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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Eighty-seventh Meeting
Montreal, 28 June-2 July 2021[1]

**PROJECT PROPOSAL: EGYPT**

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

Refrigeration

| | |
|---|---|
| • Conversion of refrigeration compressor manufacturing facility from HFC-134a-based compressors to R-600a-based compressors at Misr Compressor Manufacturing Co. (MCMC) | UNIDO/UNEP |

[1] Online meetings and an intersessional approval process will be held in June and July 2021 due to coronavirus disease (COVID-19)

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

**PROJECT TITLE BILATERAL / IMPLEMENTING AGENCY**

| | |
|---|---|
| Conversion of refrigeration compressor manufacturing facility from HFC-134a-based compressors to R-600a-baased compressors at Misr Compressor Manufacturing Co. (MCMC) | UNIDO/UNEP |

| | |
|---|---|
| **NATIONAL CO-ORDINATING AGENCY** | Egyptian Environmental Affairs Agency |

**LATEST REPORTED CONSUMPTION DATA FOR HFC ADDRESSED IN PROJECT**
**A: ARTICLE-7 DATA (METRIC TONNES (MT))**

| | | |
|---|---|---|
| HFCs | mt | n/a |
| | mt $CO_2$-eq | n/a |

**B: COUNTRY PROGRAMME SECTORAL DATA (MT)**

| | | |
|---|---|---|
| HFCs | 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** | |
| | 1,605,000 | mt | 150.00 |
| | | mt $CO_2$-eq | 214,500 |

| **PROJECT TITLE:** | | **MCMC Egypt** |
|---|---|---|
| HFC-134a used at enterprise | mt | n/a |
| | mt $CO_2$-eq | n/a |
| HFC-134a to be phased out through this project (indirect) | mt | 150.00 |
| | mt $CO_2$-eq | 214,500 |
| HFC-134a alternative to be phased in: R-600a (indirect) | mt | 75.00 |
| | mt $CO_2$-eq | 225 |
| Climate benefit | mt $CO_2$-eq | 214,500 |
| Project duration (months): | | 24 |
| Initial amount requested (US $) | | 1,661,662 |
| Final project costs (US $) | | |
| Incremental capital cost | | 3,020,000 |
| Contingency (10 %) | | 302,000 |
| Incremental operating cost | | 0 |
| Total project cost | | 3,322,000 |
| Local ownership (%) | | 89.39 |
| Non-Article 5 export component (%) | | 7.00 |
| Co-financing | | 1,664,000 |
| Requested grant (US $) | | 1,305,536 |
| Cost-effectiveness | US $/kg | n/a |
| | US $/mt $CO_2$-eq | n/a |
| Implementing agency support costs (US $) | | 91,388 |
| Total cost of project to Multilateral Fund (US $): | | 1,396,923 |
| Status of counterpart funding (Y/N) | | Y |
| Project monitoring milestones included (Y/N) | | Y |

| | |
|---|---|
| **SECRETARIAT'S RECOMMENDATION** | Individual consideration |

## PROJECT DESCRIPTION

1. On behalf of the Government of Egypt, UNIDO has submitted a project proposal to convert the manufacturing of refrigeration compressors at Misr Compressor Manufacturing Co. (MCMC) from HFC-134a to R-600a, at a total cost of US $1,852,600, as originally submitted, and an associated funding request of US $1,781,158 from the Multilateral Fund, consisting of US $1,608,662, plus agency support costs of US $112,606 for UNIDO, and US $53,000, plus agency support costs of US $6,890 for UNEP. UNIDO submitted this project proposal without receiving preparation funding from the Multilateral Fund.

Project objective

2. The project will convert the production of compressors for domestic and stand-alone commercial refrigeration equipment that work with HFC-134a as a refrigerant to compressors that work with R-600a. As approximately 84 per cent of the compressors manufactured by MCMC are for the local market, the project will support the local refrigeration manufacturing enterprises when they convert their production lines from HFC-134a to R-600a refrigerant.

