Rwanda Towards the Implementation of Montreal Protocol on Substances that Deplete the Ozone Layer. the Current Status of ODS, Ods Alternatives, and HFCS Alternatives.

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ABSTRACT

In August 2003, Rwanda ratified both the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, along with all the subsequent amendments, including the Kigali Amendment, which was most recently ratified in May 2017. Within this context, by the Law n°63/2013 of 27/08/2013, Rwanda Environment Management Authority (REMA) was created with the legal mandate for national environmental protection, conservation, promotion and overall management, including advisory to the government on all matters pertinent to the environment and climate change. According to Decision XIX/6 of the 19th Meeting of the Parties to the Montreal Protocol on accelerated phase-out of HCFCs, Rwanda is committed to phase-out use of HCFCs by 2030 except for 2.5% for servicing essential use appliances up to 2040. The Hydrochlorofluorocarbons Phase-out Management Plan (HPMP) Stage-I for Rwanda was approved at the 64th Meeting of the Executive Committee for the period 2011 to 2020 to meet a 35% reduction of HCFC by 2020. The HPMP Stage-II has been approved by the 86thmeeting of the Executive Committee of the Multilateral Fund Secretariat, to be implemented by UNEP, UNIDO and REMA to enable Rwanda achieve phase-out targets on consumption of Annex C Group 1 Substances of the Montreal Protocol by 2030. The HPMP Stage-II has prioritized key activities to be implemented which include: establishment and implementation of a robust certification scheme for refrigeration technicians, development and implementation of national technical standards in the Refrigeration and Air-Conditioning (RAC) sector that will promote safe use of natural refrigerants and further promote use of highly energy efficiency technologies, capacity building of refrigeration technicians on handling natural refrigerants, training of customs and other enforcement officers on controlling and monitoring HCFC trade and strengthening the Refrigeration Association of Rwanda, technical training institutes and the consumers.The implementation of HPMP Stage-II activities will enable RWANDA reduce consumption of HCFC-22 from the baseline of 4.1 ODP tonnes to 80 percent by 2025 and 100 percent by 2030.This paper represents the results of the national survey conducted to inform the preparation of the project proposal for Kigali HFC Implamentation plan as well as the strategic KIP/HFC phase-down plan.

Keywords: HydrofluorocarbonsSubstances (HFCS), Hydrochlorofluorocarbons Phase-out Management Plan (HPMP), Montreal protocol, Ozone Depleting Substances (ODS), Rwanda.

RESEARCH BACKGROUND

Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty that was adopted in 1987, just two years after the Vienna Convention. The Montreal Protocol is a legally binding agreement that

aims to phase out the production and consumption of substances that are responsible for ozone depletion, such as chlorofluorocarbons (CFCs) and other ozone-depleting chemicals. The protocol has been highly successful in reducing the emissions of these harmful substances and mitigating damage to the ozone layer (UN, 1978). While the Vienna Convention established the framework for addressing ozone depletion, the Montreal Protocol provided the specific measures and timelines for the elimination of ozone-depleting substances (UN, 1988). The two agreements are often discussed together because they work in tandem to protect the ozone layer.

Rwanda's commitments toimplement Montreal protocol

Rwanda promoted the adoption of low GWP alternatives under theHCFC Phase-Out. Management Plan(HPMP) Stage I and has committed to the phase-out of controlled substances under the Protocol including viHydrocloroflourocarbons (HCFCs). According to Decision XIX/6 of the 19th Meeting of the Parties to the Montreal Protocol on accelerated phase-out of HCFCs, Rwanda is committed to phase-out use of HCFCs by 2030 except for 2.5% for servicing essential use appliances up to 2040. Rwanda has taken proactive actions to phase-out consumption of HCFCs and is in compliance with the phase-out schedule as set under the Montreal Protocol (UNEP, 2016).

The HPMP Stage-I for Rwanda was approved at the 64th Meeting of the Executive Committee with a total funding of US$280,000 for the period 2011 to 2020 to meet a 35% reduction of HCFC by 2020. Rwanda has made tremendous progress in the implementation of activities under stage I of the HPMP. The HPMP Stage-I has successfully enabled Rwanda to freeze HCFC baseline in 2013, and achieve 10 percent reduction in consumption of HCFC by 2015 in line with the accelerated HCFC phase-out schedule under the Protocol. The HPMP Stage-I has successfully phased out approximately 2.2 ODP tons of HCFCs in the country (UNEP& UNIDO, 2020).

