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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: EGYPT

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

Refrigeration

• Conversion of discontinuous panel manufacturing facility from HFC-134a to HFO blowing agent at Army Factory	UNDP

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT

EGYPT

PROJECT TITLE(S)	BILATERAL/IMPLEMENTING AGENCY
(a) Conversion of discontinuous panel manufacturing facility from HFC-134a to HFO blowing agent at Army Factory, Egypt.	UNDP

NATIONAL CO-ORDINATING AGENCY	Egyptian Environmental Affair Agency (EEAA)

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT
A: ARTICLE-7 DATA (METRIC TONNES, 2017, AS OF MAY 2018)

Annex F, Group I	mt	n/a
	mt CO_2-eq.	n/a

B: COUNTRY PROGRAMME SECTORAL DATA (METRIC TONNES, 2017, AS OF MAY 2018)

Annex F, Group I	mt	n/a
	mt CO_2-eq.	n/a

HFC consumption remaining eligible for funding	mt	n/a
	mt CO_2-eq.	n/a

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

PROJECT TITLE:	Army Factory	
HFC-134a used at enterprise:	mt	55.5
	mt CO_2-eq.	79,365
HFC-134a to be phased out through this project:	mt	55.5
	mt CO_2-eq.	79,365
HFO to be phased in:	mt	35.52
	mt CO_2-eq.	107
Project duration (months):		24
Initial amount requested (US $):		1,007,400
Final project costs (US $):		
Incremental capital cost:		
Contingency (10%):		
Incremental operating cost:		
Total project cost:		
Local ownership (%):		100
Export component (%):		0
Requested grant (US $):*		1,007,400
Cost-effectiveness*:	US $/kg	18.15
	US $/mt CO_2-eq.	12.71
Implementing agency support cost (US $):*		70,518
Total cost of project to Multilateral Fund (US $):*		1,077,918
Status of counterpart funding (Y/N):		N
Project monitoring milestones included (Y/N):		Y
SECRETARIAT'S RECOMMENDATION	For individual consideration	

***** As submitted.

PROJECT DESCRIPTION

1. On behalf of the Government of Egypt, UNDP has submitted a project proposal to convert the manufacturing of discontinuous panels using HFC-13a as foam-blowing agent to HFOs in Army Factory, Egypt at a total cost of US $1,007,400, plus agency support costs of US $70,518, as originally submitted including. At the 80th meeting, US $30,000, plus agency support costs of US $2,100, was approved for the preparation of this project.

2. In line with decisions 78/3(g) and 79/45, the endorsement letter from the Government of Egypt for the project indicates the Government's intention to ratify Kigali Amendment;[1] that the Government 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 that the Government acknowledges that in case this project is approved, any HFC reduced would be deducted from its starting point (which may be agreed in the future).

HFC consumption and sector background

3. The project proposal did not include information on total HFC consumption nor information on HFC-134a consumption in the polyurethane (PU) foam industry in Egypt. The project proposed indicated that there is at least one other foam manufacturer in Egypt using HFCs; but it did not include information on the type of HFC being used and the level of consumption.

Global use of HFC-134a in the foam sector

4. Based on the TEAP Task Force Report submitted to the Twenty-eighth Meeting of the Parties,[2] in 2015 the consumption of HFC-134a in the foam sector in Article 5 countries amounted to 3,364 metric tonnes (mt), representing 4.2 per cent of total HFC-134a consumption. This amount represented the total consumption used as a blowing agent for extruded polystyrene (XPS) and PU foams, though their relative proportions of HFC-134a consumption is not available.

5. Information from the surveys on ODS alternatives for 119 Article 5 countries submitted to the 80th meeting,[3] shows that the consumption of HFC-134a in the foam sector accounted for 1.46 per cent of the total HFC-134a consumption in 2015. Further, it is also noted that only four countries (of the 119 covered in the survey) have reported HFC-134a consumption in PU foam applications.

PU foam industry in Egypt

6. The PU foam industry, mainly manufacturing rigid foam and, to a lesser degree, integral skin products, plays a significant role in the economy of Egypt. Foam manufacturers rely heavily on chemical and technology supply through systems houses, and mainly use HCFC-141b as a blowing agent. During the implementation of stage II of the HPMP[4] approved at the 79th meeting, the Government has agreed to fully replace the use of HCFC-141b (pure and contained in imported pre-blended polyols) with hydrocarbon (HC-) or HFO-based polyol systems by 1 January 2020.

Enterprise background

7. The Army Factory is not a commercial enterprise; it undertakes construction projects for the Army, producing discontinuous foam for sandwich panels and for construction applications such as cold stores, prefabricated housing, and other uses. The enterprise also has spray/pour-in-place (PIP) foam operations.

