

**United Nations
Environment
Programme**Distr.
GENERALUNEP/OzL.Pro/ExCom/79/45
12 June 2017

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Seventy-ninth Meeting
Bangkok, 3-7 July 2017

**OVERALL ANALYSIS OF THE RESULTS OF ODS ALTERNATIVES SURVEYS AS
SUBMITTED TO THE 79TH MEETING (DECISION 74/53(h))****Background**

1. In paragraph 4 of decision XXVI/9, the Parties requested the Executive Committee to consider providing additional funding to conduct inventories or surveys on alternatives to ODS in interested Article 5 parties. In response to the decision by the Parties, at its 74th meeting the Executive Committee *inter alia* considered the requests for funding surveys of ODS alternatives submitted by bilateral and implementing agencies, allowed the submission of funding requests for surveys from countries that had not submitted a request to the 74th meeting, and requested the Secretariat to prepare a format for preparation of the surveys. The Secretariat was also requested to provide an overall analysis of the results of the surveys for consideration of the Executive Committee by its first meeting in 2017 (decision 74/53).
2. At the 75th meeting, the Executive Committee noted the format for the preparation of surveys of ODS alternatives and the presentation of the resulting data¹ (decision 75/67). At the 77th meeting, in the context of the discussion on issues relevant to the Executive Committee arising from the Twenty-eighth Meeting of the Parties, the Executive Committee *inter alia* requested the Secretariat to prepare a document containing preliminary information in response to the elements in decision XXVIII/2 that requested the Executive Committee to take action, and addressing *inter alia* available information on HFC consumption and production, as well as on HFC-23 by-product, including from surveys of ODS alternatives funded by the Fund and other sources (decision 77/59(b)(i)).
3. In response to decision 77/59(b)(i), the Secretariat presented to the 78th meeting initial results of surveys of ODS alternatives from 30 Article countries focusing only on HFC consumption². Subsequent to a discussion, the Executive Committee urged bilateral and implementing agencies to work with relevant Article 5 countries to complete and submit, no later than 8 May 2017, as many ODS alternatives

¹ The format of the surveys is contained in UNEP/OzL.Pro/ExCom/75/77/Rev.1. The Secretariat prepared a Guide for preparation of the surveys of ODS alternatives (MLF/IACM.2016/2/21), based on the format noted by the Committee, and distributed to bilateral and implementing agencies to facilitate data collection and reporting.

² UNEP/OzL.Pro/ExCom/78/4 and Corr.1.

survey reports as possible, and to return to the 81st meeting unspent balances for those reports that had not been submitted to either the 79th or 80th meetings (decision 78/2).

4. This document is prepared in response to decision 74/53(h).³

Scope of the document

5. The document presents an overview of the 57 reports⁴ on surveys on ODS alternatives that were submitted prior to 8 May 2017 (out of 127 approved) briefly describing the methodology followed by the countries in collecting and analysing data, and broad observations resulting from the review of the reports. It presents preliminary information on alternatives to ODS, particularly related to HFCs and HFOs, in 43 LVC and 14 non-LVC countries and the distribution of the consumption by sector and subsector. It also presents a forecast of the consumption up to 2030, and a recommendation. A more comprehensive document will be submitted to the 80th meeting comprising all outstanding surveys on ODS alternatives funded by the Multilateral Fund.

6. The document also contains the following annexes:

Annex I Information on HFC consumption from surveys on ODS alternatives from 57 Article 5 countries

Annex II Article 5 countries with approved funding to conduct surveys on ODS alternatives

Overview of reports on surveys on ODS alternatives

7. The Executive Committee approved funding for undertaking ODS alternatives surveys for 127 Article 5 countries; 28 countries in Latin America and the Caribbean region, 48 countries in Africa, 11 countries in East Europe, 8 countries in the West Asia, and 32 countries in South Asia, South East Asia and the Pacific region; the survey covered 34 non-LVC and 93 non-LVC countries. Out of these, only 57 countries have submitted their survey reports so far.

8. In general, the 57 Article 5 countries that submitted a report to the 79th meeting, followed a combination of top-down and bottom-up approach in collecting data on ODS alternatives. National Ozone Units (NOUs), together with bilateral and implementing agencies, developed methodologies for data collection and analysis (for example, several countries prepared structured questionnaires that were distributed to stakeholders). The data was consolidated and cross-checked, and an analysis was made to present *inter alia* the market structure of supply of ODS alternatives; consumption of ODS alternatives by applications, and consumption trends (2016 to 2020/2030); and an overview of policy and regulatory framework relating to ODS alternatives.

9. An analysis of the information presented in the 57 reports resulted in the following observations:

(a) Limited information was provided on the status of policies and regulations, standards for handling refrigerants, and imports of other non-HFC alternatives. Six countries reported having a licensing system for ODS alternatives, and two countries are amending their licensing systems to include HFCs. Ten countries require permits/licenses for HFC

³ The Secretariat was requested to provide an analysis of the results of the surveys for consideration at the first meeting in 2017. As the first meeting of 2017 (78th meeting) focused only on policy related to the Kigali Amendment, the Committee agreed that the document be submitted to the 79th meeting.