Currently, Rwanda is implementing Stage II of its Hydrochloroflorocarbons Phase-out Management Plan (HPMP) to enable Rwanda achieve phase-out targets on consumption of Annex C Group 1 Substances of the Montreal Protocol by 2030. The HPMP Stage-II attributed to address the phase-out of the remaining consumption of HCFC-22 which is exclusively used in the RAC servicing sector. The Plan is built on the success stories on the implementation of HPMP Stage-I activities (UNEP & UNIDO, 2020).

Some of the achievements recorded include the following:Total phase out of CFCs by 2010;Complied with the 2020 56% HCFC reduction in consumption; Timely reported Article 7 data to the Ozone and MLF Secretariats; Conduct training workshops for refrigeration technicians throughout the country and trained more than 200 technicians on Good Refrigeration Practices and safe use of flammable refrigerants; Conduct workshops for customs officers and trained 180 customs officers from the major ports of entry on monitoring and controlling of ODS trade. The NOU in collaboration with UNEP/CAP organized boarder training workshops for boarder customs officers, Police, clearing agents and Bureau of standards. The one-day training was done on 3 boarders for 56 Customs Officers in total; Carry out public awareness and the commemoration of the International Day for the preservation of the Ozone Layer every year. This includes the exhibition, Ozone Schools competitions, Rwanda Medical Council workshops on the health benefits of protecting the Ozone Layer, media houses on how to report environment and ozone related news, hosted the MOP 28, regional African workshop, and other regional workshops among others; In terms of collaboration, signed MoU together with three training centers, work with vendors of RAC equipment, among others; Adoption of various regulations including the National Cooling Startegy, Ministerial order governing the use, import and export of all substances controlled under the Montreal Protocol Among others.

Rwanda has promoted the adoption of low GWP alternatives under the HPMP programme. However, the ODS alternative survey conducted in 2016, 2020 and the current of 2023 has revealed the HFCs and HFC blends are the commonly refrigerants used in Rwanda for servicing refrigeration and air conditioning appliances. The appliances serviced include fridges, chillers, freezers, cold rooms, and air conditioning units (UNEP, 2017).

The rationale of the research

The Government of Rwanda has received funds for the project/programme entitled: "Rwanda preparation of Kigali HFC implementation plan "with objectives to which small-scale funding contributes to undertake a

nation-wide survey on HFC consumption and existing HFC-related policies for development of a project proposal of the Kigali HFC Implementation plan in accordance with the guidelines of the Executive Committee. Specifically, to support the country to undertake a nation-wide survey to understand the current and future use of HFCs; To collect information on the existing HFC related policies; and to develop a project proposal of the Kigali HFC Implementation plan.At its 87th meeting, the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol approved the guidelines for preparation of stage I of HFC phase-down plans for Article 5 countries, referred to as Kigali HFC implementation plans (KIPs). In this perspective, REMA contracted JD and Associates Consultancy firm to conduct the national wide survey of ODS, ODS alternatives, HFCs alternative and Refrigeration and Air Conditioning (RAC) and Mobile and Air Conditioning (MAC) Equipment; and develop the HFC Phase-down Strategic Management Plan.

Generalobjective

The main objectives of the survey was to carry out an inventory establishing the volumes of imported and exported substances, products and equipment containing the substances in accordance of art. 20 of ministerial order no 004/2021 of 12/02/2021 governing the use of substances that deplete the ozone layer or may cause climate change and preparation of HFC national survey report.

