**UNITED NATIONS**

**EP**

**United Nations Environment Programme**

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/62/49
1 November 2010

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Sixty-second Meeting
Montreal, 29 November - 3 December 2010

**PROJECT PROPOSAL: SUDAN**

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

Foam

| | |
|---|---|
| • Umbrella project for the phase-out of HCFC-141b from the polyurethane (PU) rigid foam production in the manufacturing of domestic refrigerators, commercial refrigerators and PU insulated composite panels (Modern, Amin, Coldair, Akadabi) | UNIDO |

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

| PROJECT TITLE(S) | BILATERAL/IMPLEMENTING AGENCY |
|---|---|
| (a) Umbrella project for the phase-out of HCFC-141b from the polyurethane (PU) rigid foam production in the manufacturing of domestic refrigerators, commercial refrigerators and PU insulated composite panels (Modern, Amin, Coldair, Akadabi) | UNIDO |

| NATIONAL CO-ORDINATING AGENCY | Environment and Natural Resources |
|---|---|

**LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT**

**A: ARTICLE-7 DATA (ODP TONNES, 2009, AS OF OCTOBER 2010)**

| | | | |
|---|---|---|---|
| HCFCs | 50.6 | | |
| | | | |
| | | | |

**B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, 2009, AS OF OCTOBER 2010)**

| ODS | | | | | | Totals |
|---|---|---|---|---|---|---|
| HCFC-22 | 11.55 | HCFC-123 | 0.0 | | | 50.6 |
| HCFC-141b | 39.05 | HCFC-142b | 0.0 | | | |

| CFC consumption remaining eligible for funding (ODP tonnes) | n/a |
|---|---|

| CURRENT YEAR BUSINESS PLAN ALLOCATIONS | | Funding US $ | Phase-out ODP tonnes |
|---|---|---|---|
| | (a) | 288,025 | 3.4 |

| PROJECT TITLE: | |
|---|---|
| ODS use at enterprise (ODP tonnes): | 11.87 |
| ODS to be phased out (ODP tonnes): | 11.87 |
| Project duration (months): | 30 |
| Initial amount requested (US $): | 1,056,072 |
| Final project costs (US $): | |
| Incremental Capital Cost: | 960,828 |
| Contingency (10 %): | 96,083 |
| Incremental Operating Cost: | (-570) |
| Total Project Cost: | 1,056,341 |
| Local ownership (%): | 100 |
| Export component (%): | 0 |
| Requested grant (US $): | 1,056,341 |
| Cost-effectiveness (US $/kg): | 9.79 |
| Implementing agency support cost (US $): | 79,226 |
| Total cost of project to Multilateral Fund (US $): | 1,135,567 |
| Status of counterpart funding (Y/N): | n/a |
| Project monitoring milestones included (Y/N): | Y |
| | |
| **SECRETARIAT'S RECOMMENDATION** | Individual consideration |

## PROJECT DESCRIPTION

1. On behalf of the Government of Sudan, UNIDO has submitted to the 62nd Meeting of the Executive Committee a project to phase out the use of 11.87 ODP tonnes (107.9 metric tonnes) of HCFC-141b used for polyurethane (PU) rigid foam production in the manufacture of domestic refrigerators, commercial refrigerators and PU insulated composite panels. The cost of the project as submitted is US $1,056,072 plus agency support costs of US $79,205. The project is scheduled to be completed in 30 months, before the end of 2012.

2. The HPMP preparation in Sudan is still in progress and thus the projects have been submitted in accordance with decision 54/39(d).

Conversion project

3. The project proposal is for the conversion of four locally-owned enterprises using HCFC-141b as a blowing agent in the manufacture of domestic refrigerators and freezers (two companies) and insulated panels (two companies), as shown in Table 1.

**Table 1. HCFC-141b consumption used as a foam blowing agent in Sudan**

| Enterprise | HCFC-141b consumption (2009) | |
|---|---|---|
| | Metric tonnes | ODP tonnes |
| Modern Refrigerators (domestic refrigerators and freezers) | 30.6 | 3.4 |
| Amin Factory for Insulation Panels (insulated composite panels) | 15.0 | 1.7 |
| Coldair Engineering (domestic refrigerators and freezers) | 23.5 | 2.6 |
| Akadabi Steel (insulated panels and slabstocks) | 38.8 | 4.3 |
| Total | 107.9 | 12.0 |

4. Following a review of the available alternative technology, the four companies selected pentane as a replacement for HCFC-141b. The conversion activities will require modifications to the foaming lines, as well as safety equipment, technology transfer, training and trials.