[1] Letter dated 29 April 2018, from the Ozone Unit, Egyptian Environmental Affairs Agency, to UNDP.
[2] TEAP XXVII/4 Task Force Report, September 2016.
[3] UNEP/OzL.Pro/ExCom/80/54
[4] UNEP/OzL.Pro/ExCom/79/32

8. The Army Factory was one of the enterprises that received funding under a foam sector project approved at the 22nd meeting for conversion from CFC-11 to HFC-134a.[5] This conversion was unique given that HFC-134a was chosen by the Army as they required the use of a non-flammable blowing agent, while the other enterprises selected cyclopentane. The project was successfully completed in 2003. The funding request submitted to the 81st meeting relates to the conversion of that manufacturing operation to HFOs that are not flammable.

HFC consumption by the enterprise

9. The Army Factory reported a consumption of 55.5 mt of HFCs in 2017. The fluctuation in consumption of HFC-134a in previous years is driven by the demand for foam manufacturing by the Army (Table 1).

Table 1. Consumption of HFC-134a at Army Factory

Year	Quantity	
	Metric tonnes	**CO_2- eq**
2015	60.10	85,943
2016	33.80	48,334
2017	55.50	79,365
Average (2015-2017)	**49.80**	**71,214**

Project overview and funding request

Selection of alternative technology

10. Army Factory needs to adopt a final technology to replace HFC-134a which is non-flammable and demonstrates good foam insulation properties. On this basis, HFO was selected as the alternative blowing agent. The proposal indicated that the choice will be either HFO-1233zd(E) or HFO-1336mzz. In line with decision 74/20, commercial availability of HFOs in Egypt was confirmed by two chemical producers and one systems house that they can make available formulations using HFOs, though specific dates of availability were not provided.[6]

Project description

11. The project proposes to replace the current high pressure (HP) foaming equipment, that is more than 15 years old, with a new high-pressure foam machine and a spare mixing head, as the age of the foam machine makes it difficult for the enterprise to use it with HFOs, and need for provisions for co-blowing with other blowing agents. The project also includes costs relating to technical assistance for the development of new HFO formulations, trials, safety audit, and international seminar and project support. Incremental operating cost (IOC) is requested based on the proposed HFO formulation.

Project costs

12. The incremental capital costs (ICC), as originally submitted, amounts to US $297,000 as shown in Table 2.

[5] EGY/FOA/22/INV/64

[6] Letters from Honeywell, Chemours and Technocom, submitted to UNDP.

Table 2: ICC for conversion to HFOs at Army Factory

Description	**Cost (US$)**
High pressure dispenser	130,000
Spare mixing head	20,000
Technical support	50,000
Trials	40,000
Safety audit	10,000
International seminar and project support	20,000
Contingencies	27,000
Total	**297,000**

13. The IOCs calculated on the costs of the different foam blowing agents, as originally submitted, amounts to US $710,400, as shown in Table 3.

Table 3. IOC to HFOs at Army Factory

Particulars	**HFC-134a**			**HFO**		
	US $/kg	**Percentage**		**US $/kg**	**Percentage**	
	(a)	**(b)**	**(c)=(a) x (b)**	**(d)**	**(e)**	**(f)=(d) x (e)**
Polyol	2.80	40	1.12	2.80	36	1.01
Isocyanate	3.00	50	1.50	3.00	50	1.50
Blowing agent	7.10	10	0.71	15.00	14	2.10
Total			**3.33**			**4.61**
Incremental cost of systems using HFOs (US $/kg of system)						1.28
Incremental cost of systems using HFOs (US $/kg of HFC-134a)						12.80
Consumption of HFC-134a (2017) (mt)						55.50
IOC (US $)						**710,400**

14. The total cost of the project amounts to US $1,007,400, plus agency support costs, with a cost-effectiveness of US $18.15/kg. The project would be implemented over a period of 24 months.

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; review of similar PU foam projects for conversion to HFO technology; and in the light of decision 78/3(g) which is primarily to gain experience in the ICCs and IOCs that might be associated with phasing down HFCs in Article 5 countries.

Replicability

16. Upon request for additional information on the replicability of this project, UNDP explained that there could be other Article 5 countries not covered in the surveys on ODS alternatives, that are consuming HFC-134a or other HFCs (e.g., HFC-245fa) in PU foam applications; the results of the project could benefit conversion of those foam applications.