Sector background

3. Preliminary information gathered during project preparation indicates that the refrigeration industry in Egypt consists of more than 10 local enterprises that manufacture both domestic and stand-alone commercial refrigeration appliances, which include refrigerators, freezers, water dispensers, and other small products. These pieces of equipment are working with HFC-134a as refrigerant, with an estimated consumption above 150 metric tonnes (mt). The demand for such applications will rapidly increase in the coming years due to the ongoing development plan to build a number of new cities and settlements across the country, resulting with a potential increase of HFC-134a consumption to 300 mt.

4. The annual market demand for compressors in the domestic and commercial stand-alone refrigeration sector is approximately three million units, out of which one and a half million are imported from China, one million are imported from Brazil, and the remainder are mostly supplied by MCMC.

5. This information will be further verified and updated during the preparation of a sector plan for the phase-out of HFC-134 in the domestic and stand-alone commercial refrigeration sector.

Enterprise background

6. MCMC, established in 1988, is the only manufacturer of hermetic compressors for household and commercial refrigeration appliances in Africa and the Middle East. Article 5 ownership of MCMC amounts to 89.39 per cent, while the International Finance Corporation owns the remaining 10.61 per cent of the enterprise's shares. Seven per cent of the enterprise's exports are destined for non-Article 5 countries.

7. MCMC produces a broad range of Low Back Pressure (LBP) and High/Medium Back Pressure (HMBP) compressors and condensing units from 1/8 horsepower (HP) up to 1/3 HP, with the trademark ZMC. Its annual maximum production capacity is two million units in two lines, although that capacity is not fully utilized. At the 8th meeting, the Government of Egypt submitted a project proposal for the conversion of MCMC manufacturing process from CFC-12 to HFC-134a-based compressors (EGY/REF/08/INV/08).[2] Production of HFC-134a-based compressors started in 1997. HFC-134a-based compressors have an average refrigerant charge of around 150 g for residential units, 200 g for commercial

[2] The project was approved at a total funding of US $2,800,000 allocated to the World Bank. It included procurement of compressor calorimeters, compressor life test stands, motor dynamometers, controlled ambient test cells, washing machines for steel parts and rubber parts, retooling, technology transfer and training. After completion of the conversion, a balance of US $950,000 was returned to the Fund (at the 17th and 36th meetings).

units, and 50 g for water dispensers. MCMC plans to optimize its compressors, taking into account the energy-efficiency index and the coefficient of performance.

8. From 1996 to 2000, MCMC also produced approximately 200,000 R-600a-based compressors, mostly for domestic refrigerators that were exported to Europe; those compressors were produced based on the design and manufacturing process that is currently used for the HFC-134a-based compressors. Subsequently, MCMC discontinued the product due to its obsolescence (i.e., 25-year-old design) and high production costs. Since 2000, both manufacturing lines are producing exclusively HFC-134a-based compressors. Table 1 presents an overview of the production at MCMC.

**Table 1. Units of HFC-134a-based compressors manufactured at MCMC between 2015 and 2020**

| Year | Domestic refrigeration | | Commercial refrigeration | | Total (domestic and commercial) | | Total |
|---|---|---|---|---|---|---|---|
| | Line 1 | Line 2 | Line 1 | Line 2 | Locally | Exported | |
| 2015 | 161,540 | 161,543 | 69,233 | 69,233 | 301,766 | 159,783 | 461,549 |
| 2016 | 170,740 | 170,739 | 73,175 | 73,174 | 363,144 | 124,684 | 487,828 |
| 2017 | 121,497 | 121,497 | 52,070 | 52,070 | 282,609 | 64,525 | 347,134 |
| 2018 | 134,050 | 134,050 | 57,450 | 57,450 | 303,000 | 80,000 | 383,000 |
| 2019 | 121,800 | 121,800 | 52,200 | 52,200 | 293,000 | 55,000 | 348,000 |
| 2020 | 175,000 | 175,000 | 75,000 | 75,000 | 420,000 | 80,000 | 500,000 |

9. In 2020, production increased by approximately 40 per cent from the 2019 output; MCMC forecast an increase to 600,000, 750,000, and one million units in the first, second and third year after the conversion, respectively. MCMC exports decreased from more than 500,000 units in 2009 to about 80,000 units in 2020, due to major customers in Europe and Algeria switching to R-600a-based equipment.