5. A brief description of the enterprises is presented below:

(a) Modern Refrigerators Factory, established in 1982, produces 16 different models of domestic refrigerators and freezers, and cold stores and refrigerated rooms using sandwich panels provided by its sister company Amin Factory. In 1999, the enterprise converted from CFC-11 to HCFC-141b using its own resources. The production equipment was installed between 2000 and 2004. Conversion of the enterprise includes retrofitting its two high-pressure dispensers; replacing a low-pressure dispenser; a pre-mixing system; a hydrocarbon storage system; safety-related equipment; safety audits; trials and training, at a total cost of US $726,550;

(b) Amin Factory for insulation panels, founded in 2005, manufactures discontinuous polyurethane-steel sandwich panels for building, container and cold room use (57,923 $m^2$ of panels). The production equipment was installed in 2005. Conversion of the enterprise includes replacing the foam dispenser; installing pre-mixing equipment; installing a hydrocarbon storage and handling system; safety-related equipment; safety audits; trials and training, at a total cost of US $360,800;

(c) Coldair Engineering Company has been manufacturing refrigerators, water-coolers, air-coolers and cold stores for vegetables and fruit since 1952 (42,000 refrigerators manufactured in 2009). In 2004, the enterprise converted its foam production from glass/rock wool to HCFC-141b blown technology resulting in higher energy efficiency of

the refrigeration systems and reductions in their size. Conversion of the enterprise includes retrofitting two Canon foam dispensers; replacing the pre-mixing unit and hydrocarbon storage and handling system; safety-related equipment; safety audits; trials and training, at a total cost of US $514,800;

(d) Akadabi Steel, founded in 1994, manufactures discontinuous polyurethane-steel sandwich panels for building, container and cold room use (140,000 $m^2$ of panels). Conversion of the enterprise includes replacing the Elastogran high-pressure foam dispenser; retrofitting an OMS Impinati foam dispenser (installed in May 2010); replacing the pre-mixing unit and hydrocarbon storage and handling system; safety-related equipment; safety audits; trials and training, at a total cost of US $391,600.

6. Introduction of pentane technology will result in operating savings of US $569 for all four plants.

## SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

### COMMENTS

HCFC consumption

7. The consumption of HCFCs reported by the Government of Sudan under Article 7 of the Montreal Protocol and found in the HCFC survey is shown in Table 2. In 2009, consumption amounted to 50.6 ODP tonnes, of which 39.05 ODP tonnes (355 metric tonnes) was HCFC-141b.

**Table 2. HCFC consumption in Sudan between 2004 and 2009**

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| Article 7 data (ODP tonnes) | | | | 8.60 | 45.30 | 50.60 |
| Surveyed found (ODP tonnes) | 37.17 | 40.06 | 42.11 | 43.60 | 46.21 | 50.60 |
| HCFC-22 from survey (metric tonnes) | 98.60 | 122.80 | 148.60 | 156.80 | 183.15 | 210.00 |
| HCFC-141b from survey ( metric tonnes) | 288.60 | 302.80 | 308.50 | 318.00 | 328.50 | 355.00 |

8. In regard to the issue of zero reported consumption of HCFCs between 2004 and 2006, UNIDO explained that although there was consumption of HCFCs for those years, the Government did not report it under Article 7 of the Montreal Protocol. This was confirmed by an official communication from the Ministry of Industry of Sudan to the Fund Secretariat on 27 September 2009. Since 2007, the Government has been reporting HCFC consumption to the Fund and Ozone secretariats.

HPMP strategy

9. The Government of Sudan has forecast an overall growth rate in HCFC consumption of 8 per cent from 2010. Based on 2009 (reported) and 2010 (estimated at 52.84 ODP tonnes) consumption, the HCFC baseline for compliance has been estimated at 51.72 ODP tonnes. The Government of Sudan has agreed to establish the starting point for aggregate reductions in HCFC consumption as the latest HCFC consumption reported under Article 7 of the Montreal Protocol (i.e., 50.6 ODP tonnes) for 2009.

10. To meet the 2013 and 2015 Montreal Protocol targets, the Government of Sudan proposes to phase out 107.9 metric tonnes (11.9 ODP tonnes) of HCFC-141b used as a blowing agent in the manufacture of rigid polyurethane foam in four enterprises.

11. The four manufacturing enterprises covered under the umbrella project are the largest consumers of HCFCs in the country (107.9 metric tonnes (11.9 ODP tonnes) of HCFC-141b). There is also one

refrigeration manufacturer, Mina Co, whose production is occasional, and an increasing number of small and medium-sized operators with mobile equipment for in-situ building works and occasional repair works. The HCFC strategy proposed by the Government of Sudan is to convert the largest HCFC consuming enterprises for benchmarking and, as a demonstration for the other small foam businesses, to support the non-ODS technology by regulatory measures such as stricter licensing and import quotas. The umbrella phase-out project is an important component of the HPMP for Sudan. This umbrella project, if approved and implemented as planned (in 30 months), will result in the phase-out of 11.9 ODP tonnes of HCFC-141b.

12. Additional non-investment activities under the HPMP for Sudan would include enforcement of legislation, addressing the refrigeration servicing sector (training of technicians and customs officers, awareness), and enhancement of the monitoring and reporting system.

