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EXECUTIVE COMMITTEE OF  
THE MULTILATERAL FUND FOR THE  
IMPLEMENTATION OF THE MONTREAL PROTOCOL  
Ninety-second Meeting  
Montreal, 29 May to 2 June 2023  
Items 9(c) and (d) of the provisional agenda<sup>1</sup>

**PROJECT PROPOSALS: MEXICO**

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

Phase-out (HCFC)

- HCFC phase-out management plan (stage II, fifth tranche)

UNIDO, UNEP,  
Germany, Italy and Spain

Phase-out (HFC)

- Control and phase-out of HFC-23 emissions in production of HCFC-22 at Quimobásicos (second tranche)

UNIDO

Refrigeration (HFC)

- Conversion of the manufacturing of commercial refrigerators from HFC-134a to propane at Friocima

UNDP

<sup>1</sup> UNEP/OzL.Pro/ExCom/92/1

## PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

## Mexico

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase-out plan (stage II)	Germany, Italy, Spain, UNEP, UNIDO (lead)	73 <sup>rd</sup>	67.5% in 2022

(II) LATEST ARTICLE-7 DATA (Annex C Group I)	Year: 2022	208.69 ODP tonnes
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(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)	Year: 2022
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Chemical	Aerosol	Foam	Fire-fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-22					208.78				208.78

**Note:** Exports of 0.05 ODP tonnes of HCFC-142b and 0.04 ODP tonnes of HCFC-123 were not included in the sectoral data

(IV) CONSUMPTION DATA (ODP tonnes)			
2009-2010 baseline:	1,148.8	Starting point for sustained aggregate reductions:	1,214.8
CONSUMPTION ELIGIBLE FOR FUNDING			
Already approved:	950.9	Remaining:	263.9

(V) ENDORSED BUSINESS PLAN		2023	2024	2025	Total
UNIDO	ODS phase-out (ODP tonnes)	21.01	0.0	0.0	21.01
	Funding (US \$)	482,142	0	0	482,142

(VI) PROJECT DATA			2014	2015	2016	2018	2020	2022	2023	Total
Montreal Protocol consumption limits (ODP tonnes)			1,148.80	1,033.92	1,033.92	1,033.92	746.72	746.72	746.72	n/a
Maximum allowable consumption (ODP tonnes)			1,148.80	1,033.92	1,033.92	746.72	574.40	373.36	373.36	n/a
Agreed funding (US \$)	UNIDO	Project costs	2,404,412	0	1,165,509	2,139,719	0	1,612,350	450,600	7,772,590
		Support costs	168,309	0	81,586	149,780	0	112,865	31,542	544,082
	Germany	Project costs	325,000	0	325,000	0	0	0	0	650,000
		Support costs	40,750	0	40,750	0	0	0	0	81,500
	Italy	Project costs	458,191	0	0	0	0	0	0	458,191
		Support costs	59,565	0	0	0	0	0	0	59,565
	Spain	Project costs	0	0	1,056,991	1,070,000	0	0	0	2,126,991
		Support costs	0	0	121,238	122,731	0	0	0	243,969
	UNEP	Project costs	0	0	40,000	0	0	40,000	0	80,000
		Support costs	0	0	5,200	0	0	5,200	0	10,400
Funds approved by ExCom (US \$)	Project costs	3,187,603	0	2,587,500	3,209,719	0	1,652,350		10,637,172	
	Support costs	268,624	0	248,774	272,511	0	118,0650		907,974	
Total funds requested for approval at this meeting (US \$)	Project costs							450,600	450,600	
	Support costs							31,542	31,542	

Secretariat's recommendation:	Blanket approval
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## PROJECT DESCRIPTION

1. On behalf of the Government of Mexico, UNIDO as the lead implementing agency has submitted a request for funding for the fifth and final tranche of stage II of the HCFC phase-out management plan (HPMP), in the amount of US \$450,600, plus agency support costs of US \$31,542 for UNIDO only.<sup>2</sup> The submission includes a progress report on the implementation of the fourth tranche, a verification report on HCFC consumption for 2022, and the tranche implementation plan for 2023 to 2024.

### Report on HCFC consumption

2. The Government of Mexico reported a consumption of 208.69 ODP tonnes of HCFC in 2022, which is 82 per cent below the HCFC baseline for compliance. The 2018-2022 HCFC consumption is shown in table 1.

**Table 1. HCFC consumption in Mexico (2018-2022 Article 7 data)**

HCFC	2018	2019	2020	2021	2022	Baseline
<b>Metric tonnes (mt)</b>						
HCFC-22	2,962.37	3,044.49	2,214.05	2,283.05	3,796.08	8,505.1
HCFC-123	45.76	40.00	-3.90	14.19	-2.22	73.1
HCFC-124	0.0	0.0	0.0	0.0	0.0	8.0
HCFC-141b	1,348.19	535.88	316.10	41.05	0.0	6,123.9
HCFC-142b	137.26	112.82	0.0	-0.44	-0.76	89.2
<b>Total (mt)</b>	<b>4,493.58</b>	<b>3,733.19</b>	<b>2,526.25</b>	<b>2,337.85</b>	<b>3,793.10</b>	<b>14,799.3</b>
<b>ODP tonnes</b>						
HCFC-22	162.93	167.45	121.77	125.57	208.78	467.8
HCFC-123	0.91	0.80	-0.08	0.28	-0.04	1.4
HCFC-124	0.0	0.0	0.0	0.0	0.0	0.2
HCFC-141b	148.30	58.95	34.77	4.52	0.0	673.6
HCFC-142b	8.92	7.33	0.0	-0.03	-0.05	5.8
<b>Total (ODP tonnes)</b>	<b>321.06</b>	<b>234.53</b>	<b>156.46</b>	<b>130.34</b>	<b>208.69</b>	<b>1,148.8</b>

3. The declining consumption of HCFCs in Mexico has mainly been due to the completion of projects in the polyurethane foam, domestic refrigeration, commercial refrigeration, extruded polystyrene foam, and the aerosol/solvent sectors, as well as the introduction of affordable new technologies in the refrigeration and air-conditioning (RAC) sector. After a significant decrease in 2020 and 2021, triggered by the COVID-19 pandemic, HCFC-22 consumption bounced back to pre-pandemic levels in 2022, indicating a recovering industry and an uptick in imports, previously delayed by supply-chain issues. However, gradual reductions are expected to extend beyond 2024.

### *Country programme implementation report*

4. The Government of Mexico reported HCFC sector consumption data under the 2022 country programme implementation report that is consistent with the data reported under Article 7 of the Montreal Protocol.

### *Verification report*

5. The verification report confirmed that the Government is implementing a licensing and quota system for HCFC imports and exports and that the total consumption of HCFCs reported under Article 7 of the Montreal Protocol for 2022 was correct (as shown in table 1 above). The verification also concluded that the data reported by importing enterprises and by the customs were consistent.

<sup>2</sup> As per the letter of 27 March 2023 from the Ministry of the Environment and Natural Resources of Mexico to UNIDO.

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

*Legal framework*

6. The Government of Mexico has an operational licensing and quota system that was developed based on the 2004 Regulation on the imports and exports of chemical substances and materials, including ozone-depleting substances (ODSs), in line with the requirements of the Montreal Protocol.<sup>3</sup> The system is operated by the national ozone unit (NOU) embedded within the Ministry of the Environment and Natural Resources, in coordination with the National Customs Agency and the Ministry of Health.

