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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: IRAN (ISLAMIC REPUBLIC OF)

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

Refrigeration

- Conversion of the manufacturing of mobile air-conditioning units from HFC-134a to HFO-1234yf at Kerman Motor Company Limited

UNIDO

**PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT
EVALUATION SHEET – NON-MULTI-YEAR PROJECT**

Iran (Islamic Republic of)

PROJECT TITLE(S)**BILATERAL/IMPLEMENTING AGENCY**

Conversion of the manufacturing of mobile air-conditioning units from HFC-134a to HFO-1234yf at Kerman Motor Company Limited	UNIDO
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NATIONAL CO-ORDINATING AGENCY

National Ozone Unit, Environmental Research Centre, Department of Environment, Islamic Republic of Iran

**LATEST REPORTED CONSUMPTION DATA FOR OZONE-DEPLETING SUBSTANCES (ODS)
ADDRESSED IN PROJECT**

A: ARTICLE 7 DATA (METRIC TONNES (MT), 2018)

HFCs	*
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B: COUNTRY PROGRAMME SECTORAL DATA (MT, 2018)

HFCs	*
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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)	0.00	0.00

Particular	Units	HFC-134a
	HFC used at enterprise	mt
mt CO ₂ -eq		31,689
HFC to be phased out through this project:	mt	32.58
	mt CO ₂ -eq	46,585
HFC/alternatives to be phased in:	Units	HFO-1234yf
	mt	22.16
	mt CO ₂ -eq	66.48
Project duration (months):		24
Initial amount requested (US \$):		795,055
Final project costs (US \$):		
Incremental capital costs:		173,000
Contingency:		0
Incremental operating costs:		516,000
Total project costs:		689,000
Local ownership (%):		100
Export component (%):		0
Requested grant (US \$):		689,000
Cost-effectiveness	US \$/kg	21.15
	US \$/mt CO ₂ -eq	14.79
Implementing agency support costs (US \$):		48,230
Total cost of project to Multilateral Fund (US \$):		737,230
Counterpart funding (Y/N):		Y
Project monitoring milestones included (Y/N):		Y

SECRETARIAT'S RECOMMENDATION	For individual consideration
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*Total consumption of 2,577 mt of HFC-134a estimated in the project proposal, including 562 mt in mobile air-conditioning.

PROJECT DESCRIPTION

1. On behalf of the Islamic Republic of Iran, UNIDO has submitted a project proposal to convert the manufacturing of mobile air-conditioning (MAC) units from HFC-134a to hydrofluoro-olefin (HFO-1234yf) at Kerman Motor Company Limited (Kerman Motor), at a total cost of US \$795,055, plus agency support costs of US \$55,653, as originally submitted. UNIDO submitted this project proposal without receiving preparation funding from the Multilateral Fund.

HFC consumption and sector background

2. Globally, HFC-134a continues to be used as a refrigerant in mobile air-conditioning (MAC) systems. According to the Technology and Economic Assessment Panel (TEAP), HFO-1234yf is currently being used in MAC units in new vehicles, primarily in non-Article 5 countries.

3. The automotive industry of the Islamic Republic of Iran is the second most active industry in the country, and consists of Government¹ and private automotive manufacturers producing their own brands, as well as foreign brands, mainly for the local market. There are also two local MAC system producers, but the majority of systems are imported for vehicles being produced as complete knock-down.

4. Based on the data reported under the surveys on ODS alternatives submitted to the 80th meeting, a total of 2,557.0 metric tonnes (mt) of HFC-134a were imported into the country in 2015. UNIDO indicated that 562.0 mt were consumed in the MAC sector (approximately 22 per cent of the total). The consumption of HFC-134a at Kerman Motor amounted to 22.16 mt (2015-2017 average).

Enterprise background

5. Kerman Motor is 100 per cent Iranian-owned and manufactures vehicles from JAC and Lifan (two Chinese enterprises) and Hyundai (a Korean enterprise), and represents 3.4 per cent of the national market share. Vehicle annual production over the last three years has ranged between 20,300 and 21,800 units. The enterprise's servicing workshops (consisting of 109 workshops for Kerman's JAC and Lifan models and 38 workshops for Hyundai models) consume at least one mt annually for recharging.