⁴ Twelve surveys were incomplete only providing data tables.

imports; and one country requires that importers provide information on imports of non-ODS alternatives on a voluntary basis. In certain countries, the European Union regulations have contributed to the adoption of HFO-based technologies;

- (b) Several reports provided data for all alternative substances used in the country, including HFCs (pure or contained in blends); HFOs; hydrocarbon-based (reported as hydrocarbon, propane (HC-290a), isobutane (HC-600a), propane/butane blend, pentane, and cyclopentane); ammonia (R-717); and CO₂ (R-744). However, other reports submitted data only related to HFCs;
- (c) The number of ODS alternatives used in non-LVC countries is higher than in LVC countries where ODS are largely used in the refrigeration servicing sector;
- (d) For certain sectors and applications, the level of consumption was not disaggregated by sub-sector (e.g., data for refrigeration manufacturing and data for refrigeration servicing was reported aggregated under the refrigeration and air-conditioning sector);
- (e) The use of some substances was reported incorrectly in certain applications (e.g., R-404A was reported in the mobile air-conditioning subsector).
- (f) Forecast of ODS alternative substances was provided only in 37 reports. The forecast was done based on only four-year data (2012-2015), with major annual fluctuations on consumption, and with consumption of some alternatives reported for the first time during the last or two-last years of the reporting period. In some cases, the forecast was for every year up to 2030, while in other cases it was for intermediate years (e.g., 2020, 2025, 2030); and
- (g) It is expected a sharp increase in the consumption of alternatives to HCFCs (namely R-404A, R-407C, R-410A, HFC-32 and HC-290a) in the next several years, partially due to the phase-out of HCFC-22 as a result of the conversion of lines manufacturing HCFC-based equipment, as well as the issuance of policies banning the manufacturing (where applicable) and/or the importation of HCFC-based equipment. As technologies in the refrigeration/air-conditioning and/or foam sectors based on HFC-32, HC-290a and HFO further penetrate local markets and become more cost-effective, the consumption trend of HFCs and hydrocarbons could be altered.

Preliminary analysis of data from surveys on ODS alternatives

10. Except for HFCs, most other alternative substances are used in many applications not related to industrial processes where ODS are used (e.g., the consumption of hydrocarbons may be used as refrigerants or for heating applications). It was, therefore, not possible to ascertain whether the reported amounts of most of the alternative substances were entirely used as replacement of ODSs or also used in other applications. For this reason, the analysis presented below focusses mainly on HFCs.

11. Based on the data provided on the reports submitted by 57 Article 5 countries, a total of 17 HFCs (pure) and 32 HFC blends, with GWPs ranging from 124 to 14,800 (e.g., small amounts of HFC-23 are used for firefighting and in specialized refrigeration applications in a few countries), are currently used. For most of the countries, consumption was mainly HFC-134a, R-410A, R-404A, R-407C, and R-507A, and mainly used in refrigeration and air-conditioning (RAC) applications. For LVCs, the consumption was mainly used in servicing and/or installation/charging of refrigeration and air-conditioning equipment.

12. In 2015, total HFC consumption (pure and blends) reported for the 57 countries was 49,451 metric tonnes (mt) equivalent to 81,434,000 CO₂ tonnes. The main HFCs and HFC-blends in these

countries are summarized in Table 1. As reference, the CFC and HCFC baselines for compliance of the 43 LVC countries that submitted reports on ODS alternatives represented 58.7 and 64.5 per cent, respectively of all LVC countries, while the CFC and HCFC baselines of the 14 non-LVC countries that submitted reports represented 14.8 and 11.3 per cent, respectively of all non-LVC countries.

Table 1. Main HFCs and HFC-blends consumed in 57 Article 5 countries

HFC	No. of countries reported	% of total	Growth rate%*	Uses
HFC-134a	57	45	8	Domestic and commercial refrigeration and MAC; with small uses in other RAC applications, foam and aerosols
HFC-410A	57	25	23	Air-conditioning applications
R-404A	56	7	5	Low temperature refrigeration applications
R-507A	37	2	21	RAC sector
R-407C	51	2	12	Air-conditioning applications
HFC-152a**	11	7	33	Industrial aerosol sector and extruded polystyrene foam
HFC-245fa***	5	7	9	PU foam
Others	53	5	34	Small uses in all applications
Total	-	100	13	

(*) Calculated as compounded annual growth rate between 2012 and 2015.

(**) Over 90 per cent of this consumption was reported for only one country.

(***) One country reported a high use of HFC-245fa for the PU foam sector (i.e., around 15 per cent of its total HFC consumption).

Overall consumption of HFCs

13. HCFs are mostly used in the RAC sector, representing over 80 per cent of the total HFC consumption in 2015 (measured in mt), followed by the foam (9.4 per cent) and aerosol sectors (8.6 per cent); however, in terms of CO₂ tonnes, the RAC sector represents over 90 per cent of the total consumption. The main HFCs used are HFC-134a (representing 44.9 per cent of the total HFC consumption in mt in 2015), R-410A (24.7 per cent) and HFC-245fa, HFC-152a and R-404A (approximately 7.0 per cent each). However, in terms of CO₂ tonnes, the consumption of HFC-134a represents 39 per cent of the total, followed by HFC-410A (31.3 per cent) and R-404A (16.3 per cent). The annual growth rates (between 2010 and 2015) of R-410A (22.5 per cent), HFC-152a (32.8 per cent), R-507A (21.2 per cent), and R-407C (12.1 per cent) are higher than that of HFC-134a (7.9 per cent). Table 2 provides an overall analysis of the aggregated consumption of HFCs by sector and by HFC by all 57 countries. A similar analysis is presented separately for LVC and non-LVCs countries in Annex I to the present document.

