UNITED NATIONS **EP**

United Nations Environment Programme

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/64/25
17 June 2011

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Sixty-fourth Meeting
Montreal, 25-29 July 2011

PROJECT PROPOSAL: BRAZIL

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

Phase-out

- HCFC phase-out management plan (stage I, first tranche) UNDP/Germany

PROJECT DESCRIPTION

1. On behalf of the Government of Brazil UNDP, as the lead implementing agency, has submitted to the 64th Meeting of the Executive Committee stage I of the HCFC phase-out management plan (HPMP) at a total cost of US $34,581,804, as originally submitted. Of this amount, the Government is requesting US $21,538,538 plus agency support costs of US $1,774,643 (i.e., US $17,447,629 and agency support costs of US $1,308,572 for UNDP, and US $4,090,909 and agency support costs of US $460,000 for Germany). Implementation of the activities included in stage I of the HPMP will allow the Government to meet the Montreal Protocol's compliance targets up to the 10 per cent per cent reduction in HCFC consumption by 2015.

2. The first tranche for stage I being requested at this meeting amounts to US $8,067,636 plus agency support costs of US $605,073 for UNDP and US $2,209,091 plus agency support costs of US $253,000 for Germany, as originally submitted.

Background

3. Brazil, with a total population of 190.73 million inhabitants, has ratified all the amendments to the Montreal Protocol.

ODS policy and regulatory framework

4. The Ozone Layer Protection Coordination, under the Secretariat for Climate Change and Environment Quality of the Ministry of Environment, is the national entity responsible for formulating and implementing ODS phase-out projects funded by the Multilateral Fund. It also acts as the Executive Secretariat for the Inter-Ministerial Committee for Ozone Layer Protection (PROZON), created in 1995 to develop guidelines and coordination on activities for the protection of the ozone layer. The Institute of Environment and Natural Renewable Resources (IBAMA) is responsible for the enforcement of national environmental policies at all levels of the federation (states, municipalities, and the Federal District).

5. Since 1988, the Government of Brazil has enacted several laws and regulations related to ODS, including controls for CFC imports, the ban on the use of methyl bromide in controlled uses, and the mandatory registration of ODS producers, importers, exporters and sellers. In November 2008, the Government issued a normative instruction establishing the maximum amounts of HCFCs and HCFC-blends that could be imported by each company during the 2009-2012 period, thus avoiding a speculative increase in HCFC consumption associated with the accelerated phase-out of HCFCs agreed by the Parties in 2007.

HCFC consumption

6. Between 2005 and 2009, HCFC consumption in Brazil increased from 11,674.9 metric tonnes (mt) (847.2 ODP tonnes) to 20,058.5 mt (1,415.5 ODP tonnes) as shown in Table 1. The baseline for compliance has been estimated at 1,327.5 ODP tonnes.

Table 1. HCFC consumption in Brazil*

HCFCs	2005	2006	2007	2008	2009	2010
Metric tonnes						
HCFC-22	7,866.2	8,897.9	10,235.8	10,599.1	13,692.7	15,109.3
HCFC-141b	3,758.5	4,180.6	5,216.4	3,932.8	5,902.9	3,584.5
HCFC-142b	-	15.1	33.0	22.7	67.2	105.2
HCFC-123	32.9	17.3	47.1	20.6	10.0	20.0
HCFC-124	16.5	203.8	520.3	166.5	385.7	317.6
HCFC-225	0.8	-	0.2	0.1	0.1	-
Total (mt)	11,674.9	13,314.6	16,052.7	14,741.8	20,058.5	19,136.6
ODP tonnes						
HCFC-22	432.7	488.0	563.0	583.0	753.1	831.0
HCFC-141b	413.4	459.9	573.8	432.6	649.3	394.3
HCFC-142b	-	1.0	2.1	1.5	4.4	6.8
HCFC-123	0.7	0.3	0.9	0.4	0.2	0.4
HCFC-124	0.4	4.5	11.4	3.7	8.5	7.0
HCFC-225	0.1	-	0.0	0.0	0.0	-
Total (ODP tonnes)	847.2	953.6	1,151.3	1,021.1	1,415.5	1,239.5

(*) Consumption data reported under Article 7 for 2005 to 2009. Consumption data for 2010 based on the survey conducted for the preparation of the HPMP.

7. The two main HCFCs consumed in Brazil are HCFC-22 and HCFC-141b, representing over 98 per cent of total consumption in the country. Small amounts of HCFC-142b (used as a blowing agent for the production of extruded polystyrene (XPS) foam), HCFC-123, HCFC-124, and HCFC-225 (contained in refrigerant blends) are also consumed. Measured in metric tonnes, HCFC-22 and HCFC-141b represented 68 per cent and 29 per cent respectively of the total HCFC imports in 2009, while, measured in ODP tonnes, HCFC-22 and HCFC-141b represented 53 per cent and 46 per cent, respectively.

8. HCFC-22 is mainly used for servicing refrigeration and air conditioning equipment (84.7 per cent of total use), and manufacturing refrigeration and air conditioning equipment (15.0 per cent) and XPS foam applications (0.3 per cent). HCFC-141b is mainly used as a foam blowing agent and, to a lesser extent, in aerosol and solvent applications (5 per cent), as shown in Table 2.