Project description

10. MCMC aims to convert one of the two production lines manufacturing LBP models, from HFC-134a to R-600a. The conversion of the second production line to R-600a will be a part of the sector strategy to be included in the HFC phase-down plan for Egypt.

11. R-600a was selected as the alternative technology as it is a mature technology worldwide; it is already available in the local market; it has zero ODP and very low global-warming potential (GWP); it is more energy-efficient than HFC-134a-based technology; and its average market price is slightly lower than that of an HFC-134a-based compressor (due to larger swept volume and savings and the use of aluminium windings instead of copper windings in the electro-motor). Introducing locally manufactured R-600a-based compressors at a lower cost and the associated benefits of local manufacturing and servicing availability, shorter lead times, and local sourcing will encourage the local refrigeration manufacturers to shift to this technology.

12. The following changes are required in the manufacturing process to convert to R-600a-based compressors:

(a) *Development of mechanical parts for a new pump:* including a set of fixtures for the assembly lines, a set of gauges for the new components, new crank case die, crankshaft die and fixtures, cylinder head group or fine blank valve plate, aluminium cylinder head die and fixtures, and plastic suction muffler;

(b) *Modification of one electric motor production line:* including machine modification and fixture for stator tester, dies for new lamination with bolster plate, unload device and spare parts, modification of existing rotor dies to produce new rotor lamination, first stator line modification pack and insulation machine modification, main winding machine modification and inserting machine, intermediate forming, auxiliary winding machine

modification and inserting machine, forming modification, and final forming;

(c) *Upgrade of the suspension system to bottom support:* including special manual fixture for counterweight assembly, special manual fixture for rotor and crankshaft assembly, modification of a set of dies for new box and cover, new welding machine for bottom pins and foot straps, modification of a set of fixtures for the existing box welding machine, and a set of new gauges;

(d) *Adaptations to the enterprise laboratories:* including modifications to the calorimeter as well as to the overload and locked rotor, and high-temperature test set for chambers; and

(e) *Transfer of technical know-how for the new design:* including safety measures and the compressor performance design; technical assistance to purchase a new R-600a design and to carry out the necessary modifications for the machine conversion; and execution of the new design by the MCMC development team.

13. The project proposal also includes a component on market transformation, readiness and capacity-building to safely and efficiently deploy the R-600a-based technology at a commercial scale to all local manufacturers. This component, to be implemented by UNEP, includes the following two parts:

(a) *A policy roadmap:* intended to review and update the existing regulations and institutional capacities to facilitate the introduction of R-600a-based refrigeration equipment at a commercial scale while avoiding the introduction of high-GWP-based domestic and stand-alone commercial refrigeration equipment; and

(b) *A market readiness study:* intended to provide an analysis of the risks and safety considerations when converting to R-600a-based technology, including *inter alia* transportation and storage of R-600a pre-charged final products, transportation and storage of R-600a cylinders (in non-manufacturing facilities), and servicing practices at end-users and within servicing workshops.

Project costs and co-financing

*Conversion cost*

14. The incremental capital costs (ICCs), as originally submitted, have been estimated at US $3,300,000; of this amount, US $1,799,600 (excluding funding adjustments due to foreign ownership) is requested from the Multilateral Fund, and US $1,664,000 is a counterpart contribution by MCMC. The total ICCs are shown in Table 2.

