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EXECUTIVE COMMITTEE OF  
THE MULTILATERAL FUND FOR THE  
IMPLEMENTATION OF THE MONTREAL PROTOCOL  
Forty-third Meeting  
Geneva, 5-9 July 2004

**PROJECT PROPOSALS: CUBA**

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

Phase-out

- National CFC phase-out management plan: phase-out of ODS in the refrigeration and air-conditioning sector (first tranche) Canada, France, Germany, UNDP

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## PROJECT EVALUATION SHEET CUBA

SECTOR: Phase-out ODS use in sector (2003): 261 ODP tonnes

Sub-sector cost-effectiveness thresholds: n/a

**Project Titles:**

- (a) National phase-out management plan (first tranche, Germany component)
- (b) National phase-out management plan: (first tranche, France component)
- (c) National phase-out management plan: (first tranche, Canada component)
- (d) National phase-out management plan: (UNDP component)

Project Data	Refrigerant management plan			
	(a)	(b)	(c)	(d)
Enterprise consumption (ODP tonnes)	n/a	n/a	n/a	n/a
Project impact (ODP tonnes) (*)				
Project duration (months)	12	12	12	12
Initial amount requested (US \$) (**)	170,000	250,000	300,000	(***)
Final project cost (US \$):	170,000	250,000	300,000	
Incremental capital cost (a)				
Contingency cost (b)				
Incremental operating cost (c)				
Total project cost (a+b+c)	600,000	1,500,000	900,000	1,000,000
Local ownership (%)				
Export component (%)				
<b>Amount requested for first tranche (US \$)</b>	170,000	250,000	300,000	
Cost effectiveness (US \$/kg.) (****)	n/a	n/a	n/a	
Counterpart funding confirmed?				
National coordinating agency		National Ozone Unit		
Implementing agency	Germany	France	Canada	UNDP

<i>Secretariat's Recommendations</i>				
Amount recommended (US \$)				
Project impact (ODP tonnes)				
Cost effectiveness (US \$/kg)				
Implementing agency support cost (US \$)				
Total cost to Multilateral Fund (US \$)				

(\*) The total impact of the Cuba national phase-out plan is 361 ODP tonnes of CFCs.

(\*\*) The total cost of the Cuba national plan as submitted is US \$4,000,000.

(\*\*\*) The first tranche for UNDP component would be requested in 2005.

(\*\*\*\*) The CE of the Cuba national plan as submitted is US \$9.56/kg, based on a consumption of 464 ODP tonnes

## PROJECT DESCRIPTION

1. The Government of Cuba has submitted for consideration by the Executive Committee at its 43<sup>rd</sup> Meeting a national CFC phase-out management plan (NPP). Implementation of the plan will lead to the phase-out of the remaining consumption of Annex A, Group I (CFCs) substances (360 ODP tonnes), which represents the remaining consumption of CFCs in the country.

### Remaining ODS consumption in Cuba

2. Between 1999 and 2002, the Government of Cuba reported the following consumption of ODSs under Article 7 of the Montreal Protocol:

ODS (ODP tonnes)	1999	2000	2001	2002	Baseline
CFC	571.4	533.7	504	488.8	625.1
CTC	0.1	8	1.3	3.5	2.7
HAL	0	0	0	0	0
MB	62.1	22.8	15.2	21.1	50.5
TCA	0	0	0	0	0

3. According to the 2003 progress report on the implementation of the Cuba country programme, the 2003 ODS consumption in the country is as follows: 119.6 ODP tonnes of CFCs used in the manufacturing of MDIs (to be phased-out through an approved project); 360.8 ODP tonnes of CFCs used in the refrigeration servicing sector; 0.5 ODP tonnes of CFC-113 and 0.1 ODP tonnes of CTC used as a solvent; and 29.7 ODP tonnes of methyl bromide (MB).

