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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Eightieth Meeting
Montreal, 13-17 November 2017

PROJECT PROPOSAL: ARGENTINA

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

Phase-out

•	Conversion project for replacement of HFC-134a with isobutane (R-600a) / propane (R-290)-based refrigerant in the manufacture of domestic and commercial refrigeration equipment	UNIDO

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

ARGENTINA

PROJECT TITLE(S)	BILATERAL/IMPLEMENTING AGENCY
(a) Conversion project for replacement of HFC-134a with isobutane (R-600a) / propane (R-290)-based refrigerant in the manufacture of domestic and commercial refrigeration equipment	UNIDO

NATIONAL CO-ORDINATING AGENCY	OPROZ

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (ODP TONNES, [INSERT YEAR], AS OF [INSERT MONTH AND YEAR])

HFCs	*

B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, [INSERT YEAR], AS OF [INSERT MONTH AND YEAR])

HFCs	*

HFC consumption remaining eligible for funding (ODP tonnes)	n/a

CURRENT YEAR BUSINESS PLAN ALLOCATIONS		Funding US $	Phase-out ODP tonnes
	(a)	0	0

PROJECT TITLE:	(a)
HFC-134a used at enterprise (mt):	96.55
HFC-134a to be phased out (mt):	96.55
HFC-134a to be phased out (mt CO_2 equivalent):	138,069
Project duration (months):	24
Initial amount requested (US $):	2,619,710
Final project costs (US $):	
Incremental capital cost:	1,105,810
Contingency (10 %):	78,300
Incremental operating cost:	656,645
Total project cost:	1,840,755
Local ownership (%):	100
Export component (%):	0
Requested grant (US $):	1,840,755
Cost-effectiveness (US $/kg):	19.07
Implementing agency support cost (US $):	128,853
Total cost of project to Multilateral Fund (US $):	1,969,608
Status of counterpart funding (Y/N):	Y
Project monitoring milestones included (Y/N):	Y

SECRETARIAT'S RECOMMENDATION	For individual consideration

*A total of 4,988 mt of HFC (including 1,790 mt of HFC-134a) was estimated in 2015 (source: ODS survey).

PROJECT DESCRIPTION

1. On behalf of the Government of Argentina, UNIDO has submitted a project for conversion of HFC-134a with isobutane (R-600a) / propane (R-290)-based refrigerant in the manufacture of domestic and commercial refrigeration equipment, at a total cost of US $2,619,710, plus agency support costs of US $183,380, as originally submitted.

Project objective

2. The project will eliminate the annual consumption of 96.55 metric tonnes (mt) (138,069 of CO_2 tonnes) of HFC-134a at the three domestic and commercial refrigeration equipment manufacturing enterprises - Briket S.A. (Briket), Talleres Metalurgicos Bambi (Bambi), and Mabe-Kronen Int. SRL (Mabe-Kronen). The energy efficiency of the domestic refrigerators will also increase by at least 20 per cent through changes in the refrigerant, and equipment design and components.

HFC consumption and sector background

3. In 2015, a consumption of 4,988 mt of HFCs and blends of HFCs was identified in the country, with the refrigeration and air-conditioning (RAC) sector accounting for the vast majority (approximately 91.6 per cent) of that consumption. A small amount of HFCs (8.4 per cent) are consumed in the manufacture of metered-dose inhalers (MDI), in the aerosol and fire-fighting sectors, and in the manufacture of polyurethane foam.

4. Table 1 shows the 2015 consumption of HFC consumption in RAC applications based on ODS alternatives survey. After R-410A, HFC-134a is the second most consumed refrigerant in the country, accounting for approximately 32 per cent of the country's HFC consumption in mt.

Table 1. Consumption of HFCs in the RAC sector in 2015 (mt)

Particulars	HFC-134a	R-404A	R-410A	R-407C	Other HFCs	Other HFC blends	Total
Refrigeration							
Manufacturing	157	60					217
Servicing	963	244				501	1,708
Air-conditioning							
Manufacturing	328*		1,816				2,144
Servicing			294	6	14	184	498
Total	**1,447**	**304**	**2,110**	**6**	**14**	**685**	**4,567**
% of total consumption	**31.7**	**6.7**	**46.2**	**0.1**	**0.3**	**15.0**	**100.0**

*Relates to mobile air-conditioning.

