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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Sixtieth Meeting
Montreal, 12-15 April 2010

PROJECT PROPOSALS: COLOMBIA

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

Foam

- Demonstration project to validate the use of super-critical CO_2 in the manufacture of sprayed polyurethane (PU) Rigid Foam – Phase I — Japan
- Conversion plan from HCFCs to hydrocarbons in the production of polyurethane rigid insulation foam in the domestic refrigeration subsector (Mabe Colombia, Industrias Haceb, Challenger and Indusel) — UNDP

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT
COLOMBIA

PROJECT TITLE(S)	BILATERAL/IMPLEMENTING AGENCY
(a) Demonstration project to validate the use of super-critical CO_2 in the manufacture of sprayed polyurethane (PU) rigid foam – Phase I	Japan

NATIONAL CO-ORDINATING AGENCY	Ministry of Environment – National Ozone Unit

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (ODP TONNES, 2008, AS OF FEBRUARY 2010)

HCFCs	206.2		

B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, 2008, AS OF FEBRUARY 2010)

ODS				
HCFCs				
HCFC-22	67.2	HCFC-123	1.5	
HCFC-141b	137.5	HCFC-124	0.0	
HCFC-142b	0.0	**Total**	**206.2**	

CFC consumption remaining eligible for funding (ODP tonnes)	0.0

CURRENT YEAR BUSINESS PLAN ALLOCATIONS		Funding US $ million	Phase-out ODP tonnes
	(a)	0.5	55

PROJECT TITLE:	
ODS use at enterprise (ODP tonnes):	17.6
ODS to be phased out (ODP tonnes):	n/a
ODS to be phased in (ODP tonnes):	n/a
Project duration (months):	8
Initial amount requested (US $):	441,100
Final project costs (US $):	
Incremental Capital Cost	401,000
Contingency (10 %):	40,100
Incremental Operating Cost:	n/a
Total Project Cost:	441,100
Local ownership (%):	100%
Export component (%):	0%
Requested grant (US $):	441,100
Cost-effectiveness (US $/kg):	n/a
Implementing agency support cost (US $):	57,343
Total cost of project to Multilateral Fund (US $):	498,443
Status of counterpart funding (Y/N):	Y
Project monitoring milestones included (Y/N):	Y

SECRETARIAT'S RECOMMENDATION	For Individual Consideration

PROJECT DESCRIPTION

1. On behalf of the Government of Colombia, the Government of Japan has submitted a demonstration project to validate the use of super-critical CO_2 in the manufacture of sprayed polyurethane (PU) rigid foam in Colombia to the 60th Meeting of the Executive Committee. The total cost of the project is US $441,100 plus agency support costs of US $57,343.

Sector background

2. There are four local PU foam systems houses in Colombia that supply small and medium-sized enterprises (SMEs) with foam material, as well as multinational chemical manufacturers (i.e., BASF, Bayer, Dow and Huntsman) that supply mostly the larger users. The largest locally-owned systems house in the country is Espumlatex, which produces about 3,000 metric tonnes of PU systems annually. Out of this amount, 140 tonnes are used for spray rigid foam.

3. The Executive Committee has approved the following two projects for Espumlatex: conversion from CFC-11 to water-based technology in the manufacture of flexible moulded and integral skin foam (COL/FOA/32/INV/49); and conversion from CFC-11 to HCFC-141b and water-based technology in the manufacture of various polyurethane foam applications at 25 SMEs centred around their systems house Espumlatex (COL/FOA/32/INV/48).

Super-critical CO_2 technology

4. Currently, the most technically feasible option to replace HCFC-141b in the production of PU spray foam is HFC-245fa. The use of hydrocarbon-based technologies is limited due to safety-related issues during foaming operations. The use of CO_2 generated by the water-isocyanate reaction is limited, as the foam produced has poor dimensional stability, poor adhesion to different substrates and relatively high thermal conductivity.

5. An alternative option is the direct injection of supercritical CO_2, a technology that was developed by Achilles Corporation of Japan and, so far, only used in that country (supercritical CO_2 refers to carbon dioxide that is in a fluid state at conditions of temperature and pressure above its critical point). This technology could be successfully introduced in Article 5 countries, given its lower operating costs compared to HFCs and the relatively low investment needed for modifications to the foam machines in the baseline (i.e., about US $15,000).