Specific Objectives

Specific objecives of the survey were: to identify the importers, distributors and big users of refrigerants and refrigeration equipment and determine the quantities of each person; to determine the quantity of ozone depleting substances (ODS) (CFCs, HCFCs) and related equipment that are currently banked in the country; to determine the ODS quantities imported in the period of 2016-2022 from customs services; and to propose the HFC Phase-down Strategic Management Plan

1. Legal, Policy, And Strategic Framework Related To The Implementation Of The Montreal Protocol

The Constitution of the Republic of Rwanda

The National Constitution of Rwanda of 2003 (amended in 2015) guarantees the right to a protected environment. Article 53 states that everyone has the duty to protect, safeguard and promote the environment that the State should ensure the protection of the environment, and do so by means of a law that determines the modalities for the protecting, conserving, and promoting the environment. In addition, its article 3 contains specific provisions regarding the waste management. Its article 22 on the right to live in clean and healthy environment; article 49 on the duty of each Rwandan to respect of the Constitution and other laws of the country.

The National Strategy for Transformation (NST1)

The National Strategy for Transformation (NST1, 2017 p.14) guides the implementation instrument for the remainder of Vision 2020 and for the first four years of the journey under Vision 2050 to implement the National Strategy for Transformation (NST1). Rwanda has made significant progress in environment and climate change mainstreaming, as reported in State of Environment Reports (SEORs, 2009 and 2015). The environment is protected by relevant environmental laws and regulations that are captured under the Environmental Organic Law of 2005, as revised to date, and Climate Change has been addressed and informed by cross sectoral strategies, including the Green Growth and Climate Resilient Strategy (GGCRS) and the Nationally Determined Contributions (NDCs) for climate change mitigation and adaptation.

National Environment and Climate Change Policy (2019) and Rwanda Environmental Management Authority (REMA)

Rwanda has started its journey and taken a strategic decision to pursue a green growth approach to development. The adoption and implementation of the updated Environment and climate change Policy 2019 defined strategic direction and responses to the emerging issues and critical challenges in environmental management and climate change adaptation and mitigation. The key issues and challenges defined by this policy were population density, water, air and soil pollution, land degradation, fossil-fuel dependency, high-carbon transport systems, irrational

exploitation of natural ecosystems, lack of low-carbon materials for housing and green infrastructure development, inadequate waste treatment for both solid and liquid waste, increase of electronic, hazardous chemicals and materials waste, among others. The policy highlights the role of REMA, MoE and line ministries in implementation of Multilateral Environmental Agreements (MEAs) as ratified(MoE, 2019).

Ministerial Order No 004/2021 of 12/02/2021

The Ministerial Order nº006/2008 of 15/08/2008 has been repealed by the Art. Nº21 of the Ministerial Order Nº 004/2021 of 12/02/2021: Governing the use of substances that deplete the ozone layer or may cause climate change. In its Art. 5, paragraph 1 on Phased-out ODS, the current Ministerial order dictate that it is prohibited to produce, import, export, use or sell phased-out substances that deplete the ozone layer or that may cause climate change, including equipment or products that contain or depend on controlled substances as provided for by Montréal Protocol on substances that deplete the ozone layer as amended to date, ratified by Presidential Order nº 143/01 of 03/04/2017. This presidential order on amendment to the Montreal protocol on substances that deplete the ozone layer was adopted at Kigali on 15/10/2016 and enumerated the controlled substances.

RESEARCH METHODOLOGY

Desk review

A desk review of the available reports and documents have been carried out to assess the status of ODS, ODS alternatives, HFCs alternative and RAC and MAC equipment in Rwanda. The information that was collected from these reports included: the types of ODS, ODS alternatives, HFCs alternative and RAC and MAC equipment present in Rwanda, their quantity, how they are managed and the involved stakeholders. Data on imports and exports together with their HS Codes were collected from Customs Officers at ports of entry through the ASYCUDA system which is also linked to the Trade Statistics Section of the National Institute of Statistics of Rwanda (NISR). REMA also keeps a register of allocated import or export quotas and during the survey, the importers with import quotas provided easy access to data on the use of ODS alternatives.The reports reviewed were also include but not limited to: the inventory and analysis of ozone depleting substances (ODS) data (CFCs and HCFCs) and non-ODS for 2018-2019 and collection of missing data, report compilation and analysis of ODS and non-ODS data for 2017-2018, by REMA (2020); Ozone Depleting Substances Alternative Survey Report (2016); HPMP stage I, (2013); Draft proposal of HPMP stage II (2020); among others.