Table 2. Overall analysis of aggregated consumption of HFCs by sector and by HFC

Description	Consumption (mt)				% of 2015 mt	Growth rate	CO ₂ tonne(*1,000)				% of 2015 GWP
	2012	2013	2014	2015			2012	2013	2014	2015	
By application											
RAC	28,592	33,369	40,905	40,111	81.1%	11.9%	52,660	62,748	79,252	73,912	90.8%
Foam	3,167	3,829	4,142	4,637	9.4%	13.5%	3,159	3,763	4,101	4,533	5.6%
Aerosol	1,943	2,725	3,534	4,257	8.6%	29.9%	1,137	1,354	1,636	1,906	2.3%
Fire-fighting	158	166	149	363	0.7%	32.0%	460	387	418	992	1.2%
Solvents	21	30	11	30	0.1%	12.8%	37	53	19	61	0.1%
Others	63	85	27	54	0.1%	-5.2%	20	251	28	31	0.0%
Grand total	33,944	40,205	48,767	49,451	100.0%	13.4%	57,474	68,556	85,455	81,434	100.0%

Description	Consumption (mt)				% of 2015 mt	Growth rate	CO ₂ tonne(*1,000)				% of 2015 GWP	
	2012	2013	2014	2015			2012	2013	2014	2015		
By substance												
HFC-134a	17,684	18,549	21,769	22,222	44.9%	7.9%	25,288	26,526	31,130	31,778	39.0%	
R-410A	6,646	10,297	13,183	12,222	24.7%	22.5%	13,877	21,501	27,527	25,519	31.3%	
HFC-245fa	2,817	3,406	3,398	3,610	7.3%	8.6%	2,901	3,509	3,499	3,718	4.6%	
HFC-152a	1,477	2,191	2,874	3,456	7.0%	32.8%	183	272	356	429	0.5%	
R-404A	2,909	3,103	3,810	3,379	6.8%	5.1%	11,407	12,169	14,943	13,251	16.3%	
HFC blends	1,073	1,090	1,247	2,135	4.3%	25.8%	-	-	-	-	0.0%	
R-507A	585	703	1,561	1,043	2.1%	21.2%	2,332	2,803	6,222	4,155	5.1%	
R-407C	555	600	720	781	1.6%	12.1%	985	1,065	1,276	1,386	1.7%	
Other HFCs	186	222	192	451	0.9%	34.2%	492	679	490	1,077	1.3%	
HFC-365mfc	12	42	13	153	0.3%	134.4%	9	33	10	122	0.1%	
Total	33,944	40,205	48,767	49,451	100.0%	13.4%	57,474	68,556	85,455	81,434	100.0%	

RAC sector

14. HFC consumption in the RAC sector was reported separately for manufacturing and servicing by both LVC and non-LVC countries. The distribution of HFC consumption for manufacturing and servicing uses varies between LVC and non-LVC countries. For all the 57 countries, 56 per cent of the total HFC consumption in RAC was for servicing, out of which 96 per cent was for LVC countries and 43 per cent for non-LVC countries.

15. In 2015, total HFC consumption in the RAC sector amounted to 40,111 mt tonnes, 79 per cent of which was consumed by non-Article 5 countries. The three main HFCs used were HFC-134a (representing 51.6 per cent of the total HFC consumption measured in mt), R-410A (30.5 per cent) and R-404A (8.4 per cent). The annual growth rate of R-410A was 22.5 per cent while that for HFC-134a was 7.2 per cent. Although the levels of consumption of R-407C, R-507A and other HFC blends are relatively low, their annual growth rate is much higher than that of HFC-134a. Table 3 provides an overall analysis of the aggregated consumption of HFCs in the RAC sector by all 57 countries. A similar analysis is presented separately for LVC and non-LVCs countries in Annex I to the present document.

Table 3. Analysis of the aggregated consumption of HFCs in the RAC sector by all 57 countries

HFC	No. of countries	2012	2013	2014	2015	% total for 2015	Growth (%)
Manufacturing							
HFC-134a	22	3,485	3,680	3,904	3,955	26.3%	4.3%
R-410A	11	4,958	7,164	9,555	9,138	60.7%	22.6%
R-404A	22	1,032	1,001	1,170	1,145	7.6%	3.5%
R-407C	11	144	125	135	152	1.0%	1.7%
R-507A	5	112	124	542	182	1.2%	17.4%
HFC blends	6	89	179	116	488	3.2%	76.3%
Total		9,820	12,274	15,422	15,060		15.3%
Servicing							
HFC-134a	56	8,619	8,710	10,960	10,665	56.6%	7.4%
R-410A	57	1,689	3,133	3,628	3,083	16.4%	22.2%
R-404A	57	1,876	2,102	2,640	2,233	11.8%	6.0%
R-407C	50	411	474	584	628	3.3%	15.2%
R-507A	37	473	579	1,019	859	4.6%	22.0%
HFC blends	32	925	809	963	1,382	7.3%	14.3%
Total		13,993	15,806	19,796	18,850		10.4%
Grand total		23,813	28,080	35,218	33,910		
MAC	6	4,779	5,289	5,687	6,201		
Grand total including		28,592	33,369	40,905	40,111		

HFC	No. of countries	2012	2013	2014	2015	% total for 2015	Growth (%)
MAC							
HFC-134a		16,825	17,631	20,478	20,707	51.6%	7.2%
R-410A		6,646	10,297	13,183	12,222	30.5%	22.5%
R-404A		2,909	3,103	3,810	3,379	8.4%	5.1%
R-407C		555	599	719	779	1.9%	12.0%
R-507A		585	703	1,561	1,041	2.6%	21.2%
HFC blends		1,073	1,036	1,152	1,983	4.9%	22.7%

(*) Other blends besides those commercially available worldwide

Other sectors

16. HFC consumption was reported in foam, aerosol, fire-fighting and solvents applications representing about 19 per cent of the total consumption in 2015. A brief overview of HFC consumption in these applications is given below, noting that a large number of HFC free alternatives were also used in this sector:

- (a) HFC consumption in the foam sector constituted 9.4 per cent of the total HFC consumption. The main HFCs consumed in the production of polyurethane foam was HFC-245fa with a total consumption of 3,610 mt (representing 88.9 per cent of the total consumption in the sector). This consumption occurred mainly in five Article 5 countries. Consumption of HFC-134a and HFC-152a, mainly used for the production of extruded polystyrene foam, represented 5 per cent each of the total HFC consumption in the foam sector;
- (b) HFCs consumed in aerosol applications included mainly HFC-134a (24.0 per cent in mt in 2015 but 76.6 per cent in CO₂ tonnes) and HFC-152a (75.5 per cent in mt in 2015 but 20.9 per cent in CO₂ tonnes). Although the consumption of HFC-365mfc is very low (133 mt in 2015), the consumption increased by 165.8 per cent between 2012 and 2015;
- (c) HFCs consumed in fire-fighting (representing 0.7 per cent of the total HFC consumption of HCFs in 2015 measured in mt) included HFC-125, HFC-365mfc, HFC-227ea, HFC-227ea/HFC-365mfc, HFC-23 and HFC-236fa (which was reported for the first time in 2015); and
- (d) HFCs consumed in solvents (representing 0.1 per cent of the total HFC consumption of HCFs in 2015 measured in mt) were mainly HFC-134a (54.9 per cent in 2015) and HFC-227ea (45.6 per cent).

Forecast consumption

17. Forecasting HFC consumption for base years would need to consider several factors (such as the rate of HCFC phase-out, analysis on the trend of new technologies being introduced, population growth rate and rate of population with access to refrigeration and air-conditioning equipment).

18. ODS alternatives consumption was projected based on estimates of future consumption presented in the survey reports. Of the 57 reports received, forecast of HFC was provided for 37 countries, using different methodologies. In some cases, projections were made annually up to 2030; in other cases, forecast was made only for specific years i.e., 2020, 2025, 2030. Table 4 presents the estimated consumption of HFC for the period 2015 to 2030.

Table 4. Forecast consumption of HFCs for the period 2015 to 2030

HFCs	2015	2025	2020	2030	Annual growth (%)
HFC-134a	17,034	19,671	25,791	28,458	18.7
HFC-152a	3,439	3,690	4,014	4,372	8.3
HFC-245fa	3,615	4,008	4,131	4,239	5.5
HFC-365mfc	77	37	44	52	-12.3
Other HFCs	303	449	581	766	36.2
HFC blends					
R-404A	2,650	3,640	5,043	6,816	37.0
R-407C	537	724	1,048	1,565	42.8
R-410A	10,815	13,002	18,161	21,165	25.1
Other HFCs	2,031	2,648	3,717	5,112	36.0
Total	40,501	47,869	62,530	72,545	21.4

Recommendation

19. The Executive Committee may wish:

- (a) To note the overall preliminary analysis of the results of the surveys of ODS alternatives contained in document UNEP/OzL.Pro/ExCom/79/45;
- (b) To urge bilateral and implementing agencies to work with relevant Article 5 countries to complete and submit all outstanding surveys on ODS alternatives, no later than 18 September 2017, noting that unspent balances of surveys not submitted to the 80th meeting would be returned to the 81st meeting in line with decision 78/2(c); and
- (c) To request the Secretariat to submit an updated overall analysis of the results of the surveys of ODS alternatives to include the reports that would be submitted to the Secretariat no later than 18 September 2017, to the 80th meeting.

Annex I

Information on HFC consumption from ODS alternatives survey reports from 57 Article 5 countries

LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
	2012	2013	2014	2015			2015	2012	2013	2014	
RAC											
HFC-134a	4,386	4,658	4,940	5,530	64.2%	8.0%	6,272	6,662	7,064	7,907	48.4%
R-404A	899	944	1,033	1,223	14.2%	10.8%	3,524	3,702	4,050	4,795	29.3%
R-407C	170	172	180	239	2.8%	11.9%	302	305	320	423	2.6%
R-410A	669	703	809	1,138	13.2%	19.4%	1,397	1,469	1,690	2,377	14.5%
R-507A	81	124	162	210	2.4%	37.3%	323	494	646	836	5.1%
Other HFCs	12	21	3	6	0.1%	-19.3%					
HFC blends	66	44	83	274	3.2%	60.7%					
Sub-total	6,284	6,666	7,211	8,619	100.0%	11.1%	11,819	12,631	13,770	16,339	100.0%
Foam											
HFC-134a	148	133	138	149	34.1%	0.2%	212	190	197	213	79.3%
HFC-152a	166	169	216	199	45.6%	6.3%	21	21	27	25	9.2%
HFC-245fa	8	9	9	18	4.0%	30.6%	8	9	9	18	6.8%
HFC-365 mfc	7	8	8	16	3.6%	30.6%	6	6	7	13	4.7%
HFC blends	16	45	54	55	12.7%	51.8%	-	-	-	-	0.0%
Sub-total	345	364	425	437	100.0%	8.2%	246	226	240	268	100.0%
Aerosol											
HFC-134a	20	18	25	28	74.6%	12.3%	29	25	35	41	84.1%
HFC-152a	0	2	1	0	0.3%	-27.1%	0	0	0	0	0.0%
HFC-227ea	1	1	2	2	6.2%	42.6%	3	4	7	8	15.9%
HFC blends	-	-	-	7	18.9%	-	-	-	-	-	0.0%
Sub-total	21	21	28	38	100.0%	21.6%	31	30	42	48	100.0%
Fire-fighting											
HFC-125	1	1	1	0	2.3%	-30.4%	3	4	3	1	3.9%
HFC-227ea	1	3	2	6	54.4%	59.7%	5	8	8	19	82.5%

LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
HFC-227ea/HFC-365mfc	-	-	2	2	15.2%		-	-	-	-	0.0%
HFC-236fa	-	-	-	3	28.0%		-	-	-	3	13.6%
Sub-total	2	4	5	11	100.0%	70.1%	7	12	11	23	100.0%
Solvents											
HFC-134a		4	4		54.9%	18.6%			6	7	35.1%
	3			5			4	6			
HFC-152a		0	1	-	0.0%				0	-	0.0%
	-						-	0			
HFC-227ea		3	3		45.1%	17.8%			9	13	64.9%
	3			4			8	9			
Sub-total	6	7	8	9	100.0%	18.2%	12	15	15	20	100.0%
Other uses											
HFC-134a	9	0	3	9	20.3%	-1.5%	14	0	4	13	52.9%
HFC-152a	39	58	18	34	75.9%	-4.6%	5	7	2	4	17.1%
HFC-23	-	0	-	0	0.1%		-	0	-	1	3.3%
R-507A	-	-	-	2	3.7%		-	-	-	7	26.7%
HFC blends	0	-	-	-	0.0%	-100.0%					0.0%
Sub-total	48	58	21	44	100.0%	-2.8%	18	8	6	24	100.0%
Grand Total	6,705	7,120	7,698	9,158		10.9%	12,134	12,922	14,084	16,723	
By Application											
RAC	6,284	6,666	7,211	8,619	94.1%	11.1%	11,819	12,631	13,770	16,339	97.7%
Foam	345	364	425	437	4.8%	8.2%	246	226	240	268	1.6%
Aerosol	21	21	28	38	0.4%	21.6%	31	30	42	48	0.3%
Fire-fighting	2	4	5	11	0.1%	70.1%	7	12	11	23	0.1%
Solvents	6	7	8	9	0.1%	18.2%	12	15	15	20	0.1%
Others	48	58	21	44	0.5%	-2.8%	18	8	6	24	0.1%
Grand total	6,705	7,120	7,698	9,158	100.0%	10.9%	12,134	12,922	14,084	16,723	100.0%
By Substance											
HFC-134a	4,567	4,813	5,109	5,721	62.5%	7.8%	6,530	6,882	7,306	8,181	48.9%
HFC-152a	205	229	237	233	2.5%	4.4%	25	28	29	29	0.2%
R-404A	899	944	1,033	1,223	13.4%	10.8%	3,524	3,702	4,050	4,795	28.7%

LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
R-407C	170	172	180	239	2.6%	11.9%	302	305	320	423	2.5%
R-410A	669	703	809	1,138	12.4%	19.4%	1,397	1,469	1,690	2,377	14.2%
R-507A	81	124	162	212	2.3%	37.7%	323	494	646	843	5.0%
HFC-245fa	8	9	9	18	0.2%	30.6%	8	9	9	18	0.1%
HFC-365mfc	7	8	8	16	0.2%	30.6%	6	6	7	13	0.1%
Other HFCs	18	28	11	22	0.2%	7.6%	18	26	27	44	0.3%
HFC blends	82	89	139	338	3.7%	60.4%					0.0%
Total	6,705	7,120	7,698	9,158	100.0%	10.9%	12,134	12,922	14,084	16,723	100.0%

NON-LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
	2012	2013	2014	2015			2015	2012	2013	2014	
RAC											
HFC-134a	12,439	12,972	15,538	15,178	48.2%	6.9%	17,787	18,551	22,220	21,704	37.7%
R-404A	2,010	2,159	2,777	2,156	6.8%	2.4%	7,883	8,467	10,893	8,456	14.7%
R-407C	385	427	539	541	1.7%	12.0%	682	758	956	959	1.7%
R-410A	5,977	9,594	12,374	11,083	35.2%	22.9%	12,480	20,032	25,837	23,142	40.2%
R-507A	504	579	1,399	831	2.6%	18.1%	2,009	2,309	5,577	3,312	5.8%
Other HFCs	4	3	13	37	0.1%	110.5%	-	-	-	-	
HFC blends	991	968	1,053	1,666	5.3%	18.9%	-	-	-	-	
Sub-total	22,309	26,703	33,694	31,492	100.0%	12.2%	40,841	50,117	65,482	57,573	100.0%
Foam											
HFC-134a	14	16	260	330	7.9%	189.4%	19	22	371	472	11.1%
HFC-245fa	2,809	3,398	3,388	3,592	85.5%	8.5%	2,893	3,499	3,490	3,700	86.8%
HFC-365 mfc	-	19	-	117	2.8%		-	15	-	93	2.2%
Other HFCs	-	0	15	31	0.7%		-	-	-	-	
HFC blends	-	32	54	130	3.1%		-	-	-	-	
Sub-total	2,823	3,465	3,717	4,200	100.0%	14.2%	2,913	3,537	3,861	4,265	100.0%
Aerosol											
HFC-134a	664	748	862	992	23.5%	14.3%	950	1,070	1,232	1,418	76.4%
HFC-152a	1,257	1,953	2,633	3,214	76.2%	36.7%	156	242	326	399	21.5%
HFC-227ea	-	4	11	13	0.3%		-	12	35	41	2.2%
Sub-total	1,922	2,705	3,506	4,218	100.0%	30.0%	1,106	1,324	1,594	1,858	100.0%
Fire-fighting											
HFC-125	22	18	35	141	40.0%	86.0%	77	63	124	493	50.9%
HFC-227ea	109	76	79	120	34.1%	3.3%	351	246	255	386	39.8%
HFC-23	0	-	-	0	0.0%	-16.5%	3	-	-	1	0.2%
HFC-236fa	19	53	24	70	19.9%	54.5%	20	55	24	72	7.5%
HFC-365mfc	5	14	5	20	5.7%	60.9%	4	11	4	16	1.6%
HFC-227ea/HFC-365mfc	1	1	1	1	0.2%	12.3%	-	-	-	-	0.0%