13. At its 19th Meeting (1996), the Executive Committee approved a project for phasing out ODS at three small domestic refrigerator factories in Sudan (Coldair Refrigerator Factory, Modern Refrigerator and Metal Furniture Co., Sheet Metal Industries Co. Refrigerator Factory) and approved US $100,000 to UNIDO for its implementation. Implementation of the project resulted in the phase-out of 4.0 ODP tonnes of CFC-11 (foam) and 3.3 ODP tonnes of CFC-12. UNIDO indicated that the project approved in 1996 was for the phase-out of CFC-12 used as refrigerant by the companies covered under the umbrella project submitted to the 62nd Meeting. The insulating operations in these companies continued with glass/rock wool. The 4.0 ODP tonnes of CFC-11 phase-out were used by Sheet Metal Industries Co., which is not included in the umbrella project.

Technical and cost issues

14. The total cost of the umbrella project as submitted is US $1,993,181 for the phase-out of 107.9 metric tonnes (11.9 ODP tonnes) of HCFC-141b. Since the cost-effectiveness of the umbrella project of US $18.47/kg was above the cost-effectiveness threshold (US $9.79/kg), the Government of Sudan requested funding of US $1,056,072, with the remaining funding of US $937,109 to be provided by the enterprises.

15. The Secretariat and UNIDO discussed technical and cost-related issues. A clarification was sought for the reasons for not considering the introduction of newer blowing agents such as methyl formate and methylal, which are currently being evaluated. UNIDO indicated that it had extensive discussions with the enterprises on different alternative technologies, including emerging technologies, where advantages, disadvantages and financial implications were presented. Based on these discussions, the four companies selected pentane as a replacement for HCFC-141b, as hydrocarbon technology is widely used for insulation foam for domestic refrigeration equipment (manufactured by two of the enterprises), and is also contained in imported insulated refrigerators and has a low global warming potential (GWP). The enterprises were informed of, and agreed to, the levels of counterpart funding required for the introduction of this technology. Letters on counterpart funding were provided by the enterprises (in accordance with decision 24/49).

16. Subsequent to the discussion on technical and cost related issues, the total cost of the project was adjusted from US $1,993,181 to US $1,670,660, with a cost-effectiveness value of US $15.48/kg (i.e., above the threshold value). Therefore it was agreed that US $1,056,341 would be provided through the Multilateral Fund and US $614,319 as a counterpart contribution by the enterprises, as shown in Table 3.

**Table 3. Level of funding agreed for the phase-out of HCFC-141b in Sudan**

| Enterprise | Funding (US $) | | |
|---|---|---|---|
| | Total | Grant | Counterpart |
| Modern Refrigerators | 607,200 | 299,574 | 307,626 |
| Amin Factory for Insulation Panels | 290,160 | 146,850 | 143,310 |
| Coldair Engineering | 381,700 | 230,065 | 151,635 |
| Akadabi Steel | 391,600 | 379,852 | 11,748 |
| Total | 1,670,660 | 1,056,341 | 614,319 |

Climate impact

17. A preliminary calculation of the impact on the climate of HCFC consumption through the foam project in Sudan, based only on the GWP values of the blowing agents and their level of consumption before and after conversion, is as follows: 107.9 metric tonnes of HCFC-141b will be phased out, 64.7 tonnes of cyclopentane will be phased in, and 75,315 tonnes of $CO_2$-equivalent that would have been emitted into the atmosphere will have been avoided.

| Substance | GWP | Metric tonnes/year | CO2-eq (tonnes/year) |
|---|---|---|---|
| **Before conversion** | | | |
| Before conversion | | | |
| HCFC-141b | 713 | 107.9 | 76,933 |
| **After conversion** | | | |
| Cyclopentane | 25 | 64.7 | 1,618 |
| **Net impact** | | | (75,315) |

**RECOMMENDATIONS**

18. The Executive Committee may wish to consider:

(a) Approving the umbrella project for the phase-out of HCFC-141b from the polyurethane rigid foam production in the manufacturing of domestic refrigerators, commercial refrigerators and polyurethane insulated composite panels at a total cost of US $1,056,341 and agency support costs of US $79,226 for UNIDO noting that a counterpart contribution of US $614,319 would be provided by the beneficiary enterprises;

(b) Noting that the Government of the Sudan agreed at the 62nd Meeting to establish as its starting point for sustained aggregate reduction in HCFC consumption the latest data reported by Sudan under Article 7 of the Montreal Protocol (50.6 ODP tonnes);

(c) Deducting 11.9 ODP tonnes (107.9 metric tonnes) of HCFCs from the starting point for sustained aggregate reductions in eligible consumption; and

(d) Requesting UNIDO to provide to the Secretariat, at the end of each year of the umbrella project's implementation period, progress reports that address the issues pertaining to the collection of accurate data in line with the objectives of decision 55/43(b), and to include those reports in the implementation reports on the HPMP, once it has been approved.

---