Project description

6. The project proposes to demonstrate the use of supercritical CO_2 for spray applications of rigid polyurethane foam (polyurethane (PUR) and polyisocyanurate (PIR[1])), and to disseminate the technology to interested systems houses in Colombia and other Latin American countries. The demonstration will be carried out in cooperation with Espumlatex and will include the acquisition of foaming equipment designed for the supercritical CO_2 technology; foam injection in typical spray applications (i.e., industrial factories and warehouses, commercial buildings, thermal insulation for tanks and public transportation); the evaluation of immediate and aged foam properties; and a performance/cost analysis versus HCFC-141b.

7. The company that has developed the supercritical CO_2 technology, Achilles Corp., is committed to participating in the demonstration; however, at this stage the company will not disclose the

[1] Polyisocyanurate is a foam in which the proportion of methylene diphenyl diisocyanate (MDI) is higher than for polyurethane foam and where a polyester derived polyol instead of a polyether polyol is used. Catalysts and additives used also differ from those used in polyurethane foams.

formulation. In the event that Espumlatex decides to introduce the technology using local materials, Achilles will provide the formulation under a confidential agreement. Based on the outcome of this demonstration, Achilles Corp., is willing to work with local systems houses to develop suitable formulation based on local raw materials under confidential agreement.

8. The total cost of phase I has been estimated at US $441,100 with the breakdown shown in the table below:

Description	**Cost (US $)**
Project preparation and start-up costs	50,000
Training of local staff	80,000
Foaming unit for supercritical CO_2 technology	80,000
Foam testing and laboratory equipment	76,000
Technical advice fees	55,000
Technology dissemination workshops	60,000
Technology transfer fee	401,000
Contingencies (10 per cent)	40,100
Total cost	441,100

9. The project will be implemented by the Government of Japan with assistance from UNDP. UNDP has stipulated, and Achilles Corp. has agreed, to offer the technology to systems houses located in Article 5 countries in Latin America with good standing. Everything that is developed during the project implementation using money from the Multilateral Fund will be in the public domain (i.e., detailed experimental protocols used to test the technology, including application methods and testing procedures; the complete results obtained during the validation including dimensional stability of the foam; and the cost analysis of the technology based on standard prices).

10. Relevant activities such as equipment procurement, recruitment of experts, and payment of the technology transfer fee to Achilles will be arranged under the UNDP financial rules and regulations. The Government of Japan will monitor overall implementation of the project.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

11. The project proposal was first submitted by UNDP on behalf of the Government of Colombia to the 58th Meeting, and by the Government of Japan (as bilateral cooperation) to the 59th Meeting. In reviewing the proposal, the Secretariat noted that the project was not eligible considering the decision taken by the Executive Committee at its 57th Meeting with regard to the removal of all HCFC demonstration projects from the implementing agencies' business plans, except for five projects in Brazil, China and Egypt (decision 57/6). On this basis, the project was withdrawn at each Meeting.

12. The Secretariat raised several issues regarding the project, which were addressed by the Government of Japan as follows:

(a) The Secretariat asked about the relatively small market penetration of supercritical CO_2 technology in Japan and elsewhere, despite its potential advantages as a replacement of HCFC-141b. Japan responded by indicating that the introduction of supercritical CO_2 technology started later than other technologies (water/CO_2, HFCs), and requires additional equipment and experience by spray technicians, as the foaming operation is slightly different. Furthermore, almost all polyurethane spray applications are in the construction sector, which is a highly price-sensitive market, and involves mainly small and medium size enterprises; it is therefore very difficult to increase the price of spray.

However, penetration of the supercritical CO_2 technology is expected to increase in the local market because the Japanese foam industry has decided to phase out the use of HFCs as of October 2010 except for limited applications. Other countries may have fewer constraints for using HFCs, so Achilles Corp. and other companies with the same technology have not promoted the supercritical CO2 technology in those markets.