5. The domestic and commercial refrigeration manufacturing sector consists of six medium-sized enterprises, the three enterprises participating in the project, Autosal, Pilisar[1], and the non-Article 5-owned Electrolux-Frimetal S.A., and some very small manufacturers. The 2015 consumption of HFC-134a in the sector was 153 mt; a further 15 mt of R-600a was consumed by Autosal and Pilisar. The total market for the sector is estimated at 1.1 million units; exports from the country are negligible. Autosal and Pilisar manufactured approximately 240,000 R-600a units in 2015, a 20 per cent increase from their 2014

[1] Autosal received funding from the Multilateral Fund to convert from CFC-11 and CFC-12 to cyclopentane and R-600a in 1997. Pilisar is manufacturing R-600a-based domestic refrigerators; however the enterprise has not received funding from the Fund.

manufacturing level. Imports accounted for approximately 10 per cent of units sold on the market; data is not available on the relative proportion of HFC-134a-based and R-600a-based imports.

Enterprise background

6. Briket and Bambi are 100 per cent locally-owned and Mabe-Kronen is 100 per cent Article 5-owned. Both Briket and Mabe-Kronen have one assembly line with capacity of 60 units/hour, while Bambi has three assembly lines with a total capacity of 100 units/hour. Briket and Bambi manufacture domestic refrigerators, freezers, bottle coolers, chest freezers and display cabinets, while Mabe-Kronen only manufacturers domestic refrigerators and freezers.[2] Briket and Bambi received funding from the Multilateral Fund to convert from CFC-11 and CFC-12 to cyclopentane and HFC-134a in 1997, while Mabe-Kronen received funding from the Multilateral Fund to convert from HCFC-141b to cyclopentane in 2012[3] under stage I of the HPMP.

HFC consumption by enterprise

7. The 2014-2016 HFC-134a consumption at the enterprises is shown in Table 2.

Table 2. Consumption of HFC-134a (mt) at Briket, Bambi, and Mabe-Kronen (2014-2016)

Year	2014	2015	2016
Briket	23.70	27.30	29.50
Bambi	31.00	43.00	39.00
Mabe-Kronen	27.9	31.00	28.05
Total (mt)	**82.60**	**101.30**	**96.55**
Total (CO_2 tonnes)	**118,118**	**144,859**	**138,067**

Selection of alternative technology

8. R-600a was selected as the alternative technology for domestic refrigerators, freezers and bottle coolers while R-290 was selected for display cabinets. Both refrigerants are cheaper than HFC-134a in terms of the refrigerant charge per appliance (26 per cent), and have a higher coefficient of performance and energy efficiency ratio compared to HFC-134a; there is no need to recycle or reclaim the refrigerant on the repair line or at the end of life of the appliances, if safely released, due to low GWP; and the technology is well-proven and components are widely available.

Project description

9. Given the flammability of R-600a and R-290, changes are foreseen to the production process at the three enterprises and the end-products, as well as modifications to their testing laboratory to work with hydrocarbon-based (HC) refrigerants. The conversion at each enterprise includes the following five components:

(a) Product development includes: ventilation and safety for the laboratory for development and testing; redesign, prototyping, trials and test per model; and certification of models;

[2] The three enterprises manufacture equipment that use hermetic compressors of 250 rated watts and below, which are classified as belonging to the domestic refrigeration sub-sector, in line with decision 26/36.

[3] At the time of approval of the stage I HPMP for Argentina, the enterprise had 48.4 per cent non-Article 5 ownership. That non-Article 5 ownership was purchased by an Article 5-owned conglomerate in 2016.

(b) Modifications to the charging area include: assembly line modifications; refrigerant charging stations suitable for flammable refrigerants; introduction of ultrasound sealing of the refrigeration system; post-charge leak detectors; antistatic flooring; a recovery machine for the repair zone; and installation of a safety and ventilation system in the charging area (US $268,000);

(c) Modifications to the refrigerant storage and supply equipment include: a storage stand for sufficient refrigerant cylinders and automatic change-over valves; refrigerant transfer pump; and a safety and ventilation system (US $110,000);

(d) Common infrastructure includes: a fire extinguisher sprinkler system, and hand-held HC leak detectors for the storage area and laboratory (US $72,700); and

(e) General activities include installation, delivery, training, and safety certification (US $142,629).