7. The ban on the imports of HCFC-141b has been enforced since January 2022, and on 7 June 2022 a new Law on the general import and export taxes was adopted to implement the updated World Customs Organization's Harmonized System codes, with individualized tariff headings for pure and blended substances. The Government of Mexico ratified the Kigali Amendment on 25 September 2018.

*Conversions of enterprises in the manufacturing sector*

8. Eight aerosol/solvent manufacturing enterprises included in stage II completed their conversion to HCFC-free technologies by 2018, collectively phasing out 63.37 ODP tonnes of HCFC-141b and HCFC-22. In addition, the consumption of HCFCs by enterprises that were ineligible for funding due to foreign ownership, reported at 272.10 ODP tonnes of HCFC-141b and HCFC-22 at the time of approval of stage II, has been phased out. In line with the established ban, the Government stopped granting import quotas for HCFC-141b in 2022.

*Refrigeration servicing sector*

9. The following activities have been implemented since the approval of the fourth tranche in 2022:

- (a) *Phase-out of HCFC-22 and HCFC-141b in flushing and RAC servicing (UNIDO)*: Bidding to purchase an additional 500 servicing and flushing toolkits<sup>4</sup> (for a total of 1,000) and a sample of molecular transformers was finalized; the toolkits will be delivered between May and October 2023 and distributed to 19 training centres and participating technicians between the last quarter of 2023 and the first half of 2024;
- (b) *Technician training programme (UNIDO)*: Fifty-one trainers from 15 training centres received training in best practices in refrigeration; 25 of these trainers participated in a study tour that involved attending conferences and visiting industrial facilities to learn about the operation of RAC enterprises, low-global-warming-potential technologies and energy efficiency; 11 training centres signed contracts to provide training to 2,640 technicians and eight centres are being contracted to train an additional 1,920 technicians; the previously developed manual on best practices in refrigeration was updated, published online, and scheduled for printing and distribution of 6,000 copies to technicians; an e-learning training module on best servicing practices is under development and will be released in mid-2023;
- (c) *Strengthening of the refrigerant recovery, recycling and reclamation (RRR) network (UNIDO)*: The two RRR centres assisted under the previous tranches have continued their operations, despite difficulties encountered in operating a chromatographer; UNIDO and

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<sup>3</sup> Amendments to the regulation were published and entered into force on 13 February 2014 and on 5 December 2022.

<sup>4</sup> Containing *inter alia* pressure-testing regulator kits, multi-function digital manifolds, vacuum pumps with electrovalve and vacuum gauge, refrigerant recovery units and cylinders, charge scales, standard hoses, clamp-on meters, pinch-off piercing pliers (1/4" SAE connection), mechanical manifold gauge with hose sets, leak detectors, and tube cutters.

the NOU organized field visits to the RRR centres to assess their capacity in terms of equipment, qualified staff and knowledge;

- (d) *Assistance for the introduction of alternatives based on hydrocarbon (HC)* (Germany): A training demonstration unit based on HC and carbon dioxide is being procured; training material on the safe use of HC has been developed; and a labour competency standard developed to certify technicians in the safe use of HC has been published, with three evaluators, two training centres and three technicians accordingly certified; and
- (e) *Monitoring of HCFC production* (UNIDO): The verification report on HCFC-22 production and HFC-23 by-product emissions for 2022 was completed; detailed discussion of the phase-out of HFC-23 by-product emissions generated during the production of HCFC-22 is presented in paragraphs 27-51 of the present document.

*Project implementation and monitoring*

10. The HPMP project coordinator, under the supervision of the NOU, is responsible for monitoring the progress of all activities; holding coordination meetings with industry stakeholders, importers, and Government institutions to assure the timely implementation of all projects; maintaining and updating the Government system for the reporting and monitoring of ODS consumption (SISSAO); and implementing the associated public-awareness activities. The coordinator is supported by one project assistant and local consultants as required for specific activities, including training logistics, development of legal agreements, communications, and information technology. During the implementation of the fourth tranche, work to redesign and update SISSAO has been initiated. The costs incurred for project implementation and monitoring since the first tranche are presented in table 2.

**Table 2. Costs breakdown of project implementation and monitoring expenditures (US \$)**

Particulars	Approved in principle	Cumulative first four tranches		
		Approved	Disbursed	Balance
Project coordination staff (one coordinator and one assistant)	500,000	485,000	464,000	21,000
Local consultants	100,000	110,000	87,500	22,500
Stakeholder meetings, public-awareness activities	40,000	35,000	34,550	450
Maintenance and redesign of SISSAO and other activities related to the HCFC quota and licensing system	50,000	60,000	15,500	44,500
<b>Total</b>	<b>690,000</b>	<b>690,000</b>	<b>601,550</b>	<b>88,450</b>

Level of fund disbursement

11. As of April 2023, of the US \$10,637,172 approved so far, US \$6,778,661 had been disbursed (US \$4,630,681 for UNIDO, US \$40,000 for UNEP, US \$359,600 for the Government of Germany, US \$458,191 for the Government of Italy, and US \$1,290,189 for the Government of Spain), as shown in table 3. The balance of US \$3,858,511 will be disbursed in 2023-2024.

**Table 3. Financial report of stage II of the HPMP for Mexico (US \$)**

Funding per tranche		UNIDO	UNEP	Germany	Italy	Spain	Total	Disbursement rate (%)
First	Approved	2,404,412	0	325,000	458,191	0	<b>3,187,603</b>	99.9
	Disbursed	2,403,985	0	325,000	458,191	0	<b>3,187,176</b>	
Second	Approved	1,165,509	40,000	325,000	0	1,056,991	<b>2,587,500</b>	89
	Disbursed	1,165,509	40,000	34,600	0	1,056,268	<b>2,296,377</b>	
Third	Approved	2,139,719	0	0	0	1,070,000	<b>3,209,719</b>	30
	Disbursed	728,888	0	0	0	233,921	<b>962,809</b>	
Fourth	Approved	1,612,350	40,000	0	0	0	<b>1,652,350</b>	20
	Disbursed	332,299	0	0	0	0	<b>332,299</b>	
Total	Approved	<b>7,321,990</b>	<b>80,000</b>	<b>650,000</b>	<b>458,191</b>	<b>2,126,991</b>	<b>10,637,172</b>	64
	Disbursed	<b>4,630,681</b>	<b>40,000</b>	<b>359,600</b>	<b>458,191</b>	<b>1,290,189</b>	<b>6,778,661</b>	
	Balance	<b>2,691,309</b>	<b>40,000</b>	<b>290,400</b>	<b>0</b>	<b>836,802</b>	<b>3,858,511</b>	

Implementation plan for the fifth and final tranche of stage II of the HCFC phase-out management plan

12. The following activities will be implemented by UNIDO between June 2023 and December 2024:

- (a) *Training of RAC trainers and technicians (UNIDO)*: organization of train-the-trainer courses for 60 instructors, including 12 women; renewal of cooperation agreements with 19 training centres to continue providing training in best practices to 4,560 refrigeration technicians, and inclusion of one more institution to train an additional 240 technicians (US \$450,600); and
- (b) *Project implementation and monitoring (UNIDO)*: continued coordination and monitoring of the implementation of activities; continued audits of ODS consumption; commissioning and preparation of verification reports; communication and dissemination of the results of stage II activities; release of the updated SISSAO with integrated e-learning modules for technicians on best practices in refrigeration, under the new name SIIPROM, by December 2023; and implementation of e-training for SISSAO users (balances from previous tranches).

## SECRETARIAT'S COMMENTS AND RECOMMENDATION

### COMMENTS

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

*Legal framework*

13. The Government of Mexico has issued the 2023 quotas for HCFC imports and production at 230.23 and 508.06 ODP tonnes, respectively. While no quotas are issued for HCFC exports, at the beginning of each year exporters are required to report on the kind, quantity, and destination of exported substances.