Manufacturing process

6. Kerman Motor has one production line, comprising three main production halls: a body shop, paint shop and trim shop where the refrigerant charging unit is located. It produces nine vehicle models using a fixed HFC-134a filling machine; an additional trim shop dedicated to two Hyundai models uses a small capacity HFO-1234yf filling machine, which is more suitable for servicing than manufacturing.

Project description and costs

7. HFO-1234yf is currently the only alternative technology commercially available for converting HFC-134a-based MAC. Given that the alternative refrigerant is mildly flammable, Kerman Motor is proposing the following modifications to the manufacturing line:

- (a) Installation of safety systems suited to the handling of flammable refrigerants, including a ventilation blower and piping, detectors, cylinder storage chambers with hoods, and fire extinguishers;
- (b) Replacement of the existing charging unit with one that can handle HFO-1234yf, and procurement, installation and commissioning of the equipment at the beneficiary company, as determined in the agreement and subcontract;

¹ Around 80 per cent of the vehicle market belongs to state-owned car producers Iran Khodro and Saipa.

- (c) Training of the production-line workers involved in charging the refrigerants by designated trainers familiar with the acquired equipment;
- (d) Training provided at associated servicing workshops; and
- (e) Sourcing of HFO-1234yf from relevant and affordable suppliers.

8. The incremental capital costs (ICCs), as originally submitted, were US \$279,055, as shown in Table 1. Funds for the safety system, estimated to be US \$100,000, were not included in the request.

Table 1. ICCs of the conversion in MAC manufacturing in Kerman Motor

Item	Units	Cost (US \$)	
		Unit	Total
Fixed production charging stations (zone-free concept)	1	216,055	216,055
Anti-explosive (ATEX equivalent) air blowers	4	500	2,000
Fire extinguishers	10	100	1,000
Training of production-line workers by a specialized trainer	1	10,000	10,000
Training at 10 servicing workshops	10	5,000	50,000
Total ICCs			279,055

9. The incremental operating costs (IOCs) were calculated as the difference in the price of HFC-134a and HFO-1234yf. Currently, the cost of HFO-1234yf is about 20 times higher than that of HFC-134a; it is expected that with the increase of demand for the refrigerant, the supply will increase in the local market at a lower cost. Given the high volatility of the local currency, IOCs were calculated on the expected 2018 consumption of 24.2 mt of HFC-134a, considering three scenarios for the exchange rate of Iranian rials (IRR) to US dollars, as shown in Table 2.

Table 2: Estimated IOCs for the conversion in MAC manufacturing in Kerman Motor

Scenarios	Exchange rate (IRR to US \$)	Unit price (US \$/kg)		Difference (US \$/kg)	Annual IOCs (US \$)
		HFC-134a	HFO-1234yf		
Low-cost	57,000	5.57	101.96	96.38	2,332,574
High-cost	42,000	7.57	138.38	130.81	3,165,636
Average	49,500	6.57	120.17	113.60	2,749,105

10. Kerman Motor requested IOCs for US \$516,000. This corresponds to approximately 18.5 per cent of the average scenario calculated by UNIDO.

11. The summary of the total project funding, as submitted, is given in Table 3. The project will be implemented in two years.

Table 3. Total project funding request for conversion in MAC manufacturing in Kerman Motor

Item	Costs in US \$
ICCs	279,055
IOCs	2,749,105
Total	3,028,160
Requested funding	795,055
HFC-134a consumed in mt (average 2015–2017)	22.16
HFC-134a consumed in mt CO ₂ -eq (average 2015–2017)	31,689
Cost-effectiveness (US \$/kg)	35.88
Cost-effectiveness (US \$/mt CO ₂ -eq)	25.09

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Eligibility

12. The project proposal for the conversion at Kerman Motor has been submitted in line with decisions 78/3(g) and 79/45. The proposal includes an official letter from the Government of the Islamic Republic of Iran acknowledging 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 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

13. Responding to the Secretariat's concern about the sustainability of the project given the high price of HFO-1234yf, UNIDO explained that it is the alternative to HFC-134a that is the least expensive for vehicle manufacturers to switch to in assembly lines and car system design. In addition, it has the lowest life-cycle climate-performance rating, owing to its higher energy efficiency, which results in lower fuel consumption.