(b) In response to a request for clarification on technology transfer fees for the provider of the technology, Japan pointed out that at present, it is not clear whether the supercritical CO_2 technology will be selected by systems houses or foam manufacturing enterprises operating in Article 5 countries. The arrangement for the technology transfer fee could only be assessed at the time the technology is selected to replace HCFC-141b. Furthermore, the supercritical CO_2 technology has been commercially available for several years; therefore, it may be considered differently from technologies proposed in approved demonstration projects, which may not be commercially available in most non-Article 5 countries or could even be rejected for various reasons (i.e., toxicity, poor cost-effectiveness, safety related concerns). The detailed formulation and the drawing of equipment requirements will be disclosed after the technology has been validated by the demonstration project. Transfer fees will depend on the amount of HCFC phased-out, the number of system houses and the business strategy of Achilles Corp. According to Achilles Corp., local equipment manufacturers would be able to manufacture the equipment required for supercritical CO_2 technology with guidance from Achilles;

(c) In the review of the project proposal submitted to the 59th Meeting, the Technical Reviewer raised issues related to "the suitability of the technology for different altitudes given that the processing conditions are close to the critical point of CO_2, and given the thermal conductivity and its variation with time (ageing). This latter point is extremely important for insulating foams and is one of the main reasons why water (CO_2) technology is little used in polyurethane foams". The Secretariat pointing out that this issue was not addressed in the revised project, requested an explanation, and further asked about the technical and cost implications for the systems houses to work jointly with Achilles to develop the appropriate formulations (i.e., any royalty/technology transfer fees).

Japan indicated that ageing at high ambient temperature has never been an issue in the more than eight years of market experience by Achilles. Nevertheless, the ageing test, which is an important aspect in the evaluation of the performance of the technology, will be conducted in the field during the implementation of the project. If the results of the demonstration project are positive, it is anticipated that several system houses would be interested in introducing the supercritical CO_2 technology. Achilles Corp. would be willing to enter into economic/commercial agreements to provide to local system houses, under confidential agreement, formulations to start with. Subsequently, each systems house will have to develop its own proprietary technology based on local raw materials.

RECOMMENDATION

13. In light of the comments by the Secretariat, the Executive Committee may wish to consider whether to approve the demonstration project to validate the use of super-critical CO_2 in the manufacture of sprayed polyurethane (PU) rigid foam in Colombia, at a cost of US $441,100 plus agency support costs of US $57,343 for Japan, on the understanding that the project would be the final validation project for supercritical CO_2 technology in the manufacture of sprayed polyurethane rigid foams.

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT
COLOMBIA

PROJECT TITLE(S)	BILATERAL/IMPLEMENTING AGENCY
(a) Conversion plan from HCFCs to hydrocarbons in the production of polyurethane rigid insulation foam in the domestic refrigeration subsector (Mabe Colombia, Industrias Haceb, Challenger and Indusel)	UNDP

NATIONAL CO-ORDINATING AGENCY	Unidad Técnica de Ozono (UTO)

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (ODP TONNES, 2008, AS OF FEBRUARY 2010)

HCFCs	206.2		

B: COUNTRY PROGRAMME SECTORAL DATA (ODP TONNES, 2008, AS OF FEBRURY 2010)

HCFCs				
HCFC-22	67.2	HCFC 142b	0.0	
HCFC-123	1.5			
HCFC-141b	137.5	**Total**	**206.2**	

CFC consumption remaining eligible for funding (ODP tonnes)	

CURRENT YEAR BUSINESS PLAN ALLOCATIONS		Funding US $	Phase-out ODP tonnes
	(a)	4,076,000	55

PROJECT TITLE:	
ODS use at enterprise (ODP tonnes):	56.02
ODS to be phased out (ODP tonnes):	56.02
ODS to be phased in (ODP tonnes):	0
Project duration (months):	36
Initial amount requested (US $):	9,178,580
Final project costs (US $):	
Incremental capital cost	5,805,500
Contingency (10 %):	580,550
Incremental Operating Cost:	809,943
Total Project Cost:	7,195,993
Local ownership (%):	78.12
Export component (%):	0
Requested grant (US $):	5,621,483
Cost-effectiveness (US $/kg):	n/a
Implementing agency support cost (US $):	421,611
Total cost of project to Multilateral Fund (US $):	6,043,094
Status of counterpart funding (Y/N):	Y
Project monitoring milestones included (Y/N):	Y
SECRETARIAT's RECOMMENDATION	**For individual consideration**

PROJECT DESCRIPTION

14. On behalf of the Government of Colombia, UNDP has submitted to the 60th Meeting of the Executive Committee a project for the conversion from HCFCs to hydrocarbons in the domestic refrigeration subsector (foam component) in Colombia at a total cost of US $9,178,580 plus agency support costs of US $688,392. Implementation of the project will result in the phase-out of 61.4 ODP tonnes of HCFC-141b and HCFC-22 in 2013.