*Refrigeration servicing sector*

14. The Secretariat noted additional progress achieved in the implementation of most activities since the approval of the fourth tranche at the 90<sup>th</sup> meeting. Regarding the training of 120 to 150 customs and enforcement officers that did not take place as planned, UNIDO explained the delay as a result of the establishment of a new National Customs Agency in 2022, which entailed staff changes and the

reassignment of responsibilities. The NOU has already established contact with the new authorities and the training is planned to take place in the third quarter of 2023.

15. Regarding the status of operation of the two RRR centres assisted under the HPMP, UNIDO informed the Secretariat that one of them (Silver Breeze), with an estimated refrigerant inventory of 120 metric tonnes (mt), had three fully operational facilities, one offering the full scope of refrigerant RRR and two others providing recovery and recycling services. The second centre (EcoSave), offering recovery and recycling services with an estimated refrigerant inventory of 57.35 mt, has experienced low demand in the aftermath of the COVID-19 pandemic. After a 2020 accident at its Celaya facility, the centre's equipment was moved to another facility in Mexico City, where it operates at partial capacity while expanding its range of services to collect other types of waste beside RAC equipment and gases.

16. A survey conducted by the NOU in 2022 identified a total of six RRR centres in the country, all operating at a lower capacity than expected, mainly due to the low rates of HCFC and HFC recovery performed by technicians. Out of the 42 refrigerant collection centres involved in the Electricity Savings Trust programme that replaced over two million RAC equipment units over 2006-2012, only five remain operational today, albeit with reduced capacity in the absence of new programmes for equipment replacement. UNIDO reported that, in the course of implementing stage III, the NOU intended to assist in increasing the quantity of recovered refrigerant by improving the collection centres' technical capacity, creating an updated business model for the RRR network, and regulating the recovery of gases from equipment servicing and decommissioning.

17. Upon enquiry regarding the purpose, benefits, and cost of procurement of molecular transformers, UNIDO explained that, at a unitary cost of US \$200, these small devices significantly improved the speed and safety of the recovery process by reducing refrigerant temperature and working pressure, especially at high ambient temperatures. They were also reported to eliminate liquid slugging at colder temperatures, thus improving performance and extending the life of recovery units and tools, including hoses and manifolds. The transformers were recommended by Mexican technicians based on their working experience, and the procured sample was intended for trial use, to determine the potential benefits of their more wide-spread use.

#### Gender policy implementation<sup>5</sup>

18. UNIDO declared that efforts to promote the hiring of women as consultants, supervisors, trainers, and managers across all programmes would continue during the implementation of the fifth tranche. In 2022, the NOU staff developed a gender baseline and an action plan, identifying areas where gender gaps existed and proposing opportunities to close them. The gender action plan will be used for all projects supported by the Multilateral Fund, including stages II and III of the HPMP and the Kigali HFC implementation plan for Mexico.

#### Completion of stage II of the HCFC phase-out management plan

19. UNIDO confirmed that stage II for Mexico would be completed on 31 December 2024, as established by decision 90/46(b) of the Executive Committee.

#### Sustainability of the HCFC phase-out and assessment of risks

20. In the manufacturing sectors, the sustainability of HCFC phase-out achieved in the aerosol/solvent and polyurethane foam sectors is being supported by the ban on imports of HCFC-141b, effective from

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<sup>5</sup> In line with decision 84/92(d), decision 90/48(c) encouraged bilateral and implementing agencies to continue ensuring that the operational gender mainstreaming policy was applied to all projects, taking into consideration the specific activities presented in table 2 of document UNEP/OzL.Pro/ExCom/90/37.

1 January 2022, while the phase-out in the extruded polystyrene foam sector is being supported by the commitment not to issue any import quotas for HCFC-142b as of 1 January 2020.

21. The sustainability of training programmes implemented over the last few years in the refrigeration servicing sector will be ensured by mandating their inclusion in the curricula of the training centres, with the expectation that they will continue being provided regardless of external financing. The Government of Mexico has recognized that the technician certification scheme can provide resources to the training centres. As part of the preparation for stage III of the HPMP, the Government is evaluating the strategy to implement the certification scheme in the country and the associated regulations to be developed in cooperation with the Secretariat of Labour and Social Welfare. In terms of customs training, further support is required, given the reorganization of the National Customs Agency, high staff turnover, and additional controls on HFCs associated with the implementation of the Kigali Amendment.

22. Regarding the overall sustainability of reductions in HCFC consumption, in addition to the completed activities and the associated reduction in demand for HCFCs, the new Agreement on the Scheduled Reduction in Consumption of HCFCs for 2024-2030 is expected to further strengthen the legal framework that regulates these substances and provides legal certainty to producers and importers.

23. The greatest risk to the timely and successful implementation of stage II in Mexico so far has been associated with the delays in equipment imports, which have hindered the distribution of toolkits to technicians and training centres. To mitigate this risk in the future, the Government of Mexico, in collaboration with relevant institutions, has developed a procedure to prevent delays in the customs clearance process for goods imported under Montreal Protocol projects. Coordination between the institutions and agencies involved has been strengthened, and the procedure was initiated in January 2023.

### Conclusion

24. The 2022 consumption of HCFCs in Mexico stood at 208.69 ODP tonnes, that is 44 per cent below the allowable maximum of 373.36 ODP tonnes stated in the Agreement between the Government and the Executive Committee. Sufficient progress in the implementation of the fourth tranche of stage II has been achieved, including procurement of additional tools for RAC technicians and a training demonstration unit based on HC and carbon dioxide; signature of additional cooperation agreements with training centres; continued training of technicians; satisfactory operation of two assisted RRR centres; and the certification of evaluators and technicians in the use of HC. The level of fund disbursement for the last approved tranche reached 20 per cent, while the overall disbursement rate is 64 per cent. Under the fifth and last tranche, the Government will continue implementing the ongoing activities, and it will ensure that close to 5,000 RAC servicing technicians receive training under the renewed cooperation agreements with training centres.

### **RECOMMENDATION**

25. The Fund Secretariat recommends that the Executive Committee:
- (a) Note the progress report on the implementation of the fourth tranche of stage II of the HCFC phase-out management plan (HPMP) for Mexico; and
  - (b) Request the Government of Mexico, UNIDO, UNEP, and the Governments of Germany, Italy and Spain to submit a progress report on the implementation of the work programmes associated with the final tranche to the first meeting of the Executive Committee in 2025, verification reports until approval of stage III, and the project completion report to the second meeting of the Executive Committee in 2025.



26. The Fund Secretariat further recommends blanket approval of the fifth and final tranche of stage II of the HPMP for Mexico and the corresponding 2023-2024 tranche implementation plan at the funding level shown in the table below.

	<b>Project title</b>	<b>Project funding (US \$)</b>	<b>Support costs (US \$)</b>	<b>Implementing agency</b>
(a)	HCFC phase-out management plan (stage II, fifth tranche)	450,600	31,542	UNIDO

## PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

## Mexico

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
Control and phase-out of HFC-23 emissions in production of HCFC-22 at Quimobásicos	UNIDO (lead)	86 <sup>th</sup>	Phase-out to the extent practicable by 1 January 2022*

\* The project was approved on the understanding that the Government of Mexico would ensure that, by 1 January 2022 and thereafter, emissions of HFC-23 by-product from HCFC-22 production lines were destroyed in compliance with the Montreal Protocol, such that emissions for both lines were at or below 0.1 kg of HFC-23 per 100 kg of HCFC-22 produced.