**Table 2: ICCs of the conversion of one compressor production line at MCMC (US $)**

| Item | Cost |
|---|---|
| **Development of mechanical parts for a new pump** | |
| Set of fixtures for the assembly lines | 60,000 |
| Set of gauges for the new components and others | 24,000 |
| New crank case die and fixtures | 120,000 |
| New crankshaft die and fixtures | 120,000 |
| Cylinder head group or fine blank valve plate | 12,000 |
| Aluminium cylinder head die and fixtures | 24,000 |
| Plastic suction muffler | 12,000 |
| *Subtotal development of mechanical parts for a new pump* | *372,000* |
| **Modification of one electric motor production line** | |
| Machine modification and fixture for stator tester | 60,000 |
| Dies for new lamination with bolster plate, unload device and spare parts | 240,000 |

| Item | Cost |
|---|---|
| Modification of existing rotor dies to produce new rotor lamination | 12,000 |
| First (out of two) stator line modification pack and insulation machine modification | 120,000 |
| Main winding machine modification and inserting machine | 372,000 |
| Intermediate forming | 84,000 |
| Auxiliary winding machine modification and inserting machine | 372,000 |
| Forming modification | 48,000 |
| Final forming | 48,000 |
| Installation commissioning | 24,000 |
| Set of gauges | 24,000 |
| *Subtotal modification of one electric motor production line* | *1,404,000* |
| **Upgrade of the suspension system to bottom support** | |
| Special manual fixture for counterweight assembly | 60,000 |
| Special manual fixture for rotor and crankshaft assembly | 120,000 |
| Modification of a set of dies for new box and cover | 180,000 |
| New welding machine for bottom pins and foot straps | 180,000 |
| Modification of a set of fixtures for the existing box welding machine | 60,000 |
| Set of new gauges | 48,000 |
| *Subtotal upgrade of the suspension system to bottom support* | *648,000* |
| **Adaptations to the enterprise laboratories** | |
| Calorimeter modification | 180,000 |
| Overload and locked rotor modification | 120,000 |
| High-temperature test set for chambers | 36,000 |
| *Subtotal adaptations to the enterprise laboratories* | *336,000* |
| **Transfer of technical know-how for the new design** | |
| *Subtotal transfer of technical know-how for the new design* | *540,000* |
| **Total ICCs** | **3,300,000** |
| Co-financing | (1,664,000) |
| Contingency (10%) | 163,600 |
| **Total ICCs before deduction for non-Article 5 ownership** | **1,799,600** |

15. No incremental operational costs (IOCs) are being requested. Based on the material use for manufacturing an R-600a-based compressor, MCMC estimates potential savings of US $1.66 per unit. Accordingly, the enterprise plans to sell R-600a-based compressors at a lower price than HFC-134a-based compressors to be competitive in the market. Detailed information on the resulting ICCs and IOCs will be provided upon completion of the conversion, as per decision 78/3(g).

*Technical assistance cost*

16. The technical assistance component to be implemented by UNEP amounts to US $53,000, consisting of US $35,000 for the market assessment study and US $18,000 for the policy roadmap.

*Total cost*

17. The total cost of the project to the Multilateral Fund, after deducting foreign ownership and considering the counterpart funding from MCMC, amounts to US $1,781,158, as summarized in Table 3.

**Table 3. Total cost of the MCMC conversion project as submitted (US $)**

| Item | Cost |
|---|---|
| ICCs | 3,300,000 |
| Co-financing from the enterprise | (1,664,000) |
| Contingency (10%) | *163,600 |
| Awareness programme and market readiness assessment by UNEP | 53,000 |
| Total cost | 1,852,600 |

| Item | Cost |
|---|---|
| Deduction for non-Article 5 ownership (10.61%)[3] | *(190,938) |
| Deduction for exports to non-Article 5 countries (7%)[4] | 0 |
| **Total project cost** | **1,661,662** |
| Agency support costs | 119,496 |
| **Grand total** | **1,781,158** |
| Indirect HFC phase-out associated to the project (mt) | 150 |
| Cost-effectiveness (US $/kg) | 11.87 |

*The Secretariat notes that the 10 per cent contingency and the 10.61 per cent deduction for non-Article 5 ownership in the project proposal, as submitted, were calculated after deducting the co-financing rather than based on the overall cost of the project. Corrected calculation is provided in Table 4.