4. On the basis of Decision 35/57, the remaining CFC consumption eligible for funding was calculated at 585.7 ODP tonnes (Option 1). Since the 35<sup>th</sup> Meeting, the Executive Committee has approved one investment project for the phase out of 109 ODP tonnes of CFCs used in the manufacture of metered dose inhalers (41<sup>st</sup> Meeting), and the renewal of the institutional strengthening project with an associated phase-out of 12.3 ODP tonnes (40<sup>th</sup> Meeting). Therefore, the remaining CFC consumption eligible for funding is 464.4 ODP tonnes.

### ODS regulations

5. The Government of Cuba has enacted regulations for imports and exports of ODS and ODS-based products. Specifically, Resolution N° 65 of 10 June 1999 by the Ministry of Science, Technology and Environment established, *inter alia*, a timetable for the reduction of the import and export and manufacture of ODSs, as well as equipment and technology that uses these chemicals; and from 31 December 1998, every association that produces equipment, manufactures or imports systems using ODS in their production processes and/or offering services is obliged to inform the Environment Agency on actual production, use or destination of these substances.

6. In addition, the Government of Cuba, supported by the Government of Canada, had implemented regulations for the protection of the ozone layer, including the certification of refrigeration technicians, introduction of eco-labels for domestic refrigerators, and a draft regulation making recovery and recycling of CFCs mandatory.

7. In total, 615 customs and enforcement officials have been trained on the licensing system and on the Montreal Protocol; and three custom offices have been equipped with a computer-based information system to keep track of ODS imports.

#### Refrigeration manufacturing sector

8. There is one domestic refrigeration enterprise in Cuba (INPUD). The annual production of the plant is 30,000 units based on hydrocarbon technology (the enterprise did not receive financial assistance from the Multilateral Fund).

#### Refrigeration servicing sector

9. A survey was conducted in 2003 during the preparation of the NPP for Cuba. Based on the survey, the current CFC consumption in the country is 360 ODP tonnes, with the following breakdown:

Type of equipment	Description	Consumption (ODP tonnes)
Domestic refrigerators	2 million units, of which 100,000 units are serviced annually	16
Cold rooms (supermarkets, hotels and restaurants); food processing and storage	62,800 cold rooms, display cabinets and bottle coolers (140 ODP tonnes of CFC12/year) and deep freezer (3 ODP tonnes of R502)	167
Air conditioning systems in office buildings	7,000 units	100
Chillers	200 chillers (CFC-11 and CFC-12 based refrigerants)	71
MAC systems	4,000 units in vehicles, 400 units in busses and 50 units in train wagons	6
<b>Total</b>		<b>360</b>

10. Currently, there are about 2 million domestic refrigerators in the country, of which 40,000 systems are based on HFC-134a or R600a refrigerants. A large number of the CFC-12 based refrigerators are old (30 or more years). About 100,000 units are repaired every year in 239 Government-operated service workshops with 2,000 technicians. Of these systems, 80,000 are serviced with CFC-12 (16 ODP tonnes) and the 20,000 remaining have been retrofitted to a locally developed hydrocarbon-based refrigerant (LB12). Since 1996, over 200,000 systems have been converted to LB12 refrigerant.

11. The total number of commercial refrigeration systems in operation in Cuba is about 63,000 units mainly operating with CFC-12 refrigerant. About 160 tonnes of CFC refrigerants (143 ODP tonnes of CFC-11 and CFC-12) are used on an annual basis for servicing these units. The distribution of commercial refrigeration systems by type is presented in the table below:

Type	Units available	Refrigerant used	Refrigerant charge (kg)	Installed capacity (tonnes)	Leakage rate (tonnes)
Cold rooms	26,000	CFC-12	14.0	364	109
Cold rooms	1,200	R502	50.0	60	18
Display cabinets	5,600	CFC-12	2.5	14	4
Water coolers	30,000	CFC-12	3.0	90	27
<b>Total</b>	<b>62,800</b>			<b>528</b>	<b>158</b>

12. The CFC consumption in the air-conditioning and chillers sub-sectors represents 50 per cent of the total CFC consumption in the country. Most of the systems are operated in public areas and include:

Type	Refrigerant used	Refrigerant charge (kg)	Units available
Chillers	CFC-12	150 – 500	200
Chillers	CFC-11	150 – 1,500	200
Air-conditioners	CFC-12	10 – 150	6,800

13. The refrigeration technicians in Cuba were generally trained in polytechnics and service workshops. However, the training programme in good refrigeration practices, implemented by the Government of Canada as part of the RMP project approved by the Executive Committee at its 29<sup>th</sup> Meeting, introduced a new training approach. Through this programme, 20 local refrigeration technicians were trained as trainers; they have developed their own training programmes and material and have since trained about 1,700 technicians out of the 3,000 in the country.