Data collection procedures

Approach and procedure used for data collection and analysis for Refrigeration and air conditioning: After two days of training for the selected chemical graduate, a set of different questionnaires depending on the category of the interviewee were used for data collection (refer to the link for the programmed tools) in the national wide survey for refrigeration and air conditioning. The content of these questionnaires was based on model questionnaire developed by the UNEP to guide the survey. Technical meetings between experts and representatives of the Rwanda Environment Management Authority were held beginning in September 2023 to discuss the content of the questionnaires. It was followed by a field visits and consultations, which were conducted with different representative staff from Ministries and agencies among others at MINICOM, NIDA, MINEDUC,MINAGRI,RNP,MINADEF, RURA, NIRDA, UR, RP, IPRCs, MoE, RICA, REMA, RRA and RSB, Hospitals, Higher learning Institutions on the public side and Hotels with 2-5 starts; Banks, administrative buildings for districts and provinces, ODS, ODS alternatives, HFCs alternative, RAC equipment importers, sellers, industries, Kanombe International airport and RAC Technicians and engineers involved in the Air conditioners and Refrigeration / cooling system on the private side. Data collection covered all the four Provinces and the City of Kigali. The statistical approaches specifically on sampling were employed in order to get representative and reliable data.

Training of enumerators

Thirty-three (33) enumerators composed of 15 young women and 18 young men were hired and trained in field data collection in all 30 districts of Rwanda. The training was conducted within four (4) days: 2 days for

theoretical (a review the theory of the questionnaire,) Technical (how to use tablets in completing electronic questionnaire) and Classroom practice(individual and group exercises to become familiar with the practice of asking and filling electronic questionnaire) and 2 days of field practice to be familiar with questionnaire where each enumerator visited 2 sites and completed and submitted questionnaires by collecting errors occurred in data collection process. The training of the enumerators' objective was to increasing their skills and enhances performance. The point was that each enumerator has to understand each question properly and know the type of calculation to be expected from that question. The trainers explained the whole questionnaire answering theoretical and practical questions raised by enumerators.

Data collectiontools

To capture Primary data, enumerators used tablets using KOBOCOLLECT-ODK Collect making easy to design forms, collect data, monitor for quality. It included these primary components: On basis of the developed datasets the data cleaning was done through SPSS; by detecting, diagnosing and editing faulty data. Data cleaning was done to deal with data problems occurred. Data cleaning used a three-stage process, involving repeated cycles of screening, diagnosing, and editing of suspected data abnormalities.

Focus Group Discussions (FGDs), Key Information Interviews (KIIs), Case studies were used as qualitative data collection methods. The note takers produced detailed write-ups for each of the FGDs, KIIs and Case Studies.

DATA ANALYSIS

From data collected for the period 2016 – 2022, a trend analysis has been applied on the use of different ODS and non-ODS substances in Rwanda. Data from all surveyed sector have been analyzed and plotted in order to compare consumption trends by sector and by products. The numeric data collected during the survey was aggregated into tables as provided under the MLF guidelines. From the data tables, trend analysis and future projections of each category of ODS alternative was done using linear extrapolation.For non-numeric data, deductive and inductive approaches were used to establish scenarios and trends. In addition, the questionnaires provided a section where respondents were asked to list the challenges, opportunities and barriers to the introduction and use of ODS Alternatives. The qualitative responses also gave an insight on the projected demand of ODS Alternatives.

Primary data were collected by use of digital questionnaires (Kobo collect and Open Data Kit –ODK Collect) Statistical Package for Social Science (SPSS) was used in data analysis. The data base from KOBO-ODK was translated into SPSS. Frequencies and crosstabs were developed to produce tables that were interpreted during the report writing. In addition, Microsoft Excel was used to prepare tables and graphs.Handwritten notes from FGDs, and KIIs were documented covering a range of information including but not limited to; causal and structured observations, verbatim quotes, paraphrases of participants' responses, interview and focus group backup documentation, questions, conclusions and observations discussed during debriefing sessions. These notes were written on standardized forms, the interview, Case studies or focus group questions guides or field notebooks, according to the situation.

