As of August 2018, of the US \$1,784,940 approved so far,³ US \$1,733,066 had been disbursed (US \$1,671,066 for UNIDO and US \$62,000 for UNEP) as shown in Table 2. The balance of US \$51,874 will be disbursed in 2019 and 2020.

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

Tranche		UNIDO	UNEP	Total	Disbursement rate (%)
First tranche	Approved	1,531,940	30,000	1,561,940	100.0
	Disbursed	1,531,940	30,000	1,561,940	
Second tranche	Approved	86,500	20,000	106,500	100.0
	Disbursed	86,500	20,000	106,500	
Third tranche	Approved	86,500	30,000	116,500	55.5
	Disbursed	52,626	12,000	64,626	
Total	Approved	1,704,940	80,000	1,784,940	97.1
	Disbursed	1,671,066	62,000	1,733,066	

Implementation plan for the fourth tranche of the HPMP

14. The following activities will be implemented between September 2018 and September 2020:
- (a) Strengthening of the ODS legal framework (UNEP) (US \$25,000): revision of the technical regulation for manufacturing and import of commercial refrigeration equipment; and training of 30 customs officers and other enforcement officers;
 - (b) Technical assistance for the refrigeration servicing sector (UNIDO) (US \$76,500): training of 25 instructors and 200 refrigeration technicians at SECAP centres; training of 60 university students on safe handling of flammable refrigerants; procurement of basic tools and equipment (e.g. recovery units, vacuum pumps, manifolds, cylinders and other small tools) for four SECAP centres; replication of the zero-leak initiative with one or two end users in different sectors; establishment of a reclamation centre (one reclaiming unit to be purchased) and continuation of the support to the Galapagos Islands initiative;
 - (c) Activities postponed from previous tranches (UNEP/UNIDO) (funding from previous tranches): update of the technical standard to include safety issues linked to the handling, transport, recovery, recycling and storage of flammable refrigerants; implementation of a pilot project to replace an HCFC-22-based condensing unit with equipment designed to operate with R-290 (these activities had been postponed to allow more research on international standards and to define various aspects of implementation);

³ Excluding the amount of US \$431,719 approved for the foam investment project at the 81st meeting.

- (d) Continued implementation of the foam investment project approved at the 81st meeting (UNIDO) (funding approved at the 81st meeting); and
- (e) Implementation, monitoring and control (UNIDO) (US \$10,000): Continued implementation of activities within the HPMP; and preparation of relevant progress reports.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Report on HCFC consumption and verification report

15. The verification report indicated that in the five years verified there was only a 0.02 ODP-tonne difference in HCFC-124 consumption between Article 7 and verified data in 2014. This minor inconsistency does not represent a risk of non-compliance. Nevertheless, UNIDO will ask the NOU to submit the amended report for 2014.

16. Based on the import data in the verification report, one enterprise imported a slightly higher amount than the quota (0.03 ODP tonnes). UNIDO indicated that the NOU is aware of this situation and is working to resolve it. The importer was reported and its quota for next year will be reduced by which the approved amount was exceeded. Penalization of the importer is also being considered. An update on the measures taken by the country to avoid any import above the authorized individual quotas is requested to be submitted with the fifth tranche request.

Progress report on the implementation of the third tranche of the HPMP

Legal framework

17. The Government of Ecuador has issued HCFC import quotas for 2018 at 19.03 ODP tonnes, which is lower than the Montreal Protocol control targets.

Refrigeration servicing sector

18. The Secretariat discussed with UNIDO the need for an additional reclamation unit and the associated business model, noting that a reclaiming machine is installed on SECAP premises. UNIDO clarified that the existing unit was used for didactic purposes and could not reprocess large amounts of refrigerants. The reclaiming centre targets end users with stored refrigerant that will be reclaimed for a fee and returned to the owner. The reclamation centre will be capable of reclaiming multiple refrigerants, including 170 kg of HFC-134a recovered under an earlier energy-efficiency programme implemented by the Government.

19. UNIDO also confirmed that certification for refrigerant recovery, recycling and reclaiming, as well as for good refrigeration practices is provided by SETEC (Secretaría Técnica del Sistema Nacional de Evaluación Profesional). Obtaining the certification is recommended to the technicians, but it is not mandatory.