10. In addition to the above costs, US $20,000 for international consultants and US $8,000 for dissemination of technology was requested for each enterprise.

11. As the baseline equipment varied by enterprise, the requested funding varied by enterprise. For example, in 2016, Briket purchased a dual-use HFC-134a/R-600a charging machine and a HC recovery machine although the enterprise currently only manufactures with HFC-134a, while Mabe-Kronen is currently using a helium leak detection system which could be used for HC and HFC-134a. The enterprises did not request funding for equipment already in their baseline. In addition, the following equipment that would be used in the HC manufacturing processes were considered counterpart input by the three enterprises: pneumatic refrigerant booster pump; antistatic flooring; a dedicated building for refrigerant storage with a fly-open roof and windows, explosion-proof lights, and transfer pipes; emergency diesel generator; and marketing.

12. The incremental operating costs (IOC) were estimated based on the cost of raw materials, considering safety and rearrangement of electric components, and improvement in energy efficiency. The price of HFC-134a and R-600a was reported at US $6.45/kg and US $9.50/kg, respectively. The average charge of HFC-134a per unit varied between 112 g/unit and 191 g/unit, depending on the mix of equipment manufactured by the enterprise. Components included in the IOCs were the compressor, filter, thermostat, explosion-proof fans, and light; the costs of each component varied depending on the mix of equipment manufactured by the enterprise. IOCs were requested for six months.

13. The enterprises decided to use the opportunity of conversion to improve by at least 20 per cent the energy efficiency of their products by *inter alia* optimizing the insulation foam formulation and foam density; improving the condenser and evaporator tubes; selecting higher efficiency compressors; redesigning the internal air flow to improved air circulation; improved temperature controls; and the use of light-emitting diode bulbs. Only some of the changes related to the refrigerant conversion are requested to be funded by the Multilateral Fund; all other costs will be borne by the enterprise.

14. On that basis, the total request to the Multilateral Fund is US $2,619,710 as reflected in Table 3. The duration of the project is 24 months.

Table 3. Estimated costs for conversion at Briket, Bambi, and Mabe-Kronen, as submitted (US $)

Particulars	Briket	Bambi	Mabe-Kronen
Product development			
Ventilation and safety system for laboratory	9,000	9,000	9,000
Redesign, prototyping, trials and tests	24,538	25,800	19,750
Certification of models	64,000	40,000	56,000
Sub-total	**97,538**	**74,800**	**84,750**

Particulars	Briket	Bambi	Mabe-Kronen
Charging area equipment			
Assembly line modification	10,000	20,000	10,000
Charging machine	-	110,000	75,000
Safety and ventilation system	-	65,000	65,000
HC leak detector	22,000	44,000	44,000
Ultrasonic welding machine	-	-	64,000
Recovery machine for R-600a refrigerant, Ex proof	-	10,000	5,000
Helium leak testing equipment	134,000	134,000	-
Refrigerant storage and supply equipment			
Storage stand for refrigerant cylinders with valves	9,000	9,000	9,000
Refrigerant transfer pump	-	30,000	15,000
Safety and ventilation system	-	14,000	24,000
Common infrastructure			
Fire extinguisher sprinkler system	30,000	30,000	10,000
Hand-held leak detector for HCs	900	900	900
Sub-total	**205,900**	**466,900**	**321,900**
Contingency	20,590	46,690	32,190
Other costs			
Installation	8,236	18,676	12,876
Training	5,000	8,000	5,000
Delivery	6,177	14,007	9,657
Safety certification (TÜV Süd)	15,000	25,000	15,000
Sub-total	**34,413**	**65,683**	**42,533**
Total ICCs	**358,441**	**654,073**	**481,373**
Grand total ICCs		**1,493,887**	
Average charge (g/unit)	191.0	168.1	112.4
Incremental refrigerant cost (US $/unit)	(0.27)*	(0.21)	(0.19)
Incremental component cost (US $/unit)	5.84	3.23	2.46
IOC per unit (US $/unit)	5.57	3.02	2.27
IOC per kg (US $/kg)	29.06	17.96	20.19**
IOC for six months (US $)	**428,604**	**350,257**	**262,963**
Grand total IOCS		**1,041,824**	
International consultant	20,000	20,000	20,000
Dissemination	8,000	8,000	8,000
Total incremental cost	**815,045**	**1,032,330**	**772,336**
Consumption (mt)	**29.50**	**39.00**	**28.05**
Cost-effectiveness (US $/kg)	**27.63**	**26.47**	**27.53**