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

19. The project will indirectly eliminate an annual consumption of 150 mt (214,500 mt $CO_2$-eq) of HFC-134a. The energy efficiency of R-600a-based compressors is estimated to improve by about 45 to 60 per cent through improved energy-efficient performance design.

## SECRETARIAT'S COMMENTS AND RECOMMENDATION

### COMMENTS

*Eligibility for HFC investment projects*

20. The Secretariat has reviewed the project proposal on the basis of the current policies of the Multilateral Fund, decisions of the Executive Committee relating to HFC investment projects (decisions 78/3(g), 79/45, 81/53 and 84/53) and similar approved conversion projects for CFC and HFC phase-out.

21. The project proposal includes an official letter from the Government of Egypt with the commitment required in decision 78/3(g), indicating that the Government is making every effort to ratify the Kigali Amendment as soon as possible, in line with decision 79/45. The Government is aware that, if the project is approved by the Executive Committee:

(a) 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

(b) Any reduction in HFC consumption will be deducted from any starting point for aggregate reductions on HFC consumption that may be agreed in the future.

22. While the present project proposal does not come under one of the priority sectors identified in decision 84/53,[5] the Secretariat notes that conversions of compressor manufacturing lines to R-600a technology had previously been approved as project components for HFC-134a-based domestic refrigeration manufacturing enterprises that converted to R-600a technology in Bangladesh[6] and Mexico.[7] The Secretariat further notes that the project is in the African region and relates to an enterprise that

[3] Applied only on the investment component associated to the enterprise.
[4] In line with existing policies, where exports to non-Article 5 countries correspond to or are less than 10 per cent of total production, the total incremental costs shall be covered (document UNEP/OzL.Pro/ExCom/15/45, paragraphs 146-147).
[5] Decision 84/53 allows for the submission of HFC investment project proposals up to the 87th meeting, prioritizing the stationary air-conditioning, commercial refrigeration and mobile air-conditioning sectors.
[6] UNEP/OzL.Pro/ExCom/80/32
[7] UNEP/OzL.Pro/ExCom/81/45

exclusively manufactures compressors and supplies them to domestic and stand-alone commercial refrigeration manufacturing enterprises located in Egypt and in the region, and that these refrigeration manufacturing enterprises might decide to convert their production lines to R-600a technology once the enterprise under the project supplies R-600a-based compressors at a lower cost than the HFC-134a-based compressors, reducing the future demand for HFC-134a for servicing purposes. In addition, the conversion to R-600a technology will contribute to mitigating climate change, as energy consumption will be substantially decreased due to an increase in the energy efficiency of the units. Further, the project will provide detailed information on the costs for the conversion of compressors from HFC-134a to R-600a refrigerant, and its impact on the IOCs of domestic and stand-alone commercial refrigeration conversions, available in several Article 5 countries.

*Second-stage conversion*

23. The Secretariat notes that MCMC received funding from the Multilateral Fund at the 8th meeting of the Executive Committee (1992) to convert from CFC-12-based compressors to HFC-134a-based compressors. As such, the Secretariat considers that the present conversion would fall under paragraph 18(b) of decision XXVIII/2, and would therefore be eligible for funding.

*MCMC's competitiveness in the market*

24. The Secretariat requested additional clarification on the competitiveness of MCMC in light of the competition from international compressor manufacturers, noting that at present, compressors imported from China and Brazil dominate the market, and that the independent technical review undertaken by UNIDO indicated that the cost of manufacturing R-600a-based compressors in large-scale manufacturing enterprises in other regions would be lower than that of locally manufactured compressors, even after taking into consideration transportation and other additional expenses.