Table 2. Sector distribution of HCFC-22 and HCFC-141b in Brazil (2009 consumption)

Application	mt	ODP tonnes	% of total
HCFC-22			
Manufacturing sector			
Refrigeration	410.8	22.6	3.0%
Air conditioning	1,643.1	90.4	12.0%
XPS foam	40.0	2.2	0.3%
Subtotal manufacturing	2,093.9	115.2	15.3%
Servicing sector			0.0%
Refrigeration	6,141.7	337.8	44.9%
Air conditioning	5,457.1	300.1	39.9%
Subtotal servicing	11,598.8	637.9	84.7%
Total	13,692.7	753.1	100.0%
HCFC-141b			
Foam	5,607.7	616.8	95.0%
Aerosol/solvent	295.1	32.5	5.0%
Total	5,902.9	649.3	100.0%

9. The refrigeration market has been growing in Brazil in recent years. In 2009, over 6.4 million refrigeration and air conditioning units were manufactured and over 1.0 million units were imported, as

shown in Table 3. The manufacturing of domestic refrigerators is concentrated in five large enterprises accounting for over 90 per cent of total production. The main refrigerants used are isobutane (R-600a) and HFC-134a. The commercial refrigeration subsector consists of freezers for low temperatures, refrigerated machines for beverage sale, coolers, ice makers and freezers, which are made and charged with refrigerant at the manufacturing facilities. Systems for medium temperatures are charged with HFC-134a refrigerant, while systems for low and very low temperatures are charged with HCFC-22. The HCFC-141b that was predominately used as a foam blowing agent for thermal insulation has been progressively replaced with cyclopentane. Most of the enterprises use locally formulated HCFC-141b-based polyol systems.

Table 3. Production and imports of refrigeration systems in 2009 (units)

Type of equipment	Import	Production	Export
Domestic refrigerators		5,010,000	584,217
Air conditioning	740,159	1,102,500	8,434
Other systems	212,915	330,000	46,560
Total	1,028,751	6,442,500	639,211

10. Brazil is also a major producer of window air conditioners, split systems, medium-to-large units, and chillers. Over 90 per cent of imported and locally manufactured air conditioning units are charged with HCFC-22 refrigerant, while the remaining 10 per cent are charged with HFC-410a; however, the use of the latter refrigerant is increasing. Most manufacturers of window and split air conditioners are partially or totally owned by non Article-5 stakeholders. A small number of locally-owned enterprises manufacture small and medium sized chillers for industrial applications.

11. Consumption of HCFCs in other sectors is very limited. It is estimated that less than 300 mt of HCFCs are used in the solvents sector, including HCFC-141b for flushing refrigeration circuits, and as cleaning agent in the pharmaceutical, electronic and mechanical industries. The consumption of HCFC-123 in the fire extinguishing sector is below one mt.

HCFC phase-out strategy

12. To meet the 2013 and 2015 HCFC compliance targets, the Government of Brazil decided to phase out 3,243.9 mt (356.8 ODP tonnes) of HCFC-141b used in the manufacturing of rigid, flexible moulded and integral skin foams, and 909.1 mt (50.0 ODP tonnes) of HCFC-22 used for servicing refrigeration and air conditioning systems, as shown in Table 4. Of this amount, 1,829.4 mt (201.2 ODP tonnes) used by foreign-owned enterprises for the production of insulation foam for domestic refrigerators will be phased out on a voluntarily basis.

Table 4. Total amount of HCFCs to be phased out in stage I of the HPMP

HCFC	2013	2015	Total
Metric tonnes			
HCFC-141b (foam)	2,347.2	896.7	3,243.9*
HCFC-22 (servicing)	-	909.1	909.1
Total (mt)	2,347.2	1,805.8	4,153.0
ODP tonnes			
HCFC-141b (foam)	258.2	98.6	356.8*
HCFC-22 (servicing)		50.0	50.0
Total (ODP tonnes)	258.2	148.6	406.8

(*) Including 1,829.4 mt (201.2 ODP tonnes) to be phased out on a voluntarily basis.

13. With regard to the phase-out of HCFC-141b used as a foam blowing agent, the introduction of hydrocarbon-based technologies (i.e., cyclopentane) for large sized enterprises is technically viable and economically feasible. However, for small sized and most of the medium sized enterprises, this

technology is not viable given the low levels of HCFC-141b used; the rudimentary foam equipment in their baseline; the high capital costs required for safety equipment and systems; and local regulations that would restrict the use of flammable substances in the urban areas where such enterprises are usually located. Moreover, these enterprises purchase formulated polyol systems from systems houses (i.e., they do not blend *in situ*). Accordingly, stage I of the HPMP would phase out HCFC-141b in four companies in the continuous panels sector by replacing it with hydrocarbons; in eleven medium sized integral skin (IS) and flexible moulded foam ((FMF) companies by replacing it with methyl formate, and in a large number of SMEs through systems houses in the IS and FMF sector also by replacing it with methyl formate and in some applications (i.e., shoe-sole) with methyal.

14. HCFC-22 consumption is growing at a higher rate than the country's gross domestic product (GDP). It is expected that this trend will continue in the foreseeable future, in particular in the servicing sector, given the national economy's expansion and ongoing imports of HCFC-22-based equipment. Since about 85 per cent of Brazil's total HCFC-22 consumption is for servicing refrigeration systems, the Government decided to control the increasing consumption of this refrigerant in stage I of the HPMP.

15. The most viable alternative technology for immediate replacement of HCFC-22 in the manufacturing of air-conditioning equipment is HFC-410A. However, the cost of conversion to HFC-410A will be high given the higher working pressure of the refrigerant, the need to redesign the equipment and to change some components. For end-users, the cost of HFC-410A systems will be 70 per cent higher than the cost of HCFC-22 systems. Moreover, the global warming potential (GWP) of HFC-410A is higher than that of HCFC-22. Although the development of new, low-GWP refrigerants is expected on the global market, it will take some time to be accepted and used on the local market. A similar situation prevails in the industrial and commercial refrigeration subsectors. Although HCFC-22 could be replaced in some applications with low/no-GWP refrigerants (i.e., hydrocarbons, ammonia or CO_2), these refrigerants have limited applications in Brazil given the local regulations on safety and environmental permits; the lack of trained technicians; the high risks associated with the refrigerants' use (i.e., flammability, high operating pressures or toxicity); and the lack of national components designed to operate with high-pressure refrigerants. Based on these considerations, the Government of Brazil decided to convert the refrigeration and air conditioning manufacturing sector to non-HCFC technologies at a future stage of the HPMP, once technically viable, economically feasible and environmentally sound alternative technologies become available.