14. UNIDO also emphasized that Kerman Motor will continue its production of Hyundai vehicles following that enterprise's technical specifications for the use of HFO-1234yf as the refrigerant in the MAC systems. The enterprise already uses 6.5 mt of HFO-1234yf/year in the manufacturing of three Hyundai models. In addition, several European car brands charged with HFO-1234yf are imported to the country and serviced in their own workshops. Kerman Motor expects to negotiate with its Chinese partners to convert their vehicles (the JAC and Lifan models) to HFO so that the enterprise can deal with only one refrigerant.

15. Notwithstanding the above, the Secretariat still had concerns about the short and mid-term sustainability of the proposal, particularly during the servicing of the vehicles fitted with an HFO-1234yf MAC unit, given the price differential between HFC-134a (US \$6/kg) and HFO-1234yf (US \$120/kg). Furthermore, Kerman Motor represents only 3.4 per cent of the market, and service workshops around the country will neither be adequately equipped, nor likely to procure a refrigerant that is needed for only a very small number of vehicles. On that basis, the Secretariat enquired whether, with the approval of this project, the Government would be in position to promulgate a regulation to prohibit the change of the refrigerant in a system designed to use HFO-1234yf to any other, including HFC-134a.

16. UNIDO explained that 38 out of the more than 100 service workshops of Kerman Motor are already equipped with HFO charging stations. Dealers and servicing workshops under the direct influence of Kerman Motor would be instructed to use HFO-1234yf for the best performance of the vehicles. At the time of issuance of this document, UNIDO was still consulting with the Government with regard to the regulatory measure proposed.

Project implementation and duration

17. Given the need to complete the project in a period of no more than two years, the Secretariat asked about measures planned to mitigate the risk of delays caused by external factors, such as the country's fluctuating exchange rate and the custom clearance process for the refrigerant and equipment. UNIDO highlighted its extensive experience in implementing projects, making funds transfers and procuring equipment in the Islamic Republic of Iran and a wide variety of countries with different customs clearance

processes and currency situations. In addition, on the basis of trials already made, Kerman Motor is committed to effecting the conversion within two years. However, any potential trade restriction on Iranian enterprises could cause some delays.

Incremental costs

18. The Secretariat reviewed the project proposal in light of previous conversions from CFC-12 to HFC-134a and consulted a refrigeration and air-conditioning expert.

19. Over 77 per cent of the total ICC is related to a new refrigerant charging machine. Noting that there is already one HFO charging unit in the baseline for the Hyundai models, and considering that the total number of vehicles manufactured in the plant per year is around 21,000, with a charge per vehicle below one kg, the Secretariat asked why a smaller capacity charging machine, such as those being proposed in projects for charging R-290 in air-conditioning systems with a similar refrigerant charge at a cost of US \$50,000, would not be suitable for Kerman Motors.

20. UNIDO explained that the HFO-1234yf charging unit currently used for Hyundai production (less than 6,000 units per year), is not suitable for the entire plant owing to its lack of accuracy, the inability to conduct standard leakage tests with nitrogen and vacuums, and low reliability. In addition, these units work with small cylinders and are not suitable for the long hours of continuous operation of an automotive production line.

21. Concerning the possibility of using standard charging units (e.g. those used for domestic refrigerators), UNIDO explained that these can be programmed only by the supplier (they are microprocessor-controlled), while automotive factories always require equipment using programmable logic controllers (PLCs), which enable re-programming according to factory's needs.

22. The additional requirements for a charging unit in the automotive sector relate to control (PLC, valves, safe controller as per EN13849-1 and EN 50402 with two-stage ventilation control, safety stop for conveyor); process (built-in pressure test with nitrogen (or air) up to 14 bar, charge amount up to 1300 g with 100 g/sec speed, total cycle time down to 2 min); adapter (high and low pressure pneuadapter as per SAE J636 for connection); and operator/integration (hoses to the conveyor mounted on boom, hoses up to 10 m without influence on performance, special adapter parking integrated on boom, control, mechanics and cylinders integrated into one unit with small footprint).

23. Based on the elements provided and the adaptations required, the Secretariat acknowledged that an increase in the cost would be required. As it was still uncertain whether the additional cost would amount to the US \$216,055 requested, the Secretariat and UNIDO agreed at a total level of US \$110,000 for the charging unit, on the understanding that, as per existing policies, if the cost of the charging unit became higher than the level agreed, UNIDO would be able to allocate up to 20 per cent of the IOC to ICC, and report accordingly to the Secretariat.