14. The current prices of refrigerants are: US \$4.0/kg for CFC-11; US \$4.7/kg for CFC-12; US \$10.0/kg for HFC-134a; US \$3.3/kg for HCFC-22; and US \$0.5/kg for LB12 (hydrocarbon based refrigerant locally produced).

#### Recovery and recycling programmes

15. So far, the Executive Committee has approved the following recovery and recycling programmes in Cuba:

- (a) Implementation of a national programme for recovery and recycling of refrigerant (approved at the 15<sup>th</sup> Meeting for UNDP), through which 49 ODP tonnes of CFCs was planned to be recovered and recycled annually. However, the actual amount of refrigerant recovered to date has been 8 ODP tonnes. The limited number of recovery units procured, the lack of a reclamation unit, and the lack of storage facilities prevented the project from being successful; and
- (b) Recovery and recycling of CFC-12 in the MAC sector (approved at the 30<sup>th</sup> Meeting for the Government of Canada). MAC recovery/recycling machines were provided to 8 service workshops where technicians were trained in the use of the machines. There are currently 5 additional MAC services workshops without appropriate recovery and recycling equipment.

Production of LB12 refrigerant

16. In 1996, the University of Santiago in Cuba developed a hydrocarbon-based refrigerant (LB12) as a replacement for CFC-12 in domestic refrigerators. LB12 is currently produced in Cuba (20 tonnes/year) and distributed to service workshops throughout the country. So far, more than 700 refrigeration technicians have been trained in the use of LB12 refrigerant, a user manual for LB12 has also been published and distributed, and about 200,000 domestic refrigerators and 5,000 commercial refrigerators (0.87 to 3.5 kW refrigeration capacity) have been retrofitted to the use of LB12 (the estimated cost for retrofitting a domestic refrigerator is US \$5 for spare parts, US \$10 for labour and US \$0.5/kg for the refrigerant and lubricant).

17. The current level of LB12 production does not satisfy the demands of the local market. However, through direct bilateral assistance provided by the Governments of Canada and Germany (outside the Multilateral Fund), the production capacity of LB12 is to be increased. The quantities produced will satisfy the demand for servicing domestic refrigeration and commercial refrigeration equipment up to 2 kg of refrigerant charge.

Cost of the NPP

18. The total cost of the NPP has been estimated at US \$4.0 million (US \$11.11/kg), with the following breakdown:

<b>Sector</b>	<b>Activities</b>	<b>Cost (US\$)</b>
Commercial refrigeration, air conditioning and MAC	Recovery and recycling scheme	550,000
Commercial refrigeration	Refrigeration service tools	100,000
	Public awareness	190,000
	Development and implementation of regulations	60,000
Sub total (Canada)		900,000
Air conditioning	Chiller containment and engineering. Incentive programme for retrofit chillers and consoles	1,500,000
Sub total (France)		1,500,000
Commercial refrigeration	Incentive programme for stimulation of drop-in and retrofit. Provision of refrigeration service tools	800,000
Domestic refrigeration	Incentive programme for retrofit to LB12 refrigerant	200,000
Sub total (UNDP)		1,000,000
Domestic refrigeration	Classification of refrigerators, eco label, certification of technicians	50,000
Commercial refrigeration	Training programme in good service practices	200,000
All	Capacity building: monitoring as financial support to the Ozone Unit	200,000
All	Technical support, monitoring and evaluation	150,000
Sub total (Germany)		600,000
<b>Grand total</b>		<b>4,000,000</b>

### Monitoring and management unit

19. The NPP is proposing the establishment of a monitoring and management unit to ensure that all the subprojects are implemented as planned.