Proposed phase-out activities

16. The main activities to be implemented during stage I of the HPMP are: regulatory actions, conversion of foam enterprises to non-HCFC based technologies, activities in the refrigeration servicing sector, and support to the project implementation and monitoring unit.

Regulatory actions

17. In order to comply with the HCFC phase-out targets, the Government of Brazil will establish HCFC import quotas from 2013 to 2040; enact regulations limiting HCFC leakage during refrigeration system maintenance, ensuring the replacement of end-of-life equipment with non-HCFC equipment, and establish mandatory recycling/regeneration of refrigerants when possible. It will also discuss with stakeholders the need to control imports and production of specific equipment based on HCFC-22; propose a legal instrument to ban the use of disposable cylinders for the purchase/sale of virgin and recycled HCFCs; and develop a set of technical standards. The Government of Brazil is requesting US $572,727 for implementation of these activities.

Phase-out activities in the foam sector

Background of the foam sector

18. Financial support was provided by the Multilateral Fund for the conversion of CFC-based foam enterprises to alternative technologies. The majority of the enterprises converted selected HCFC-141b and, to a lesser extent, water-blown technologies. Over the last two decades, the number of foam enterprises using HCFC-141b has increased.

19. The main foam products and applications include foam insulation for domestic and commercial refrigerators, refrigerated trucks and containers, and water heaters; sandwich panels and blocks; continuous panels for construction and rigid foam for structural applications. By 2009, just two foreign-owned domestic-refrigerator enterprises were using 1,829.4 mt (201.2 ODP tonnes) of HCFC-141b for the production of insulation foam. HCFC-141b is also used in the manufacturing of integral skin foams for the furniture, auto-parts, and shoe-sole industries; and in the manufacturing of flexible moulded foam in the production of high and low resilience pillows, cover-tops for slabstock and moulded seats for furniture. Since 2008, HCFC-22 and HCFC-142b are being used as blowing agents for the production of XPS foam by two foreign-owned enterprises.

20. More than half of the HCFC-based foam enterprises purchase formulated polyol systems from 17 locally-owned and 5 foreign-owned systems houses (located in Brazil) that pre-blend all of the chemicals required and provide technological support to their customers, particularly to the smaller ones. Exports of formulated systems containing HCFC-141b started to be controlled in 2009. About 86 mt (9.5 ODP tonnes) of HCFC-141b contained in preblended polyols were exported in 2010. Usually, large sized enterprises formulate their systems *in situ*. Some of these enterprises manufacturing continuous panels or foam insulation for commercial refrigerators had partially converted to cyclopentane technology, but only when requested by their clients.

21. Nearly 92 per cent of the enterprises consumed less than 20 per cent of the total HCFC-141b in the country; while 18 enterprises consumed over 58 per cent of the total consumption. The distribution of the foam enterprises by estimated level of HCFC-141b consumption is presented in Table 5.

Table 5. Distribution of foam enterprises by estimated level of HCFC-141b consumption

Range (mt)	No. enterprises	% total enterprises	HCFC-141b consumption		% total consumption
			mt	ODP tonnes	
> 200	2	0.3%	1,829.4	201.2	32.4%
> 100 < 199	5	0.7%	663.8	73.0	11.8%
> 50 < 99	11	1.5%	754.0	82.9	13.4%
> 40 < 49	7	1.0%	292.5	32.2	5.2%
> 35 < 39	4	0.5%	147.0	16.2	2.6%
> 30 < 34	6	0.8%	185.0	20.4	3.3%
> 25 < 29	13	1.8%	386.7	42.5	6.9%
> 20 < 25	13	1.8%	286.0	31.5	5.1%
< 20	674	91.7%	1,092.7	120.2	19.4%
Total	735	100.0%	5,637.1	620.1	100.0%

Action plan for the foam sector

22. Of the total consumption of 5,637.1 mt (620.1 ODP tonnes) of HCFC-141b, Brazil would need to phase-out 1,453.5 mt (159.9 ODP tonnes) by 2015. The Government therefore decided to include in stage I of the HPMP those subsectors where low-GWP alternative foam blowing technologies could be applied immediately; and where phase-out would be complete, covering all eligible enterprises irrespective of their size or level of HCFC-141b consumption. Table 6 shows the subsectors to be converted during stage I of the HPMP, based on those criteria.

Table 6. Foam subsectors to be converted during stage I of the HPMP

Subsector	No. enterprises	HCFC-141b consumption	
		mt	ODP tonnes
Integral skin/flexible moulded through 6 systems houses	274	358.7	39.5
Integral skin/flexible moulded	11	430.4	47.3
Continuous panels	4	294.1	32.4
Small rigid foam applications (mainly thermoware, pipe in pipe, water heaters and packaging)	45	370.3	40.7
Total	334	1,453.5	159.9

23. Given the key role of systems houses in Brazil, the decision has been made to phase out HCFC-141b consumption with their assistance. This approach makes it possible to achieve conversion of a large number of SMEs within the cost-effectiveness threshold. It was also considered important to seek assistance from all systems houses at the same time since foam enterprises can purchase formulated polyol systems from any of them. However, six systems houses do not sell systems for the integral skin and flexible moulded foam subsectors (i.e., two of the subsectors to be addressed in stage I), while four others did not provide information on their operations and baseline equipment. Therefore, they were not included in stage I of the HPMP. The systems houses that did not provide data could be subject to possible future regulation, as the phase-out of HCFC-141b has to be completed in the selected subsectors by 2015.

