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ANALYSIS OF THE REMAINING ELIGIBLE HCFC CONSUMPTION IN VARIOUS SECTORS AND SUBSECTORS OF POTENTIAL DEMONSTRATION RELEVANCE (DECISION 72/40(d))

Background

1. Pursuant to paragraph 4 of decision XXV/5[1], at its 72nd meeting the Executive Committee decided to consider at its 75th and 76th meetings proposals for demonstration projects for low-global-warming potential (GWP) alternatives to HCFCs at a funding level that should not exceed US $10 million (decision 72/40(b)), and up to four feasibility studies for district cooling at a funding level that should not exceed US $100,000 for each study (decision 72/40(c)). The Executive Committee also requested the Secretariat "to prepare a paper analyzing the remaining eligible HCFC consumption in various sectors and subsectors of potential demonstration relevance, for consideration by the Executive Committee at its 74th meeting" (decision 72/40(d)).

2. In response to decision 72/40(d), the Secretariat has prepared the present document. This document describes the methodology used to determine the remaining HCFC consumption in Article 5 countries; presents an analysis of the remaining HCFC consumption per sector and subsector; and provides an assessment of the sectors and subsectors of potential demonstration relevance.

Methodology used to determine the remaining HCFC consumption in Article 5 countries

3. For the preparation of this document, the HCFC phase-out management plans (HPMPs) for 140 Article 5 countries approved so far[2], including the respective agreements between the countries concerned

[1] To request the Executive Committee to consider the information provided in the report on additional information on alternatives to ozone-depleting substances prepared by the Technology and Economic Assessment Panel pursuant to decision XXIV/7 and other related reports, with a view to considering whether additional demonstration projects to validate whether low-global-warming potential alternatives and technologies, together with additional activities to maximize the climate benefits in the HCFC production sector, would be useful in assisting parties operating under paragraph 1 of Article 5 in further minimizing the environmental impact of the HCFC phase-out.

[2] There are still five Article 5 countries that are eligible for receiving assistance from the Multilateral Fund to phase out HCFC consumption, that do not yet have an approved HPMP. Two of these countries (Botswana and South

and the Executive Committee, were reviewed. These documents provided, *inter alia,* the HCFC baseline for compliance, the starting point for aggregate reductions in HCFC consumption (referred to as "starting point")[3], and the remaining HCFC consumption eligible for funding. The data on HCFC baseline was further corroborated with the HCFC consumption reported by Article 5 countries under Article 7 of the Montreal Protocol.

4. Based on this analysis, it was noted that approximately 63 per cent of the aggregated remaining HCFC consumption is consumed in China, 27 per cent in the second 14 largest HCFC consuming countries[4], and the remaining 10 per cent in the other 125 Article 5 countries, comprising both low-volume consuming (LVC) and non-LVC countries, where the majority of the consumption is in the refrigeration servicing sector, although there are several small and medium-size enterprises (SMEs) using HCFC in various manufacturing sectors.

5. The distribution of the remaining HCFC consumption by sector, as required by decision 72/40(d), was based on an analysis of the information contained in the progress report on the implementation of country programmes (CP data reports) submitted by Article 5 countries on an annual basis. As CP data reports do not provide information at the sub-sector levels, the HPMPs for the 15 largest HCFC consuming Article 5 countries were reviewed. From this review, the following sectors and main subsectors where HCFCs are used in Article 5 countries were identified:

(a) Polyurethane (PU) foam[5]: Rigid, spray, and integral skin;

(b) Extruded polystyrene (XPS) foam;

(c) Air-conditioning manufacturing (AC): room AC, and other AC (multi-split, hot water heating heat pumps, scroll and screw chillers, mobile AC);

(d) Refrigeration manufacturing (condensing units, centralized systems, freezer, cold storage, large size refrigeration and transport refrigeration);

(e) Refrigeration servicing; and

(f) Other sectors: aerosol, solvents and fire-fighting.

6. Based on this analysis, the remaining HCFC consumption of the 15 largest consuming countries was accurately distributed by sector and subsector. For the other 125 countries:

(a) The remaining consumption of HCFC-141b in PU foam was distributed among the rigid, spray and integral skin subsectors using same proportions found in the 14 second largest countries;

(b) The remaining consumption of HCFC-22 in the refrigeration and AC manufacturing

Sudan) are categorized as LVCs, with an aggregated HCFC consumption baseline of 12.0 ODP tonnes; while the remaining three countries (Libya, Mauritania and Syrian Arab Republic) are non-LVCs with an aggregated HCFC consumption baseline of 273.9 ODP tonnes.