(II) LATEST ARTICLE-7 DATA (Annex C, Group I)	Year: 2022	208.69 ODP tonnes
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(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (mt)		Year: 2022
Chemical		Total sector consumption
HCFC-22 production*		7,808.18
HFC-23 generation		112.46
HFC-23 emissions		31.89

\* Includes production for controlled and feedstock uses.

(V) ENDORSED BUSINESS PLAN		2023	2024	2025	Total
UNIDO	Funding (US \$)	526,611	400,588	2,657,650	3,584,849

(VI) PROJECT DATA			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Maximum allowable emissions of Annex F, Group II substances per 100 kg of Annex C, Group I substances produced (kg)			n/a	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	n/a
Funding agreed in principle (US \$)	UNIDO	Project costs	483,058	0	492,160	374,381	473,131	433,131	414,381	374,381	414,381	374,380	3,833,384
		Support costs	33,814	0	34,451	26,207	33,119	30,319	29,007	26,207	29,007	26,206	268,337
Funds approved by ExCom (US \$)		Project costs	483,058	0		0	0	0	0	0	0	0	483,058
		Support costs	33,814	0		0	0	0	0	0	0	0	33,814
Total funds recommended for approval at this meeting (US \$)		Project costs			387,561								387,561
		Support costs			27,129								

<b>Secretariat's recommendation:</b>	Blanket approval
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## PROJECT DESCRIPTION

27. On behalf of the Government of Mexico, UNIDO as the designated implementing agency has submitted a request for funding for the second tranche of the project for the control and phase-out of HFC-23 emissions in production of HCFC-22 at Quimobásicos, Mexico, in the amount of US \$284,270, plus agency support costs of US \$19,899, as originally submitted.<sup>6</sup> The submission includes a progress report on the implementation of the first tranche, the verification report on HCFC-22 production and HFC-23 by-product emissions for 2022, and the tranche implementation plan for 2023 to 2024.

### Report on HCFC-22 production and HFC-23 by-product generated and emitted

28. As confirmed by the verification report, the Government of Mexico reported a total of 7,808.18 metric tonnes (mt) of HCFC produced in 2022,<sup>7</sup> with 31.89 mt of HFC-23 by-product emitted before 1 May 2022, as shown in table 1. Emissions following that date were below the agreed 0.1 kg of HFC-23 per 100 kg of HCFC-22 produced.

**Table 1. Total HCFC-22 production for all uses at Quimobásicos in 2022 (mt)**

Component	Quantity January – April	Quantity May – December
HCFC-22 produced	2,069.00	5,739.18
HFC-23 generated	31.89	80.57
HFC-23 destroyed	0.00	80.57
HFC-23 emitted	31.89	*0.00

\* Emissions in the amount of 0.00028 mt (0.28 kg) took place from 1 May to 31 December 2022.

29. The enterprise refurbished one of its plasma-arc destruction units (PDUs) and began destroying HFC-23 by-product on 2 May 2022, with destruction continuing throughout the remainder of 2022. Destruction could not take place from 1 January to 1 May 2022 in light of supply chain disruptions exacerbated by the COVID-19 pandemic, which delayed the provision of the components necessary to refurbish the PDU and enable its operation before 1 May 2022.

### *Verification report*

30. The verification report confirmed that the reported figures for 2022 shown in table 1 above are a reliable and accurate representation of HCFC-22 production and HFC-23 generation and destruction that occurred at Quimobásicos in 2022, and that the enterprise did not sell or store any HFC-23. The report concluded that the enterprise was in compliance with the Agreement between the country and the Executive Committee for HFC-23 by-product emissions released to the atmosphere as a result of HCFC-22 production. As further described in paragraph 46 below, the verification report also proposed a methodology for verifying HFC-23 by-product control that was based on the methodology used in the Clean Development Mechanism (CDM).<sup>8</sup>

### Progress report on the implementation of the first tranche

31. Quimobásicos began refurbishing the first of its two PDUs (PDU-1) in October 2021 and, in light of a delay in replacing the power supply, decided instead to refurbish the second unit (PDU-2) for the destruction of HFC-23 by-product generated at the enterprise.<sup>9,10</sup> Though delayed by supply chain

<sup>6</sup> As per the letter of 17 March 2023 from the Ministry of the Environment and Natural Resources of Mexico to UNIDO.

<sup>7</sup> The reported production is the total production of HCFC-22 for both feedstock and controlled uses.

<sup>8</sup> CDM methodology AM 001 (“Incineration of HFC-23 waste streams”) version 3.0 (13 May 2005).

<sup>9</sup> This decision is in line with the flexibility provided under decision 86/96(b)(ii).

<sup>10</sup> As reflected in the verification report, refurbishment of PDU-1 was subsequently also completed. PDU-1 is used to provide HFC and HCFC destruction services to third parties.

disruptions, refurbishment of PDU-2 was completed and the unit began operating in May 2022, allowing for destruction of HFC-23 by-product generated at either of Quimobásicos' two HCFC-22 production lines.

32. During the first week of operation of the PDU, Quimobásicos experienced and addressed power supply issues caused by the controllers not sending the startup signal to the plasma-arc torch; obstruction of the PDU cooling pipes; and a plate and frame heat exchanger in need of replacement. In addition, due to concerns about the quality of the electricity provided by the local utility, Quimobásicos purchased and installed an uninterruptible power supply system following four shutdowns that had occurred since the PDU began operation.

33. Quimobásicos undertook a number of operational improvements to optimize the operation of the PDU and minimize the HFC-23 by-product generation rate. Regarding the former, the enterprise optimized the operation of the PDU by operating it at a lower capacity than the design capacity, which extended the PDU torch's useful lifetime and ensured optimal operational continuity, thereby enhancing the performance of the PDU. Quimobásicos was able to reduce its HFC-23 by-product generation rate by purchasing and installing an upgraded anhydrous hydrogen fluoride (AHF) vaporizer, which improved the control of AHF flow to the reactor. In addition, due to increased demand for HCFC-22, the enterprise was able to increase the operational continuity of its HCFC-22 production line, thereby reducing start-ups and shut-downs of the line and reducing the HFC-23 by-product generation rate in 2022 from 1.57 to 1.44 per cent.

#### *Project implementation and monitoring*

34. Of the US \$7,500 allocated under the first tranche, US \$4,946 (66 per cent) has been disbursed for project monitoring and verification of production and emissions; the remaining US \$2,554 will be disbursed in 2023.

#### *Level of fund disbursement*

35. As of March 2023, of the US \$483,058 approved so far, US \$480,504 (99 per cent) had been disbursed. The balance of US \$2,554 will be disbursed in 2023.

#### Implementation plan for the second tranche

36. Activities under the second tranche will be implemented between July 2023 and December 2024 and include:

- (a) Continued destruction of HFC-23 by-product from the production of HCFC-22 at Quimobásicos; total production of HCFC-22 for all uses is anticipated to be 8,600 mt for 2023, with 129.00 mt of HCF-23 by-product generated and subsequently destroyed (US \$264,270); and
- (b) Monitoring and verification of destruction, including an independent verification report (US \$20,000).