24. As a national effort to support HCFC phase-out activities, the Government of Brazil is seeking the support from the two foreign-owned domestic refrigerator manufacturing enterprises to convert to non-HCFC blowing agent with their own resources by 2015.

Selection of technology

25. During the preparation of the HPMP, the technical and economic aspects of all available technologies for the replacement of HCFC-141b as a foam blowing agent were discussed with all stakeholders. Based on technical and economic considerations, the decision was made to introduce hydrocarbon-based (cyclopentane, n-pentane and its blends) technology for the continuous panels subsector; and methyl formate for the integral skin and flexible moulded subsectors. Although systems houses agreed that methyl formate is the lowest cost technology, they noted that for some integral skin applications (i.e., shoe soles) methylal technology may be more appropriate. If this proved to be the case, they would also provide methylal formulated systems to their clients at no additional cost to the Multilateral Fund.

Incremental costs for the conversion of flexible moulded/integral skin enterprises through six systems houses

26. The conversion of the 274 SMEs manufacturing integral skin or flexible moulded foam products to methyl formate technology will be undertaken with technical support from their six systems houses (i.e., Amino, Arinos, Ariston, Ecoblaster, Purcom and Shimtek). At the systems houses, capital costs will be provided to retrofit the facilities, including explosion-proofing of blending tanks and pumps (US $35,000 for each tank and pump); nitrogen dispenser (US $8,000); emission monitors (US $2,500 each) and safety-related system (US $10,000); testing equipment (up to US $25,000); technology transfer (US $20,000); and contingencies (calculated at 10 per cent of the capital costs). An additional US $1,000 per customer of the systems house is included for project management.

27. At the enterprise level, capital costs will be provided for retrofitting the existing equipment in the baseline as follows: US $10,000 for each low-pressure dispenser; US $15,000 for each high-pressure dispenser; US $5,000 for each spray dispenser; and US $15,000 for a new dispenser. An additional

US $3,000 for each piece of equipment in the baseline is provided for trials, testing and training. Contingencies are calculated at 10 per cent of the capital costs.

28. Operating costs have been calculated on the basis of baseline prices and formulations from systems houses and replacement formulations from technology providers, as well as the information gathered by UNDP from the methyl formate validation project. Higher densities and/or rejection rates are expected given the limited experience available with this technology in Article 5 countries. Accordingly, operating costs were estimated at US $0.15 per kilogram of system used.

Incremental costs for the flexible moulded/integral skin individual companies

29. The eleven foam enterprises covered under this group, namely Cairu, Cantegrill, Duoflex, Espumatec, Frisokar, Kalf, Luguez, and four enterprises of the Spandy Group (i.e., Espumauto, MPU, PTP, Spandy) have in-house blending facilities, and/or have an annual consumption of HCFC-141b over 25 mt (2.8 ODP tonnes), except for one (Cantegrill with a consumption of 7.6 mt) that blends its formulations *in situ* for the production of flexible moulded foams for high resilience applications.

30. The costs for the conversion to methyl formate technology includes explosion proofing of blending tanks (US $30,000 for each tank); nitrogen dispenser (US $10,000); emission monitors (US $2,500 each) and safety related system (US $10,000); retrofitting the existing equipment in the baseline (US $10,000 for each low-pressure dispenser and US $15,000 for each high-pressure dispenser); technology transfer (US $30,000); and contingencies (calculated at 10 per cent of the capital costs). Operating costs have been estimated at US $0.66 per kilogram of HCFC-141b.

Incremental costs for continuous panels

31. This group includes four panel manufacturers (i.e., Danica, Isoeste, Metalúrgica Barra do Piraí and Panisol). Conversion to hydrocarbon technology includes the installation of storage tanks for cyclopentane, pumps and a premix system, retrofitting of high-pressure foam machines; replacement of low-pressure foam machines with a high-pressure unit when applicable; safety-related equipment for the use of a flammable blowing agent; training, trials, testing and contingencies. Operating savings have been calculated based on baseline prices and formulations from the participating enterprises.

Incremental costs for small rigid foam applications

32. A project proposal to address the phase-out of HCFCs used for foam applications for thermoware, pipe in pipe, water heaters and packaging by 45 SMEs will be submitted during implementation of stage I (prior to 2015). The incremental cost for the conversion of these enterprises has been estimated at US $2,229,482 as shown in Table 7.

Table 7. Estimated cost for the conversion of small rigid foam applications

Application	No. enterprises	HCFC-141b consumption		Estimated cost (US$)
		mt	ODP tonnes	
Water heaters	28	169.9	18.7	961,634
Thermoware	6	39.5	4.4	223,570
Pipe in pipe	6	115.1	12.7	785,050
Packaging	5	45.8	5.0	259,228
Total	45	370.3	40.7	2,229,482
Cost effectiveness (US$/kg)				6.02

Total cost of the foam sector

33. The total cost for the conversion of the foam enterprises covered under stage I of the HPMP amounts to US 12,009,056, with an overall cost-effectiveness value of US $11.09/kg (Table 8). The overall cost-effectiveness of the flexible moulded/integral skin foam subsector is US $12.37/kg; while that for continuous panels and rigid foam applications is US $6.73/kg. The cost-effectiveness thresholds for integral skin and rigid polyurethane foams are US $16.86/kg and US $7.83/kg, respectively.