17. The Secretariat considers that the replicability of this project is limited for the following reasons: it appears that Army Factory is the only enterprise using HFC-134a for PU foam in Egypt; the TEAP Task Force report on ODS alternatives shows that HFC-134a consumption in both XPS and PU foam in Article 5 countries represented only 4.2 per cent of global HFC-134a consumption; the report on the surveys on ODS alternatives covering 119 Article 5 countries indicated that HFC-134a in PU foam applications was only used in four countries; and only two projects (with a total consumption of 30.8 mt of CFC-11) out of the 989 projects approved to phase-out 68,863 mt of CFC-11 in foam sector were converted to HFC-134a.

Maturity of technology

18. Upon a request of additional information on maturity of technology using HFO-1233zd(E) and HFO-1336mzz, UNDP mentioned that new formulations would be developed in the Army Factory and/or a local systems house during the implementation of the project, and will include formulations co-blown with other agents for cost-effectiveness and meeting the requirement of discontinuous panels produced in the Army Factory. Details of formulation and co-blowing agents were not provided. UNDP clarified that the Government of Egypt and the Army Factory are committed to adopting HFO-based formulation in this enterprise.

19. The Secretariat considers that additional efforts are needed for formulation development using HFOs. The Secretariat also notes that experience on the use of HFO as a blowing agent under the Multilateral Fund is being gained through:

(a) The demonstration project to validate the use of HFO for discontinuous panels in Article 5 parties through the development of cost-effective formulations in Colombia,[7] approved at the 76th meeting for UNDP. The comprehensive report on this project has been submitted to the 81st meeting;[8]

(b) Implementation of HPMPs in several Article 5 countries (e.g., Jordan[9], Lebanon, Malaysia) where foam enterprises had agreed to replace HCFC-141b with HFO-blowing agents.

Availability of HFOs

20. Upon a request for additional clarification on the availability of HFOs in the local market, UNDP informed that two chemical manufacturers, and one systems house operating in Egypt have confirmed that HFOs will be available in Egypt. It is noted that foam enterprises are currently facing difficulties in securing sufficient supply of HFOs for their conversion from HCFC-141b; however, the situation is expected to change in the future.

[7] UNEP/OzL.Pro/ExCom/76/26
[8] UNEP/OzL.Pro/ExCom/81/10
[9] Table 5 in page 8, UNEP/OzL.Pro/ExCom/77/51

Regulatory framework and sustainability

21. UNDP advised that the Government is committed to implement the project at Army Factory; however, at this time the Government is not considering issuing regulations relating to limiting the use of HFC-134a in PU foam applications.

22. On a clarification on how the enterprise would sustain high cost of the HFO-based formulation (i.e., US $15.00/kg for HFOs compared to US $7.10/kg for HCFC-134a), UNDP explained that during project implementation, HFO-based formulations would be developed with the aim to lower cost and, through this, sustainability of HFO adoption would be ensured.

Selection of enterprise

23. The Secretariat notes that the Army Factory received funding from the Multilateral Fund in 1997 to convert from CFC-11 as a blowing agent to HFC-134a. As such, the Secretariat considers that this conversion falls under paragraph 18(b) of decision XXVIII/2.

Incremental cost calculations

24. Upon a request for clarification on the requirements of a new HP foam machine that replaces the 15 year-old HP foam machine, UNDP mentioned that the old foam machine cannot be used with HFOs as equipment spares and components are not easily available and the provisions for co-blowing with other agents is not available.

25. The Secretariat thoroughly considered the eligibility of the request for replacement of the current 15 year-old HP foam machine based on the following:

(a) The Army Factory currently uses HFC-134a as a blowing agent in the existing foam machine as they need a non-flammable blowing agent; accordingly the enterprise selected HFO-1233zd(E) or HFO-1336mzz as blowing agent;

(b) The technical report on calculation of the ICCs and IOCs for foam sector alternatives submitted to the 76th meeting,[10] stated that for the conversion from HCFCs to HFCs, HFOs, water-based systems or methyl formate technologies, no additional capital costs for replacing HP dispensers will be required for rigid PU and integral skin foam applications;

(c) The report of the demonstration project to validate the use of HFO for discontinuous panels (previously mentioned), did not indicate a need for replacing or retrofitting HP foam machine for using HFO formulations;

(d) Projects approved for PU foam conversion in discontinuous panels to HFOs approved under HPMPs in several Article 5 countries did not request funding for replacement of HP foam equipment as the HP equipment in the baseline can be used with the alternative blowing agent; and

(e) Projects approved for replacing HCFC-141b to flammable-based blowing agents considered first the option to retrofit the HP equipment on the baseline; in case a low-pressure (LP) foam machine was in the baseline, appropriate equipment, including its replacement with a HP machine, was considered to take care of flammability of the blowing agent.