### **SECRETARIAT'S COMMENTS AND RECOMMENDATION**

#### **COMMENTS**

##### Report on HFC-23 by-product control

37. In line with paragraph 9 of the Agreement between the country and the Executive Committee, and due to the extraordinary circumstances brought about by the COVID-19 pandemic, Mexico had the flexibility to commence destruction of HFC-23 by 1 May 2022. UNIDO provided a detailed report that

demonstrated that the primary reason for the delay in commencing destruction was the global supply chain disruptions, exacerbated by the COVID-19 pandemic, including the need for Quimobásicos to identify multiple suppliers of the power supply for the PDU; the need to switch from refurbishing PDU-1 to PDU-2 given the challenges in securing the power supply for the unit; the need to hire a plasma consultant to provide technical expertise and to source components locally; the need to operate the initial trials in partial manual mode, overcoming disruptions in the power supply during those trials; and the need to modify the programmable logic controller given a flaw in the signal processing sequence. In short, the Secretariat considers the efforts by the enterprise to ensure the refurbishment of the PDU as soon as possible and that HFC-23 by-product was not emitted after 1 May 2022 to be outstanding.

38. Destruction commenced on 2 May rather than 1 May 2022, and the Secretariat sought confirmation that HFC-23 by-product generated on 1 May was not emitted but was stored and subsequently destroyed. UNIDO confirmed that storage and subsequent destruction given that Quimobásicos has two small buffer tanks that can store the HFC-23 by-product generated over two to three days.

39. Noting that UNIDO had reported insignificant quantities of HFC-23 emissions between May and December 2022 (280 grams) relative to the quantity of HFC-23 destroyed in that period (80.56 mt), and that the emitted quantities were estimated based on the destruction and removal efficiency (DRE) of the PDU, the Secretariat sought additional information on possible fugitive emissions of HFC-23. UNIDO indicated that Quimobásicos considered that the only source of HFC-23 emissions from the production facility was the PDU, which resulted in insignificant emissions. In particular, the enterprise considers there are negligible fugitive emissions of HFC-23 between the reactor and the PDU as the production line is a closed system. The most common source of fugitive emissions in refrigerant production plants are the compressors shafts; for that reason, Quimobásicos uses a special coating on the shafts, which are recoated on an annual basis to prevent fugitive emissions.

40. HFC-23 by-product is considered destroyed to the extent practicable in the context of Multilateral Fund-supported projects when up to a maximum of 0.1 kg of HFC-23 by-product was emitted per 100 kg of the relevant Annex C, Group I or Annex F substance produced (decision 89/7(b)(i)). Starting from 1 May 2022, emissions of HFC-23 by-product at Quimobásicos were substantially below that level:  $5 \times 10^{-6}$  kg of HFC-23 emitted per 100 kg of HCFC-22 produced.

41. UNIDO confirmed that no additional funding from other sources, including HFC-23 credits or offsets, for the control of HFC-23 by-product emissions from Quimobásicos have been requested or were received, in line with decision 86/96(b)(vi).

#### *Funding requested*

42. In line with paragraph 9(a) of the Agreement between the Executive Committee and the Government of Mexico, and the Executive Committee's wish to incentivize process optimization to reduce the HFC-23 by-product generation rate, funding for the second tranche amounts to US \$414,690, consisting of agreed funding of US \$387,561 plus agency support costs for UNIDO of US \$27,129, calculated based on the funding for the second tranche agreed in principle (i.e., US \$492,160) and reducing that funding based on the quantity of HFC-23 by-product not destroyed between 1 January 2022 and 1 May 2022 (31.89 mt).

#### *Verification report*

43. The verification team confirmed that in addition to the refurbishment of PDU-2, the enterprise refurbished PDU-1 to provide destruction services to third parties, including by verifying the permit for that destruction issued by the Ministry of the Environment. UNIDO confirmed that the refurbishment of PDU-1 was completed in September 2022, and that it had since been used for such third-party destruction. Recalling the commitment by Quimobásicos to suspend production of HCFC-22 for up to two weeks to

allow for the repair of the PDU, the Secretariat inquired whether PDU-1 could be used should PDU-2 need repairs, thus helping to minimize the risk that Quimobásicos would need to suspend production of HCFC-22. UNIDO indicated that while such use was possible, PDU-1 had not been tested for that use and additional work and replacement of components might be required for the unit to operate continuously.

44. In line with the guidelines for the verification of ODS production (decision 32/70),<sup>11</sup> the verification team reviewed raw material (AHF and chloroform) procurement and material use ratios; changes in inventory of HCFC-22; and generation and sales of muriatic acid, a by-product generated during HCFC-22 production that is sold by the enterprise in the Mexican market; and cross-checked the reported HCFC-22 production with daily transfers and logbook entries, as well as the enterprise's financial and accounting records. The verification team also physically inspected the pipes and buffer tanks used to transfer the HFC-23 to the PDU, and the two mass flow meters used to measure the HFC-23 waste stream before entering the PDU; the certificate of third-party calibration of both flow meters and the gas chromatograph used for composition analysis was also verified. A cut-off valve controls the incoming flow into the torch chamber, and the PDU has an interlock sequence to ensure that no gas is injected unless the torch is at plasma conditions, thereby ensuring that the PDU's DRE is met. To determine DRE, following the practice during the CDM, Quimobásicos uses a third-party analytical enterprise specialized in chimney and flue gas analysis. The regular practice entails measuring flow (with pitot tube) at the exit pipe of the PDU-2 and sampling by triplicate the flue gas once per month for off-site analysis by an accredited laboratory.

45. The verification team noted that the composition of the HFC-23 waste stream was measured by discrete sampling between the buffer tanks and flow meters, and that the frequency of this sampling varied (i.e., from initially 39 analyses per month, or more than one sample per day, to six analyses per month, or approximately one sample every five days). Notwithstanding the use of the buffer tanks, which help homogenize the HFC-23 waste stream composition before sampling and analysis, there was considerable variability in the composition of HFC-23 in the waste stream, with the HFC-23 content varying between 82.6 and 90.1 per cent. Following those observations, and noting that the purity of the HFC-23 waste stream is an important variable in determining the quantity of HFC-23 by-product sent to the PDU and that there is a need for balance between frequency of sampling and cost and practical considerations, the enterprise adjusted their quality control process to include waste stream sample testing more frequently (i.e., every other day), which the Secretariat agrees is an appropriate frequency.

46. The verification report included a proposed methodology to determine HFC-23 by-product emissions based on the CDM methodology that *inter alia* takes into account the variability and uncertainty in the measurement of the HFC-23 waste stream composition, and the amount of HFC-23 not destroyed due to shutdowns of the PDU. Regarding the latter, when the PDU shuts down, the cut-off valve feeding the unit closes. The potential lag between the PDU's distributed control system identifying the shutdown and actually closing the valve is less than 0.5 seconds; that quantity of HFC-23 is assumed not to be destroyed and instead vented. Based on the number of shutdowns in 2022, the average hourly mass flow rate to the PDU, and the maximum time lag to close the cut-off valve, the maximum additional emissions of HFC-23 is 1.84 kg. Regarding the former, a statistical analysis of the population of gas chromatograph analyses was performed, indicating an average HFC-23 purity of 86.09 per cent, a standard deviation of 2.466 per cent and uncertainty of 0.028 per cent. On that basis, the quantity of HFC-23 by-product destroyed is calculated at 78.25 mt.

47. The Secretariat considers the proposed methodology robust, and notes that the outcome of the methodology is the minimum quantity of HFC-23 destroyed, taking into account measurement variability, uncertainty, and possible additional emissions associated with PDU shutdowns. The difference between the reported HFC-23 destroyed (80.57 mt) and the minimum quantity of HFC-23 destroyed (78.25 mt) is

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<sup>11</sup> The draft guidelines and standard format used during the verification of ODS production phase-out funded by the Multilateral Fund are contained in document UNEP/OzL.Pro/ExCom/32/33.

2.32 mt, or 2.9 per cent of the reported HFC-23 destroyed. This provides an estimate of the maximum possible additional emissions of HFC-23 from the production facility.