## **SECRETARIAT'S COMMENTS AND RECOMMENDATION**

### **COMMENTS**

20. The four major issues related to the NPP for Cuba raised by the Secretariat were: (i) the retrofit of commercial refrigerators with a hydrocarbon-based refrigerant; (ii) chiller retrofits; (iii) technical issues and issues related to implementation; and (iii) the total cost of the project.

### Equipment retrofits with hydrocarbon-based refrigerant

21. The Secretariat expressed its concern about the proposed request for funding of activities for retrofit of CFC-based commercial refrigerators to LB12 refrigerant, taking into account the potential safety-related risks associated with the relatively high charge of a hydrocarbon-based refrigerant (up to 5 kg) in a refrigeration system that was designed to operate with a CFC refrigerant.

22. The Government of Germany reported that hydrocarbons have been commonly used in domestic, commercial and industrial refrigeration systems for more than 130 years (today, one third of the world production of domestic refrigerators is based on hydrocarbon foam and refrigerant technologies). Refrigeration systems should be equipped with the necessary safety procedures and follow international established standards (refer to EN378). In the case of the NPP for Cuba, only refrigeration equipment with a refrigerant charge of up to 2 kg would be retrofitted with LB12 refrigerant; refrigeration technicians would be trained to follow the established international procedures which would be adopted in Cuba. The Secretariat noted that although it was aware of widespread use of hydrocarbons in refrigeration systems, it understood that this was typically confined to new domestic refrigerators that had been designed for the use of such refrigerant.

23. The Secretariat also noted that the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee has not recommended retrofits with hydrocarbon-based refrigerants as a feasible alternative for refrigeration systems that were designed for a non-hydrocarbon based refrigerant (2002 Assessment Report).

### Chiller retrofits

24. The Secretariat drew the attention of the Government of Germany to relevant decisions taken by the Executive Committee (Decision 37/21) and the Parties to the Montreal Protocol (Decision XIV/9) on the chiller sector<sup>1</sup>. The Secretariat also pointed out that phase-out activities related to the chiller sector (estimated at US \$1.55 million) could be considered for funding only after the TEAP report on chillers is considered by the Parties, and the Executive Committee had considered the issue of an update of the policy guidance on chillers. In the absence of updated policy guidance on chillers, national ODS/CFC phase-out plans that have been approved by the Executive Committee have addressed the overall level of CFC consumption in the servicing sector, including any consumption in chillers. For non-LVC countries, the level of funding agreed for the overall consumption for servicing has been US \$5/kg.

25. Notwithstanding the above issue, the Secretariat also noted that according to the project proposal, the majority of the chillers in Cuba are more than 15 or 20 years old, with very high refrigerant annual leakage rate (100 per cent or more); 20 per cent of the chillers are out of service, awaiting replacement parts which are very difficult to obtain; and the difference in current prices between CFC-12 (US \$4/kg) and HFC-134a (US \$13) is very high. Under these circumstances retrofitting to a non-CFC refrigerant may not be technically feasible or economically viable.

26. The Government of Germany indicated that the project proposed to implement refrigerant containment practices in CFC-11-based chillers (direct expansion) in three hospitals, where the chillers are relatively new and well maintained. Under this programme, chillers currently out of service would not be considered in the project proposal.

### Technical issues and issues related to implementation

27. The Secretariat also noted that:

- (a) The current LB12 production does not satisfy the demand of the local market (even though the capacity of the plant is planned to be increased). As reported in the proposal, refrigeration technicians are lacking the knowledge to do the required modifications to the systems, and the net cost of US \$15.50 per system may not be viable for end-users;
- (b) Recovery/recycling operations and incentive programmes for end-user conversions cannot commence until the prices of CFC and non-CFC refrigerants are similar (Decision 38/38); and

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<sup>1</sup> Through Decision 37/21, the Executive Committee requested the Secretariat to prepare a report (for submission to a future meeting) on the chiller sector in order to possibly update the policy guidance on chillers. The report should provide a clarification of the nature of savings that could be envisaged as a result of increased energy efficiency of new chillers and how soon those energy savings might be realized. Also, through Decision XIV/9, the Parties to the Montreal Protocol requested the Technology and Economic Assessment Panel (TEAP) to prepare a report on the chiller sector to identify incentives and impediments for the transition to non-CFC equipment (TEAP was requested to collect data and assess the portion of the refrigeration service sector made up by chillers).