Table 8. Total cost for the conversion of the foam sector

Description	No of enterprises	HCFC-141b		Cost (US $)		
		mt	ODP tonnes	Capital	Operating	Total
Flexible moulded/integral skin through six systems houses						
Amino				225,500		225,500
Foam enterprises	49	62.3	6.8	831,600	187,500	1,019,100
Arinos				294,800		294,800
Foam enterprises	85	98.5	10.8	1,515,800	295,500	1,811,300
Ariston				154,000		154,000
Foam enterprises	7	12.4	1.4	73,700	37,500	111,200
Ecoblaster				173,800		173,800
Foam enterprises	17	51.8	5.7	467,500	157,500	625,000
Purcom				309,100		309,100
Foam enterprises	101	107.1	11.8	1,773,200	320,400	2,093,600
Shimtek				145,200		145,200
Foam enterprises	14	26.8	2.9	238,700	80,250	318,950
Subtotal	273	358.7	39.5	6,202,900	1,078,650	7,281,550
Cost-effectiveness (US$/kg)						20.30
Flexible moulded/integral skin						
Cairu	1	30.0	3.3	174,900	19,800	194,700
Cantegril	1	7.6	0.8	108,350	5,013	113,363
Duoflex	1	27.6	3.0	113,850	18,225	132,075
Espumatec	1	108.9	12.0	231,000	71,894	302,894
Frisokar	1	64.2	7.1	762,850	42,390	805,240
Kalf Plasticos	1	40.0	4.4	113,850	26,400	140,250
Luguez	1	120.0	13.2	162,250	79,200	241,450
Spandy Group	4	32.1	3.5	531,300	21,198	552,498
Subtotal	11	430.4	47.3	2,198,350	284,120	2,482,470
Cost-effectiveness (US$/kg)						5.77
Continuous panels						
Danica	1	69.6	7.7	752,245	(45,216)	707,029
Isoeste	1	45.0	5.0	440,000	(58,037)	381,963
Barra do Piraí - MBP	1	152.5	16.8	818,400	(18,156)	800,244
Panisol	1	27.0	3.0	412,500	(56,700)	355,800
Subtotal	4	294.1	32.4	2,423,145	(178,109)	2,245,036
Cost-effectiveness (US$/kg)						7.63
Small rigid foam applications						
Estimated cost	45	370.3	40.7	2,229,482		2,229,482
Cost effectiveness (US$/kg)						6.02
Total	333	1,453.5	159.9	13,053,877	1,184,661	14,238,538
Overall cost-effectiveness (US$/kg)						9.80

Phase-out activities in the refrigeration servicing sector

Background of the servicing sector

34. About 85 per cent of the total HCFC-22 consumption in Brazil is for servicing refrigeration systems. Over the last few years, the amount of HCFC-22 has risen sharply due to the increasing demand for new domestic air conditioners. It is estimated that 3.3 million buildings have one or more air conditioners in operation with a total refrigerant charge of approximately 2,300 mt (126.5 ODP tonnes) of HCFC-22; over 1.8 million air conditioners were manufactured or imported in 2009. Additionally, consumption of HCFC-based refrigerant blends for maintenance and/or retrofit of CFC-12 and HCFC-22-based refrigeration equipment have been increasing, as these blends are cheaper than HFC-based refrigerants.

35. The two main users of HCFC-22 for servicing are supermarkets, with an HCFC-22 consumption of over 6,000 mt (330.0 ODP tonnes), and air conditioning systems, with a consumption of nearly 5,460 mt (300.3 ODP tonnes). Small amounts of HCFC-123 were also used for servicing chillers. A large number of service workshops use about 85 mt (9.4 ODP tonnes) of HCFC-141b to flush refrigeration systems, which is much cheaper and effective than other techniques, such as the use of nitrogen. The phase-out of HCFC-141b in this application will be addressed in stage 2 of the HPMP.

36. There are approximately 8,000 refrigeration servicing workshops, 3,000 of which operate informally, and only 100 of which can perform complex servicing operations. The majority of workshops provide low-standard services because they have not received technical training and do not have access to adequate tools. According to estimates by refrigeration experts in Brazil, 60 per cent of refrigerant leaks are due to poor servicing practices during maintenance and repair operations and the lack of awareness, while the remaining 40 per cent is due to the poor quality of the refrigeration equipment.

Action plan for the refrigeration servicing sector

37. The phase-out activities to be implemented during stage I include: containment of refrigerant leaks, introduction of best servicing practices for installation, maintenance, repair, use of refrigerants, and recovery and recycling operations; and information dissemination as described below. These activities will focus on domestic refrigeration systems (small sized air conditioning) and commercial refrigeration systems, (large sized air conditioning and refrigeration systems for supermarkets).

(a) Training programmes for 4,800 refrigeration technicians who install and maintain refrigeration systems and equipment in supermarkets, to reduce HCFC-22 consumption in the long term;

(b) Demonstration projects on better containment of HCFCs and technical assistance in at least five supermarkets located in different regions of the country. The results of the demonstration activities will be published as case studies and will enhance business decision-making in favour of low-GWP alternative refrigerants;

(c) Design and implementation of an interactive application for the administration, documentation and maintenance of refrigeration equipment in commercial installations. Servicing enterprises will be encouraged to use an online refrigerant log and maintenance system on a voluntary basis. Depending on the results achieved after a testing period, specific regulations on the subject might be considered; and

(d) Outreach and awareness-raising activities supporting the establishment of the refrigeration servicing programme.

Cost of the refrigeration servicing activities

38. Implementation of these activities would result in the phase-out of 909.1 mt (50 ODP tonnes) of HCFC-22 at a total cost of US $4,090,909 (calculated at US $4.50/kg).

Project implementation and monitoring unit

39. The Ministry of Environment and IBAMA will coordinate the activities proposed in stage I of the HPMP. The decision has been made to continue supporting the implementation and monitoring unit established under the CFC phase-out plan. This unit will assist the Government with technical expertise, administrative, managerial and operational activities, and undertake the field-work activities (end-user level) to meet the obligations of this HPMP. The total requested cost is US $2,636,364.

Total cost of stage I of the HPMP

40. The total cost of the activities proposed in stage I of the HPMP to be funded through the Multilateral Fund amounts to US $21,538,538 (excluding agency support costs). These activities will result in the phase-out of 2,362.6 mt (209.9 ODP tonnes) of HCFCs, representing 15.8 per cent of the estimated baseline of 1,327.5 ODP tonnes, with an overall cost-effectiveness of US $9.12/kg (Table 9).