NON-LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
	155	163	144	352			453	375	407	969	
Sub-total	155	163	144	352	100.0%	31.3%	453	375	407	969	100.0%
Solvents											
HFC-125	-	-	-	6	29.7%		-	-	-	21	53.1%
HFC-134a	0	1	1	1	2.6%	3.4%	1	1	1	1	1.9%
HFC-152a	-	-	0	3	15.8%		-	-	0	0	1.0%
HFC-218	0	0	0	0	0.1%	44.2%	0	0	1	0	0.7%
HFC-4310	-	0	1	1	5.5%		-	0	1	2	4.6%
HFC-43-10mee	15	23	1	10	46.2%	-13.5%	24	37	1	16	38.7%
Sub-total	15	23	3	21	100.0%	10.6%	25	38	4	40	100.0%
Other uses											
HFC-134a	-	-	0	2	16.3%		-	-	0	2	35.6%
HFC-152a	15	9	4	6	64.3%	-25.7%	2	1	1	1	12.1%
HFC-23	-	16	1	-	0.0%		-	240	21	-	0.0%
R-404A	-	0	-	-	0.0%		-	0	-	-	0.0%
R-407C	0	1	0	2	19.4%	152.5%	0	2	0	3	52.3%
Sub-total	15	26	6	9	100.0%	-14.2%	2	243	22	6	100.0%
Grand Total	27,239	33,085	41,069	40,293		13.9%	45,340	55,634	71,371	64,711	
By Application											
RAC	22,309	26,703	33,694	31,492	78.2%	12.2%	40,841	50,117	65,482	57,573	89.0%
Foam	2,823	3,465	3,717	4,200	10.4%	14.2%	2,913	3,537	3,861	4,265	6.6%
Aerosol	1,922	2,705	3,506	4,218	10.5%	30.0%	1,106	1,324	1,594	1,858	2.9%
Fire-fighting	155	163	144	352	0.9%	31.3%	453	375	407	969	1.5%
Solvents	15	23	3	21	0.1%	10.6%	25	38	4	40	0.1%
Others	15	26	6	9	0.0%	-14.2%	2	243	22	6	0.0%
Grand total	27,239	33,085	41,069	40,293	100.0%	13.9%	45,340	55,634	71,371	64,711	100.0%
By Substance											
HFC-134a	13,117	13,736	16,660	16,502	41.0%	8.0%	18,757	19,643	23,824	23,597	36.5%
HFC-152a	1,272	1,962	2,637	3,223	8.0%	36.3%	158	243	327	400	0.6%
R-404A	2,010	2,159	2,777	2,156	5.4%	2.4%	7,883	8,467	10,893	8,456	13.1%
R-407C	385	428	539	542	1.3%	12.1%	683	760	957	962	1.5%

NON-LVC COUNTRIES											
Particulars	Consumption in mt				Percentage of consumption in sectors	Annual growth rate	CO ₂ tonnes (thousand)				Percentage total CO ₂ tonnes
R-410A	5,977	9,594	12,374	11,083	27.5%	22.9%	12,480	20,032	25,837	23,142	35.8%
R-507A	504	579	1,399	831	2.1%	18.1%	2,009	2,309	5,577	3,312	5.1%
HFC-245fa	2,809	3,398	3,388	3,592	8.9%	8.5%	2,893	3,499	3,490	3,700	5.7%
HFC-365mfc	5	34	5	137	0.3%	206.0%	4	27	4	109	0.2%
Other HFCs	169	194	181	429	1.1%	36.5%	474	653	463	1,033	1.6%
HFC blends	991	1,001	1,108	1,797	4.5%	21.9%	-	-	-	-	0.0%
Total	27,239	33,085	41,069	40,293	100.0%	13.9%	45,340	55,634	71,371	64,711	100.0%

LVC COUNTRIES - RAC							
Substances	Application	No. of countries	2012	2013	2014	2015	Growth (%)
HFC-134a	manufacturing	10	91	135	131	152	18.6%
HFC-134a	servicing	43	3,840	4,043	4,292	4,753	7.4%
R-404A	manufacturing	10	62	60	76	94	14.5%
R-404A	servicing	43	836	884	956	1,129	10.5%
R-407C	manufacturing	3	1	3	5	4	46.5%
R-407C	servicing	37	169	169	175	235	11.5%
R-410A	manufacturing	3	10	17	20	24	31.0%
R-410A	servicing	43	659	686	790	1,115	19.2%
R-507A	manufacturing	3	13	10	24	23	20.4%
R-507A	servicing	27	68	114	138	187	40.1%
Other HFCs	manufacturing	0	-	-	-	-	0.0%
Other HFCs	servicing	4	12	21	3	6	-19.3%
Other HFC blends	manufacturing	1	-	0	-	0	0.0%
Other HFC blends	servicing	15	19	15	39	197	117.8%
Other substances	manufacturing	5	63	68	58	73	5.2%
Other substances	servicing	87	1,247	1,531	1,414	1,586	8.4%
Total			7,091	7,755	8,122	9,577	10.5%
MAC							
HFC-134a	All	15	455	481	517	625	11.1%
Other HFCs	All	0	-	-	-	-	0.0%
Other HFC blends	All	5	47	29	44	77	17.8%
Others	All	5	1	1	1	1	24.6%
Total			503	510	562	703	11.8%
Grand total			7,594	8,265	8,684	10,280	10.6%