[3] Solely for the purpose of this document, the starting point is broken down by substance and/or by sectors and subsectors to have a better understanding of where the remaining HCFCs are being used.

[4] Argentina, Brazil, Colombia, Egypt, India, Indonesia, Kuwait, Malaysia, Mexico, Nigeria, Saudi Arabia, South Africa, Thailand and Turkey.

[5] Rigid PU foam includes insulation panels for domestic and commercial refrigeration, continuous and discontinuous panels for construction, transport and other applications, and spray foam. Spray foam was discriminated as a separate category given that several Article 5 countries have not addressed this sector in stage I in the absence of an acceptable low-global warming potential alternative. Minor amounts of flexible moulded foam were classified within the integral skin category.

sectors was distributed among the room AC, other AC and refrigeration manufacturing subsectors using same proportions found in the 14 second largest countries. The remaining consumption of HCFC-22 in foam was allocated to XPS foam, and a minor remaining eligible consumption of HCFC-22 in solvents and process agents was allocated to solvents;

(c) The remaining consumption of HCFC-142b (18.94 ODP tonnes) was allocated to the XPS foam; and

(d) The remaining consumption of HCFC-123 and HCFC-124 (3.16 ODP tonnes) was allocated to the refrigeration servicing sector. `

7. The funding eligibility of the remaining HCFC consumption contained in this document will only be known during the preparation of future stages of HPMPs, as has been the case for stage I. For example, the non-eligible HCFC consumption that was identified as part of the baseline in stage I of HPMPs has been deducted from the starting points of relevant countries (e.g., PU foam in Saudi Arabia and South Africa) while, in other cases, this consumption will be deducted in future stages of HPMPs (e.g., Brazil PU insulation foam used in domestic refrigerators and AC manufacturing).

8. In preparing this document, due consideration was given to the Report on alternatives pursuant to decision XXV/5 of the Technology and Economic Assessment Panel (TEAP), as a comprehensive source of information on the distribution of sectors and subsectors, and the availability of alternative technologies.

Remaining HCFC consumption in Article 5 countries

9. Thus far the Executive Committee has approved 140 HPMPs, 86 for LVC countries and 54 for non-LVC countries that will result in the total phase-out of 111,192 metric tonnes (8,746.0 ODP tonnes) of HCFCs, including 2,634 mt (290.0 ODP tonnes) of HCFC-141b contained in imported pre-blended polyols[6]. The HCFC consumption remaining to be phased out amounts to 384,227 mt (24,331.0 ODP tonnes) as shown in Table 1.

Table 1. Total amounts of HCFCs to be phased out in the 140 HPMPs approved as of April 2015 (ODP tonnes)

Description	All HCFC	HCFC-22	HCFC-141b	HCFC-142b	HCFC-141b-polyols(1)	Others(2)
Metric tonnes						
Starting point (3)	495,419	359,934	96,926	30,725	5,105	2,729
		73.0%	19.5%	6.0%	1.0%	0.5%
Consumption to be phased out (4)	111,192	55,538	43,506	9,467	2,634	47
		50.0%	39.0%	9.0%	2.0%	0.0%
Remaining consumption(5)	384,227	304,418	53,418	21,262	2,473	2,656
		79.2%	13.9%	5.5%	0.6%	0.7%
ODP tonnes						
Starting point	33,077	19,796	10,662	1,997	562	60
		60.0%	32.0%	6.0%	2.0%	0.0%
Consumption to be phased out	8,746	3,055	4,786	615	290	1
		35.0%	55.0%	7.0%	3.0%	0.0%
Remaining consumption	24,331	16,743	5,876	1,382	272	59
		69.0%	24.0%	6.0%	1.0%	0.0%

(1) HCFC-141b-polyol, refers to HCFC-141b contained in imported pre-blended polyols and not reported under Article 7 of the Montreal Protocol.
(2) Others include HCFC-21, HCFC-123, HCFC-124, HCFC-141, HCFC-225, HCFC-225ca, HCFC-225cb.

[6] This consumption is not reported under Article 7 of the Montreal Protocol.

(3) Aggregated starting point for aggregate reductions in HCFC consumption. Starting points for several Article 5 countries would be adjusted based on the established baseline in line with decision 60/44(e).
(4) Amounts of HCFCs approved to be phased out in approved HPMPs.
(5) Remaining amounts of HCFCs eligible for funding.

10. Approximately 99 per cent of the starting point (measured in mt) is composed of 73 per cent of HCFC-22, 20 per cent of HCFC-141b and 6 per cent of HCFC-142b, while approximately 99 per cent of the remaining HCFC consumption is composed of 79 per cent of HCFC-22, 14 per cent of HCFC-141b and 6 per cent of HCFC-142b.