15. The domestic refrigeration sector plan consists of four manufacturing plants, namely, Mabe Colombia (with 50.1 per cent local ownership), Industrias Haceb, S.A. Challenger and Indusel S.A. The levels of HCFC consumption and the estimated costs of conversion for each of the manufacturing enterprises, as submitted, are summarized in Table 1 below.

Table1. Domestic refrigeration enterprises in Colombia

Enterprise	HCFC-141b		HCFC-22		Funding (US$)
	Tonnes	ODP tonnes	Tonnes	ODP tonnes	
Mabe Colombia	221.3	24.3	197.1	10.8	2,715,308*
Industrias Haceb, S.A.	157.2	17.3			3,326,193
Challenger	59.1	6.5			2,220,152
Indusel S. A.	21.7	2.4			916,927
Total	459.3	50.5	197.1	10.8	9,178,580

After deducting 49.9 per cent of foreign ownership.

16. The four companies selected cyclopentane as the replacement for HCFCs, considering that hydrocarbon technology is widely used and proven in foaming operations in domestic refrigerators. Other alternative technologies do not perform well on the insulation value and density (CO_2/water), are too expensive and have high global warming potential (GWP) values (HFCs), or are not yet fully proven (methyl formate, methylal, unsaturated HFCs). The four enterprises use HFC-134a as refrigerant.

17. The description of the foam operations and conversion requirements of each manufacturing enterprise are presented below.

Mabe Colombia

18. Mabe Colombia is a refrigerator manufacturing company with a local ownership share of 50.1 per cent, and a total production of about 902,000 units in 2008. The company started producing household appliances in 1955 under the name of Incorsa. Since then, it has changed its name several times, until it was bought by Mabe Mexico in 1996. Two HCFCs are used for the production of insulation foam: 221.5 metric tonnes (24.36 ODP tonnes) of HCFC-141b, which is supplied to the company as a component of the premixed polyol, and 197.1 metric tonnes (10.84 ODP tonnes) of HCFC-22, which is added at the plant. The combination of HCFC-141b and HCFC-22 allows for a low foam core density (32 kg/m^3) in doors and cabinets by taking advantage of the high vapour pressure of HCFC-22.

19. The company operates three foaming lines; each line is equipped with two Cannon high pressure foaming machines each, with an assembly of molds and fixtures for cabinets and doors. The conversion to cyclopentane technology involves the installation of 30 m^3 underground pentane storage tank, three pre-mixers, three polyol tanks and buffer tanks for the hydrocarbon storage and blending facility (US $504,000). Four of the six foam machines are proposed to be replaced, at a cost ranging from US $186,000 to US $284,000 (the price depending on the capacity of the dispensers and the number of heads installed), while the other two will be retrofitted at a cost of US $120,000 each (for a total cost of foam equipment replacement and retrofit of US $1,190,000). Conversion also includes molds and fixtures retrofit (US $585,000); safety-related equipment (US $1,123,000); and training, trials, testing, safety

audits and system optimization (US $300,000). Incremental operating costs have been estimated at US $1,352,974 for a two-year period.

Industrias Haceb, S.A.

20. Industrias Haceb is a locally owned enterprise with over 65 years in the market, manufacturing heating and refrigeration products. In 2008 the company made 276,230 units. In total, 157.2 metric tonnes (17.29 ODP tonnes) of HCFC-141b are used for the production of insulation foam. The company has four iso-tanks (two for polyol and two for isocyanate); a complete network system for polyol and isocyanate distribution; three cabinet foaming lines equipped with 17 fixtures and two door foaming lines, one drum and one carrousel, each with six fixtures. Three high pressure dispensers, two installed in 1992 and one in 1994, are used for the cabinet foaming line, while two dispensers installed in 1994 are used for the door foaming line. Conversion to cyclopentane involves retrofitting the five dispensers (US $145,000 each) and purchasing five new L-type mixing heads (US $63,000 each). It also includes a 25 m³ cyclopentane storage tank and a buffer tank (US $149,000), a pre-mixer and a transfer pump (US $129,000), molds and fixtures retrofit (US $286,000) and safety-related equipment (US $692,000). Training, trials, testing, safety audits and system optimization are also requested (US $240,000). Incremental operating costs have been estimated at US $547,193 for a two-year period.