20. The Secretariat expressed concern over the increase in HCFC-141b consumption for flushing refrigeration circuits during servicing. UNIDO clarified that some importers have been promoting this practice. The implementing agencies have been discouraging the initiative through workshops and trainings provided to trainers and technicians, including training on cleaning refrigeration equipment without solvent

and using high-efficiency filters (currently not available in Ecuador, but being promoted and expected to enter the market). Following the approval of the investment project to phase out HCFC-141b contained in imported pre-blended polyols in the PU foam sector at the 81st meeting, MIPRO is preparing, starting from 1 January 2020, a ban on the import of pure HCFC-141b, that is to be enforced together with the commitment of the Government of Ecuador not to issue any import quota for HCFC-141b contained in pre-blended polyols, except for a maximum of 0.86 ODP tonnes (7.78 metric tonnes) for spray foam for 2020 and 2021 (decision 81/47(c)(i)).

21. Regarding the availability and promotion of more climate-friendly alternatives to HCFCs, UNIDO indicated that R-290 and R-600a are present in the market, and that R-600a-based domestic refrigerators and some R-290-based commercial refrigeration equipment are also available. The country is encouraging the use of those alternatives *inter alia* through the inclusion of R-600a-based domestic refrigerators in the training of refrigeration technicians, as well as through the distribution of these refrigerators to training centres, public awareness programmes and promotion through dealers.

Conclusion

22. The Government of Ecuador is in compliance with the Montreal Protocol and its Agreement with the Executive Committee. The HCFC import licensing and quota system was further improved, 140 customs officers were trained, and the country has put in place a ban on the manufacturing and import of HCFC-based air conditioners and domestic refrigeration equipment using HCFCs in thermal insulation and HCFCs and HFCs as refrigerants. The foam investment project for the remaining eligible PU foam enterprises will be launched in October 2018. Training was provided to 322 refrigeration technicians nationwide, the end-user programme has successfully commenced and the certification scheme is in place. The total disbursement rate is 97.1 per cent. Activities planned under the fourth tranche, in particular further training of technicians, strengthening of SECAP centres, the establishment of a reclamation centre and the proposed ban on the import of pure HCFC-141b, as well as the commitment of the Government of Ecuador, as of 1 January 2020, not to issue any import quota for HCFC-141b contained in pre-blended polyols, except for a maximum of 0.86 ODP tonnes (7.78 metric tonnes) for spray foam for 2020 and 2021, will ensure effective HCFC phase-out.

RECOMMENDATION

23. The Fund Secretariat recommends that the Executive Committee:

- (a) Take note of:
 - (i) The progress report on the implementation of the third tranche of stage I of the HCFC phase-out management plan (HPMP) for Ecuador;
 - (ii) The commitment to implement a ban on the import of pure HCFC-141b as of 1 January 2020; and
- (b) Request the Government of Ecuador, UNIDO and UNEP to include in the fifth tranche an update on the measures taken by the country to ensure that HCFC imports by individual importers do not exceed the issued quotas.

24. The Fund Secretariat further recommends blanket approval of the fourth tranche of stage I of the HPMP for Ecuador and the corresponding 2018-2020 tranche implementation plan, at the funding levels shown in the table below:

	Project title	Project funding (US \$)	Support costs (US \$)	Implementing agency
(a)	HCFC phase-out management plan (stage I, fourth tranche)	86,500	6,487	UNIDO
(b)	HCFC phase-out management plan (stage I, fourth tranche)	25,000	3,250	UNEP

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT

Ecuador

PROJECT TITLE

BILATERAL/IMPLEMENTING AGENCY

Conversion of the manufacturing of domestic and commercial refrigerators from HFC-134a and R-404A to isobutane (R-600a) and propane (R-290) at Ecasa	UNIDO
--	-------

NATIONAL COORDINATING AGENCY	Ministry of Industries and Productivity of Ecuador
------------------------------	--

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (METRIC TONNES (MT), 2017)

HFCs	n/a
------	-----

B: COUNTRY PROGRAMME SECTORAL DATA (MT, 2017)

HFCs	n/a
------	-----

HFC consumption remaining eligible for funding (mt)	n/a
---	-----

CURRENT YEAR BUSINESS PLAN ALLOCATIONS	Enterprise name	Funding (US \$)	Phase-out (mt)
	Ecasa	71,710	8.80