#### Gender policy implementation<sup>12</sup>

48. While Quimobásicos has no specific gender policy in place, policies related to workplace discrimination and equality exist and include a component on gender. The policies were considered while recruiting for the project.

#### Sustainability of the HFC-23 emission control and assessment of risks

49. The sustainability of HFC-23 emission controls was an important element of the Executive Committee's consideration of the project, including the commitment by Quimobásicos to suspend production of HCFC-22 for up to two weeks to allow for the repair of the PDU, and the commitment by the Government of Mexico to ensure that emissions of HFC-23 by-product from HCFC-22 production by Quimobásicos would continue to be controlled and verified in the same manner after the completion of the project, including by means of policies and legislation (decision 86/96(c)(i) and (ii)). PDU-2 has been refurbished and tested and is operational; the refurbishment of PDU-1 further reduces the risk of potential emissions of HFC-23 in case of a repair of PDU-2 taking longer than two weeks. In addition, while funding from the Multilateral Fund was tied to the quantity of HFC-23 by-product destroyed, the Agreement for the project specified a maximum level of funding and incentivized a reduction in the HFC-23 by-product generation rate. The steps taken by the enterprise to ensure the optimal operation of the PDU and to minimize the HFC-23 by-product generation rate reduce the risk of HFC-23 emissions.

#### Conclusion

50. Quimobásicos, with the support of the Government of Mexico and UNIDO, undertook outstanding efforts to ensure the PDU could be refurbished in time so that HFC-23 by-product generated after 1 May 2022 was destroyed, in line with the Agreement between the Government of Mexico and the Executive Committee. Since 1 May 2022, emissions of HFC-23 by-product from the production of HCFC-22 have been insignificant. Ninety-nine per cent of the approved funds have been disbursed.

### **RECOMMENDATION**

51. The Fund Secretariat recommends that the Executive Committee note the progress report on the implementation of the project for the control and phase-out of HFC-23 emissions at Quimobásicos, Mexico, and further recommends blanket approval of the second tranche of the project and the corresponding 2023-2024 tranche implementation plan for Mexico at the funding level shown in the table below.

	<b>Project title</b>	<b>Project funding (US \$)</b>	<b>Support costs (US \$)</b>	<b>Implementing agency</b>
(a)	Control and phase-out of HFC-23 emissions in production of HCFC-22 at Quimobásicos (second tranche)	387,561	27,129	UNIDO

<sup>12</sup> In line with decision 84/92(d), decision 90/48(c) encouraged bilateral and implementing agencies to continue ensuring that the operational gender mainstreaming policy was applied to all projects, taking into consideration the specific activities presented in table 2 of document UNEP/OzL.Pro/ExCom/90/37.

## PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECTS

## Mexico

PROJECT TITLE	IMPLEMENTING AGENCY
Conversion of the manufacturing of commercial refrigerators from HFC-134a to propane at Friocima	UNDP
<b>NATIONAL COORDINATING AGENCY</b>	Ministry of the Environment and Natural Resources

## LATEST CONSUMPTION REPORTED FOR SUBSTANCES ADDRESSED BY THE PROJECT

## A: ARTICLE-7 DATA (2022)

HFC-134a	9,875.04 mt	14,121,319 CO <sub>2</sub> -eq tonnes
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## B: COUNTRY PROGRAMME SECTORAL DATA (2022)

HFC-134a (pure)	9,188.43 mt	13,139,461 CO <sub>2</sub> -eq tonnes
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HFC consumption remaining eligible for funding (mt)	n/a
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CURRENT YEAR BUSINESS PLAN ALLOCATIONS	Enterprise	Funding (US \$)	Phase-out (mt)
	Friocima	0	0

Particular	Unit	HFC-134a
HFC used at enterprise	mt	5.18
	CO <sub>2</sub> -eq tonnes	7,407
HFC to be phased out through this project	mt	5.18
	CO <sub>2</sub> -eq tonnes	7,407
HFC alternatives to be phased in	<b>Unit</b>	<b>R-290</b>
	mt	2.59
	CO <sub>2</sub> -eq tonnes	7.77
Project duration (months)		18
Initial amount requested (US \$)		237,800
Final project costs (US \$)		
Incremental capital costs		136,500
Contingency (10 % of equipment)		7,350
Incremental operating costs*		0
Total project cost		143,850
Local ownership (%)		100
Export component (%)		0
Requested grant (US \$)		143,850
Cost-effectiveness	US \$/kg	27.77
	US \$/CO <sub>2</sub> -eq tonne	32.10
Implementing agency support costs (US \$)		12,947
Total cost of project to Multilateral Fund (US \$)		156,797
Counterpart funding (Y/N)		Y
Project monitoring milestones included (Y/N)		Y

\*Not requested

<b>SECRETARIAT'S RECOMMENDATION</b>	Individual consideration
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## PROJECT DESCRIPTION

52. On behalf of the Government of Mexico, UNDP has submitted a proposal for a project to convert the manufacturing of commercial refrigerators<sup>13</sup> at Friocima from HFC-134a to propane (R-290), at a total cost of US \$237,800, plus agency support costs of US \$21,402, as originally submitted.

### Project objective

53. The project will eliminate 5.18 metric tonnes (mt) (7,407 CO<sub>2</sub>-eq tonnes) of HFC-134a consumed annually by one line manufacturing commercial refrigerators at Friocima.

### HFC consumption and sector background

54. In 2022, 48,556 mt of HFCs (pure and in blends) were consumed in Mexico, including 20,815 mt of R-410A (43 per cent of overall HFC consumption), 9,188 mt of pure HFC-134a (19 per cent), 6,113 mt of R-404A (13 per cent) and 5,660 mt of HFC-152a (12 per cent), followed by other HFCs and HFC blends. Table 1 presents the consumption of HFCs in Mexico over the past four years according to the country programme (CP) implementation report. CP data has been used for reference rather than Article 7 data as it presents the consumption of HFC-134a pure and contained in blends separately.

**Table 1. HFC consumption in Mexico in 2019–2022 (CP data) (mt)**

Substance	2019	2020	2021	2022
HFC-134a (pure)	7,758.79	6,889.56	7,208.19	9,188.43
HFC-125	43.05	22.54	535.47	854.31
HFC-152a	2,710.90	3,350.37	4,053.50	5,660.76
HFC-245fa	3,019.61	99.34	155.09	244.68
HFC-32	0.24	6.77	221.42	1,947.39
R-404A	1,717.19	1,629.57	2,019.90	6,112.96
R-410A	12,420.58	13,942.86	11,592.36	20,815.48
Other HFCs and HFC blends	1,405.98	1,197.00	1,525.39	3,732.83
<b>Total</b>	<b>29,076.34</b>	<b>27,138.00</b>	<b>27,311.33</b>	<b>48,556.85</b>

55. HFCs are used in the manufacturing of commercial refrigeration in Mexico in three subsectors: centralized systems (for supermarkets), condensing units (for businesses and industries) and stand-alone equipment (such as freezers, showcases and plug-in beverage coolers). R-404A is used in the three subsectors, R-507A is mainly used as a substitute for HCFC-22 in centralized systems, and HFC-134a is used in condensing units and stand-alone equipment.

56. Mexico has three enterprises manufacturing centralized systems and condensing units, of which only one is locally owned, and nine enterprises manufacturing stand-alone equipment, seven of which are locally owned.