Challenger

21. The company is a locally owned enterprise that was established in September 1966. The manufacturing of domestic refrigerators (80 per cent of total production), and commercial refrigerators and mini bars (10 per cent each) started in 1995. In total, 59.1 metric tonnes (6.50 ODP tonnes) of HCFC-141b are used for the production of insulation foam. The company operates four dispensers, installed in 1991, 1994, 1998 and 2001. The conversion to cyclopentane involves retrofitting one dispenser (US $202,000) and replacing three others (at an average cost of US $275,000 each). It also includes a cyclopentane supply system from barrels (US $26,000), installation of a pre-mixer and buffer tank (US $124,000), molds and fixtures retrofit (US $65,000), safety-related equipment (US $285,000), and training, trials, testing, safety audits and system optimization (US $180,000). Incremental operating costs have been estimated at US $342,152 for a two-year period.

Indusel, S.A

22. The company (Industria de Electrodomésticos or Indusel, S.A.) was established on 1994 and produces a range of conventional and non-frost refrigerator models. In total, 21.7 metric tonnes (2.39 ODP tonnes) of HCFC-141b are used for the production of insulation foam. The company operates one dispenser installed in 1995 for foaming both the refrigerator cabinets and doors. The conversion to cyclopentane involves replacing the dispenser (US $145,000) and installing a new high pressure L-type mixing head (US $63,000). Cyclopentane is to be supplied from barrels; therefore no storage tank is requested. The conversion also includes a pre-mixer, a buffer tank and a pump (US $124,000), molds and fixtures retrofit (US $130,000), safety-related equipment (US $200,000), and training, trials, testing, safety audits and system optimization (US $90,000). Incremental operating costs have been estimated at US $89,927 for a two-year period.

23. The proposed time for project implementation is three years.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

24. The Secretariat reviewed the projects in the context of the policy paper on the revised analysis of relevant cost considerations surrounding the financing of HCFC phase-out submitted to the 55th Meeting (UNEP/OzLPro/ExCom/55/47), relevant decisions adopted on HCFC phase-out, as well as relevant guidelines and policies relating to approval of foam projects under the Multilateral Fund.

Projects previously approved for conversion from CFC-11 to HCFC-141b

25. The Executive Committee approved funding for conversion from CFC-11 (foam) and CFC-12 (refrigerant) for the following five domestic refrigeration manufacturing enterprises in Colombia: Icasa, Industrias Haceb, Corelsa, Polarix Electrodomésticos and Challenger. Upon a request for an explanation regarding the correlation between the previously approved projects and the projects submitted to the 60th Meeting, the following information was prepared by UNDP (Table 2). Additionally, UNDP provided a brief description of the status of the other 20 investment projects for the conversion of CFC-11 to HCFC-141b in the foam and commercial refrigeration sectors that were also approved by the Committee.

Table 2. Status of domestic refrigeration projects previously approved for Colombia

Enterprise	Status
Mabe Colombia (previously Polarix Electrodomesticos)	The company was purchased by Mabe Mexico. Conversion was completed satisfactorily. The company is currently using HCFC-141b as blowing agent.
Icasa, S.A.	Conversion was completed satisfactorily. The company declared bankruptcy; part of its operations were bought by Industrias Haceb
Industrias Haceb, S.A.	Conversion was completed satisfactorily. The company is currently using HCFC-141b as blowing agent.
Indusel S.A (previously Corelsa)	The company changed its name to Indusel. Conversion was completed satisfactorily. The company is currently using HCFC-141b as blowing agent.
Challenger S.A. (previously Unilemh Ltd.)	The company changed its name to Challenger. Conversion was completed satisfactorily. The company is currently using HCFC-141b as blowing agent.

Level of HCFC consumption

26. The HCFC consumption of the four manufacturing plants covered under the domestic refrigeration subsector was calculated based on the average consumption over the last two years (2007 and 2008) instead of the methodology adopted by the Executive Committee at its 16th Meeting (i.e., ODS consumption should in project proposals be calculated on the basis of either the year, or an average of the three years, immediately preceding project preparation). UNDP therefore revised the consumption in the project based on the 2006-2008 average consumption, as shown in Table 3.