Particular	Units	HFC-134a	R-404A
HFC used at enterprise:	mt	2.32	3.52
	mt CO ₂ -eq	3,317.60	13,805.44
HFC to be phased out through this project:	mt	2.32	3.52
	mt CO ₂ -eq	3,317.60	13,805.44
HFC alternatives to be phased in:	Units	R-600a	R-290
	mt	1.16	1.76
	mt CO ₂ -eq	3.48	5.28
Project duration (months):			24
Initial amount requested (US \$):			235,190
Final project costs (US \$):			
Incremental capital costs:			184,800
Contingency (10 %):			14,680
Incremental operating costs:			*n/a
Total project cost:			199,480
Local ownership (%):			100
Export component (%):			0
Requested grant (US \$):			199,480
Cost-effectiveness:	US \$/kg		34.16
	US \$/mt CO ₂ -eq		11.65
Implementing agency support costs (US \$):			17,953
Total cost of project to Multilateral Fund (US \$):			217,433
Counterpart funding (Y/N):			Y
Project monitoring milestones included (Y/N):			Y

*Not available as a detailed review of the IOC did not take place

SECRETARIAT'S RECOMMENDATION	For individual consideration
------------------------------	------------------------------

PROJECT DESCRIPTION

Background

Consideration of the projects for Ecasa and Induglob at the 81st meeting

25. On behalf of the Government of Ecuador, UNIDO submitted to the 81st meeting two project proposals for the phase-out of HFCs in line with decision 78/3(g):

- (a) Conversion of the manufacturing of domestic and commercial refrigerators⁴ at Ecasa from HFC-134a and R-404A to isobutane (R-600a) and propane (R-290), at a total cost of US \$235,190, plus agency support costs of US \$21,167; and
- (b) Conversion of the manufacturing of commercial refrigerators at Induglob from HFC-134a to isobutane (R-600a) and propane (R-290), at a total cost of US \$319,370, plus agency support costs of US \$22,356. UNIDO submitted this project proposal without receiving preparation funding from the Multilateral Fund.

26. Further to discussions with UNIDO on technical and cost aspects of the proposals, the Secretariat recommended that the Executive Committee consider approving the project proposal for Ecasa in the amount of US \$199,480, plus agency support costs of US \$17,953 and the project proposal for Induglob in the amount of US \$220,660, plus agency support costs of US \$19,859.⁵

27. At the 81st meeting, the Executive Committee considered both proposals, but did not approve them owing to concerns raised during the discussion in the contact group established for the discussion of HFC investment projects. In the case of Induglob, some members did not support the proposal as the Executive Committee had decided not to approve preparatory funding for that project. In the case of Ecasa, concerns were raised in relation to the project's cost-effectiveness and the fact that it did not account for potential incremental savings, as there was no discussion about incremental operational costs (IOCs) that were not requested in the project. Another issue discussed by the contact group was the need to take into consideration the geographic distribution of proposals approved by the Executive Committee.

28. As a result of the discussions, the Executive Committee decided that those HFC investment projects about which concerns had been expressed at the 81st meeting could be resubmitted in accordance with decision 79/45⁶ only if those specific concerns had been addressed (decision 81/53(c)).

Re-submission of the project for Ecasa for consideration at the 82nd meeting

29. On behalf of the Government of Ecuador, UNIDO has re-submitted to the 82nd meeting the project to convert the manufacturing of domestic and commercial refrigerators at Ecasa from HFC-134a and R-404A to R-600a and R-290, at a total cost of US \$199,480, plus agency support costs of US \$17,953.

30. The project for Ecasa submitted to the 82nd meeting is the same as the proposal submitted at the 81st meeting, adjusted after discussions with the Secretariat. The following sections⁷ comprise a description

⁴ For the purpose of the present document, commercial refrigerators refer to stand-alone appliances used in the commercial refrigeration sector, which contain HFC refrigerant charges below 500 grams.

⁵ UNEP/OzL.Pro/ExCom/81/32.

⁶ Decision 79/45 states that all submitted HFC investment projects should have broad replicability within the country, region or sector, and should take into account geographic distribution.

⁷ Information was extracted from document UNEP/OzL.Pro/ExCom/81/32 where relevant.

of the proposal, the Secretariat's comments including the discussion on how the concerns at the 81st meeting have been addressed in the present resubmission, and a recommendation.