[10] Paragraph 66 of Annex I, UNEP/OzL.Pro/ExCom/76/58

26. In light of the above facts, the Secretariat considers that the request for the replacement of existing HP foam dispenser and a spare mixing head are not eligible incremental costs.

27. The Secretariat also reviewed the other ICCs and considered the requirement for technical assistance to develop new formulations and trials and testing at US $15,000 each are eligible incremental costs. However, costs related to safety audit would not be incremental as this would need to be carried out as a part of the regular business operations, and the request for international seminar is not a requirement for implementing this project. In light of the above, the Secretariat recommended that the US $30,000 associated with these activities, be used for additional technical assistance for development of cost-effective foam formulations, through trials and testing.

28. In reviewing the IOCs, the Secretariat noted that the HFO formulation proposed includes 14 per cent of HFOs in place of 10 per cent of HFC-134a in the system, resulting in a much higher cost of HFO-based system. During project consultations, UNDP mentioned that the specific formulations and the HFO to be used have not yet been finalised, though they propose to use HFO-1233zd(E) or HFO-1336mzz as blowing agents.

29. Based on the experiences from other PU foam projects approved for the conversion to HFOs in discontinuous panels, and on available technical reports on HFO formulations (including the comprehensive demonstration projects on use of HFOs in discontinuous panels approved by the Executive Committee), the Secretariat calculated IOCs based on a reduced HFO formulation noting that the technical assistance support included in the project cost would be used to develop and optimize cost-effective HFO-based formulations that would meet product performance requirements.

30. Based on the analysis of ICC and IOC, the Secretariat estimated that the eligible incremental cost for the conversion at Army Factory amounts to US $224,694 at a cost-effectiveness of US $4.05/kg or US $2.83 mt CO_2-eq. Table 4 provides a summary of the incremental costs as originally submitted, as revised by UNDP during the discussions, and as proposed by the Secretariat.

Table 4: Incremental costs for conversion to HFOs at Army Factory

	Cost (US $)		
Description	**As submitted**	**Revised**	**Secretariat proposal**
Incremental capital cost	297,000	225,500	30,000
Incremental operating cost	710,400	471,750-710,400	194,694
Total	**1,007,400**	**697,250-935,900**	**224,694**
HFC-134a phased out (mt)	**55.50**	**55.50**	**55.50**
Cost effectiveness (US $/kg)	**18.15**	**12.56 – 16.86**	**4.05**
Cost effectiveness (US $/ mt CO_2-eq.)	**12.69**	**8.79 – 11.79**	**2.83**

31. UNDP and the Secretariat could not agree on the overall cost of the project.

32. The Secretariat notes that the purpose of implementing projects under decision 78/3(g) is to gain experience in the ICCs and IOCs that might be associated with phasing down HFCs. The Secretariat, however, considers that the cost estimates might change as more information becomes available on the technology and according to the specific characteristics of the enterprises.

Climate benefits

33. The project is expected to result in emissions reduction of 79,365 mt CO2-eq with the reduction of 55.5 mt of HFC-134a, and the expected introduction of HFOs. No estimates of indirect emission savings associated with energy efficiency were provided.

Business plan 2018 -2020

34. This project is included in the 2018–2020 business plan of the Multilateral Fund at a value of US $405,966, including agency support costs.

Conclusion

35. The Secretariat considers the replicability of the project proposal is uncertain, given the very limited use of HFC-134a as a PU foam blowing agent globally and in Article 5 countries; and the small number of potential PU foam enterprises in Article 5 countries using HFC-134a as a blowing agent. It is expected that the project would enable the phase-out of HFC-134a PU foam manufacturing in only one enterprise in Egypt. UNDP and the Secretariat could agree on the overall cost of the project, which is maintained by UNDP in the range of US $697,250 to US $935,900 after adjustments, while the Secretariat's estimated cost is US $224,694.

36. Notwithstanding that agreement on the level of funding could not be reached, the Secretariat considered necessary to submit the project proposal, given the urgent requirement of the Executive Committee to gain experience in the ICCs and IOCs that might be associated with phasing down HFCs in Article 5 countries in light of decision XXVIII/2.

RECOMMENDATION

37. The Executive Committee may wish to consider:

(a) The project proposal for the conversion of from HFC-134a to HFO in the manufacture of discontinuous panels in Army Factory, Egypt, in the context of its discussion on HFC stand-alone project 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); and

(b) Whether or not to approve the project proposal in light of the information presented in the document.