Data quality assurance

Data collection activities were monitored to ensure the accuracy and reliability data. Enumerators were trained on field data collection tools and practices. The collected data have been analyzed to identify trends, patterns, and insights related to the usage, energy consumption, and environmental impact of mobile air conditioning in Rwanda.

RESEARCH FINDINGS

1.1.Importers, distributors and big users of refrigerants and refrigeration equipment

The first specific objective of the survey was to identify the importers, distributors and big users of refrigerants and refrigeration equipment and determine the quantities of each institution or person. The survey results

indicated that the main importers of above mentioned chemicals are:ABG (Akagera Business Group), Hotpot,PAF(Papeterie at Article du Froid),Cooling Air,Cold Air , Akolife,Novitas Tech Ltd,GM (General Mecanical), Asiimwe Cooling System Ltd, EDITEC.Alpha Air-Conditioning and Refrigeration Eng. Co. Ltd,ECOLSYSTEL LTD Alien Technologies,Air Familly and Air Zero. The refrigerants imports has been diminished over the years from 294.95 to 126.08 mt 2016-2022 respectively.Alpha Air-Conditioning and Refrigeration Eng. Co. Ltd is the main importer with higher quantity in mt of 119.4 followed byPAF(Papeterie at Article du Froid) with 115.2,ECOLSYSTEL LTD with 110.08,Akolife 106.18, , Hotpot 104.9 and Novitas Tech Ltd 104.03.

Table 1: List of importers and distributors of refrigerants 2016-2022

Nº	**Importer Name**	**Imports in (mt)**							
		2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**Total**
1	ABG(Akagera Business Group)	25.78	15.6	25.3	0	11.1	0	0	77.78
2	Hotpot	16.7	15.2	9.5	24.5	22.5	0	16.5	104.9
3	PAF(Papeterie at Article du Froid	23.71	16.7	8.17	18.42	19.2	16.5	12.5	115.2
4	Cooling Air	23.8	18.4	10.6	11.2	6.92	6.5	0	77.42
5	Cold Air	27.62	16.2	13.6	16.4	12.3	0	9.16	95.28
6	Akolife	19.25	17.6	16.9	16.91	15	12.5	8.02	106.18
7	Novitas Tech Ltd	21.3	17.03	13.5	20.5	19.2	0	12.5	104.03
8	GM (General Mecanical)	21.87	19.5	18.5	22.5	10.23	9.4	3	105
9	Asiimwe Cooling System Ltd	0	17.5	15.6	0	21.5	19.5	0	74.1
10	EDITEC	15.6	15.1	20.6	19.5	15.6	12.9	0	99.3
11	Alpha Air-Conditioning and Refrigeration Eng. Co. Ltd	36.7	20.5	15.4	0	17.8	16.5	12.5	119.4
12	ECOLSYSTEL LTD	20.16	18.2	16.5	20	0	19.62	15.6	110.08
13	Alien Technologies	17.36	12.5	0	21.2	12.5	20.6	11.6	95.76
14	Air Familly	16.2	12.3	8.9	8.2	8	15.5	12.5	81.6
15	Air Zero	8.9	8.7	6.3	0	6.1	21.2	15.2	66.4
	Total	**294.9**	**241.0**	**199.4**	**199.3**	**186.9**	**170.7**	**126.1**	**1432.4**

Source: ODS Survey, 2023.

1.2.The refrigeration and air-conditioning equipment in Rwanda

The important number of the RAC equipment is found in the Residential Refrigeration sub-sector especially in Household fridges, freezers and Water-coolers followed byVehicle Air-Conditioning sub-sector. The vehicle air conditioning includes refrigerated trucks and mobile air-conditioning units. The commercial sub-sector has smaller number of equipment, but most of the units have large charge capacity as compared to the domestic ones. Bigger numbers of HFCs are used in the commercial sub-sector than the domestic and transport sub-sectors.