Table 3. Level of HCFC consumption at the four refrigeration manufacturing enterprises

Company	Metric tonnes			ODP tonnes		
	HCFC-22	HCFC-141 b	Total	HCFC-22	HCFC-141 b	Total
Mabe Colombia	178.6	202.5	381.1	9.82	22.28	32.10
Industrias Haceb		142.1	142.1		15.63	15.63
Challenger		52.8	52.8		5.81	5.81
Indusel		22.6	22.6		2.49	2.49
Total	178.6	420.0	598.6	9.82	46.20	56.02

HCFC phase-out strategy in Colombia

27. Responding to a request for additional information regarding the HCFC phase-out strategy in Colombia, UNDP indicated that discussions with major stakeholders, including governmental authorities

and industrial sectors, are being completed. The Government is proposing to submit the HPMP to the 61st Meeting of the Executive Committee. Based on the surveys conducted so far, the 2009-2012 HCFC consumption for each HCFC currently used in Colombia has been estimated, as shown in Table 4. In 2008, the country exported 303 metric tonnes (33.33 ODP tonnes) of HCFC-141b in fully formulated polyols, which have been included in the table (the issue of import/export of HCFc-141b in pre-mixed polyols will be considered by the Executive Committee at its 61st Meeting).

Table 4. Forecasted 2009-2012 HCFC consumption

Substance	2008		2009		2010		2011		2012	
	metric tonnes	ODP tonnes	metric tonnes	ODP tonnes	metric tonnes	ODP tonnes	metric tonnes	ODP tonnes	metric tonnes	ODP tonnes
HCFC-22	1,221.0	67.2	1,034.0	56.9	1,179.0	64.9	1,344.0	73.9	1,532.0	84.3
HCFC-141b	947.0	104.2	802.3	88.3	914.4	100.6	1,042.5	114.7	1,188.7	130.8
HCFC-141b*	303.0	33.3	256.7	28.2	292.6	32.2	333.5	36.7	380.3	41.8
HCFC-142b	1.0	0.1	1.0	0.1	1.0	0.1	1.0	0.1	1.0	0.1
HCFC-123	74.0	0.2	62.0	0.1	71.0	0.1	81.0	0.2	92.0	0.2
Total	2,546.0	204.9	2,156.0	173.6	2,458.0	197.8	2,802.0	225.5	3,194.0	257.1

(*) HCFC-141b contained in pre-mixed polyols that are exported.

28. Based on the figures presented in the above table the estimated HCFC baseline for compliance is 185.7 ODP tonnes. From the extrapolated consumption of 257.1 ODP tonnes in 2012, which includes 41.8 ODP tonnes of HCFC-141b in pre-mixed polyols exported to other countries, the Government of Colombia would need to phase out 71.4 ODP tonnes of HCFCs to meet the 2013 freeze and an additional 18.6 ODP tonnes of HCFCs to meet the 2015 compliance target, or 90.0 ODP tonnes in total (if the amount of HCFC-141b contained in polyols that are exported is excluded from the analysis, a total of 75 ODP tonnes of HCFCs would need to be phased out to meet the 2013 and 2015 phase-out targets). The total HCFC-141b and HCFC-22 used by the manufacturing plants covered under the project is 56.02 ODP tonnes (or 70.3 ODP tonnes forecasted in 2012).

29. With regard to the reasons for submitting the domestic refrigeration subsector phase-out plan, and its impact on meeting the 2013 and 2015 HCFC consumption levels, UNDP responded by indicating that the subsector plan is crucial to ensure Colombia's compliance with the Protocol. Based on the results of the surveys conducted in the country for the preparation of the HPMP, and meetings held with major stakeholders, it was found that no other manufacturing sector could have contributed more effectively in meeting the compliance targets than the domestic refrigeration sector. Furthermore, in some of the manufacturing sectors (i.e., spray foam, air-conditioning applications), no cost-effective technologies other than HFCs (with high GWP) or hydrocarbon-based (which could not be applied to all of the companies) are available. The hydrocarbon-based technology chosen is proven worldwide. The four enterprises grouped in this subsector are medium to large size companies committed to starting the conversion process to non-HCFC technologies. The successful experience in phasing out CFCs in the domestic refrigeration subsector in Colombia can be capitalized on and repeated. Once the enterprises are fully converted, the Government of Colombia will issue a regulation banning the production and importation of HCFC-based domestic refrigerators, facilitating the HCFC consumption control and ensuring sustainability of the phase-out. Considering the time required for the implementation of the projects (36 months), it is important to start as soon as possible in order to contribute to reductions in HCFC consumption to meet the 2013 and 2015 targets.