Table 9. Overall cost of stage I of the HPMP for Brazil

Activity	HCFC to be phased out		Total cost (US $)
	mt	ODP tonnes	
Regulatory action			572,727
Activities in the foam sector	1,453.5	159.9	14,238,538
Activities in the refrigeration servicing sector	909.1	50.0	4,090,909
Project implementation and monitoring unit			2,636,364
Total	2,362.6	209.9	21,538,538
Cost effectiveness (US$/kg)			9.12

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

41. The Secretariat reviewed the HPMP for Brazil in the context of the guidelines for the preparation of HPMPs (decision 54/39), the criteria for funding HCFC phase-out in the consumption sector agreed at the 60th meeting (decision 60/44) and subsequent decisions on HPMPs made at the 62nd and 63rd meetings.

Funding approved for the preparation of the HPMP

42. The Executive Committee approved US$573,750 for the preparation of stage I of the HPMP including phase-out plans in various sectors (i.e., air-conditioning and refrigeration manufacturing, foam and solvents). Noting that only the foam sector plan and activities in the refrigeration servicing sector have been developed and submitted as the main components of stage I of the HPMP, UNDP informed that once the projects are operationally and financially completed, any remaining balances of the funding approved for project preparation will be returned to the Multilateral Fund.

Starting point for aggregate reduction in HCFC consumption

43. The Government of Brazil had estimated the HCFC baseline for compliance at 1,327.5 ODP tonnes calculated using actual consumption of 1,415.5 ODP tonnes reported for 2009 and a consumption of 1,239.5 ODP tonnes estimated for 2010. The results of a recent data survey showed a lower level of

consumption of HCFC-141b in 2010 than previously estimated, due to the use of HCFC-141b that had been stockpiled in 2009. Based on the results of the survey, the Government of Brazil has forecast an HCFC consumption level of 1,388.6 ODP tonnes in 2012. Therefore, the Government will need to phase out 61.1 ODP tonnes of HCFCs to meet the freeze and an additional 132.8 ODP tonnes to meet the 2015 control target, resulting in a total phase-out of 193.9 ODP tonnes (representing 14.6 per cent of the estimated baseline).

Justification for second-stage conversion enterprises

44. A number of the enterprises covered under stage I of the HPMP received assistance from the Multilateral Fund for conversion from CFC-11 to HCFC-141b technology. In providing the justification for considering second-stage conversion projects in stage I of the HPMP (as per decisions 60/44 (b) and 62/16), UNDP explained that only 49 of the 274 integral skin/flexible moulded foam enterprises to be converted are second-stage conversion projects. Excluding the second-stage conversion enterprises would have a negative impact on the phase-out strategy given that it is based on conversion of the entire subsector so as to avoid market distortion and minimize issues related to monitoring and compliance. Furthermore, no new equipment will be provided to second-stage conversion enterprises.

Import controls on HCFC-141b

45. Of the 20 systems houses in operation in Brazil (including five fully owned by non-Article 5 capital), seven that provide systems for flexible moulded and integral skin foams will be participating in stage I of the HPMP. Therefore, HCFC-141b will continue to be imported by systems houses after 2014, once stage I of the HPMP is completed. Moreover, preblended polyol systems based on HCFC-141b could be imported into the country and not counted as consumption under the Montreal Protocol. Also, as stated in the project proposal, several of the foam enterprises purchase polyol systems from multiple systems houses. Given this situation, an explanation was sought on: how the Government will control future imports of HCFC-141b by systems houses and end-users; what controls will be introduced for the importation of preblended polyol systems based on HCFC-141b; and what mechanisms will be established to prevent those foam enterprises converted during stage I of the HPMP from reverting back to HCFC-141b-based polyol systems.

46. UNDP indicated that the current system in place in Brazil controls the import and export of pure ODS, ODS-based blends and HCFC-141b-based preblended polyols. HCFC-141b is purchased by importers or distributors who sell it to systems houses. The Government of Brazil is of the view that the market will regulate the use of HCFCs imported into the country and controlled by the import quotas that will be established during implementation of stage I of the HPMP. The Government will continue to monitor overall consumption.

Technical and cost-related issues in the foam sector

47. One of the investment components of stage I of the HPMP relates to the phase-out of HCFC-141b consumption by 274 foam enterprises through the support of six systems houses. The total cost for the conversion of these enterprises was estimated at US $7,281,550 (including US $1,302,400 for the conversion of the systems houses) with a cost-effectiveness value of US $20.30/kg (or US $16.67/kg excluding the costs for the conversion of the systems houses). Conversion is made less cost-effective by the fact that less than 8 per cent of the total HCFC consumption is by 195 enterprises (representing 58 per cent of all foam enterprises), with annual consumptions between 5 and 500 kg. Given the limited time available for the 2013 and 2015 control targets, the extraordinary effort required for the conversion of a large number of SMEs, and the availability of resources, it would be expected that the most cost-effective and sustainable enterprises would be converted first during stage I of the HPMP.

48. UNDP indicated that, in the development of the overarching strategy for the HPMP, the Government of Brazil gave due consideration to the recommendations by the Parties to the Montreal Protocol and the Executive Committee on prioritizing HCFCs with the highest ODP value and the conversion to non-HCFC technologies in the manufacturing sector; and introducing, where feasible, alternative technologies with low levels of impact on the environment, including the climate. Furthermore, given the fact that Brazil has a well established and organized free market system, in developing the overarching strategy the coordinator of the intergovernmental committee for the protection of the ozone layer decided to include free market principles and equal competition between national and international enterprises; prioritize those HCFC-consuming sectors and applications that could be fully converted to low-GWP technologies in a cost-effective manner; and address large enterprises and SMEs equally.