* Actual value is US $ 0.32/kg with corrected average charge per unit of 191 g.

** Based on average consumption per unit.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Eligibility

15. The Secretariat reviewed the project proposal based on the current policies and decisions of the Multilateral Fund, similar approved conversion projects for CFC phase-out (i.e., conversion of refrigerant component from CFC-12 to R-600a involving product and manufacturing process redesign) and approved projects to phase-out ODS with flammable alternatives.

16. This project has been submitted in line with decisions 78/3(g) and 79/45. It included an official letter from the Government with the commitment required in decision 78/3(g). In line with decision 79/45, the endorsement letter from the Government of Argentina indicates it would make every effort to ratify the Kigali Amendment as soon as possible, confirmed that it is aware that no further funding would be available until the instrument of ratification of the Kigali Amendment had been received by the depositary at the United Nations Headquarters in New York, if this project would be approved by the Executive Committee; and acknowledged that in case this project is approved, any HFC reduced would be deducted from its starting point (which may be agreed in the future). The Secretariat also notes with appreciation that this proposal was submitted without preparation funding.

17. UNIDO also explained that the enterprises and the Government are strongly committed to implementing this project and the results of the project are expected to encourage adoption of energy efficient R-600a-based equipment in Argentina and in the region.

18. Noting that the project proposed conversion of the production lines in three manufacturing enterprises, the Secretariat requested clarification on the need for conversion project at multiple enterprises as decision 79/45 indicates stand-alone investment projects in individual enterprises. UNIDO emphasized that the enterprises have different product types, manufacturing processes, and layouts, and as such will provide information to understand the incremental costs associated with the conversion of different products at different types of enterprises. The Secretariat concurs that the incremental cost of conversion at the three enterprises are likely to be different and notes that decision 79/45 refers to "enterprises" rather than "enterprise," and considers it likely that the project would provide information on the incremental costs different enterprises that manufacture a range of products might experience.

Regulatory framework

19. The Secretariat requested clarifications on how sustainability of production of HC-based refrigeration equipment of the three beneficiaries would be achieved, noting that there is at least one medium-sized local enterprise that could still produce HFC-134a-based refrigerators after the project is completed and domestically-produced HC-based refrigeration equipment would need to also compete with imported HFC-134a-based equipment. UNIDO clarified that the Government plans to put in place other measures such as the mandatory energy efficiency labeling for domestic refrigerators that will help faster adoption of HC-based refrigeration equipment; however, the Government at this stage is not in a position to enact a ban on HFC-based domestic refrigerators. It is expected that the economic situation in the country would continue to drive growth in refrigerator market, both HFC- and HC-based equipment. While noting with appreciation the willingness of the Government to consider measures that would help faster adoption of HC-based refrigeration equipment, identification of specific measures that will be put in place could provide additional assurance of the sustainability of the conversion and ensure that market disparity on account of products with different technologies at different prices is avoided.

Proposed costs

20. The Secretariat requested clarifications on the need for product redesign and certification for all models; the costs of key equipment items which were at higher levels than similar equipment in other projects such as refrigerant charging machines, helium leak detectors, ultrasonic welding machine, HC leak detector, and HC recovery machine, and the costs for safety verification, technical assistance, and information outreach.

21. UNIDO explained that the requested modifications were necessary to implement the conversions, and agreed to adjust costs of several of the equipment items based on comparable costs of similar equipment of other projects. The Secretariat noted that some of the cost reductions achieved (i.e., costs related to technical assistance and certification) reflected savings that could be achieved through efficient scheduling

and procurement practices, in particular by implementing the activities at the three enterprises in a coordinated manner.