Table 2: Refrigeration and air-conditioning equipment in Rwanda

Sector		**Approx. number of RAC equipment**								
		R134a	**R404A**	**R407A**	**R407C**	**R410A**	**R507A**	**R290**	**R600a**	**R22**
Residential Refrigeration	Household fridges	1,650,000						15,000	70,000	
	Household freezers	50,000						20	1000	
	Water-coolers	42,849						0	0	
Residential Air-Conditioning units						1,433				50,000
Vehicle Air-Conditioning		870,000								
Commercial Air-Conditioning					2,945	4,820				17,655
Chillers		220				1,130				2,549
Commercial Refrigeration	Stand-alone systems	52,845	2,913	1,250	1,030			85		12,765
	Condensing units	41,540	1,370	850	788		107	55		18,545
	Centralized systems	34,612	710					63		8,770
Transport Refrigeration			205							2100
Mobile Air Conditioning -MAC		526				620				
Total		**2,742,108**	**5,309**	**2,100**	**4,763**	**7,421**	**107**	**15,223**	**71,000**	**115,539**

Source: RAC Survey, 2023.

1.3. RAC Servicing Technicians

The survey results indicate that Rwanda has about 323 formal (registered) and 138 informal (unregistered) technicians. A big number of 240 RAC Technicians work in Unitary Air conditioners and Domestic Refrigeration, 120 work in Mobile air conditioning, 55 in transport refrigeration while 46 work in commercial and industrial refrigeration. The data findings shows clearly that only 24 women among 461 technicians are work in RAC Sector, 5% of women participation. The informal technicians' service is observed in all RAC sector but most of them are working in Mobile Air Conditioning and transport refrigeration.

Table 3: Number of technicians working in the RAC sector by Gender

Type of Equipment Served	**Number of Technicians**		**Total Number of technicians**	**% of women participation in RAC Sector**
	Formal/registered	**Informal/unregistered**		
Unitary Air conditioners/ Domestic Refrigeration	F*: 15 M*:195 T*: 210	F: 5 M: 25 T:30	240	8%
Mobile Air conditioners	F: 3 M: 60 T: 63	F: 1 M:56 T:57	120	3.3%
Transport refrigeration	F: 0 M: 20 T: 20	F: 0 M:35 T: 35	55	0%
Commercial and Industrial Refrigeration	F: 0 M: 30 T: 30	F: 0 M: 16 T: 16	46	0%
Total	**F:18 M:305 T:323**	**F:6 M:132 T:138**	**461**	**5.%**
F*: Female M*:Male T*: Total				

Source: RAC Survey, 2024.

Rwanda has one RAC Association which is: Rwanda Heating Ventilation Air conditioning and Refrigeration Cooperation Technicians and Engineers Association registered at National level. The member of the registered association have received a number of capacity building trainings aiming at reducing HCFC gases which depletes Ozone layer. The trainings were coordinated by the associations in collaboration with the NOU. Only 28 percent of the RAC technicians have been trained, there is a need to train the remaining 72 percent of the RAC technicians.

1.4. RAC training institutes in Rwanda

Rwanda has three vocational training schools namely; IPRC Kigali, which trains about 12 RAC technicians annually, The Kigali Technical Training Centre (Centre of Excellence) with 68. These trainings institutes have 7 trainers in total. RAC technicians follow the training curriculum in the vocational training schools which don't have adequate content of good refrigeration best practices, hence there is a need to build capacity of the graduate trainees and also mainstreaming good refrigeration practices in the new training program (curriculum). The refrigeration and Air Conditioning Servicing Sector need advanced knowledge and skills to tackle on innovation technological changes in RAC Sector.

Table 4: RAC training institutes in Rwanda

Class	Name of Institute	City	Types of courses for RAC (short course/ certificate, degree/diploma)	Average Number of graduates annually	Number of trainers
Technical University	IPRC	Kigali	Higher National Diploma	15	4
	Kigali Technical Training Centre (Centre of Excellence)	Kigali	Certificate 2	68	3
Total				**83**	**7**

Source: ODS-HFC survey 2023.

Basing on the increased population of RAC technicians and the increased usage of low GWP technologies, there is a need for more RAC trainings and provision of additional equipment to the RAC Training Canters and further capacity building of trainers to equip with innovation RAC technology best practices. Equally, capacity building of the business owners is required including registration of non-registered RAC Technicians to work and operates in formal way. The new business model to stimulate engagement of private sector is needed by promoting gender in the RAC Sector.