49. UNDP also pointed out that the overall cost effectiveness of the activities proposed in the foam sector should be considered (US $9.80/kg) rather than that of a specific subsector. Although the cost-effectiveness for SMEs could be improved by, for instance, renting foam equipment available in systems houses to multiple users and/or limiting technical support for micro-users, in the case of Brazil, even the enterprises with the lowest levels of HCFC consumption have foam equipment in their baseline. This equipment would need to be retrofitted, to avoid potential corrosion due to the use of methyl formate. Furthermore, technical assistance and support would also have to be provided to all those enterprises, and will be given through the systems houses to reduce costs.

50. Upon a request for clarification on whether all the foam equipment in the baseline was purchased prior to the cut-off date of September 2007, and all the enterprises were locally owned, UNDP confirmed that all the equipment included was within the eligibility rules as informed by the participating enterprises. However, additional data will be collected as part of the initial implementation assessment, which includes a workshop at each systems house that will be attended by the Ozone Unit and UNDP staff. Relevant data will be verified and validated and changes will be made as required by the eligibility rules.

51. Funding for the conversion of Purcom, one of the seven systems houses covered in stage I of the HPMP, is also being requested. However, the eligibility of this request was doubtful given that this systems house holds the rights to produce methyl formate preblended systems worldwide and should therefore have the requisite facilities. Furthermore, financial support (including equipment) was provided to this systems house for the demonstration of methyl formate technology, as approved at the 56th Meeting. UNDP explained that, although Purcom has a license for the use of ecomate (the foam technology based on the use of methyl formate) in Latin America, during the implementation of the pilot demonstration project to assess the use of methyl formate it agreed to make this a non-exclusive license so that all other systems houses could have the same options as Purcom. No funding has been requested for testing and trial equipment at Purcom, as this equipment was provided during the implementation of the pilot project. UNDP also confirmed that no other systems houses in Brazil had received technical assistance under the pilot project.

52. Given the economy of scale of the project, where a relatively large number of similar equipment items will be purchased and/or retrofitted and similar technical assistance, training and trials will be given to both systems houses and foam enterprises, the Secretariat asked whether UNDP would be able to negotiate better prices from suppliers and also rationalize the proposed technical assistance, training and trials. UNDP indicated that due consideration had been given to cost reductions during the preparation of the project proposal. For instance, the current cost to retrofit a 100 kg high-pressure dispenser is US $20,000, including freight and clearance. Therefore, UNDP will need to negotiate a 25 per cent discount to cover the US $15,000 requested in the proposal. This also applies to the other equipment items required for conversion.

53. It was also noted that US $1,000 was being requested for project management for each of the 274 enterprise to be converted, irrespective of the level of consumption. For example, less than 8 per cent of the total HCFC consumption was by 195 enterprises with annual consumption between 5 and 500 kg. UNDP acknowledged the concern raised by the Secretariat. Although the foam enterprises in Brazil are small, the majority are equipped with foam dispensers.

54. With regard to the conversion of the foam panel enterprises to hydrocarbon technology, issues related to the high costs requested for piping, retrofitting the low-pressure dispenser, safety alarm systems and process exhaust were raised as well as the possibility for rationalizing the costs for trials and technical support.

55. It is indicated that during implementation of stage I, a more detailed proposal for the phase-out of 370.3 mt (40.7 ODP tonnes) of HCFCs used by 45 rigid foam enterprises manufacturing thermoware, pipe-in-pipe, water heaters and packaging. Noting that the phase-out associated with this project is required to meet the 2013 and 2015 compliance targets, since the total amount of HCFC-141b to be phased out by the conversion of the integral skin/flexible moulded and continuous panel subsectors would not be sufficient, the Secretariat requested UNDP to provide additional information on the enterprises, otherwise this project component would have to be submitted once stage I of the HPMP has been completed.

Justification for activities in the refrigeration servicing sector

56. In light of decision 60/44 (xv)[1], justification was requested for the phase-out of 50 ODP tonnes (909.1 mt) of HCFC-22 used in the servicing sector in addition to the phase-out of 159.9 ODP tonnes of HCFC-141b used as a foam blowing agent. The Government of Germany (as the agency that will assist in the implementation of the activities in the refrigeration servicing sector) explained that, for stage I of the HPMP, the Government of Brazil is requesting funding for the phase-out out 209.9 ODP tonnes of HCFCs, representing slightly over 15 per cent of the estimated baseline consumption. It was also noted that while the two foreign-owned enterprises consuming 1,829.4 mt (201.2 ODP tonnes) of HCFC-141b in the manufacturing of domestic refrigerators had agreed to convert to hydrocarbon technology at their own cost, it is expected that they will be converted in the earlier phase of stage II of the HPMP.

57. During the preparation of the HPMP the Government gave due consideration to concerns raised by the Executive Committee regarding the conversion of the air-conditioning and refrigeration manufacturing sector to high-GWP alternative technologies and decided to postpone the conversion of that sector to a future stage of the HPMP. HCFC-22 consumption in the refrigeration servicing sector represents 57 per cent measured in ODP tonnes (or 70 per cent measured in metric tonnes) of total HCFC consumption in 2010, and 85 per cent of total HCFC-22 consumption. The growth rate of HCFC-22 for servicing is the highest among all HCFCs, with accumulated growth of 14 per cent from 2005 to 2010. Table 10 below indicates the projected development of HCFC-22 consumption until 2020. Scenario 1 assumes the historical growth rate in the various subsectors, while scenario 2 assumes a lower growth rate reflecting the indirect effects of HPMP servicing-sector activities on market behaviour. The reduction scenario describes the impact of the proposed activities in the servicing sector (i.e., training of technicians, recovery operations, certification, and leak control measures) on projected consumption.