NON-LVC COUNTRIES - RAC

Substances	Application	No. of countries	2012	2013	2014	2015	Growth (%)
HFC-134a	manufacturing	12	3,394	3,545	3,773	3,803	3.9%
HFC-134a	servicing	13	4,779	4,667	6,669	5,912	7.3%
R-404A	manufacturing	12	970	941	1,093	1,052	2.7%
R-404A	servicing	14	1,040	1,218	1,684	1,105	2.0%
R-407C	manufacturing	8	143	122	130	147	1.1%
R-407C	servicing	13	242	305	409	393	17.6%
R-410A	manufacturing	8	4,947	7,147	9,535	9,115	22.6%
R-410A	servicing	14	1,030	2,447	2,839	1,969	24.1%
R-507A	manufacturing	2	99	115	518	159	17.0%
R-507A	servicing	10	405	465	881	672	18.4%
Other HFCs	manufacturing	1	3	3	2	1	-43.9%
Other HFCs	servicing	5	1	1	11	35	249.1%
Other HFC blends	manufacturing	4	86	176	114	487	78.3%
Other HFC blends	servicing	8	893	773	910	1,144	8.6%
Other substances	manufacturing	19	1,487	1,124	1,080	1,169	2.0%
Other substances	servicing	30	4,511	5,303	8,010	4,831	1.1%
Total			24,031	28,351	37,658	31,992	17.6%
MAC							
HFC-134a	All	6	4,265	4,760	5,097	5,463	8.6%
Other HFCs	All	1	-	-	-	2	
Other HFC blends	All	3	12	19	29	35	43.7%
Others	All	2	-	0	0	202	
Total			4,277	4,780	5,126	5,702	10.1%
Grand total			28,308	33,132	42,785	37,693	10.0%

Annex II

ARTICLE 5 COUNTRIES WITH APPROVED FUNDING TO CONDUCT SURVEYS ON ODS ALTERNATIVES

Country	Region	HCFC status	Agency	Approved	Submitted
Afghanistan	Asia and the Pacific	Non-LVC	UNEP	74 th	
Albania	Europe	LVC	UNIDO	74 th	78 ^{th*}
Algeria	Africa	Non-LVC	UNEP	74 th	
Angola	Africa	LVC	UNEP	74 th	79 th
Antigua and Barbuda	Latin America and the Caribbean	LVC	UNEP	74 th	
Argentina	Latin America and the Caribbean	Non-LVC	UNIDO	74 th	78 th
Armenia	Europe	LVC	UNEP	74 th	80 th
Barbados	Latin America and the Caribbean	LVC	UNEP	74 th	
Benin	Africa	LVC	UNEP	74 th	
Bosnia and Herzegovina	Europe	LVC	UNIDO	74 th	78 th
Bhutan	Asia and the Pacific	LVC	UNEP	74 th	
Burkina Faso	Africa	LVC	UNEP	74 th	
Bolivia	Latin America and the Caribbean	LVC	UNIDO	74 th	78 th
Botswana	Africa	LVC	UNEP	74 th	79 th
Brunei Darussalam	Asia and the Pacific	LVC	UNEP	74 th	
Cape Verde	Africa	LVC	UNEP	74 th	
Chad	Africa	LVC	UNEP	74 th	
Chile	Latin America and the Caribbean	Non-LVC	UNIDO	74 th	78 th
Comoros	Africa	LVC	UNEP	74 th	
Costa Rica	Latin America and the Caribbean	LVC	UNDP	74 th	78 th
Djibouti	Africa	LVC	UNEP	74 th	
Korea, DPR	Asia and the Pacific	Non-LVC	UNEP	74 th	
Ecuador	Latin America and the Caribbean	LVC	UNIDO	74 th	78 th
El Salvador	Latin America and the Caribbean	LVC	UNDP	74 th	78 ^{th*}
Equatorial Guinea	Africa	LVC	UNEP	74 th	
Eritrea	Africa	LVC	UNEP	74 th	79 th
Ethiopia	Africa	LVC	UNEP	74 th	79 th
Micronesia	Asia and the Pacific	LVC	UNEP	74 th	
Gambia	Africa	LVC	UNEP	74 th	79 th
Georgia	Europe	LVC	UNIDO	74 th	
Ghana	Africa	LVC	UNEP	74 th	79 th
Guatemala	Latin America and the Caribbean	LVC	UNIDO	74 th	78 th
Guinea	Africa	LVC	UNEP	74 th	
Guyana	Latin America and the Caribbean	LVC	UNEP	74 th	
Honduras	Latin America and the Caribbean	LVC	UNIDO	74 th	78 th
India	Asia and the Pacific	Non-LVC	UNDP	74 th	
Iran (Islamic Republic)	Asia and the Pacific	Non-LVC	UNDP	74 th	
Cote d'Ivoire	Africa	LVC	UNEP	74 th	
Jamaica	Latin America and the Caribbean	LVC	UNEP	74 th	
Cambodia	Asia and the Pacific	LVC	UNEP	74 th	79 th
Kenya	Africa	LVC	UNEP	74 th	78 th
Kyrgyzstan	Europe	LVC	UNEP	74 th	79 th
Lao, PDR	Asia and the Pacific	LVC	UNEP	74 th	
Lebanon	Asia and the Pacific	Non-LVC	UNDP	74 th	78 th
Lesotho	Africa	LVC	UNEP	74 th	79 th
Liberia	Africa	LVC	UNEP	74 th	79 th
Madagascar	Africa	LVC	UNEP	74 th	78 ^{th*}
Macedonia, FYR	Europe	Non-LVC	UNIDO	74 th	78 th