25. UNIDO explained that the price of the compressor was not the only consideration in selecting the compressor supplier. MCMC, as the only local supplier of compressors, is suited to tackle challenges associated with imported compressors by offering a shorter lead time for product availability, not requiring hard currency for payments, and providing after-sales service, technical support and spare parts. Purchasing from MCMC also represents savings to local refrigeration manufacturers, as they do not need to maintain high inventory levels of compressors. At present, despite competition from lower-priced imported HFC-134a-based compressors, MCMC still maintains a significant market share. Further, the R-600a-based compressors to be produced by MCMC are expected to have a lower cost than the currently produced HFC-134a-based compressors, and MCMC aims to be able to achieve additional cost reductions with a decrease in the amount of material required for production, and an increase in the production output. The Secretariat notes that despite reduction in production in the last 10 years, especially with regard to compressors destined for export, MCMC has been in operation for more than 30 years, with an increase in production in 2020 as compared to the previous five years. Nevertheless, the enterprise would face strong competition in the market and would need to continue to work on cost reduction to sell their products competitively in the market.

*Impact of the project in the domestic and stand-alone commercial refrigeration manufacturing sector*

26. As submitted, the project proposes to reduce by 150 mt the total consumption of HFC-134a used in the manufacturing of refrigeration equipment in Egypt. Noting that the actual phase-out would occur only when the refrigeration manufacturers would be converted to an alternative technology, rather than when the compressor manufacturer has converted, the Secretariat enquired how it could be assured that after conversion of the compressor manufacturing enterprise, the local manufacturers of domestic and commercial refrigerators would undertake their conversions so that the HFC phase-out claimed by the project would effectively take place.

27. UNIDO explained that the Government of Egypt is committed to prioritizing the domestic and stand-alone commercial refrigeration manufacturing sector in its plan to address the phase-down of HFCs. The conversion of this sector will be part of stage I of the HFC phase-down strategy. UNIDO, on behalf of the Government of Egypt, submitted to the 87th meeting a funding request for the preparation of the sector plan for the conversion of HFC-134a to R-600a in the domestic and stand-alone commercial refrigeration manufacturing sector. However, as the country has not ratified the Kigali Amendment, the request was removed from UNIDO work programme. UNIDO will resubmit it, along with the preparation request for the HFC phase-down plan, as soon as Egypt ratifies the Kigali Amendment, a process expected to be completed before the end of 2021.

28. In the meantime, the Government of Egypt is already discussing with local manufacturers the conversion strategy for the sector, which would include *inter alia* technical support to the manufacturers; the conversion of MCMC; regulatory tools supporting the conversions; market acceptance activities; training for the after-sales service; and logistical activities related to the safe handling of R-600a. It is expected that the full conversion of the sector could take place within three to four years.

29. UNIDO also explained that the early conversion of this sector in Egypt could have an impact on limiting the growth of HFC consumption in the coming years due to an increase in demand for refrigeration equipment aligned with the country's urban development plan that has been underway for the last five years. The plan comprises urban projects including a new capital and around 40 new cities, settlements and city extensions, with millions of new houses scheduled to enter the market within the next three years.

30. The Secretariat acknowledges that the conversion of MCMC is a key element of the sector plan for the phase-out of HFC-134a in the domestic and stand-alone commercial refrigeration manufacturing sector, but under the current policy framework, at present Egypt can only submit an individual investment project rather than the entire sector plan. However, the Secretariat is concerned that by associating the funding of the phase-out of 150 mt of HFC-134a to the compressor manufacturer, once this tonnage is deducted from the starting point for sustained reductions in HFC consumption, it cannot be funded again for the enterprises in the domestic and stand-alone commercial refrigeration manufacturing sector once the sector plan is submitted. In case the consumption by eligible enterprises in the sector is below 150 mt, there would be no additional funding available for the conversion of those enterprises.

31. In addressing the Secretariat's concern, UNIDO indicated that the consumption of HFC-134a in the domestic and stand-alone commercial refrigeration sector was expected to be above 150 mt, and confirmed the Government's understanding of the potential funding implications for allocating the 150 mt of HFC-134a to the compressor manufacturer rather than to the manufacturers of domestic and stand-alone commercial refrigerator equipment, including the possibility of low availability of funds for these enterprises, if during the preparation of the sector plan it was determined that the eligible consumption of HFC-134a was below 150 mt.