HFC consumption

31. Based on the data reported under the surveys on ODS alternatives submitted to the 78th meeting, a total of 813.1 mt of HFCs (pure and in blends) were imported in 2015 into Ecuador. The main HFCs were HFC-134a (461.9 mt representing 56.8 per cent of the total consumption), R-404A (113.5 mt representing 14.0 per cent), R-410A (103.1 mt representing 12.7 per cent), and R-507A (85.6 mt, representing 10.5 per cent). The remaining consumption (49.0 mt representing 6.0 per cent) included one pure HFC (HFC-152a) and six blends of HFCs.

32. In 2017, 897.15 mt of HFCs were imported into Ecuador, including 509.51 mt of HFC-134a (57.0 per cent) and 108.43 mt of R-404A (12.0 per cent). Table 1 presents the imports of HFC-134a and R-404A between 2012 and 2017 as presented in the proposal.

Table 1. Imports of HFC-134a and R-404A in Ecuador (2012–2017) (mt)

Substance	2012	2013	#	2014	2015	2016	2017
HFC-134a	265.19	351.08	#	484.35	521.37	485.81	509.51
R-404A	43.33	81.00	#	116.31	120.95	107.33	108.43
Total	308.52	432.08	#	600.66	642.32	593.14	617.94

33. In 2017, the total consumption of HFC-134a and R-404A in the domestic and commercial refrigerator manufacturing sector was estimated at 21.81 mt and 3.52 mt, respectively. Practically all the consumption is by two enterprises, Ecasa and Induglob, with 0.10 mt of HFC-134a used by a few small and medium size enterprises (SMEs) providing technical assistance and assembly of small refrigeration equipment, as shown in Table 2.

Table 2. HFC-134a and R-404A use in domestic and commercial refrigerators (2017) (mt)

Enterprise	HFC-134a	R-404A
Ecasa	2.32	3.52
Induglob	19.39	0.00
Others (Fibroacero, Mafrico, Megafrio, Refricerm, and other SMEs)	0.10	n/a
Total	21.81	3.52

Enterprise background

34. Ecasa, a locally owned enterprise, received Multilateral Fund assistance to replace CFC-12 with HFC-134a at the 26th meeting (November 1998).⁸ Since the completion of the project in November 2001, HFC-134a has been used as refrigerant to charge Ecasa's products. As such, the Secretariat considers that this conversion falls under paragraph 18(b) of decision XXVIII/2.

35. Ecasa manufactures 18 models of self-contained domestic and commercial refrigeration including vertical and horizontal coolers, which operate with different temperature ranges, in three manufacturing lines operating for one eight-hour shift per day. In 2017 the enterprise produced 14,518 units using HFC-134a and 12,283 units using R-404A. Table 3 presents the 2015–2017 production of HFC-based domestic and commercial refrigerators at Ecasa.

⁸ Project ECU/REF/26/INV/26. Ecasa also received assistance to convert its foam panels from CFC-11 to water-based technology (later changed to HCFC-141b) at the 9th meeting (March 1993) (ECU/FOA/09/INV/10), and technical assistance for the conversion from HCFC-141b to cyclopentane at the 81st meeting (ECU/PHA/81/INV/65).

Table 3. Manufacturing of domestic and commercial refrigerators at Ecasa (2015–2017)

Production (units/year)	HFC-134a	R-404A	Total
2015	12,225	9,957	22,182
2016	13,752	11,619	25,371
2017	14,518	12,283	26,801
Average	13,498	11,286	24,785
Consumption (kg/year)			
2015	1.96	2.84	4.80
2016	2.20	3.33	5.53
2017	2.32	3.52	5.85
Average	2.16	3.23	5.39

Conversion

36. Ecasa aims to convert the manufacturing line with the highest production ratio with assistance from the Multilateral Fund. Through implementation of the project, the enterprise will integrate the production of the other two lines into the converted line.

37. The currently available replacements for HFC-based capacity are HCs (R-290 and R-600a), HFOs and their blends. R-290 and R-600a have been selected as they: have zero ODP and very low global-warming potential (GWP); are proven, commercially available, and internationally accepted; require the use of 40 per cent less refrigerant; use mineral oil; have low corrosiveness; enhance overall technical reliability and performance; and reduce operating noise. In addition, the enterprise has experience in manufacturing panels with pre-blended HCs.