57. Friocima is the only locally owned manufacturer of stand-alone commercial refrigerators in Mexico still consuming HFC-134a, while most of the other manufacturers of similar equipment have already converted to the use of hydrocarbon (HC) refrigerants, mainly R-290. However, there are still imports and manufacturing of larger commercial self-contained refrigerators using HFCs due to the amount of refrigerant charge they require (i.e., large cabinets, open cabinets and other larger equipment).

<sup>13</sup> For the purposes of this document, commercial refrigerators refer to stand-alone appliances containing HFC refrigerant charges below 500 gr, used in the commercial refrigeration sector.

Enterprise background

58. Friocima is a locally owned enterprise producing a range of small to medium-sized commercial refrigerators, mainly display units and ice cube freezers, for supermarkets, malls, hotels, and other buildings with larger cooling needs. Friocima's products are mainly sold in the Mexican market.

59. The current project proposal was prepared with funds approved for UNDP at the 90<sup>th</sup> meeting (MEX/REF/90/PRP/191) and is submitted in line with decision 87/50(e) on assistance to Article 5 countries that choose to implement individual HFC investment projects in advance of submitting stage I of their Kigali HFC implementation plan (KIP).

Enterprise-level HFC consumption

60. Friocima has one manufacturing line where both refrigerant charging and testing are done. The enterprise manufactures its own condensing units, evaporators, and cabinets, while some of the high technology components, such as the compressor, are outsourced. In 2022, Friocima's total manufacturing output was 14,405 equipment units, including ice cube freezers (7,376), freezers (5,257), vertical coolers (1,246), horizontal coolers (511) and vertical freezers (15), while its annual reported consumption was 5.18 mt of HFC-134a, with products typically having a refrigerant charge between 200 and 500 grams. The enterprise has also consumed negligible amounts of R-404A but not as part of its regular production. Table 2 presents the 2019-2022 production data for commercial refrigerators manufactured at Friocima.

**Table 2. Refrigeration manufacturing data for Friocima**

Type of product	Production output (equipment units)				HFC-134a consumption (mt)			
	2019	2020	2021	2022	2019	2020	2021	2022
Ice cube freezers	5,235	7,295	8,974	7,376	1.80	2.45	2.94	2.55
Freezers	1,541	2,598	3,053	5,257	0.71	1.17	1.26	2.23
Vertical coolers	1,183	616	1,089	1,246	0.28	0.16	0.28	0.31
Horizontal coolers	427	0	602	511	0.07	0.00	0.09	0.08
Vertical freezers	1	0	0	15	0.00	0.00	0.00	0.01
<b>Total</b>	<b>8,387</b>	<b>10,509</b>	<b>13,718</b>	<b>14,405</b>	<b>2.86</b>	<b>3.78</b>	<b>4.56</b>	<b>5.18</b>

Project description

61. The present proposal requests funds for the conversion of the only line in the enterprise manufacturing commercial refrigeration stand-alone units.

62. Propane was selected from among the currently available replacements for HFC-based capacity, including HCs, HFOs and blends, because it has no ozone-depleting potential and a negligible global-warming potential; it is a proven and mature technology; it is locally produced and competitively priced in Mexico; it requires up to 50 per cent less refrigerant charge than HFC-134a; it uses mineral oil; and because R-290-based products have a better coefficient of performance and energy-efficiency ratio than HFC-134a-based products.

63. Conversion to R-290 will require product redesign, due to the lower use of refrigerant and safety considerations due to its flammability. This encompasses the modification of the heat exchanger and condenser due to lower refrigerant charge; and modification of the charging and testing areas, including automatic charging unit, advanced vacuum check, refrigerant evacuation system, and refrigerant monitoring and ventilation systems, to address safety considerations associated with the use of a flammable refrigerant.

### Project costs

64. Funds are requested for the hiring of a technical expert to assist the conversion; a new assembly line including *inter alia* the refrigerant charging station, ultrasonic welding, leak detectors; layout and safety modifications; product redesign and prototyping; training of the servicing team; a safety audit; and contingencies. The requested incremental capital costs (ICCs), shown in table 3 as originally submitted, stood at US \$237,800.

**Table 3. ICCs proposed for the conversion of a commercial refrigeration line at Friocima**

Item	Description	Estimated ICCs (US \$)
Technical support	Refrigeration expert	15,000
New filling line	Vacuum controller with advanced vacuum check function	3,000
	HC blowoff and vacuum station	10,000
	Industrial leak detectors	14,000
	Refrigerant charging station including supply	60,000
	Ultrasonic welding station	28,000
	Installation services, including maintenance and operator training and spare parts	13,000
Layout and safety	Separation of charging area	5,000
	Ventilation system	8,000
	Related infrastructure work	10,000
Consultancy	Product redesign, competency development of the research and development team	20,000
Training	Training of the servicing team	5,000
Prototyping	Prototype components	10,000
Safety audit	Final safety audit of R-290 installation	17,000
External services	Shipping	6,000
<b>Subtotal</b>		<b>224,000</b>
Contingencies	10% of the equipment items	13,800
<b>Total</b>		<b>237,800</b>

65. No funding for the incremental operating costs (IOCs) is being requested from the Multilateral Fund. The submission included an indicative estimate of IOCs at US \$0.53 per unit converted from HFC-134a to R-290, based on incremental costs related to changes in the compressor (US \$15 per unit) and electrical components (US \$10 per unit) and savings on the refrigerant (US \$1.47 per unit), the heat exchanger (US \$10 per unit), fan assembly (US \$8 per unit) and others (US \$5 per unit). Assuming a production output of 14,405 units, the IOCs calculated for a 12-month period amount to US \$7,634.

66. Based on the funding request, the overall cost-effectiveness of the conversion from the use of HFC-134a to R-290 at one line manufacturing commercial refrigerators at the enterprise Friocima, implemented over a period of 18 months, amounts to US \$45.90/kg and is set to eliminate 5.18 mt (7,407 CO<sub>2</sub>-eq tonnes) of HFC-134a. Table 4 presents a summary of project costs and expected outcomes, as submitted.

**Table 4. Total costs requested for the conversion of one refrigerator-manufacturing line at Friocima**

Item	Cost in US \$	
ICCs	237,800	
IOCs	0	
<b>Total requested</b>	<b>237,800</b>	
HFC phase-out from the funded line (mt)	5.18	
Cost-effectiveness	(US \$/kg)	45.90
	(US \$/CO <sub>2</sub> -eq tonne)	32.10

### Energy efficiency

67. The proposal included an indicative estimate of US \$80,000 to achieve energy-efficiency improvements of up to 40 per cent in the R-290-based product through additional redesign, prototyping, laboratory testing, certification, and training, although this funding was not requested as part of the project.

### Gender mainstreaming considerations

68. During the implementation of the project UNDP will identify opportunities to provide relevant training at the enterprise level.

## **SECRETARIAT'S COMMENTS AND RECOMMENDATION**

### **COMMENTS**

#### Relation to stage I of the Kigali HFC implementation plan and sustainability of HFC reductions

69. The Friocima project proposal was submitted in line with decision 87/50(e) in advance of stage I of the KIP. Accordingly, UNDP explained that the conversion of Friocima was aligned with the commitments to be included into the overarching strategy for the KIP for Mexico. The self-contained commercial refrigeration subsector was planned to be transitioned to R-290 before 2024 due to the availability of and access to R-290 technology. While the other six nationally owned enterprises have converted to R-290 with their own funds, Friocima is the only Mexican enterprise in this subsector that remains to be converted and requires Multilateral Fund assistance. Friocima's conversion needs to be completed in 2024 in line with the overarching strategy for the KIP for the subsector and to remain competitive and meet industry trends.