30. According to the HCFC phase-out strategy, in addition to the conversion of the domestic refrigeration subsector, partial conversion of the commercial refrigeration subsector and control of the levels of consumption of HCFC-22 in the refrigeration and air-conditioning sectors would also need to be implemented to meet the 2013 and 2015 consumption levels. The Government of Colombia is closely monitoring the results of the ongoing demonstration projects, expected to provide environmentally and economically viable solutions for small and medium sized enterprises.

31. Upon a request for further clarification, UNDP confirmed that fully formulated polyols for the domestic refrigeration subsector are supplied by two systems houses (Huntsman and Dow Chemical) operating in Colombia. They locally blend the formulated polyol (pure polyol plus additives) with the imported HCFC-141b and sell a two-component system (a fully formulated polyol which includes HCFC-141b, and an isocyanate).

Cost and other related issues

32. The overall cost-effectiveness of conversion of the domestic refrigeration subsector as submitted is US $18.11/kg (before cost adjustment due to the foreign ownership component of the largest manufacturing plant). Considering the level of funding available to meet the freeze and the 10 per cent reduction in HCFC consumption by all Article 5 countries, projects would need to be prioritized according to various criteria, including their cost-effectiveness values. Addressing this issue, UNDP explained that the Government of Colombia recognizes that cost effectiveness has been an important parameter in the approval of projects. However, cost effectiveness values for HCFC projects are still under discussion by the Committee. With regard to prioritization of sectors, during the preparation of the HPMP (which is in an advanced stage of development) it was concluded by all stakeholders concerned that the conversion of the domestic refrigeration subsector would be the most cost-effective approach to meeting the compliance phase-out targets. Addressing HCFC consumption in all other manufacturing subsectors together would have a lower impact on compliance than through the four domestic refrigeration manufacturing enterprises. Furthermore, a number of applications in those subsectors still do not have a proven alternative technology besides HFCs (with high GWP) or hydrocarbons (which could not be used by all companies). Giving priority to another sector would not be consistent with the HPMP and would put the plan for meeting the compliance targets at risk.

33. The Secretariat also raised a number of cost-related issues with regard to the capital and operating costs requested. These included the request for new foam dispensers for the use of hydrocarbon rather than retrofitting the dispensers in the baseline, as has been the case in similar projects (including the project for the phase-out of HCFCs at Mabe Mexico, approved at the 59th Meeting); rationalization of production in cases where such rationalization could be introduced (i.e., in one manufacturing plant three pre-mixers are requested for each production line when one pre-mixer would be adequate). Funding requested for safety-related equipment, such as ventilation and associated items, is high compared to similar approved projects. It was also noted that funding for optimization, training, and trials could also be rationalized considering that this is a sectoral phase-out approach rather than stand-alone projects. Prices of raw materials, foam density increases and duration of the incremental operating costs were also discussed.

34. It was subsequently agreed to retrofit nine of the foam dispensers in the baseline for the use of cyclopentane, replace two foam dispensers by one dispenser in one enterprise, and replace six dispensers, which were not technically viable to be retrofitted, with similar capacity equipment. Costs of storage tanks for cyclopentane and ancillary equipment, premixers, and safety related equipment were adjusted according to the production levels and sizes of the enterprises. Furthermore, considering that the project addresses HCFC consumption in the refrigeration manufacturing subsector in Colombia, costs associated with training, trials, commissioning and safety audits were also rationalized. Conversion to cyclopentane technology resulted in incremental operating costs of US $809,943 for a one-year period (instead of the two-year period originally requested). These costs were associated with a higher price of cyclopentane (US $3.00/kg) compared to HCFC-141b (US $2.40/kg) and foam density increase. The total cost of the project as agreed amounts to US $7,195,993, with a cost-effectiveness of US $12.02/kg. Of this amount, US $5,621,483 is being requested from the Multilateral Fund after deducting the foreign ownership of one enterprise (resulting in a cost-effectiveness of US $9.39/kg). The level of funding agreed by enterprises is presented in Table 5 below:

Table 5. Level of funding agreed by manufacturing enterprise

Enterprise	Consumption (ODP tonnes)	Cost (US $)		
		Capital	Operating	Total
Indusel	2.49	645,018	27,196	672,214
Challenger	5.81	1,119,360	84,562	1,203,922
Haceb	15.63	1,963,720	203,839	2,167,559
Mabe (*)	32.10	2,657,952 (1,327,594)	494,346 (246,916)	3,152,298 (1,574,510)
Total	56.03	5,058,456	563,027	5,621,483

(*) Adjustment due to foreign ownership.