[1] Non-LVC countries should first address consumption in the manufacturing sector to meet the reduction steps in 2013 and 2015. If this is not the case, these countries should clearly demonstrate that they require assistance in the refrigeration servicing sector to comply with these targets.

Table 10 Projected consumption of HCFC-22 in Brazil (ODP tonnes)

Scenarios	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Scenario 1	728	772	835	903	975	1,050	1,130	1,213	1,301	1,392	1,486
Scenario 2	728	772	815	861	910	962	1,006	1,042	1,068	1,083	1,087
Reduction scenario	728	768	772	772	762	735	698	645	576	491	454

58. During consultations with all sector stakeholders, the activities proposed for the servicing sector in stage I were found to be indispensable for the country to comply with the national phase-out target and to reduce the growing trend in HCFC consumption (i.e., an additional 4,654 mt between 2010 and 2015). It should be noted that the quota system established by the Government by 2012 aims to control all ODS consumption based on total ODP tonnes. The HPMP strategy for the servicing sector has been designed based on previous experiences in addressing CFC consumption.

59. The Executive Committee might wish to note that the issue of allowing Article 5 countries that have a total HCFC consumption above 360 mt to address consumption in the servicing sector instead of the manufacturing sector to meet their reduction steps in 2013 and 2015 is presented in the document UNEP/OzL.Pro/ExCom/64/17, "Overview of issues identified during project review".

60. Approximately 85.0 mt (9.4 ODP tonnes) of HCFC-141b are being used for flushing refrigeration systems (a high emissivity rate application as HCFC-141b immediately reaches the atmosphere as it is being used). In addressing this issue, UNDP indicated that the Government of Brazil decided to phase-out HCFC-141b in this application during stage II of the HPMP, given that the users claimed that using nitrogen was complex and more expensive.

Impact on the climate

61. The implementation of stage I of the HPMP in Brazil would avoid the emission into the atmosphere of some 1,038,895 tonnes of CO_2-equivalent associated with the conversion of the HCFC-141b-based foam enterprises as shown in Table 11. The proposed technical assistance activities in the servicing sector, which include the introduction of better containment of refrigerants and leakage control, and the enforcement of HCFC import controls, will reduce the amount of HCFC-22 used for refrigeration servicing. Each kilogram (kg) of HCFC-22 not emitted due to better refrigeration practices results in approximately 1.8 CO2-equivalent tonnes saved. However, at this time, the Secretariat is not in a position to quantitatively estimate the impact on the climate. The impact might be established through an assessment of implementation reports by, *inter alia*, comparing the levels of refrigerants used annually from the beginning of HPMP implementation, the reported amounts of refrigerants being recovered and recycled, the number of technicians trained and the HCFC-22-based equipment being retrofitted.

Table 11. Impact on the climate

Substance	GWP	Tonnes/year	CO2-eq (tonnes/year)
Before conversion			
HCFC-141b	725	1,453.0	1,053,425
Total			
After conversion			
Methyl formate/cyclopentane	20	726.5	14,530
Net impact			(1,038,895)

Co financing and total cost of the HPMP

62. In response to decision 54/39(h) on potential financial incentives and opportunities for additional resources to maximize the environmental benefits from HPMPs pursuant to paragraph 11(b) of decision XIX/6 of the Nineteenth Meeting of the Parties, the Government of Brazil explained that during the preparation of stage I of the HPMP several co-funding options were analyzed; however, given the

approach adopted by the Government of Brazil to phase-out HCFC consumption in the foam and refrigeration servicing sectors, those potential options were constrained as they could only be applied to sectors that will be converted during stage II of the HPMP. Specifically, the conversion HCFC-141b used by two manufacturers of domestic refrigerators, estimated at a total cost of US $13 million, is expected after 2014. Brazil is implementing a multi-year programme of US $26 million funded by the International Development Bank, the Global Environment Facility and the Multilateral Fund (the latter focused in CFCs) to replace low-energy efficiency chillers, including those based on HCFC refrigerants. The service component will also be implemented during stage II of the HPMP. Furthermore, the Ministry of Environment is preparing a funding scheme with the National Bank for Economic and Social Development to grant US $160 million that could be accessed by industries and enterprises for purchasing energy efficient equipment. Although this scheme is still under negotiation, it could be included in stage II of the HPMP.

Adjusted 2011-2014 business plans

63. Table 12 shows the level of funding and amounts of HCFCs to be phased out according to the 2011-2014 business plan of the Multilateral Fund. The level of funding requested for the implementation of stage I of the HPMP of US $23,307,110 (including support costs) as originally submitted, is US $4,545,551 below the amount in the business plan.

Table 12. 2011-2014 business plan of the Multilateral Fund

Agency	2011	2012	2013	2014	2015	Total
Funding (US$)						
UNDP	6,698,647	6,698,647	6,698,647	2,750,382	345,000	23,191,323
Germany	1,260,000	3,071,338	-	330,000	-	4,661,338
Total	7,958,647	9,769,985	6,698,647	3,080,382	345,000	27,852,661
Phase-out (ODP tonnes)						
UNDP	78.9	78.9	78.9	32.2	3.9	272.8
Germany	13.6	33.4	-	3.6	-	50.6
Total	92.5	112.3	78.9	35.7	3.9	323.4

Overall cost of the HPMP

64. The Secretariat and UNDP are still discussing a few outstanding issues related to the costs of the foam investment projects and the funding request of US $572,727 for regulatory actions which is high given the level of assistance so far provided during the implementation of the national phase-out plan and the preparation of the HPMP. The results of the discussions will be communicated to the Executive Committee prior to the 64th Meeting.

Draft Agreement

65. A draft Agreement between the Government of Brazil and the Executive Committee for HCFC phase-out is being prepared.

RECOMMENDATION

66. Pending.