32. The Government of Egypt indicated that there was enough awareness to convert the entire domestic and stand-alone commercial refrigeration sector to R-600a-technology, and that the conversion of the compressor manufacturer would only accelerate this process. Furthermore, domestic and stand-alone commercial manufacturing enterprises agreed with the commitment to shift to R-600a and stressed the urgent need for technical assistance and risk assessment in the manufacturing and after-sales service sub-sectors.

*Sustainability of the conversion*

33. Noting that one out of two manufacturing lines will be converted by the project, that both lines are able to produce HFC-134a-based compressors, and that both lines are operating below maximum capacity and could at any time increase production based on market needs, the Secretariat expressed a concern on the long-term sustainability of the conversion; for example, the enterprise could be producing the same or

even a larger number of HFC-134a-based compressors, several years after the conversion of the line to R-600a technology. In addressing this concern, UNIDO, on behalf of the Government of Egypt, agreed on the following path to ensure that the funding being provided by the Multilateral Fund will result in the phase-out of the manufacturing of HFC-134a-based compressors and associated indirect phase-out of 150 mt of HFC-134a:

(a) Conversion of the assisted manufacturing line at MCMC will be completed within two years after the project has been approved, and information on incremental costs will be submitted, as per decisions 78/3 (g) and 79/45;

(b) Commitment to stop the manufacturing and sales of HFC-134a-based compressors for the manufacturing of new domestic and stand-alone commercial refrigeration units and to render unusable the capacity of manufacturing HFC-134a-based compressors in the converted line, no later than 1 January 2025;

(c) Commitment to limit the annual manufacturing of HFC-134a-based compressors to no more than 150,000 units per year between 2025 and 2027, and no more than 100,000 units per year in 2028 and 2029, exclusively to serve the existing HFC-134a-based equipment;

(d) Commitment to stop the manufacturing and sales of all HFC-134a-based compressors and to render unusable the second line's capacity to manufacture HFC-134a-based compressors no later than 1 January 2030, at no additional cost to the Multilateral Fund; and

(e) Commitment to implement regulatory measures to promote the introduction of compressors based on R-600a and other low-GWP refrigerants in the domestic and commercial stand-alone appliances manufacturing sector no later than 2025.

*UNEP component on market transformation, readiness and capacity-building*

34. The Secretariat explained that decision 78/3(g) referred to HFC-related projects in the manufacturing sector only, without prejudice to different kinds of technology, and hence that the component relating to market transformation, readiness and capacity building estimated at US $53,000 could not be considered under the present project. UNIDO and UNEP agreed to withdraw this project component and to examine opportunities for implementing the capacity-building activities with the aid of other funding sources, including the HFC-134a phase-down plan for Egypt.

*Energy efficiency of R-600a-based compressors*

35. UNIDO explained that the conversion to R-600a would automatically result in manufacturing more energy-efficient compressors, and that optimizing the new R-600a-based compressor designs would create an opportunity to further improve energy efficiency by about 45 to 60 per cent. This would require additional research and development efforts and investments by MCMC; and as per the current proposal, the coefficient of performance is expected to increase from the current level of about 1.00-1.20 to about 1.60-1.75.

*Proposed costs and agreed level of funding*

36. The incremental costs proposed for the conversion at MCMC were, to a large degree, aligned with those of previous compressor manufacturing projects approved by the Executive Committee.

37. The Secretariat compared the costs of the present project with those of another compressor conversion project whose implementation was completed in 2020 and requested clarification on the costs associated with changes in the manufacturing facility (e.g., compressor motor, piston, crankshaft and other

components), in product redesign, testing facilities and training. UNIDO clarified that MCMC would provide co-financing for the modification of the electric motor and for laboratory equipment. Following the discussions, the agreed incremental costs for conversion of the compressor manufacturing process amount to US $1,305,536, to phase out 150 mt (214,500 mt $CO_2$-equivalent) of HFC-134a, as shown in Table 4. Co-financing by the enterprise would contribute to most of the costs related to the electric motor and laboratory adaptations.