38. Given the flammability of R-290 and R-600a, changes are required in the manufacturing process, in the refrigerant storage and supply and in the products themselves. The conversion contains two main components for which funds are being requested:

- (a) Product redesign for the new refrigerant and pilot production of 10 products;
- (b) Replacement of the manufacturing equipment, including adaptation of the assembly line; introduction of one refrigerant charging station suited to R-290 and R-600a, along with a refrigerant booster pump; safety control systems, ventilation and an antistatic floor; one ultrasonic welding machine; one post-charge leak detector and one helium leak detection system; one HC recovery unit and four handheld leak detectors for product leak tests; contingencies; safety certification, training and installation.

Project costs

Incremental capital costs (ICCs)

39. The ICCs, as originally submitted to the 81st meeting, stood at US \$235,190. Upon discussion with UNIDO of the elements included in the project, the following adjustments were made and agreed at the 81st meeting: a reduction in the cost of the charging unit, including safety elements, from US \$55,000 to US \$40,000, given the level of production required; a reduction in the cost of the helium management system from US \$55,000 to US \$38,000, in line with other proposals; and a reduction in the number of handheld leak detectors from four to two, based on the needs of the line. It was also agreed to include US \$5,000 for the adaptation of refrigerant storage and supply area, as it is required but had not been included in the proposal, and to increase the cost of redesign and trial of products from US \$1,200 to US \$1,500 per product, in line with the other proposal in Ecuador by Induglob. The ICCs as originally submitted at the 81st meeting and as agreed and resubmitted at the 82nd meeting are shown in Table 4.

Table 4. Proposed and revised costs of the conversion of domestic and commercial refrigerator manufacturing at Ecasa

Item	As originally proposed at the 81 st meeting (US \$)	As agreed at the 81 st meeting and re-submitted at the 82 nd meeting (US \$)
1. General product redesign		
Platform redesign	12,000	15,000
Total product design and trials	12,000	15,000
2. Production equipment		
Adaptation assembly line	5,000	5,000
Explosion-proof charging machine for R-600a/R-290, safety control system and pneumatic booster pump	55,000	40,000
Safety ventilation	12,000	12,000
HC leak detector, plus calibration unit	15,000	15,000
Ultrasonic welding machine	30,000	25,000
Antistatic floor	3,800	3,800
HC recovery machine, explosion-proof	3,500	2,000
Helium charging unit	20,000	38,000
Helium recovery/recycling unit	20,000	
Helium leak detector, plus calibration	15,000	
Handheld HC leak detectors	1,600	1,000
Refrigerant storage area, including safety items	0	5,000
Subtotal equipment costs	180,900	146,800
Contingency (10% of investment costs)	19,290	14,680
Safety certification by TÜV Süd	15,000	15,000
Training and installation	8,000	8,000
Total ICCs	235,190	199,480

IOCs

40. The IOCs, which include costs related to changes in the compressor, capillary tube, electrical components and refrigerant, were estimated in the submission to the 81st meeting at US \$12.11 per unit converted from HFC-134a to R-600a, and US \$12.00 per unit converted from R-404A to R-290. The IOCs calculated for a 12-month period were US \$323,301, as shown in Table 5. IOC was not requested from the Multilateral Fund.

Table 5. IOCs for domestic and commercial refrigerators manufacturing at Ecasa (US \$) as submitted at the 81st meeting

Item	HFC-134a to R-600a			R-404A to R-290		
	Baseline	New	Difference	Baseline	New	Difference
Compressor	50.55	55.90	5.35	60.85	65.90	5.05
Filter	2.50	2.50	-	2.50	2.75	0.25
Capillary tube	5.00	6.50	1.50	5.00	6.50	1.50
Other electrical components	45.50	51.50	6.00	55.50	61.75	6.25
Refrigerant	1.73	0.99	(0.74)	2.98	2.05	(0.94)
Total	105.28	117.39	12.11	126.83	138.95	12.00
Units per year	14,518			12,283		
IOCs per type of product	175,871			147,430		
Total IOCs	*323,301					

*IOCs had initially been calculated at US \$37,055 using the average production by model (1,320 units using HFC-134a and 1,755 units using R-404A), but it was later corrected to US \$323,301 to cover the entire production (14,518 units using HFC-134a and 12,283 units using R-404A).