22. The Secretariat also noted that some of the enterprises already had some of the requested equipment in their baseline equipment and therefore did not request funding for it, and that the enterprises would co-finance some of the requested costs, such as charging machines, ultrasonic welding machines, and safety infrastructure.

23. The IOC had been estimated at US $2.27 per unit (Mabe), US $5.57 per unit (Briket), including US $2.00 per compressor for two enterprises (Briket and Bambi) and US $1.00 per compressor for Mabe-Kronen. Upon request for clarifications on variations of the IOC for components across the enterprises, UNIDO explained that Mabe-Kronen has negotiated lower procurement costs for some of the components as compared to the other two enterprises. The Secretariat recalled that the evaluation of requests for financing incremental costs of a given project shall take into account several principles, including that the most cost-effective and efficient option should be chosen. Taking into account the national industrial strategy proposed by the Government of Argentina to convert three of the local manufacturers of domestic and commercial refrigeration equipment from HFC-134a to HC technology, it considered the need to rationalise the incremental cost of the components to be same for all enterprises, i.e., US $1 per unit for compressors for domestic refrigerators, and US $2.17 per unit for compressors for freezers, bottle coolers, chest freezers and display cabinets. Further to consultations, UNIDO agreed to this approach resulting in a request of US $656,645 determined based on the product mix at each enterprise.

24. In concluding the discussion on technical and cost-related matters, the agreed costs of the conversion of the domestic and commercial refrigeration equipment manufacturing at the three enterprises amounts to US $1,840,755 to phase-out 96.55 mt (138,069 CO_2-equivalent tonnes) of HFC-134a, with a cost-effectiveness of US $19.07/kg, as summarized in Table 4.

Table 4. Agreed costs for conversion of domestic and commercial refrigeration equipment manufacturing in Argentina (US $)

Particulars	Briket	Bambi	Mabe-Kronen	Total
Product design, testing and certification	59,600	42,500	53,900	156,000
Refrigerant storage and supply system	9,000	39,000	24,000	72,000
Assembly line modification and production equipment	115,000	250,000	115,000	480,000
Safety systems	37,000	109,000	94,000	240,000
Technical assistance and training	18,000	21,000	19,000	58,000
Installation and delivery	18,270	18,270	18,270	54,810
Safety audit and certification	15,000	15,000	15,000	45,000
Dissemination of technology	0	0	0	0
Total funding request	**271,870**	**494,770**	**339,170**	**1,105,810**
Contingency	26,100	26,100	26,100	78,300
Total ICC	**297,970**	**520,870**	**365,270**	**1,184,110**
IOC (6 months)	177,255	238,664	240,727	656,645
Total incremental cost	**475,225**	**759,534**	**605,997**	**1,840,755**
HFC-134a consumption (mt)	**29.50**	**39.00**	**28.05**	**96.55**
Cost-effectiveness (US $/kg)	**16.11**	**19.48**	**21.60**	**19.07**

25. The Secretariat notes that the purpose of implementing projects under decision 78/3(g) is to gain experience in the incremental capital costs and IOCs that might be associated with phasing down HFCs. Based on available information 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 might change as more information becomes available, and according to the specific characteristics of the enterprises. The Secretariat, therefore, considers that the agreed costs above would not constitute a precedent.

26. The enterprises have committed to stop using HFC-134a in producing domestic refrigerators upon project completion by December 2019, leading to a reduction of 96.55 mt of the HFC-134a used in domestic refrigerator manufacturing in the country.

2017-2019 Business plan

27. This project does not fall under the regular business plans submitted to the Secretariat and presented to the Executive Committee as it falls under the purview of decisions 78/3(g) and 79/45.

RECOMMENDATION

28. The Executive Committee may wish to consider the project for conversion of HFC-134a with isobutane (R-600a) / propane (R-290)-based refrigerant in the manufacture of domestic and commercial refrigeration equipment for Argentina, in the context of its discussion of the proposals for HFC-related projects described in the document on Overview of issues identified during project review (UNEP/OzL.Pro/ExCom/80/22).