24. The Secretariat noted that the IOCs were calculated based on a consumption of 24.2 mt of HFC-134a expected in 2018. However, as per Multilateral Fund policies, incremental costs are calculated on the basis of either last year's use or average consumption over the last three years (i.e., 22.16 mt for Kerman Motor). On this basis, the estimated IOCs for the project in the average scenario would be US \$2,517,376. Nevertheless, this adjusted IOC is still significantly above the level of funds requested for IOCs (US \$516,000).

25. The Secretariat also noted that generally no IOCs had been approved to other projects in the MAC sector previously funded by the Multilateral Fund, although some of them were related to the changes in the production of condensers, evaporators and compressors. Given the purpose of decision 78/3(g), to collect information on ICCs and IOCs that might be associated with phasing down HFCs, it was agreed that

funding for the IOCs could be requested at a level of US \$516,000, on the understanding that the enterprise assumes the additional cost that may be incurred due to difference in price.

26. Considering the large price difference between HFC-134a and HFO-1234yf, the sustainability of the conversion remains the main concern, particularly with regard to servicing vehicles fitted with HFO-MAC units. In order to increase the ability of the service workshops to provide servicing for HFO-based MAC equipment, the Secretariat would agree to recommend the US \$50,000 requested for the training of servicing workshops, on the understanding that they will be discounted at US \$4.80/kg, as done for other projects where a servicing component has been added to the cost of conversion. The tonnage associated with the servicing funding of 10.42 mt of HFC-134a will also be deducted from any future starting point.

27. The revised and agreed costs for the conversion at Kerman Motors are presented in Table 4.

Table 4. Total agreed funding for conversion in MAC manufacturing in Kerman Motor

Item	Total cost (US \$)
Fixed production charging station (zone-free concept)	110,000
Anti-explosive (ATEX equivalent) air blowers	2,000
Fire extinguishers	1,000
Training of production-line workers by a specialized trainer	10,000
Training at 10 servicing workshops	50,000
Total ICCs	173,000
IOCs	516,000
Total cost conversion	689,000
HFC-134a consumed in mt (average 2015–2017)	22.16
HFC-134a consumed in mt CO ₂ -eq (average 2015–2017)	31,689
Cost-effectiveness conversion (US \$/kg)	31.09
Cost-effectiveness conversion (US \$/mt CO ₂ -eq)	21.74
HFC-134a including servicing component in mt (average 2015–2017)	32.58
HFC-134a including servicing component in mt CO ₂ -eq (average 2015–2017)	46,585
Cost-effectiveness including servicing component (US \$/kg)	21.15
Cost-effectiveness including servicing component (US \$/mt CO ₂ -eq)	14.79

28. On the basis of the information available at the time of review, the Secretariat considers that the agreed costs are its best estimates of the overall incremental costs of conversion; these estimates, however, might change as more information becomes available and according to the specific characteristics of the enterprises. The Secretariat, therefore, considers that approval of the project at the levels proposed above would not constitute a precedent.

2018–2020 business plan

29. The Secretariat notes that this project is not included in the 2018–2020 business plan of the Multilateral Fund.

RECOMMENDATION

30. The Executive Committee may wish to consider

- (a) The project proposal to convert the manufacturing of mobile air-conditioning (MAC) units from HFC-134a to hydrofluoro-olefin (HFO 1234yf) at Kerman Motor Company Limited, 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 \$689,000, plus agency support costs of US \$48,230 for UNIDO, 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 the Islamic Republic of Iran had been received by the depositary at the Headquarters of the United Nations in New York;
 - (ii) That 32.58 metric tonnes (46,585 CO₂ equivalent metric tonnes) of HFC-134 would be deducted from the starting point for sustained aggregate reduction in HFC once it had been established;
 - (iii) That the project would be completed within 24 months of the transfer of funds to UNIDO, and 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;
 - (iv) That, in the event that the cost of the charging unit surpasses the amount agreed of US \$110,000, UNIDO would report the level of funds reallocated from the incremental operational costs to cover the cost of the unit, and include in the final report the cost of all the elements comprised in the charging unit; and
 - (v) 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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