Total incremental cost

41. A summary of the total project cost, as submitted, is given in Table 6.

Table 6. Total project cost and total cost requested for the conversion of domestic and commercial refrigerators manufacturing at Ecasa

Item	Costs (US \$)
ICCs	199,480
IOCs	0
Total cost requested	199,480

42. The incremental cost for the conversion of domestic and commercial refrigerators at Ecasa amount to US \$199,480, to phase out a total of 5.84 mt (17,123.04 mt CO₂-eq) of HFC-134a and R-404A (2.32 mt (3,317.60 mt CO₂-eq) and 3.52 mt (13,805.44 mt CO₂-eq), respectively), with a cost-effectiveness of US \$34.16/kg. The project will be implemented over a period of 24 months. The energy efficiency of the refrigerators is estimated to improve by about 10 per cent through the modifications to the components.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

43. The Secretariat has reviewed the project proposal on the basis of the current policies and decisions of the Executive Committee, similar approved conversion projects for CFC and HFC phase-out and approved projects to phase out ODS with flammable alternatives.

Eligibility

44. The project proposal has been submitted in line with decisions 78/3(g), 79/45 and 81/53(c). It includes an official letter from the Government of Ecuador indicating that in the event that the project is approved, any reduction in HFC consumption will be deducted from any starting point that may be agreed in the future. In addition, Ecuador ratified the Kigali Amendment with an Executive Decree published on 7 December 2017 and deposited the instrument of ratification at the United Nations Headquarters in New York on 22 January 2018.

Maturity of the technology, replicability and sustainability

45. In providing information to demonstrate the sustainability of the project proposal, UNIDO explained that the Government of Ecuador is working on the development of regulatory measures to protect and support national production once the two enterprises (i.e. Ecasa and Induglob) have been converted. This includes one technical regulation (RTE-035) intended to classify and label equipment according to their refrigerant and energy consumption to prevent safety and health risks, and another regulation (RTE-009) that will restrict access to equipment containing HCFC or HFC as the refrigerant, expected to enter into force in March 2019.

46. UNIDO confirmed that even though only one of the two enterprises is requesting funding, these regulations would be in place. The second enterprise is testing R-600a and expects to convert with its own funding. UNIDO also confirmed that HC-based products are already on the market, and there is no limitation or barrier to the introduction of the domestic and commercial refrigerators converted to HC-based refrigerants, since all units produced will have a refrigerant charge lower than 150 g. Furthermore, Ecuador has a national regulation for HC operations that includes transportation considerations (standard NTE-2266). HC pre-blended polyols are also starting to be used in the manufacturing of polyurethane foam.

47. UNIDO has indicated that the results of the conversion of Ecasa are expected to encourage the adoption of energy-efficient R-290- and R-600a-based equipment by smaller commercial-refrigeration manufacturing enterprises both locally and in other regions.

48. UNIDO has confirmed that, with the approval of the project proposal, Ecasa commits to a total phase-out of HFC-134a and R-404A.

Concerns raised by the Executive Committee during the discussion of the project at the 81st meeting

Geographical distribution

49. Given that several projects have already been approved in the Latin American region, the Secretariat requested UNIDO to justify, in line with decision 78/3(g), the additional value or new information that this proposal would bring.

50. UNIDO explained that this project aims to phase out two substances (HFC-134a and R-404A) in one plant. As the production levels in Ecasa are low in comparison with other projects approved in the region, the project will provide useful information on the ICCs and IOCs of converting SMEs, which would have large replicability in Article 5 countries. The introduction of alternative technologies in the manufacturing sector in the country will raise stakeholders' and technicians' confidence in the use of flammable refrigerants, which will help both the phase-out of HCFCs and the phase-down of HFCs.

51. The Secretariat noted that out of the six enterprises that received funding in the region pursuant to decision 78/3(g), only one (Farco in Dominican Republic) has HFC consumption below 20 mt.

IOCs and cost-effectiveness

52. The Secretariat noted at the 81st meeting that the cost difference between the HFC-134a and the R-600a compressors should be no higher than US \$1.00/unit rather than US \$5.00/unit as estimated, given the existence of R-600a-based compressors on the market and the fact that the difference in the cost of the compressor for R-290 should also be lower than estimated. However, as IOCs were not requested, the Secretariat did not further discuss them.

53. During the discussions in the contact group established at the 81st meeting, it was unclear for some Executive Committee members whether there were IOCs or savings.

54. At the 82nd meeting, the Secretariat had a thorough review and discussed with UNIDO the level of IOCs. Consequently, IOCs were recalculated with reductions in the difference in the costs of the compressor, capillary tube and electronic components, at a level of US \$21,746, which is in line with the level of funds required in other similar manufacturing enterprises. The revised level of IOCs is presented in Table 7.