**Table 4. Agreed incremental costs for the conversion of compressor manufacturing components (US $)**

| Item | As submitted | As agreed |
|---|---|---|
| Development of mechanical parts for a new pump and upgrade of the suspension system to bottom support | 1,020,000 | 1,020,000 |
| Modification of one electric motor production line | 1,404,000 | 1,404,000 |
| Adaptations to the enterprise laboratories | 336,000 | 336,000 |
| Transfer of technical know-how for the new design | 540,000 | 260,000 |
| Total ICCs | 3,300,000 | 3,020,000 |
| Contingency (10%) | 330,000 | 302,000 |
| Total ICCs before deduction for non-Article 5 ownership | 3,630,000 | 3,322,000 |
| Deduction for non-Article 5 ownership | (385,143) | (352,464) |
| **Total cost** | **3,244,857** | **2,969,536** |
| Co-financing | (1,664,000) | (1,664,000) |
| **Total investment component** | **1,580,857** | **1,305,536** |
| Awareness program and market readiness assessment by UNEP | 53,000 | - |
| **Grand Total** | **1,633,857** | **1,305,536** |

**2019–2021 business plan**

38. This project is included in the 2021–2023 business plan of the Multilateral Fund at a value of US $1,605,000, to phase out 150 mt of HFC-134a. The Secretariat notes that after the adjustments to the cost, the funding requested, including agency support costs, is US $208,076 below the value included in the business plan.

**RECOMMENDATION**

39. The Executive Committee may wish to consider:

(a) Noting the project proposal for the conversion of a compressor manufacturing facility from HFC-134a-based compressors to R-600a-based compressors at Misr Compressor Manufacturing Co. (MCMC) in Egypt, contained in document UNEP/OzL.Pro/ExCom/87/25;

(b) Approving the project proposal referred to in sub-paragraph (a) above in the amount of US $1,305,536, plus agency support costs of US $91,388 for UNIDO, on the understanding:

(i) That no further funding for HFC phase-down projects would be available until the instrument of ratification by the Government of Egypt had been received by the depositary at the Headquarters of the United Nations in New York;

(ii) That 150 metric tonnes (mt) (214,500 mt $CO_2$-eq) of HFC-134a would be deducted from the starting point for sustained aggregate reduction of HFCs once the starting point 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 would be submitted within six months of the project completion with detailed information on:

a. The eligible incremental capital costs for all equipment and other components including those not funded under the project;

b. Incremental operating costs;

c. Any possible savings incurred during the conversion and relevant factors that facilitated implementation (e.g. whether any purchased and/or installed equipment or supplies had gone through a competitive quote/bidding process and the details thereof); and

d. Changes in the energy efficiency of the products being manufactured and any related policies undertaken by the Government of Egypt;

(iv) That the enterprise committed:

a. To stop the manufacturing and sales of HFC-134a-based compressors for the manufacturing of new domestic and stand-alone commercial refrigeration units and to render unusable the capacity of manufacturing HFC-134a-based compressors in the converted line no later than 1 January 2025;

b. To limit the annual manufacturing of HFC-134a-based compressors to no more than 150,000 units per year between 2025 and 2027, and no more than 100,000 units per year in 2028 and 2029, exclusively to serve the existing HFC-134a-based equipment;

c. To stop the manufacturing and sales of all HFC-134a-based compressors and to render unusable the second line's capacity to manufacture HFC-134a-based compressors no later than 1 January 2030, at no additional cost to the Multilateral Fund;

(v) That the Government of Egypt would implement regulatory measures to promote the introduction of compressors using R-600a and other low-GWP refrigerants in the domestic and commercial stand-alone appliances manufacturing sector no later than 2025; and

(vi) That any remaining funds would be returned to the Multilateral Fund no later than one year after the date of project completion.