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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Eighty-first Meeting
Montreal, 18-22 June 2018

PROJECT PROPOSAL: ZIMBABWE

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

Refrigeration

- Conversion of domestic refrigerator and freezer manufacturing at Capri from the use of HFC-134a as the refrigerant to iso-butane (R-600a)

UNDP

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT**Zimbabwe****PROJECT TITLE(S)****BILATERAL/IMPLEMENTING AGENCY**

(a) Conversion of domestic refrigerator and freezer manufacturing at Capri from the use of HFC-134a as the refrigerant to iso-butane (R-600a)	UNDP
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NATIONAL COORDINATING AGENCY	Ministry of environment, water and climate, Government of Zimbabwe
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LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT**A: ARTICLE 7 DATA (METRIC TONNES (MT), 2017)**

HFCs	n/a
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B: COUNTRY PROGRAMME SECTORAL DATA (MT, 2017)

HFCs	n/a
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HFC consumption remaining eligible for funding (mt)	n/a
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CURRENT YEAR BUSINESS PLAN ALLOCATIONS		Funding (US \$)	Phase-out (mt)
	(a)	503,000	0.00

Particular	Units	HFC-134a
HFCs used at enterprise:	mt	14.50
	CO ₂ eq	20,735
HFCs to be phased out through this project:	mt	14.50
	CO ₂ eq	20,735
HFCs/alternatives to be phased in:	Units	R-600a
	mt	10.88
	CO ₂ eq	30.45
Project duration (months):		24 months
Initial amount requested (US \$):		1,338,689
Final project costs (US \$):		
Incremental capital costs:		514,660
Contingency (10 % on equipment and trial):		48,866
Incremental operating costs:		0
Total project costs:		563,526
Local ownership (%):		100
Export component (%):		0
Requested grant (US \$):		563,526
Cost-effectiveness:	US \$/kg	38.86
	US \$/CO ₂ eq	27.18
Implementing agency support costs (US \$):		39,447
Total cost of project to Multilateral Fund (US \$):		602,973
Counterpart funding (Y/N):		Yes
Project monitoring milestones included (Y/N):		Yes

SECRETARIAT'S RECOMMENDATION	For individual consideration
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PROJECT DESCRIPTION

1. On behalf of the Government of Zimbabwe, UNDP has submitted a project proposal for the conversion of two manufacturing lines for domestic refrigerators and freezers at Capri from HFC-134a and isobutane (R-600a), at a total cost of US \$1,338,689, as originally submitted, to phase out 14.5 mt of HFC-134a.

HFC consumption and sector background

2. According to the data reported under the surveys on ODS alternatives submitted to 78th meeting, a total of 117.50 mt of HFCs (pure and in blends) was imported in 2015. These were mainly R-410A (40.94 per cent), HFC-134a (30.20 per cent), R-404A (25.36 per cent), and R-507A (1.40 per cent). HFC-134a is used both for manufacturing refrigeration equipment and in the refrigeration servicing sector. In 2015, the consumption of HFC-134a amounted to 48.30 mt.

3. Capri is a locally owned enterprise that has already received Multilateral Fund assistance. At the 20th and 65th meetings, funding was approved to replace CFC-11 with HCFC-141b technology (later changed to cyclopentane) and to replace CFC-12 with HFC-134a.¹ The Secretariat therefore considers that this conversion falls under paragraph 18(b) of decision XXVIII/2.

Enterprise background

4. The manufacturing of domestic refrigerators and freezers is done by two companies, Capri and Imperial. However, at Imperial is negligible.

5. Capri has two manufacturing lines: one for refrigerators, with production capacity of 130,000 units/year, and one for freezers, with production capacity of 104,000 units/year. In 2017, the enterprise produced 97,000 units as shown in Table 1.

Table 1. Production of domestic refrigerators and freezers at Capri (2015-2017)

Production line	Year				
	2013	2014	2015	2016	2017
Refrigerator	25,000	32,000	35,000	35,000	36,000
Freezer	40,000	46,000	43,000	56,000	61,000
Total units	65,000	78,000	78,000	91,000	97,000
HFC-134a consumption (mt)			11.60	13.60	14.50

Project description and costs

6. The currently available replacements for HFC-based capacity are R-600a, HFOs and their blends. Capri has chosen to convert all of its products to R-600a giving that it is a proven and mature technology and cost-effectiveness; the characteristics of the product, including its performance and energy efficiency; its compliance with established standards on safety and the environment; and reduced carbon emissions. In addition, the enterprise has experience in handling flammable substances as it is manufacturing insulation foam with cyclopentane.

7. Given the flammability of R-600a, changes are required in the manufacturing process, refrigerant storage and supply, and product design. As the two lines are located in two separate buildings, equipment in both places needs to be replaced. Costs associated with the refrigerant storage and supply station, training and certification are, however, shared.

¹ ZIM/REF/20/INV/08 and ZIM/PHA/65/INV/44

8. The conversion to R-600a technology includes replacement of manufacturing equipment, including: one shared R-600a refrigerant storage and supply station for two production lines; two refrigerant charging stations, along with a refrigerant booster pump; two safety control systems, ventilation systems; two ultrasonic welding machines; two post-charge leak detectors and two helium leak-detection systems; two gas ejection units to replace the proposed gas evacuation units for repair areas. Costs for safety audit, certification and installation are included in some equipment items (e.g. refrigerant storage and distribution system, leak detection system). The contingency was calculated at five per cent of total costs.

9. The incremental capital costs (ICCs), as originally submitted, stand at US \$1,338,689, as shown in Table 2.

Table 2. ICCs for the conversion of domestic refrigerator and freezer manufacturing at Capri

Description	Proposed costs (US \$)
Refrigerant storage, distribution and safety system	155,500
Helium leak-detection system including helium storage and recovery	258,017
Vacuum pump and accessories (60 units)	291,658
Refrigerant-charging system including pumps and accessories	220,502
Leak detection for R-600a in refrigerant charging area	36,759
Ultrasonic welding machine	99,519
Gas evacuation system for repair area	27,380
Safety and ventilation	107,133
Sub-total	1,196,468
Inspection visit, spare parts and startup	78,474
Contingency (5 per cent)	63,747
Total ICCs	1,338,689
IOCs	Not requested
Total costs	1,338,689
Counterpart funding	(300,000)
Total requested	1,038,689
HFC-134a consumption to be phased out (mt/year)	14.5
Cost-effectiveness based on total project costs (US \$/kg)	92.32
Cost-effectiveness based on funding requested (US \$/kg)	71.63

10. Incremental operating costs (IOCs) are not requested and not calculated in the submission. Of the total cost, the Government is requesting US \$1,038,689 from the Multilateral Fund, resulting in a cost effectiveness of US \$71.63/kg. Capri will provide co-funding of US \$300,000 plus IOCs associated with the conversion project.

11. The project will be implemented over a period of 24 months.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

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

Eligibility

13. The project proposal has been submitted in line with decisions 78/3(g) and 79/45. It includes an official letter from the Government of Zimbabwe stating: that it intends to ratify the Kigali Amendment and will make every effort to do so as soon as possible; that it is aware that, if this project is approved by the Executive Committee, no further funding will be available until the instrument of ratification of the Kigali Amendment has been received by the depositary at the United Nations Headquarters in New York; and that the Government acknowledges that, in the event that this project is approved, any reduction in HFC consumption will be deducted from any starting point that may be agreed in the future.

Maturity of the technology, replicability and sustainability

14. Providing information to demonstrate the sustainability of the project proposal, UNDP explained that the Government of Zimbabwe is working on regulatory measures to protect and support national production once the enterprise Capri has been converted. This includes a technical regulation to classify and label equipment according to its refrigerant and energy consumption to prevent safety and health risks. Furthermore, the Government is focusing on ratification of Kigali Amendment and the national ozone unit (NOU) will support activities to raise awareness of the upcoming control measures on HFC imports that will help prevent any further investment in HFC-based manufacturing capacity in the future. UNDP has confirmed that, with the approval of the project proposal, the enterprise commits to completely phase-out consumption of HFC-134a.

15. UNDP confirms that products based on hydrocarbons (HCs) are already on the local market, and there are no limitations on or barriers to the introduction of HC-based domestic refrigerators and freezers, as all units produced will have a refrigerant charge lower than 150 g. Furthermore, Zimbabwe has a national regulation on the safe use of HC refrigerants, including their transportation and storage, and a national standard (SAZ 1012:2016) for the certification of refrigeration and air-conditioning (RAC) practitioners working with HC-based appliances.

16. UNDP has indicated that the results of the conversions in the project proposal are expected to encourage adoption of energy-efficient R-600a-based equipment by small commercial refrigeration manufacturing enterprises within the region and elsewhere.

Proposed costs

17. During the discussions with UNDP about the elements included in the project, the following adjustments were agreed:

- (a) A reduction in the cost of the refrigerant supply station from US \$125,000 to US \$30,000. Capri plans to procure a large storage tank owing to the difficulty of ensuring a reliable supply of R-600a; therefore, it represents an avoidable technical upgrade and increased capacity. The agreed funding is compatible with the current scale of production;
- (b) Optimization of the cost of the helium leak detection systems, from US \$258,017 to US \$90,000; the charging machines from US \$220,502 to US \$110,000; the leak detectors from US \$36,759 to US \$26,000; and the ultrasonic welding machines from US \$99,519 to US \$50,000, based on funding levels agreed on other approved projects;
- (c) The request for vacuum pumps (60 units) were considered not incremental since vacuuming is conducted before refrigerant charge and the same vacuum pumps can be used for R-600a;

- (d) A reduction in the cost of the gas evacuation systems from US \$27,380 to US \$4,000, since R-600a is safely vented with a gas ejector instead of recovered owing to the small quantity being used;
- (e) Costs for inspection visit, start up and spare parts were adjusted to US \$46,000 noting that spare parts are included in the new equipment; and
- (f) Cost of equipment installation was calculated at the agreed seven per cent of equipment costs and applied contingency of 10 per cent on equipment and trial.

18. As IOCs are not being requested, cost calculation was not discussed in detail. However, in line with decision 78/3(g), the project will collect, and include in the final report, data on the ICCs and IOCs incurred. Furthermore, in line with decision 22/38 and subsequent decisions of the Executive Committee, equipment to be replaced in the project will, as part of the project, be destroyed or rendered unusable.

19. The revised costs of the conversion of the domestic refrigerator and freezer manufacturing lines at Capri are shown in Table 3.

Table 3. Total agreed costs for the conversion of domestic refrigerator and freezer manufacturing at Capri

Description	Agreed costs (US \$)
Refrigerant storage and distribution system	30,000
Safety system	18,000
Welding certificate	10,000
Helium leak-detection system	90,000
Vacuum pump and accessories (60 units)	0
Refrigerant-charging system	110,000
Leak detection for charging area	26,000
Gas evacuation system for repair area	4,000
Ultrasonic welding machine	50,000
Safety and ventilation	100,000
Installation	30,660
Sub-total	468,660
Inspection visit, spare parts and startup*	46,000
Contingency (10 per cent)	48,866
Total ICCs	563,526
IOCs	Not requested
Total costs	563,526
HFC-134a consumption to be phased out (mt/year)	14.5
Cost-effectiveness (US \$/kg)	38.86
Co-funding (US \$)	(300,000)

* Of the US \$46,000, contingency was provided for US \$20,000 for spare parts and startup.

20. The agree incremental costs from the Multilateral Fund for the conversion of two lines for domestic refrigerators and freezers respectively at Capri amounts to US \$563,526, with a cost effectiveness of US \$38.86/kg. The Secretariat notes that, although US \$300,000 co-funding is being provided, the cost-effectiveness of the proposal is higher than that of larger manufacturing enterprises.

21. The Secretariat recalls 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 in Zimbabwe; 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.

Climate benefits

22. The reduction of 14.5 mt of HFC-134a consumption and the expected introduction of HCs in the project is expected to result in an emission reduction of 20,735 tonnes of CO₂ equivalent. No estimate of the indirect emissions savings associated with improved energy efficiency has been provided.

2018–2020 business plan

23. This project is included in the 2018–2020 business plan of the Multilateral Fund at a value of US \$503,000, including agency support costs, but with no indication of phase-out of HFCs. The Secretariat notes that, after the adjustments to the costs, the proposal is US \$7,526 more than what had been included into the business plan.

Recommendation

24. The Executive Committee may wish to consider

- (a) The project proposal for the conversion of domestic refrigerator and freezer manufacturing at Capri from the use of HFC-134a as the refrigerant to isobutane (R-600a), in the context of its discussion on HFC stand-alone projects submitted to the 81st 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/81/14);
 - (b) Whether or not to approve the project proposal indicated in sub-paragraph (a) above in the amount of US \$563,526, plus agency support costs of US \$39,447 for UNDP, on the understanding, if the project were to be approved:
 - (i) That no further funding would be available until the instrument of ratification by the Government of Zimbabwe had been received by the depositary at the Headquarters of the United Nations in New York, noting that the Government of Zimbabwe has already submitted a request for enabling activities;
 - (ii) That 14.5 mt (20,735 CO₂ eq) of HFC-134 would be deducted from any starting point for sustained aggregate reductions in HFCs that may be established;
 - (iii) That the project would be completed within 24 months of the transfer of funds to UNDP, and that a comprehensive completion report with detailed information on the eligible incremental capital costs, incremental operating costs, any possible savings incurred during the conversion, and relevant factors that facilitated implementation would be submitted within six months of project completion; and
 - (iv) That any remaining funds would be returned to the Multilateral Fund no later than one year after the date of project completion.
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