35. The overall cost effectiveness of the project is below the thresholds of US $13.76/kg for domestic refrigeration and US $15.21/kg for commercial refrigeration. Furthermore, in cases where hydrocarbon-based technologies were chosen to replace CFCs in domestic refrigeration projects, the numerator should be discounted by up to 35 per cent when calculating the cost-effectiveness value. The Secretariat notes that projects in the refrigeration sector have historically addressed the phase-out of ODS used as blowing agent (CFC-11 or HCFC-141b) and as refrigerant (CFC-12). Accordingly, in the overview of issues identified during project review document (UNEP/OzL.Pro/ExCom/60/15), the Secretariat is presenting an issue on the cost-effectiveness of projects for the conversion of domestic and/or commercial refrigeration enterprises where the total HCFC consumption is used in foam blowing (such as the project in Colombia).

Impact on the environment

36. The Secretariat attempted to make a preliminary calculation of the impact on the climate of the phase-out of HCFC consumption in the four foam projects in Colombia, based only on the GWP values of the blowing agents and their levels of consumption before and after conversion. According to this methodology, once the project is completed, a total of 46.20 ODP tonnes (420.0 metric tonnes) of HCFC-141b and 9.82 ODP tonnes (178.6 metric tonnes) of HCFC-22 will be phased out. Beside the phase-out of 56.02 ODP tonnes of HCFCs, 606,718 tonnes of CO_2 that is emitted into the atmosphere by the use of these HCFCs would be avoided as a result of the conversion (Table 6).

Table 6. Impact on the climate of the phase-out of HCFC consumption in Colombia

Substance	GWP	Tonnes/year	CO2-eq (tonnes/year)
Before conversion			
HCFC-141b			
Challenger	713	52.8	37,646
Industrias Haceb	713	142.1	101,317
Indusel	713	22.6	16,114
Mabe	713	202.5	144,383
HCFC-22			
Mabe	1,780	178.6	317,908
Total HCFCs		598.6	617,368
After conversion			
HC(*)			
Challenger	25	34.9	873
Industrias Haceb	25	90.8	2,270
Indusel	25	14.5	363
Mabe**	25	285.8	7,145
Total		426.1	10,650
Net impact			
Challenger			(36,774)
Industrias Haceb			(99,047)
Indusel			(15,751)
Mabe			(455,146)
Grand total			(606,718)

* Quantities of HC (cyclopentane) (tonnes/year) and CO2-equivalent based on formulation ratios in each enterprise.
** Mabe: For total of HCFC-141b and HCFC-22.

RECOMMENDATION

37. Recalling its decision 55/43(b), by which the Executive Committee invited bilateral and implementing agencies to prepare and submit project proposals to the Secretariat for those HCFC uses addressed in paragraphs (c), (d), (e) and (f) of the decision so that it could choose those projects that best demonstrated alternative technologies and facilitated the collection of accurate data on incremental capital cost and incremental operating costs or savings, as well as other data relevant to the application of the technologies, the Executive Committee may wish:

(a) To consider approving the project for the Conversion plan from HCFCs to hydrocarbons in the production of polyurethane rigid insulation foam in the domestic refrigeration subsector (Mabe Colombia, Industrias Haceb, Challenger and Indusel) at a total cost of US $5,621,483 and agency support costs of US $421,611 for UNDP;

(b) To request UNDP and the Government of Colombia to deduct 56.02 ODP tonnes (598.6 metric tonnes) of HCFCs from the starting point for sustained aggregate reductions in eligible consumption to be established by Colombia's HCFC phase-out management plan (HPMP); and

(c) To request UNDP to provide to the Secretariat, at the end of each year of the projects' 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 these reports in the implementation reports of the HPMP, once it is approved.