11. The sector and subsector distribution of the remaining HCFC consumption is presented in Table 2.

Table 2. Remaining HCFC consumption in Article 5 countries per sector and subsector

Sector	Subsector	China	14 second largest countries	125 remaining countries	Total	% of total
Metric tonnes						
PU foam	Rigid	18,486	8,765	3,106	30,356	8
	Spray	9,135	3,351	1,187	13,674	4
	Integral skin	6,562	524	186	7,271	2
XPS foam		32,694	902	883	34,479	9
AC manufacturing	Room AC	64,028	26,914	10,382	101,324	26
	Others AC	31,291	1,486	573	33,350	9
Refrigeration manufacturing		4,129	5,971	2,303	12,403	3
Refrigeration servicing		69,113	54,726	21,266	145,106	38
Others	Aerosol	-	310	-	310	0
	Solvents	3,899	796	393	5,088	1
	Fire fighting	-	573	1	574	0
	Others	-	291	-	291	0
Total		**239,338**	**104,609**	**40,280**	**384,227**	**100**
Percentage of total		62	27	10	100	
ODP tonnes						
PU foam	Rigid	2,034	955	341	3,329	14
	Spray	1,005	369	131	1,505	6
	Integral skin	722	58	21	800	3
XPS foam		1,929	53	51	2,033	8
AC manufacturing	Room AC	3,521	1,480	572	5,573	23
	Others AC	1,721	80	31	1,832	8
Refrigeration manufacturing		216	324	125	665	3
Refrigeration servicing		3,845	3,011	1,166	8,022	33
Others	Aerosol	-	24	-	24	0
	Solvents	428	79	22	529	2
	Fire fighting	-	12	0	12	0
	Others	-	7	-	7	0
Total		**15,420**	**6,452**	**2,459**	**24,331**	**100**
Percentage of total		63	27	10	100	

(*) The PU foam manufacturing sector consumes mostly HCFC-141b and a small amount of HCFC-22; the XPS foam manufacturing sector consumes a combination of HCFC-22 and HCFC-142b in different proportions depending on the country; the refrigeration and air-conditioning (RAC) manufacturing and servicing sectors consume mostly HCFC-22 and small amounts of HCFC-123, HCFC-124 and HCFC-142b; other sectors (aerosol, solvents, fire-fighting) consume small amounts of HCFC-21, HCFC-22, HCFC-123, HCFC-124, HCFC-141, HCFC-141b, HCFC-142b and HCFC-225.

12. The analysis of consumption data (measured in mt) in Table 2 shows that:

(a) The RAC manufacturing sector combined and the refrigeration servicing sector[7] consume 38 per cent each of the remaining HCFC consumption, while the foam sector (both PU and XPS) consumes the remaining 23 per cent;

(b) The largest manufacturing subsector with remaining HCFC consumption is the room-AC sector (101,324 mt), where 63 per cent of the consumption is in China;

(c) The second subsector with the largest remaining HCFC consumption is the XPS foam manufacturing sector (34,479 mt), followed by the "other AC manufacturing" subsector[8] (32,824 mt). For both subsectors, almost all the consumption is in China; and

(d) The 51,301 mt of remaining HCFC-141b consumption in the PU foam sector is distributed as follows: 30,356 mt in several rigid applications, 13,673 mt in spray foam (used by a large number of small enterprises with a very small level of consumption in several countries), and 7,271 mt in integral skin foam, with 66 per cent consumed in China.

13. Given that the broad distribution of the remaining HCFC consumption among the three groups of countries (China with 63 per cent of the total remaining HCFC consumption, the second 14 largest HCFC consuming countries with 27 per cent, and the remaining 125 countries with 10 per cent), a further analysis of the remaining HCFC consumption is presented below for each group.

Remaining HCFC consumption in China

14. The sector and subsector distribution of the remaining HCFC consumption in China is presented in Table 3.

Table 3. Remaining HCFC consumption in China per sector and subsector

Sector	Subsector	ODP tonnes		Metric tonnes	
		Consumption	% of total	Consumption	% of total
All sectors					
PU foam	Rigid	2,034	13.2	18,486	7.7
	Spray	1,005	6.5	9,135	3.8
	Integral skin	722	4.7	6,562	2.7
XPS foam		1,929	12.5	32,694	13.7
AC manufacturing	Room AC	3,521	22.8	64,028	26.8
	Others AC	1,721	11.2	31,291	13.1
Refrigeration manufacturing		216	1.4	4,129	1.7
Refrigeration servicing		3,845	24.9	69,113	28.9
Others	Aerosol	-	0.0	-	0.0
	Solvents	428	2.8	3,899	1.6
	Fire fighting	-	0.0	-	0.0
	Others	-	0.0	-	0.0
Total all sectors		15,420	100.0	239,338	100.0
Foam sector					
PU foam	Rigid	2,034	35.7	18,486	27.6
	Spray	1,005	17.7	9,135	13.7
	Integral skin	722	12.7	6,562	9.8

[7] From the information available, it was not possible to determine the amount of HCFC used in installation, assembly and initial charge of refrigeration and AC equipment.

[8] Including multi split, ducted split commercial, hot water heating heat pumps, space heating heat pumps.

Sector	Subsector	ODP tonnes		Metric tonnes	
		Consumption	% of total	Consumption	% of total
XPS foam		1,929	33.9	32,694	48.9
Total foam		5,689	100.0	66,877	100.0
RAC manufacturing sector					
AC manufacturing	Room AC	3,521	64.5	64,028	64.4
	Others AC	1,721	31.5	31,291	31.4
Refrigeration manufacturing		216	4.0	4,129	4.2
Total RAC manufacturing		5,458	100.0	99,448	100.0
Other sectors					
Others	Aerosol	-	0.0	-	0.0
	Solvents	428	100.0	3,899	100.0
	Fire fighting	-	0.0	-	0.0
	Others	-	0.0	-	0.0
Total other sectors		428	100.0	3,899	100.0

15. The analysis of consumption data (measured in mt) in Table 3 shows that:

(a) The RAC manufacturing sector combined consumes 40 per cent of the remaining HCFC consumption in China, while the foam (both PU and XPS) sector consumes approximately 30 per cent;

(b) The remaining HCFC consumption in other sectors is small (below 2 per cent of the total remaining consumption) and used exclusively in the solvent sector;

(c) The refrigeration servicing sector represents approximately 30 per cent of the remaining HCFC consumption. This sector will continue to increase in importance as the phase-out of HCFCs is mainly associated with the manufacturing sector; and

(d) With regard to the foam sector alone, almost 50 per cent of the remaining HCFC consumption is for the manufacturing of XPS foam; the other 50 per cent is related to the PU foam sector, where rigid PU foam accounts for 27.6 per cent. Although spray PU foam accounts for less than 14 per cent of the total consumption in the foam sector, it is assumed to be used by a large number of SMEs scattered throughout the country.

16. Given the relevance of the RAC manufacturing subsectors in China, a more detailed analysis of the remaining HCFC consumption was undertaken based on the information contained in stage I of the HPMP[9]. The results of the analysis are presented in Table 4.

Table 4. Remaining HCFC consumption in RAC manufacturing subsectors in China

Sub-sector	Consumption (mt)			% of total remaining
	Baseline	Approved	Remaining	
AC manufacturing				
- Room AC (mini-split and small self-contained)	74,700*	10,672	64,028	64.4
- Other unitary AC**	15,804	5,033	10,771	10.8
- Multi-split	1,189	800	389	0.4
- Hot water heating heat pump	1,837	200	1,637	1.6
Chillers				

[9] The HPMP for China comprised, *inter alia*, a sector plan for HCFC phase-out in the industrial and commercial refrigeration and air-conditioning (ICR) sectors and an HCFC-22 phase-out management plan for the room air-conditioner manufacturing sector. These two sectors are described in document UNEP/OzL.Pro/ExCom/64/29.

Sub-sector	Consumption (mt)			% of total remaining
	Baseline	Approved	Remaining	
- Small sized chiller/heat pump	1,134	200	934	0.9
- Industrial and commercial chiller/heat pump (scroll, screw)	19,124	1,650	17,474	17.6
Mobile AC (public transport)	86		86	0.1
Commercial refrigeration				
- Condensing units	3,728	567	3,161	3.2
- Centralized systems	320		320	0.3
- Freezer, cold storage, large size refrigeration and transport refrigeration	648		648	0.7
Total consumption	118,570	19,123	99,448	100.0
Summary				
AC manufacturing	93,529	16,706	76,824	77.3
Chillers (scroll, screw)	20,259	1,850	18,409	18.5
Mobile AC (Public transport)	86	-	86	0.1
Commercial refrigeration	4,048	567	3,481	3.5
Transport refrigeration	648	-	648	0.7
Total	**118,570**	**19,123**	**99,448**	**100.0**

*Includes 79 per cent of HCFC consumption in mini-split AC, and 21 per cent in small self-contained equipment (portable, window and other small room AC).

** Unitary AC category as defined in the industrial and commercial refrigeration and AC sector (ICR) phase out plan in China includes *inter-alia* unitary air-conditioner, rooftop air-source air-conditioner, ducted air-conditioner, computer room air-conditioner, clean operating room air-conditioner, constant temperature and humidity air-conditioner, dehumidifier air-conditioner.

17. The analysis of the data in Table 4 shows that:

(a) Over 77 and 18 per cent of the remaining HCFC consumption is associated with the manufacturing of AC equipment and chillers (scroll and screw type), respectively, while less than 5 per cent of the consumption is used for manufacturing other refrigeration equipment;

(b) The largest amount of the remaining HCFC consumption in the RAC manufacturing sector is used for the manufacturing of mini-split AC (45.1 per cent of the total), followed by small self-contained AC (19.8 per cent), scroll and screw chillers (17.6 per cent), and other unitary and other non-ducted AC (10.3 per cent);

(c) The remaining HCFC consumption associated with the manufacturing of commercial refrigeration is small (3.5 per cent), the majority of which is used for manufacturing condensing units; and

(d) Small amounts of HCFC-22 are used in the manufacturing of several pieces of RAC equipment, including heat pumps, positive displacement chillers, transport refrigeration and mobile AC.

Remaining HCFC consumption in the next 14 largest consuming countries

18. The sector and subsector distribution of the remaining HCFC consumption in the next 14 largest consuming countries is presented in Table 5.

Table 5. Remaining HCFC consumption in the next 14 largest consuming countries per sector and subsector

Sector	Subsector	ODP tonnes		Metric tonnes	
		Consumption	% of total	Consumption	% of total
All sectors					
PU foam	Rigid	955	14.1	8,765	8.4
	Spray	369	5.5	3,351	3.2
	Integral skin	58	0.9	524	0.5
XPS foam		53	0.8	902	0.9
AC manufacturing	Room AC	1,480	21.9	26,914	25.7
	Others AC	80	1.2	1,486	1.4
Refrigeration manufacturing		324	4.8	5,971	5.7
Refrigeration servicing		3,011	44.6	54,726	52.3
Others	Aerosol	24	0.0	309.97	0.3
	Solvents	79	6.3	796.37	0.8
	Fire fighting	12	0.0	572.61	0.5
	Others	7	0.0	291.03	0.3
Total all sectors		6,452	100.0	104,609	100.0
Foam sector					
PU foam	Rigid	955	66.6	8,765	64.7
	Spray	369	25.7	3,351	24.7
	Integral skin	58	4.0	524	3.9
XPS foam		53	3.7	902	6.7
Total foam		1,434	100.0	13,541	100.0
RAC manufacturing sector					
AC manufacturing	Room AC	1,480	78.6	26,914	78.3
	Others AC	80	4.2	1,486	4.3
Refrigeration manufacturing		324	17.2	5,971	17.4
Total RAC		1,884	100.0	34,372	100.0
Other sectors					
Others	Aerosol	24	19.5	310	19.5
	Solvents	79	64.6	796	64.6
	Fire fighting	12	10.1	573	10.1
	Others	7	5.8	291	5.8
Total other sectors		123	100.0	1,970	100.0

19. The analysis of consumption data (measured in mt) in Table 5 shows that:

(a) More than 50 per cent of remaining HCFC consumption is used in the servicing sector;

(b) The room AC manufacturing sector consumes approximately 26 per cent of the remaining HCFC consumption in these 14 countries, while the foam (both PU and XPS) sector consumes approximately 12 per cent; and

(c) On the foam sector alone, over 64 per cent of the remaining HCFC consumption is used for PU foam while approximately 25 per cent is used for spray PU foam. Small amounts of HCFCs are associated with the manufacturing of integral skin foam.

20. With regard to the RAC sectors, an analysis of the remaining HCFC consumption was undertaken in five large HCFC consuming countries, namely India, Malaysia, South Africa, Thailand and Turkey, as sufficient data was available in the respective HPMPs of these countries. The results of the analysis are presented in Table 6.

Table 6. Distribution of HCFC consumption in the RAC manufacturing subsectors in five large HCFC consuming countries

Sub-sector	Percentage of total remaining HCFC consumption in RAC sectors				
	India	Malaysia	South Africa*	Thailand	Turkey
AC manufacturing					
Room AC: small self-contained, mini-split non-ducted	90	78	0	100	100
Others (multi-split ducted, split ducted, ducted split commercial, hot water/space heating heat pump	4	1	23	0	0
Chillers: positive displacement, centrifugal	6	6	0	0	0
Mobile AC : automobile, public transport	0	0	0	0	0
Refrigeration manufacturing					
Commercial refrigeration: stand-alone, condensing units, centralized systems, transport refrigeration	0	4	52	0	0
Large-size refrigeration	0	11	26	0	0

*South Africa does not have large-scale room AC manufacturing consuming HCFC.

21. From this analysis it was found that in four countries (India, Malaysia, Thailand and Turkey), the majority of the HCFC consumption in the RAC manufacturing sector corresponds to room AC, which is consistent with the data in Table 2, which shows that for all Article 5 countries, HCFC consumption in the refrigeration manufacturing sector (12,403 mt) is less than 10 per cent of the consumption in the RAC manufacturing sector (147,077 mt). Accordingly, the HCFC consumption distribution in these four countries could be used as reference for the other Article 5 countries with reported remaining HCFC consumption in the room AC manufacturing.

22. In the case of South Africa, where room AC units are imported, the proportion of HCFC used in refrigeration manufacturing is larger than in any of the other four countries (i.e., over 50 percent).

23. With regard to installation, assembly and initial charge, only the HPMP for South Africa discriminated HCFC consumption in this subsector. An estimated consumption of 668 mt of HCFC is consumed by a large number of SMEs manufacturing and assembling a variety of RAC equipment in South Africa. This value represents 20 per cent of the overall consumption of HCFC in the refrigeration servicing sector in South Africa. In the absence of more data, based on the case of South Africa it can be said as a reference that HCFC consumption in the installation, assembly and initial charge subsector could represent up to 20 per cent of the total consumption in the refrigeration servicing sector in a non-LVC country.

Remaining HCFC consumption in the other 125 countries

24. The sector and subsector distribution of the remaining HCFC consumption in the other 125 countries is presented in Table 7.

Table 7. Remaining HCFC consumption in the other countries per sector and subsector

Sector	Subsector	ODP tonnes		Metric tonnes	
		Consumption	% of total	Consumption	% of total
All sectors					
PU foam	Rigid	341	13.9	3,106	7.7
	Spray	131	5.3	1,187	2.9
	Integral skin	21	0.8	186	0.5
XPS foam		51	2.1	883	2.2
AC manufacturing	Room AC	572	23.2	10,382	25.8
	Others AC	31	1.3	573	1.4

Sector	Subsector	ODP tonnes		Metric tonnes	
		Consumption	% of total	Consumption	% of total
Refrigeration manufacturing		125	5.1	2,303	5.7
Refrigeration servicing		1,166	47.4	21,266	52.8
Others	Aerosol	-	0.0	-	0.0
	Solvents	22	0.9	393	1.0
	Fire fighting	0	0.0	1	0.0
	Others	-	0.0	-	0.0
Total all sectors		2,459	100.0	40,280	100.0
Foam sector					
PU foam	Rigid	341	62.6	3,106	57.9
	Spray	131	24.2	1,187	22.1
	Integral skin	21	3.8	186	3.5
XPS foam		51	9.5	883	16.5
Total foam		544	100.0	5,362	100.0
Refrigeration and AC sector					
Sector	Subsector	ODP tonnes		mt	
AC manufacturing	Room AC	572	78.6	10,382	78.3
	Others AC	31	4.2	573	4.3
Refrigeration manufacturing		125	17.2	2,303	17.4
Total refrigeration/AC		727	100.0	13,259	100.0
Other sectors					
Others	Aerosol	-	0.0	-	0.0
	Solvents	22	99.7	393	99.7
	Fire fighting	0	0.3	1	0.3
	Others	-	0.0	-	0.0
Total other sectors		22	100.0	394	100.0

25. The analysis of consumption data (measured in mt) in Table 7 shows that:

(a) More than 50 per cent of remaining HCFC consumption is used in the servicing sector;

(b) The room AC manufacturing sector consumes approximately 26 per cent of the remaining HCFC consumption, while the foam (both PU and XPS) sector consumes approximately 11 per cent;

(c) With regard to the foam sector alone, 58 per cent of the remaining HCFC consumption is used for PU foam while approximately 22 per cent is used for spray PU foam. Small amounts of HCFCs are associated with the manufacturing of integral skin foam; and

(d) With regard to the RAC manufacturing sector alone, 78 per cent of the remaining HCFC consumption is used for manufacturing room AC, while over 17 per cent is used for manufacturing refrigeration equipment.

Assessment of the sectors and subsectors of potential demonstration relevance

26. The assessment of the sectors and subsectors of potential demonstration relevance presented below has been prepared taking into account the remaining HCFC consumption in Article 5 countries; the criteria set out by decision 72/40; the knowledge, potential, or commercial availability of alternatives technologies; and the existence of demonstration or investment projects in the areas and technologies proposed. For ease of reference, Annex I to the present document includes the table on the status of alternative technologies in the RAC sectors extracted from the TEAP Report on alternatives pursuant to

decision XXV/5, and the remaining HCFC consumption in these sectors identified in the 15 largest consuming countries.

Foam

27. HCFC consumption in rigid PU foam (excluding spray PU foam) represents only 8 per cent of the aggregated remaining HCFC consumption. Stage I of HPMPs of several Article 5 countries have replaced HCFC-141b used by the larger consuming enterprises manufacturing insulation panels for domestic and commercial refrigeration, continuous and discontinuous panels mostly with HC-based blowing agents. However, HCFC-141b is still used in several Article 5 countries in a large number of SMEs with limited technological and capital investment capabilities, which impede the introduction of some low-GWP technologies, particularly those using flammable blowing agents or those that could represent a larger capital or operational cost. In addition, in countries with small consumption and no presence of systems houses, it is still more difficult for SMEs to have access to these technologies, as it has been seen in the implementation of few HPMPs. As a result of these constraints, several LVCs and non-LVC countries decided to convert their foam manufacturing enterprises at latter stages.

28. HCFC-141b consumption in spray PU foam represents 4 per cent of the aggregated remaining HCFC consumption. However, it is still used in a large number of Article 5 countries particularly by SMEs scattered through the countries. Given national regulations to improve energy efficiency in buildings, it appears that the spray foam sector is rapidly expanding. These enterprises have very limited technological and capital investment capabilities, which impede the introduction of non-HCFC alternative technologies. In addition, the modality of application of the foam *in-situ* creates an additional restriction to the use of flammable blowing agents. As a result of these constraints, the majority of Article 5 countries will only address spray foam during stage II or subsequent stages.

29. Despite of a relatively low level of remaining HCFC consumption in the rigid PU foam sector compared to other sectors, given the large number of SMEs involved and the limitations described above, it would be meaningful to consider approaches that could facilitate SMEs access to low-GWP alternative technologies, whether by reducing capital investment, operational cost, and/or risk of application, or by increasing know-how and commercial availability. Several of the demonstration projects implemented pursuant to decision 55/43 as well as technical assistance projects approved to systems houses in several Article 5 countries as part of stage I, have partially addressed these issues and increased the number of enterprises that could have access to low-GWP technologies. However, some of the areas where additional efforts could be considered are spray foam and technologies that can be made accessible to SMEs in countries where there are no system houses.

RAC manufacturing

30. HCFC consumption in room AC represents 27 per cent of the aggregated remaining HCFC consumption. Based on the information presented in several Article 5 countries, the majority of this consumption is related to the manufacturing of mini-split (non-ducted) AC followed by small self-contained AC, packaged and other non-ducted AC. Given the limited commercial availability of low-GWP technologies, during stage I of the HPMPs several countries introduced HFC-410A technologies. However, recently, the choice of technologies have been HFC-32 (in both LVC and non-LVC countries), and R-290 for certain AC in one country. Given the large volume of HCFC used in manufacturing room AC, and the associated HCFC used in servicing this equipment (50 per cent of the HCFC used in the servicing sector in Article 5 countries associated with room AC equipment[10]) it is worth it to consider

[10] "The analysis of a representative sample of 65 approved HPMPs in LVCs and non-LVCs showed that in average, half of the consumption of HCFC-22 in a country is in the residential air-conditioning sector and around 70 per cent of the consumption is used to serve air-conditioning systems" (UNEP/OzL.Pro/ExCom/70/53 Annex II).

additional demonstration projects that could facilitate the introduction of low-GWP technologies in this sector.

31. HCFC consumption in other RAC represents over 12 per cent of the aggregated remaining HCFC consumption, mainly used by one country (China) for the manufacturing of different types of equipment (e.g., heat pumps and scroll and screw type chillers). It also include commercial refrigeration (condensing units and centralized systems), mobile AC, and transport refrigeration. It appears that, for the majority of Article 5 countries, part of their HCFC consumption is for transport refrigeration; however, this consumption might be reported under the servicing sector.

Refrigeration servicing sector

32. HCFC consumption in the servicing sector represents 38 per cent of the aggregated remaining HCFC consumption, i.e., the largest consumption for all applications. As the phase-out of HCFCs progresses in Article 5 countries, the remaining HCFC consumption will be further concentrated in this application.

33. HCFC consumption reported in the refrigeration servicing sector generally also includes HCFC used in assembly, installation, initial charging and commissioning of new RAC equipment, in particular when such equipment is custom-made for specific installations (e.g. supermarkets, refrigerated transportation). However, most HPMPs have not differentiated HCFC used in this subsector from that used in servicing. From the HPMP for South Africa it can be taken as reference that the use of HCFC in this subsector could be up to 20 per cent of the total consumption in the refrigeration servicing sector in a non-LVC country. Given than in installation and assembly the choice of technology is not limited by an already existing system like in typical servicing, this subsector can potentially have an influence in the selection of technology in new refrigeration and AC installations. Approaches focused to explore the potential of this subsector in the introduction of low-GWP alternatives could be considered. In addition, as no HCFC consumption data on this subsector has been recorded on a systematic way, approaches to gain a better understanding of this sector seem also meaningful, although this could also be done in the surveys for stage II of the HPMPs.

RECOMMENDATION

34. The Executive Committee may wish:

(a) To take note of the document on the analysis of the remaining eligible HCFC consumption in various sectors and subsectors of potential demonstration relevance (decision 72/40(d)); and

(b) To consider the information contained in this document, together with the criteria for proposals for demonstration projects for low-global-warming potential alternatives set out in decision 72/40, to assess the demonstration project proposals submitted to the 74th meeting[11].

[11] In response to decision 72/40(b) and (c), bilateral and implementing agencies submitted 27 requests for preparing proposals for demonstration projects for low-GWP alternatives and three feasibilities studies on district cooling. These proposals are contained in the document on bilateral cooperation (UNEP/OzL.Pro/ExCom/74/14), and the 2015 work programmes of UNDP (UNEP/OzL.Pro/ExCom/74/15), UNEP (UNEP/OzL.Pro/ExCom/74/16), UNIDO (UNEP/OzL.Pro/ExCom/74/17), and the World Bank (UNEP/OzL.Pro/ExCom/74/18).

Annex I

Status of alternative technologies in the RAC sectors (TEAP Report on alternatives pursuant to decision XXV/5) and remaining HCFC consumption in these sectors identified in the 15 largest consuming countries

GWP	**0**	**1**	**3 – 5**	**4**	**4**	**6**	**290**	**330**	**490**	**490**	**600**	**630**	**716**	**Remaining eligible consumption (ODP tonnes)**	
	R-717	R-744	HC-290, HC-1270	HC-600a	HFC-1234yf	HFC-1234ze(E)	“L-40”	R-444B	“L-41”	“DR-5”	R-450A	“XP-10”	HFC-32	**China**	**14 largest consumers**
Commercial refrigeration															
— Stand-alone equipment		C	C	C	L	F	F	F	F	F	F	F	F	-	324
—Condensing units		L	L	F	F		F	F	F	F	F	F	F	174	
— Centralized systems	L	C	L		F		F	F	F	F	F	L	F	6	
Transport refrigeration		C	C		F		F	F	F	F	F	F	F	36-	
Large size refrigeration	C	C [D]	L		F		F	F	F	F	F	F	F		
Air-conditioning and heat pumps															
— Small self-contained		L	C [D]		F			F	F	F	F	F	L	3,521	1,480
— Mini-split (non-ducted)		L	C [D]					F	L	F	F	F	C		
— Multi-split		L						F	L	F	F	F	L	614 *	80
— Split (ducted)		F	F					F	F	F	F	F	L		
— Ducted split comm. & non-split		F	L					F	F	F	F	F	L [D]		
— Hot water heating HPs	C	C	C	C	F	F	F	F	F	F	F	F	L	90	
— Space heating HPs	C	C	C	L	F	F	F	F	F	F	F	F	L [D]	-	
- Chillers	C	C	C		L	L	F	F	L	F	L	L	L [D]	1,012	

GWP	**0**	**1**	**3 – 5**	**4**	**4**	**6**	**290**	**330**	**490**	**490**	**600**	**630**	**716**	**Remaining eligible consumption (ODP tonnes)**	
	R-717	R-744	HC-290, HC-1270	HC-600a	HFC-1234yf	HFC-1234ze(E)	“L-40”	R-444B	“L-41”	“DR-5”	R-450A	“XP-10”	HFC-32	**China**	**14 largest consumers**
positive displacement															
-Mobile AC Public transport		F			L						F	F		5	

“C” indicates current use on a commercial scale, “L” indicates limited use such as demonstration, trials, niche applications, etc, “F” indicates use is potentially feasible on a commercial scale, based on fluid characteristics, [D] indicates already demonstrated under the MLF.

*Includes the unitary AC category as defined in the ICR phase out plan in China (unitary air-conditioner, rooftop air-source air-conditioner, ducted air-conditioner, computer room air-conditioner, clean operating room air-conditioner, constant temperature and humidity air-conditioner, dehumidifier air-conditioner).