Table 7. Revised IOCs for domestic and commercial refrigerators manufacturing at Ecasa (US \$)

Item	HFC-134a to R-600a			R-404A to R-290		
	Baseline	New	Difference	Baseline	New	Difference
Compressor	50.55	51.50	0.95	60.85	61.00	0.15
Filter	2.50	2.50	-	2.50	2.75	0.25
Capillary tube	5.00	5.25	0.25	5.00	5.25	0.25
Other electrical components	45.50	46.10	0.60	55.50	56.30	0.80
Refrigerant	1.73	0.99	(0.74)	2.98	2.05	(0.93)
Total	105.28	106.34	1.06	126.83	127.35	0.52
Units per year			14,518			12,283
IOCs per type of product			15,447			6,299
Total IOCs						21,746

55. UNIDO explained that IOCs were not being requested by Ecasa.

56. UNIDO has confirmed that, in line with decision 78/3(g), the project will collect, and include in the final report, data on the ICCs and IOCs incurred, and that, in line with decision 22/38 and subsequent decisions of the Executive Committee, equipment to be replaced by the project will be destroyed or rendered unusable.

57. As noted by the Secretariat at the 81st meeting, although funding was not requested for IOCs, the cost-effectiveness of the proposal is higher than that of larger manufacturing enterprises. However, the proposal includes the minimum items required for the conversion and it already includes industrial rationalization, as the production of three lines will be integrated into a single line.

58. The Secretariat notes that the purpose of implementing projects under decision 78/3(g) is to gain experience in the ICCs and IOCs that might be associated with phasing down HFCs. On the basis of the information available at the time of review, the Secretariat considers that the agreed costs are its best estimates of the overall incremental costs of conversion; these estimates, however, might change as more information becomes available and according to the specific characteristics of the enterprise. The Secretariat, therefore, considers that approval of the project at the levels proposed above would not constitute a precedent.

Energy efficiency

59. The proposal indicates that the energy efficiency of the refrigerators is estimated to improve by about 10 per cent through the modifications to components. UNIDO clarified that Ecasa is part of a K-CEP⁹ global project for energy efficiency being implemented in cooperation with UNIDO. Since no results have been achieved yet under that project, it is not possible to ascertain the improvement in energy efficiency and associated costs.

2018–2020 business plan

60. This project is included in the 2018–2020 business plan of the Multilateral Fund at a value of US \$71,710, including agency support costs, to phase out 8.80 mt of HFC. The Secretariat notes that after the adjustments to the costs, the proposal is US \$141,733 more than what has been included in the business plan.

RECOMMENDATION

61. The Executive Committee may wish to consider:

- (a) The project proposal for the conversion of domestic and commercial refrigerator manufacturing at Ecasa from the use of HFC-134a and R-404A to propane (R-290) and isobutane (R-600a), in the context of its discussion on HFC stand-alone projects submitted to the 82nd meeting in line with decision 78/3(g), as described in the document on the Overview of issues identified during project review (UNEP/OzL.Pro/ExCom/82/31);
- (b) Whether or not to approve the project proposal indicated in sub-paragraph (a) above in the amount of US \$199,480, plus agency support costs of US \$17,953 for UNIDO, on the understanding, if the project were to be approved:
 - (i) That 5.84 metric tonnes (mt) (3,317.60 mt CO₂-eq) of HFC-134a and (13,805.44 mt CO₂-eq) of R-404A would be deducted from the starting point for

⁹ The Kigali Cooling Efficiency Program

sustained aggregate reduction in HFC once it had been established;

- (ii) That the project would be completed within 24 months of the transfer of funds to UNIDO, and a comprehensive completion report would be submitted within six months of project completion with detailed information on:
 - a. The eligible incremental capital costs for all equipment and other components including those not funded under the project;
 - b. Incremental operating costs, although Ecasa had not requested these costs from the Multilateral Fund;
 - c. Any possible savings incurred during the conversion and relevant factors that facilitated implementation (e.g. whether any purchased and/or installed equipment or supplies had gone through a competitive quote/bidding process and the details thereof);
 - d. Changes in energy efficiency of the products being manufactured and any related policies undertaken by the Government;
 - e. Information on the implementation of the servicing component where applicable; and
- (iii) That any remaining funds would be returned to the Multilateral Fund no later than one year after the date of project completion.