70. On whether the Government of Mexico would be in a position to establish a ban on the import and manufacturing of HFC-based self-contained commercial refrigerators after the completion of the project, UNDP explained that the Government had the intention to limit the local manufacturing and imports of small self-contained refrigeration units with HFC-134a, and that during the implementation of stage I of the KIP it would analyze regulatory mechanisms that could be applied to limit the local manufacture and imports for self-contained commercial refrigerators converted to R-290 (with refrigerant charges up to 150 gr). The KIP for Mexico is scheduled to be submitted to the 93<sup>rd</sup> meeting of the Executive Committee.

71. Regarding potential risks to the enterprise's capacity to complete the project, UNDP considers this risk low, as Friocima is a well-structured enterprise that has been active in the market for many years and has technical expertise. The Secretariat also considers this risk low because R-290 is locally produced at a lower price than HFC-134a, and because R-290-based products are already available in the Mexican market, supplied by other local manufacturers that have already converted their use.

72. Even though the reduction in HFC consumption proposed by the project is small in comparison to the overall national consumption, the Secretariat considers that it will help complete the conversion of the subsector of self-contained commercial refrigerators in Mexico and allow the Government to consider regulatory measures to restrict the import and manufacturing of similar equipment during the implementation of stage I of the KIP, making the transition to R-290 sustained and contributing to limit the increase of HFC-134a banks in this subsector, whether from newly manufactured or imported equipment, and any future associated consumption of this substance in servicing.

### Deduction of HFC reductions from the starting point

73. The phase-out of 7,407 CO<sub>2</sub>-eq tonnes (5.18 mt) of HFC-134a resulting from the approval of the present project will count against the consumption eligible for funding identified in the KIP. Accordingly, once the starting point for sustained aggregate reduction in HFC consumption is established, the reductions proposed by this project will need to be deducted in accordance with the methodology agreed under the HFC cost guidelines (currently under discussion).

### Proposed and revised costs

74. The Secretariat and UNDP discussed in detail each of the items required for the conversion at Friocima. The Secretariat noted that the proposed use of a vacuum controller with advanced vacuum check function (US \$3,000) was a cost-effective alternative option for testing leaking before charging, compared to the use of helium (for which the entire system could cost above US \$60,000). It was also noted that, even though the current process of charging equipment takes place without the use of a charging unit, such a unit would be required to ensure accuracy in the refrigerant charge due to the substantially reduced charge of R-290 in the new product, and that it would also be advantageous for safety purposes. The cost of the unit was adjusted from US \$60,000 to US \$35,000. Upon further discussion, UNDP reported that R-290 could be evacuated using the existing equipment (removing the US \$5,000 initially proposed for that purpose). The proposed costs for industrial leak detectors, installation services and shipping, layout and safety, prototype components, training of the servicing team and safety audit were also adjusted. The revised costs of the conversion of the commercial refrigeration manufacturing line at Friocima are shown in table 5.

**Table 5. Agreed costs of the conversion to R-290 at Friocima**

Item	Description	Proposed cost (US \$)	Agreed cost (US \$)
Technical support	Refrigeration expert	15,000	15,000
New filling line	Vacuum controller with advanced vacuum check function	3,000	3,000
	HC blowoff and vacuum station	10,000	0
	Industrial leak detectors	14,000	7,500
	Refrigerant charging station including supply	60,000	35,000
	Ultrasonic welding station	28,000	28,000
	Installation services, including maintenance and operator training and spare parts	13,000	0
Layout and safety	Separation of charging area	5,000	5,000
	Ventilation system	8,000	5,000
	Related infrastructure work	10,000	5,000
Consultancy	Product redesign, competence development of the R&D team	20,000	20,000
Training	Training of the servicing team	5,000	0
Prototyping	Prototype components	10,000	0
Safety audit	Final safety audit of R-290 installation	17,000	13,000
External services	Shipping	6,000	0
<b>Subtotal</b>		<b>224,000</b>	<b>136,500</b>
Contingencies	10% of the equipment items	13,800	7,350
<b>Total ICCs</b>		<b>237,800</b>	<b>143,850</b>
IOCs		0	0
HFC consumption phase-out (mt)		5.18	5.18
HFC consumption phase-out (CO <sub>2</sub> -eq tonnes)		7,407	7,407
Cost-effectiveness	(US \$/kg)	45.97	27.77
	(US \$/CO <sub>2</sub> -eq tonne)	32.10	19.42

75. As the IOCs have not been requested, their calculation was not discussed in detail; however, the Secretariat noted that UNDP's indicative calculation already took into consideration savings that could be

achieved on the heat exchanger, the fan assembly and the refrigerant due to its lower charge and competitive price due to local production. The Secretariat considered that it was possible to reduce the difference in the cost of the compressor; UNDP explained that the reason for the difference was that those available in this market were variable-speed compressors. Regarding the incremental costs of electrical components, it was acknowledged that they were still difficult to assess.

76. The revised incremental costs requested for the conversion of Friocima to phase out 5.18 mt (7,407 CO<sub>2</sub>-eq tonnes) of HFC-134a amount to US \$143,850, with a cost-effectiveness of US \$27.77/kg (US \$19.42/CO<sub>2</sub>-eq tonne).

77. The Secretariat notes that in the absence of the cost guidelines for HFC phase-out, this project has been reviewed on a case-by-case basis. Based on the information available at the time of review, the Secretariat considers that the agreed costs are the best estimate of the overall incremental costs of the conversion; however, these estimates might change, according to the specific characteristics of participating enterprises, as more information becomes available. The Secretariat considers that approval of the project at the levels proposed above would not constitute a precedent.

#### Energy-efficiency considerations

78. Even though the energy-efficiency component was not included as part of the project cost, UNDP shared a description of the main costs to be incurred, which mostly included internal engineering hours, prototyping, testing and certification, as well as assistance from an external consultant. In discussing whether the energy-efficiency component of this project could be potentially eligible under the funding window established for pilot projects by decision 91/65, UNDP reported that although this was a clear opportunity to show energy-efficiency benefits during HFC phase-out in an enterprise, the Government of Mexico was not pursuing it at present, noting that the window was limited and that it was unclear how the consideration of this project would affect the consideration of other energy-efficiency projects in the country's refrigeration and air-conditioning sector.

#### 2023–2025 business plan

79. This project is not included in the 2023–2025 business plan of the Multilateral Fund; however, it may be integrated into UNDP's component of the KIP, which is included in the business plan at US \$6,605,130, including support costs, for the year 2023.

### **RECOMMENDATION**

80. The Executive Committee may wish to consider:

- (a) Noting the project proposal for the conversion of commercial refrigerator manufacturing at Friocima from the use of HFC-134a as the refrigerant to propane (R-290);
- (b) Approving the project proposal indicated in subparagraph (a) above in the amount of US \$143,850, plus agency support costs of US \$12,947 for UNDP, on the understanding:
  - (i) That 7,407 CO<sub>2</sub>-eq tonnes (5.18 mt) of HFC-134a would be deducted from the starting point for sustained aggregate reductions in HFC consumption once it had been established, and that this deduction would be undertaken in accordance with the methodology agreed under the HFC cost guidelines currently under discussion;
  - (ii) That the present project would be integrated into stage I of the Kigali HFC implementation plan (KIP) for Mexico, once the plan had been fully formulated for submission for consideration by the Executive Committee;

- (iii) That the level of costs approved would not constitute a precedent for future HFC individual investment project proposals; and
- (c) Further noting the commitment of the Government of Mexico to undertake during stage I of the KIP an analysis of the regulatory mechanisms that could be applied to limit the local manufacture and imports of small self-contained commercial refrigeration units with HFC-134a in Mexico.

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