Country	Region	HCFC status	Agency	Approved	Submitted
Maldives	Asia and the Pacific	LVC	UNEP	74 th	
Mexico	Latin America and the Caribbean	Non-LVC	UNIDO	74 th	78 th
Malawi	Africa	LVC	UNEP	74 th	79 th
Montenegro	Europe	LVC	UNIDO	74 th	78 th
Moldova, Rep.	Europe	LVC	UNEP, UNDP	74 th	78 th
Mongolia	Asia and the Pacific	LVC	UNEP	74 th	
Mozambique	Africa	LVC	UNEP	74 th	
Myanmar	Asia and the Pacific	LVC	UNEP	74 th	
Namibia	Africa	LVC	UNEP	74 th	79 th
Nepal	Asia and the Pacific	LVC	UNEP	74 th	
Niger	Africa	LVC	UNIDO	74 th	
Nicaragua	Latin America and the Caribbean	LVC	UNIDO	74 th	78 th
Nigeria	Africa	Non-LVC	UNEP	74 th	79 th
Oman	Asia and the Pacific	LVC	UNIDO	74 th	78 th
Pakistan	Asia and the Pacific	Non-LVC	UNEP	74 th	
Panama	Latin America and the Caribbean	Non-LVC	UNDP	74 th	78 ^{th**}
Rwanda	Africa	LVC	UNEP	74 th	
Seychelles	Africa	LVC	UNEP	74 th	79 th
Sierra Leone	Africa	LVC	UNEP	74 th	80 th
Sri Lanka	Asia and the Pacific	Non-LVC	UNEP	74 th	
Sao Tome and Principe	Africa	LVC	UNEP	74 th	
Sudan	Africa	Non-LVC	UNEP, UNIDO	74 th	78 th
Swaziland	Africa	LVC	UNEP	74 th	78 th
Thailand	Asia and the Pacific	Non-LVC	IBRD	74 th	
Turkmenistan	Europe	LVC	UNEP	74 th	
Timor Leste	Asia and the Pacific	LVC	UNEP	74 th	
Togo	Africa	LVC	UNEP	74 th	
Trinidad and Tobago	Latin America and the Caribbean	LVC	UNEP	74 th	
Tunisia	Africa	Non-LVC	UNIDO	74 th	78 th
Turkey	Europe	Non-LVC	UNIDO	74 th	
Uganda	Africa	LVC	UNIDO	74 th	78 ^{th*}
Tanzania	Africa	LVC	UNEP	74 th	79 th
Uruguay	Latin America and the Caribbean	LVC	UNIDO	74 th	78 ^{th**}
Venezuela	Latin America and the Caribbean	Non-LVC	UNIDO	74 th	
Serbia	Europe	Non-LVC	UNIDO	74 th	78 th
Zambia	Africa	LVC	UNEP	74 th	79 th
Zimbabwe	Africa	Non-LVC	UNEP	74 th	78 th
Bahrain	Asia and the Pacific	LVC	UNEP, UNIDO	75 th	
Burundi	Africa	LVC	UNEP	75 th	
Bangladesh	Asia and the Pacific	Non-LVC	UNDP	75 th	79 th
Bahamas	Latin America and the Caribbean	LVC	UNEP	75 th	
Belize	Latin America and the Caribbean	LVC	UNEP	75 th	
Cook Islands	Asia and the Pacific	LVC	UNEP	75 th	
Cameroon	Africa	LVC	UNIDO	75 th	79 th
Colombia	Latin America and the Caribbean	Non-LVC	Germany	75 th	78 th
Cuba	Latin America and the Caribbean	Non-LVC	UNDP	75 th	
Dominican Republic	Latin America and the Caribbean	Non-LVC	UNDP	75 th	78 th
Congo, DR	Africa	Non-LVC	UNEP	75 th	
Fiji	Asia and the Pacific	LVC	UNEP	75 th	
Gabon	Africa	LVC	UNEP	75 th	

Country	Region	HCFC status	Agency	Approved	Submitted
Guinea-Bissau	Africa	LVC	UNEP	75 th	
Grenada	Latin America and the Caribbean	LVC	UNEP	75 th	
Iraq	Asia and the Pacific	Non-LVC	UNEP	75 th	
Kiribati	Asia and the Pacific	LVC	UNEP	75 th	79 th
Kuwait	Asia and the Pacific	Non-LVC	UNEP, UNIDO	75 th	
Libya	Africa	Non-LVC	UNIDO	75 th	
Mauritius	Africa	LVC	Germany	75 th	79 th
Marshall Islands	Asia and the Pacific	LVC	UNEP	75 th	
Mali	Africa	LVC	UNEP	75 th	
Morocco	Africa	Non-LVC	UNEP	75 th	
Nauru	Asia and the Pacific	LVC	UNEP	75 th	79 th
Niue	Asia and the Pacific	LVC	UNEP	75 th	79 th
Paraguay	Latin America and the Caribbean	LVC	UNDP	75 th	78 th
Peru	Latin America and the Caribbean	LVC	UNDP	75 th	
Philippines	Asia and the Pacific	Non-LVC	IBRD	75 th	
Papua New Guinea	Asia and the Pacific	LVC	Germany	75 th	79 th
Congo	Africa	LVC	UNEP	75 th	
Samoa	Asia and the Pacific	LVC	UNEP	75 th	
Saudi Arabia	Asia and the Pacific	Non-LVC	UNEP	75 th	
Senegal	Africa	LVC	UNEP	75 th	78 th
Solomon Islands	Asia and the Pacific	LVC	UNEP	75 th	
Saint Lucia	Latin America and the Caribbean	LVC	UNEP	75 th	
Suriname	Latin America and the Caribbean	LVC	UNEP	75 th	
Palau	Asia and the Pacific	LVC	UNEP	75 th	
Tonga	Asia and the Pacific	LVC	UNEP	75 th	79 th
Tuvalu	Asia and the Pacific	LVC	UNEP	75 th	79 th
Vanuatu	Asia and the Pacific	LVC	UNEP	75 th	
Vietnam	Asia and the Pacific	Non-LVC	IBRD	75 th	79 ^{th**}
Jordan	Asia and the Pacific	Non-LVC	IBRD	76 th	

*no narrative report

**preliminary data/report