- (c) The need for 255 recovery units (in addition to the machines already distributed through the two approved recovery/recycling programmes) has to be further demonstrated taking into consideration the high leakage rate of the existing refrigeration systems and the age of the equipment.

#### Cost of the NPP

28. The cost-effectiveness of the project (US \$11.11/kg on the basis of a phase-out of 360 ODP tonnes of CFCs) is more than double the cost-effectiveness of the refrigeration servicing sector component of similar phase-out plans approved by the Executive Committee. The cost-effectiveness values of all except one of these plans ranged from US \$4.60/kg to US \$6.74/kg (the national CFC phase-out plan for Turkey was approved at a cost-effectiveness value of US \$10.00/kg, taking into account the significant acceleration of agreed phase-out in the country and the resulting reduction in ODS emissions). Some, but not all approved plans address CFC consumption in the manufacturing sector (mainly foam and refrigeration) as well as in the servicing sector; some plans also address consumption of controlled substances other than CFCs (e.g., halons, TCA and/or CTC). Currently, the servicing sector consumption of all sectoral or national plans in non-LVC countries is being reviewed and submitted to the Executive Committee at a cost-effectiveness value of US \$5.00/kg excluding funding for any additional technical assistance support and support for management and implementation of the project by the country.

29. The Secretariat also pointed out that in all the national/sectoral phase-out plans, the activities being proposed to phase-out CFC consumption in the refrigeration servicing sector are a combination of training programmes for refrigeration technicians and/or customs officers, a combination of service tools, recovery/recycling machines and in some cases incentive programmes for end-users together with support for public awareness and information dissemination.

30. In this regard, the Government of Germany indicated its view that the cost-effectiveness of US \$5/kg applies to countries with large consumption still in the manufacturing sector and there were no remaining manufacturing lines in Cuba. The cost-effectiveness of non-investment projects approved by the Executive Committee is above US \$12/kg. Therefore, the requested project funding is below the cost effectiveness of previously approved projects.

#### An alternative approach

31. During the discussions of the project the Secretariat presented to the Government of Germany for its consideration an alternate approach for the phase-out of all CFCs used in the refrigeration servicing sector in Cuba, through which a large portion of the funds available would be fully allocated under one umbrella technical assistance component. During project implementation, funds would be withdrawn to address specific needs as they arose. Through this approach, the Government of Cuba and the relevant implementing agencies would have full flexibility in using the funds available. In this regard, the Secretariat proposed the following activities:

- (a) Training and certification programme for refrigeration service technicians (US \$200,000);
- (b) Further development of ODS regulations, public awareness and information dissemination to main stakeholders (US \$150,000);
- (c) Technical assistance programme for the refrigeration servicing sub-sector (US \$1,450,000), to address specific needs that might arise during project implementation; for example, provide more recycling machines in the event of a steep rise in the price of CFCs, to purchase basic service tools should technicians experience difficulties in implementing good practices; or promote cost-effective and sustainable end-user retrofit programmes. To the extent possible, this programme would be implemented in stages so that resources could be diverted to other activities, such as additional training or procurement of service tools, if the proposed results are not achieved; and
- (d) Monitoring and management unit (US \$135,000).

32. The Government of Germany is still assessing the approach suggested by the Secretariat and the overall level of the incremental cost of the phase-out plan for Cuba. Conclusions of the discussions together with a draft agreement between the Government of Cuba and the Executive Committee for the complete phase out of Annex A (Group I) substances will be submitted to the Executive Committee prior to its 43<sup>rd</sup> Meeting, having regard to Decision 41/80.

#### **RECOMMENDATION**

33. Pending.

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