CONCLUSION

The data presented in this report was sampled from all the 30 districts across the country and were supplemented by the data provided by the REMA. Kigali city and secondary towns of Rwanda were given much attention due to the high number of industries and commercial buildings with cooling systems.The ODS and ODS Alternatives survey was carried out in line with the guidelines developed by the MLF. Measures were put in place to collect data as accurately as could be reasonably achieved. The survey results show that the level of consumption of ODS alternatives is increasing indicating that the Rwandan refrigeration sector is shifting to the use of the ozone and climate friendly substances. The increase in the use of some ODS alternatives in the years 2012 to 2015 can be attributed to the banning of use of CFC by 2010 and implementation of the HPMP including the banning of the importation of HCFC dependent equipment in 2014.The shift to ODS alternatives has encountered challenges due to safety concerns such as flammability in case of R600a. Other challenges include, cost of change of technology and high cost of ODS alternatives.The country has already regulations in place to control the use of ODS and the promotion of the use of the alternatives. However, there is need to review current ODS regulations to include climate change aspects in relation to the use of ODS alternatives. As an opportunity, the country has the expertise to implement the phase out programs and to promote the use of ODS alternatives. The survey also revealed that the trend of the use of controlled substances such as R22 is decreasing giving relief to Rwanda that we are meeting the provisions of the Montreal Protocol.

RECOMMENDATIONS

Based on the findings from the survey, it is recommended that:

1) The National Ozone Office (NOU) should continue engaging with importers of refrigeration appliances and refrigerants as well as the public to ensure that they are aware of the phase-down of HFCs in the country.

2) Government should put in place strategies that would promote quick uptake of Low GWP and energy efficient technologies in the country.

3) Capacity of enforcement officers should be strengthened through provision of tailor made trainings on HFCs and identification tool kits. Customs Officers should be oriented on the existing legislations on the management of controlled substances under the Montreal Protocol. Additionally, issues of HFCs should be mainstreamed in the training curricula of customs officers for sustainability of the program. It is further recommended that the cooperation between NOU, Customs Department and other enforcement officials should be strengthened in order to prevent illegal trade of controlled substances.

4) Capacity of servicing sector should be strengthened through mainstreaming on good refrigeration practices in the school curriculum, trainings and provision of necessary servicing tool kits. Furthermore, the refrigeration and air conditioning servicing companies/ workshops should be encouraged to fully implement good refrigeration practices in the country.

5) Considering that most of the servicing technicians have limited servicing tool kits, it is recommended that additional servicing tool kits should be procured to be distributed to the centres of excellence. The NOU should ensure that more publicity is done to make sure that the servicing tool kits are accessed by the technicians.

6) The NOU should continue collaborating with MBS to ensure timely approval of the certification standards and MEPS. Enforcement officers should be oriented on these standards for effective implementation.

7) It is also recommended that the Multilateral Fund increases funding to Rwanda to enable the country carry out more trainings on the safe use of ODS alternative substances and equipment.

8) Regarding the certification processes, Customs should organize trainings with well-developed training manuals and invite REMA, the National Ozone Unit committee the stakeholders to attend training sessions.Training and coaching campaigns should be extended to the user of RAC.

9) Reference to the Art. No21 of the Ministerial Order No 004/2021 of 12/02/2021: Governing the use of substances that deplete the ozone layer or may cause climate change. We recommend, to set the updated acceptable standards on ODS to be enforced with REMA, RBS and RICA and other partners in achieving the formulated phase down strategy as well as develop manual(or guidelines) showing the process of controlling ODS imports.

10) REMA should finalize the ongoing draft concept note on ODS certification process to be harmonised with RSB and RICA

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LIST OF ACRONYMS

CFCs	Chlorofluorocarbons
GWP	Global-warming potential
HCFC	Hydrofluorocarbons Substances
HPMP	Hydrochlorofluorocarbons Phase-out Management Plan
MAC	Mobile and Air Conditioning
MoE	Ministry of Environment
NISR	National Institute of Statistics of Rwanda
RAC	Refrigeration and Air-Conditioning
REMA	Rwanda Environment Management Authority
ODS	Ozone Depleting Substances
ODS	Ozone Depleting Products
UN	United Nations
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation