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Environment  
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Better Future

**KIGALI IMPLEMENTATION PLAN  
NATIONAL SURVEY REPORT- SIERRA LEONE  
(Final Report)**

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Sierra Leone.

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## LIST OF ACRONYMS AND ABBREVIATIONS

AC	Air Conditioning
CO <sub>2</sub>	Carbon Dioxide
CO <sub>2eq</sub>	Carbon Dioxide Equivalent
COP	Coefficient of Performance
COMREF	Commercial Refrigeration
COVID	Corona Virus
DOMREF	Domestic Refrigeration
EER	Energy Efficiency Ratio
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH,
GoSL	Government of Sierra Leone
GWP	Global Warming Potential
HC	Hydrocarbons
HFC	Hydrofluorocarbon
HCFCs	Hydrochlorofluorocarbons
HPMP	Hydrochlorofluorocarbon Phase-out Management Plan
IMS	Information Management System
INDSREF	Industrial Refrigeration
KIP	Kigali Implementation Plan
KW	Kilowatts
KWH/Y	Kilowatts hour per Year
Kg	Kilograms
NBS	National Bureau of Statistics
NRA	National Revenue Authority
NOU	National Ozone Unit
MAC	Mobile Air Condition
MLF	Multilateral Fund
MT	Metric Tonnes
MTCO <sub>2eq.</sub>	Metric Tonnes Carbon Dioxide Equivalent

ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
PUF	Polyurethane Foam
RAC	Refrigeration and Air-Conditioning
REF	Refrigerator
RSS	Refrigerator Servicing Sector
RRR	Recycling, Recovery, and Reclamation
SFA	Sierra Leone Fisheries Authority
SEC	Sierra Leone Energy Commission
SIT	Sierra Leone Institute of Technology
SLA	Sierra Leone Licensing Authority
SRC	Sierra Leone Revenue Commission
TRANSREF	Transport Refrigeration
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United State Dollars
VRF	Variable Refrigerant Flow
VRV	Variable Refrigerant Volume

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## EXECUTIVE SUMMARY

The survey report and its accompanying analysis outline the primary discoveries and action resulting from the survey on the utilization of Hydrofluorocarbons (HFCs) in the Refrigeration and Air Conditioning (RAC) sector and other related sectors in Sierra Leone. The survey encompassed a diverse array of sectors such as; RAC end-users and sales, RAC servicing companies, RAC associations, RAC training institutions across the country, standards and refrigerant prices etc. A pre-tested questionnaire, desktop review of existing data were utilised for data gathering, and enumerators were trained for data collection using the questionnaire. In addition, there was an inception meeting during which stakeholders were informed about the survey exercise.

### HFC consumption and sector distribution

In 2022, data collected indicate that Mobile AC use is responsible for nearly 43.69% of all HFC used in the country. Domestic AC has a share of 30.69% followed by Commercial and Industrial refrigeration, Domestic refrigeration, Commercial AC, Transport refrigeration and Marine refrigeration at 16.90%, 4.38%, 2.19%, 1.12% and 1.02% respectively.

It was also established that, the HFCs and HFCs blends consumed between the timeframe 2016-2022 were R32, R404A, R410A, R134a, R407A, R407C, R507A and R508B. R134a was the largest consumed refrigerant recorded at 85.73MT in 2022. R410A, R404A, R407A, R507A, R32, R407C and R508B consumptions were 21.70MT, 16.72MT, 15.85MT, 8.59MT, 10.48MT, 9.61MT and 7.24MT respectively.

### HFC Baseline

*The country's HFC baseline is estimated at 351,294.13 TCO<sub>2</sub>eq.*

### HFC use expected to grow under BAU (2022) in Metric Tonnes

The analysis examined the consumption patterns of several key refrigerants, shedding light on their individual trajectories over the years.

- i. **R507A:** Consumption of R507A remained relatively low and stable for several years before a gradual increase from 2020 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted.
- ii. **R410a:** R410A remained relatively low and stable for several years before a gradual increase from 2021 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted
- iii. **R134A:** This refrigerant experienced steady growth from 2016 to 2022, followed by a gradual decline. R-134A is commonly used in automotive air conditioning systems, and its decline may be linked to regulatory transitions towards more climate-friendly alternatives.

- iv. **R32:** The consumption of R32 declined in 2020, then experienced growth from 2022. Its adoption might be driven by its low global warming potential (GWP) compared to some other HFCs, making it a preferable choice for various applications.
- v. **R404A:** R404A consumption exhibited notable fluctuations over the years. It saw a peak in 2021 and then underwent periodic declines and rebounds. The varying usage may reflect the challenges in transitioning away from high-GWP refrigerants in certain applications.
- vi. **R407A and R407C:** These refrigerants displayed usage patterns characterized by modest consumption levels, with minor fluctuations. Their usage could be associated with specific niche applications or regions with differing regulatory landscapes.
- vii. **R508B:** Consumption of R508B remained relatively low for several years before a gradual increase from 2020 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted.

### **Comparison between HFC consumption under BAU and Kigali phase down Schedule**

The analysis reveals a substantial contrast between Hydrofluorocarbon (HFC) consumption under Business-as-Usual (BAU) conditions and the phase-down schedule outlined in the Kigali Amendment. This contrast is particularly evident due to the significant increase in HFC usage projected under BAU, in comparison to the controlled reduction proposed by the Kigali Amendment. This situation requires drastic measures to bring down HFC usage within acceptable levels in order to achieve the targets proposed by the Kigali Amendment. Under the BAU scenario presented in Figure 8, HFC consumption experiences consistent growth, resulting in a substantial increase in the utilization of these compounds. By 2050, HFC consumption is projected to reach 2,234,814.63 TCO<sub>2</sub> equivalent (CO<sub>2</sub>eq).

The Kigali Amendment provides a structured approach to reduce HFC consumption. The Kigali Amendment establishes a cap for HFC consumption at 351,294.00 TCO<sub>2</sub>eq by 2024 but HFC consumption is expected to decrease to 245,906.00 TCO<sub>2</sub>eq by 2036, while the BAU projection for the same year stands at 1,308,803.30 TCO<sub>2</sub>eq. By 2050, the Kigali Amendment envisions a further reduction in HFC consumption to 70,259.00 TCO<sub>2</sub>eq, in contrast to the BAU projection of 2,234,814.63 TCO<sub>2</sub>eq.

### **Other relevant information**

In addition the following data were gathered from the survey.

- i. **Refrigerant Technicians:** it was estimated that there are about 2,408 technicians across the country in 2022.
- ii. **Customs and Enforcement:** The customs division of Sierra Leone plays a significant role in regulating and overseeing the importation of controlled substances, particularly in the context of the Montreal Protocol. The survey established that over the last two decades, more than 280 customs officers have been trained on the Montreal Protocol; 200 were males and 80 were females.

## **1.0 INTRODUCTION**

The Kigali Amendment establishes specific targets and timelines to phase-down the production and consumption of Hydrofluorocarbons (HFCs). Developed countries are mandated to finance through annual contributions for the transition by assisting developing countries to alternative climate-friendly technologies, through a global commitment that will avoid more than 80 billion metric tons of carbon dioxide equivalent emissions by 2050.

In developing countries and emerging economies, the demand for cooling equipment is rising. On the other hand, low levels of efficiency and high leakage rates of refrigerant gases with high GWP will increase these emissions and energy consumption drastically in these economies.

As part of the preparation for Sierra Leone's HFC phase-down plan, data were gathered on all other relevant areas in relation to the KIP Country profile, Customs involvement with the HPMP, RAC Standards, RAC servicing companies, RAC associations, RAC training institutions across the country and standards.

The scope of work for this report is to gather data on the RAC sector and other related areas to enable the preparation of the Kigali Implementation Plan (KIP) and its related activities.

### **1.1 Country Profile**

#### **1.1.1 Geographical location of Sierra Leone and Population**

Sierra Leone is a country on the Atlantic coast of West Africa. The land has a total area of 72,300 km<sup>2</sup> (27,915 mi<sup>2</sup>) and a total coastline of 402 km (249.8 mi). This land area is approximately 91% of the area of Maine. Sierra Leone is thus, the 19th smallest country in Africa and ranked 120th in the world. Only slightly less than half of all residents (44%) live within cities.

Sierra Leone is comparatively low at an average elevation of 279 meters above sea level. There are direct national borders with the two neighboring countries Guinea and Liberia. [1].

Sierra Leone is rich in natural resources, including diamonds, iron ore, gold, titanium ore, bauxite, chromite and fisheries resources.

The administrative regions in Sierra Leone, as of 2021 and their respective populations are shown in Table 1.

Table 1: Administrative regions in Sierra Leone and their respective populations

No.	District	Province	Capital	Area km <sup>2</sup> (2021)	Population census (2021)
1	<u>Kailahun</u>	<u>Eastern</u>	<u>Kailahun</u>	3,940	550,435
2	<u>Kenema</u>	<u>Eastern</u>	<u>Kenema</u>	6,345	772,472
3	<u>Kono</u>	<u>Eastern</u>	<u>Koidu Town</u>	5,391	620,703
4	<u>Bombali</u>	<u>Northern</u>	<u>Makeni</u>	3,876	387,236
5	<u>Falaba</u>	<u>Northern</u>	<u>Bendugu</u>	7,423	166,205
6	<u>Koinadugu</u>	<u>Northern</u>	<u>Kabala</u>	4,951	206,133
7	<u>Tonkolili</u>	<u>Northern</u>	<u>Magburaka</u>	6,288	557,257
8	<u>Kambia</u>	<u>North West</u>	<u>Kambia</u>	3,031	367,699
9	<u>Karene</u>	<u>North West</u>	<u>Kamakwie</u>	5,828	290,313
10	<u>Port Loko</u>	<u>North West</u>	<u>Port Loko</u>	4,668	528,038
11	<u>Bo</u>	<u>Southern</u>	<u>Bo</u>	5,463	756,975
12	<u>Bonthe</u>	<u>Southern</u>	<u>Bonthe</u>	3,547	297,561
13	<u>Moyamba</u>	<u>Southern</u>	<u>Moyamba</u>	7,012	346,771
14	<u>Pujehun</u>	<u>Southern</u>	<u>Pujehun</u>	4,179	429,574
15	<u>Western Rural</u>	<u>Western</u>	<u>Waterloo</u>	613.8	662,156
16	<u>Western Urban</u>	<u>Western</u>	<u>Freetown</u>	82.35	609,174



Figure 1: Map of Sierra Leone

### **1.1.2 Economy**

The GDP of the country in 2022 was \$3,970 million and this grew 3.5% in 2022 compared to last year. This rate is 6 -tenths of one percent less than the figure of 4.1% published in 2021[2].The absolute value of GDP in Sierra Leone rose \$178 million with respect to 2021.

As of 2022 the population of Sierra Leone was 8,376,000[3].

### **1.1.3 Power generation capacity**

Sierra Leone's power sector is less than 150 MW of operational capacity and roughly 150,000 connected customers [4]. The biggest grids are: the 161kv line that extends to Freetown and the surrounding Western Area, covering about 40% of their residents. The Bumbuna hydro power plant situated approximately 220km from Freetown, and the Kawpower ship along with thermal plants and mini Hydro provides power to the city. The Makeni grid, providing electricity to the Makeni City with Port Loko District having its own power source which is both thermal and hydro.

The 33kv electricity line, or Bo-Kenema, which provides electricity to the towns Bo and Kenema, the capitals of Bo and Kenema Districts in the southeast of the country. The costs for electricity are highly subsidised by the Government and rate approximately 1000 Leones (0.13 €) per kWh for private households and up to 0.23 €/kWh for industry.

### **1.1.4 Training Structure in Sierra Leone**

In Sierra Leone, before one can practice as a RAC technician, the person needs to obtain any of the following level of certification in RAC;

- i. National Technical Certificate I (2years)
- ii. National Diploma (3 years)
- iii. Higher National Diploma (Refrigeration and Air conditioning option)(5 years)

## **1.2Key Stakeholders and Institutional Arrangements**

The major key stakeholders in the HFC survey are the importers, wholesalers and distributors, manufacturing companies, users such as RAC technicians and owners of appliances. These provide information on quantities imported or used. Enforcement authorities such as: NRA Customs Officers, Environmental Officers, the Police, Law Officers and local authority inspectors work closely with the Government to enforce provisions of the regulations and these provided information on enforcement mechanisms. All these organization are represented in the National Ozone Steering Committee which advises Government in formulating and implementing policies as well as creating and enforcing regulations to prohibit, control and monitor the imports, use, disposal and export of HFC.

Shown in Table 2 are the key stakeholders and their roles

Table 2: The key stakeholders and their roles

Key Stakeholder	Role
<b>National Ozone Unit</b>	Hiring of a consultant, organizing Inception Workshops, designing and conducting training of the questionnaires, administrators, desk study, monitoring and supervising data collection, editing, approving and submission of Final Report.
<b>National Revenue Authority CUSTOMS department</b>	Providing data on imports
<b>Statistics Sierra Leone</b>	Statistical Data on imports
<b>Refrigeration Engineers and Technicians Association</b>	Assist in the data collection
<b>Importers</b>	Data on imports
<b>Manufacturing companies</b>	Data on ODS alternatives used in manufacturing
<b>ODS Alternative users</b>	Providing data on uses of ODS Alternatives
<b>National Consultant</b>	Facilitate data collection, collecting and producing a draft report

The National Ozone Unit (NOU) is a unit within the Division of Chemicals control and Management in the Directorate of Environmental Health and Safety in the Environment Protection Agency under the Ministry of Environment and Climate Change, reporting to the Executive Chairman who is the head of the Agency. This is schematically illustrated in Figure 2.

The NOU is headed by the Ozone Project Manager. A Project Assistant helps the Project Manager with administrative duties. The Officers are paid from the Institutional Strengthening Project which is funded by the Multilateral Fund through the United Nations Environment Programme Compliance Assistance Programme. The Government provides office space and furniture as well as other logistical support. The Project Manager is responsible for interacting with internal and external stakeholders on matters relating to ODS phase out/HFC phase down, such as drafting of project proposals, data reporting, training of refrigeration technicians and customs officers, enforcement of regulations, enunciation of policy, publicity and awareness raising.

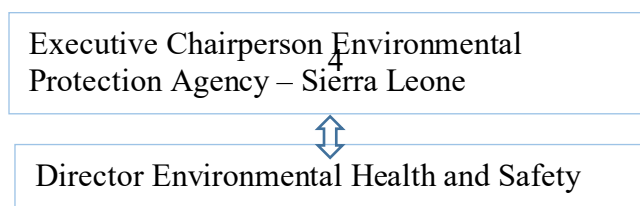


Figure 2: Schematic representation of the Institutional arrangements

### **1.3 Policy and Regulatory Frameworks**

Part VII of Environment Protection Agency Act 2022, addresses ozone issues targeting banned and controlled ozone depleting substances. In 2010 the Agency also developed ODS regulation targeting specifically the prohibition of the importation of refrigerators, air conditioning containing controlled substances, importation of second handed equipment containing banned or controlled substances. Also the Act stipulates provisions for the registration and certification of servicing workshops, establishment of certification scheme for technicians, establishment of an import /export licensing system

Although the ODS regulation of 2010 did not control the imports and exports of alternatives such as HFCs, ammonia, carbon dioxide and hydrocarbons, licensed importers were requested to supply the information to the National Ozone Office on a voluntary basis from January 2016 when applying for their import and export quotas for ODS.

There has been an enormous cooperation from stakeholders and this cooperation has been very useful in the current survey.

Colossal public awareness programmes have been initiated to discourage the sale of flammable HC refrigerants by wholesalers to untrained and uncertified technicians as well as discouraging owners of

RAC appliances to seek the services of untrained and uncertified technicians. Shown in Table 3 is the existing policy framework and controls of the country.

Table 3: Existing Policies, Legislations and Regulations

Type of Action/Legislation	Ongoing Yes/No	Since when	If No, provide comment or when expected
<b>Environment Protection Agency Act this Act has been repealed and replaced by the EPA Act 2022</b>	Yes	2008	
<b>Prohibition of ODS Regulations</b>	Yes	2010	
<b>Certification of RAC practitioners</b>	Yes	October 2016	
<b>Training on conversion from ODS to ODS Alternatives</b>	Yes	2012	
<b>Climate Change Policy; incorporating HFCs into NDCs</b>			2018

The Kigali Amendment to the Montreal Protocol was ratified in 2020.

The country has also, signed and ratified the Vienna Convention for the protection of the ozone layer, the Montreal Protocol on the phase out of the ozone depleting substances (ODS) and those of the London Copenhagen, Montreal and Beijing amendments in 2001.

Sierra Leone being party to the Montreal Protocol committed and aligned itself with other nations in phasing out the consumption of the controlled ODS under the Montreal Protocol phase out targets.

In this regard the National Ozone Unit (NOU) was established under the Environment Protection – Sierra Leone (EPA-SL) to coordinate the activities on the phasing out consumption of the ODS in the country. In 2008, the Government of Sierra Leone passed an Act in Parliament for the establishment of the Environment Protection Agency and for the protection of the environment and this 2008 EPA Act has been repealed and replaced with the EPA Act 2022. Part VII of that 2022 Act addresses ozone issues targeting banned and controlled ozone depleting substances. To accelerate the implementation of the Montreal Protocol and the Environment Protection Agency Act of 2008 as amended in 2010 and the new 2022 Act, the NOU developed an Ozone Depleting Substances regulation of 2010 and came into force in 2011.

The regulation of 2010 targets specifically the prohibition of the importation of refrigerators, air conditioning containing controlled substances, importation of second handed equipment containing banned or controlled substances as stipulated in the Part V of the EPA Act ,2008 and Part VII of

the EPA Act, 2022 , registration and certification of servicing workshops, establishment of certification scheme for technicians, establishment of an import /export licensing system etc. The private sector is also regulated through the acquisition of an environmental permit from EPA-SL wherein they are expected to report on a quarterly basis ozone protection. The NOU is also obliged to undertake any assessment of the phase-out programme and encourage stakeholders to switch to ODS alternatives. The Finance Act of 2014 requires importers and exporters to declare as required by law all products for onward inspection at all border crossing points. Similarly the Sierra Leone Customs Acts 2011 discourage the issue of smuggling of goods in and out of the country through the institution of strictly penalty

Shown in Table 4 are the list of International Agreements and Conventions ratified by the country.

Table 4: List of International Agreements and Conventions Ratified by Sierra Leone

Convention/Amendments	Ratification/Accession/Acceptance/Approval
<b>Vienna Convention</b>	29/08/2001 (Accession)
<b>Montreal Protocol</b>	29/08/2001 (Accession)
<b>London Amendment</b>	29/08/2001 (Accession)
<b>Copenhagen Amendment</b>	29/08/2001 (Accession)
<b>Montreal Amendment</b>	29/08/2001 (Accession)
<b>Beijing Amendment</b>	29/08/2001 (Accession)
<b>Kigali Amendment</b>	20/06/2020 (Accession)

## **2.0 HFC USE OVERVIEW AND DATA COLLECTION**

### **2.1 HFC Use Overview**

#### **2.1.1 Sierra Leone RAC Sector Overview**

##### **Domestic Refrigeration**

R134a is the most commonly used refrigerant replacing R22, which is used in servicing of most standalone units such as fridges and freezers. The increase in usage of this refrigerant has been as result of its readily availability and low cost in the country.

The use of R600a in domestic refrigeration is slowly gaining prominence in the servicing sector of domestic refrigeration appliances and most imported domestic fridges now are charged with R600a. In 2015, 2.3 MT of R600a was imported into the country and this is expected to rise in the coming years as the shift to HC refrigerants is now gaining momentum. The country is promoting the use of Hydrocarbon refrigerants and most technicians have been trained in the servicing of HC based equipment and good refrigeration practices. In the HPMP programme for Sierra Leone 15 small cylinders of R600a were distributed to technicians as a motivation. This has ensued in wide adoption of R600a in domestic refrigeration. The influx of the local market with imported R-600a units has caused a sharp increase in the imports of this refrigerant, which has a zero ODP and very low GWP. It has been proven that R600a refrigerants very economical in terms of charge and energy efficient. Its Energy Efficiency makes it favourable as it consumes about 10% less energy compared to ozone depleting refrigerants such as R12.

There are several challenges relating to the use of HC, which includes its flammability. The country has intensified training and awareness programmes. Wholesalers and distributors have also been trained on storage and handling as well as making sure that the refrigerant is sold to trained technicians only.

##### **Commercial Refrigeration**

The commercial refrigeration sector in Sierra Leone uses a number of ODS alternative refrigerants namely R134a, R404A, R407C R 410, 507A, R717, and R744. R400 series and R 507A are used servicing of commercial refrigeration appliances such as cold rooms, chillers and freezers. The use of these refrigerants in the servicing of commercial refrigeration appliances is also on the increase and is expected to increase sharply until a more suitable replacement for R22 is found.

The hospitality industry uses R717 refrigerant in appliances such as under bar fridges. The challenges in the adoption of ammonia are its toxicity and incompatibility with system components. Technicians need to be trained on proper use of the refrigerant.

R744 is finding its way in supermarkets where it is used in small chillers. The brewery industry and most major retail shops and supermarkets are making use of R744 based chillers.

##### **Industrial Refrigeration**

R407C and R717 are the predominant refrigerants used in industrial refrigeration. R407C is used as a refrigerant in industrial processing plants. R407C is used mainly in air driers to cool the air before the production process, as the air has to be free of moisture to avoid corroding the production piping. R717 is used in dairy and fish processing industries for cooling the production processes and also for preserving the processed products in the blast freezer rooms.

R717 is also used for servicing industrial refrigeration appliances in the food processing and storage industries such as the dairy companies, fish and meat processing companies.

### **Transport Refrigeration**

The most predominantly used refrigerants in the transportation sector are R134a and R404A and Sierra Leone is not manufacturing any of these refrigerants. The refrigerants are used for servicing purposes only.

### **Stationary Air Conditioning**

R410A AC appliances have significantly penetrated the market as R22 is being phased out. No new installations of R22 are allowed. The use of R410A in domestic, commercial and industrial AC is expected to increase sharply until suitable alternatives are introduced. R407C is used in air conditioning as a replacement for R22. It is used mostly in split units. The refrigerant is not readily available on the local market and this has limited its widespread use.

Most air conditioners being imported into the country ranging from 9000 to 72000 BTUs come pre-charged with R410A. The price of R410A is still high on the local market as compared to R22.

### **Mobile Air Conditioning**

In the mobile air conditioning sector, the commonly used ODS alternative is R134a. In the cars and small vans subsector, the use has a steady increase the years 2012 and 2015. In the large vehicle sub sector refrigerant 407C is the most predominant followed by R134a which also is indicating an increase in consumption due to more vehicles being imported in the country to bust the agriculture and fisheries sectors

In MAC units, the major refrigerant that is in use for servicing is R134a in smaller to medium sized vehicles. R134a is widely used in servicing Mobile Air Conditioning units. Nearly all used motor vehicles imported into the country are fitted with AC units that come along charged with R134a.

#### **2.1.2 Fire Suppression**

Water and carbon dioxide based chemicals are commonly used in fire suppression in the country systems. Most of the fire extinguishers imported are fitted carbon dioxide based chemicals that you can find in most public places, hospitals, government offices, banks etc.

#### **2.1.3 Aerosol, Solvent and Foam**

The utilization of solvents and aerosols is observed in Sierra Leone within various domains such as cosmetics, household cleaners, pesticides, and personal care items.

Cyclopentane is used as a foam-blowing agent in PUF foam manufacturing in the country polyurethane production in refrigeration appliances manufacturing sector. It came as a replacement for HCFC-141b in pre-blended polyols. In 2015, the year in which Cyclopentane was introduced, a total of 20MT was imported and used, this is expected to rise once the technology is fully adopted.

### **2.2 Data Collection Methodology**

Variation of methodologies were used for data collection during thenationwide survey over a period of twomonths due to the ongoing national electioneering process.

The content of this desk review was based on information collected through a systematic review of the available documents relevant to the survey, as well as from web research. A desk review was conducted by the NOU and the national consultant to identify key stakeholders and legislations relevant to the survey. The desk review also helped the unit to formulate the methodology for data collection. An inception workshop was organised drawing stakeholders across the five regions of country to inform stakeholders about the project and to determine the methodology in going about collecting the required data.

The NOU and the national consultant determined the sample size based on the population and geography of the country and adopted the questionnaire developed by the Compliance Assistance Programme of UNEP Ozone Action.

The population of this survey includes the main districts headquarter towns across the country. These include, residential homes, big business using refrigeration and air condition, government buildings, vehicles etc.

The questionnaires were distributed to identify key stakeholders that are dealing with ozone issues within the country. The questionnaires developed were used to collect data from the following sectors: refrigeration and air conditioning servicing; health; commercial and industrial sectors. The import data were sourced from the National Revenue Authority (Customs department), marine and the National Ozone Unit.

During the inception workshop, stakeholders who were identified as the potential respondents in the desk review were invited to make their inputs on how they are expecting the survey to be administered. The questionnaire was pilot tested and all unclear sections were revised.

The enumerators were selected from the list of trained and certified RAC technicians and were trained on data collection techniques. Each enumerator was given a covering letter that accompanied the questionnaires explaining why the respondents should provide the requested information as a means of giving confidence and credibility to the entire process. The respondents were guaranteed that the information collected would be handled confidentially.

The data collected were sent to the lead consultant for compilation, analysis and production of the National Survey Report using the template and data tables developed by the MLF and reviewed by CAP Regional Office for Africa.

Where the NOU detected some inconsistencies or where the data collected were not clear or insufficient, the technicians were asked to revisit the facilities to get the required data.

At the end of data collection, the NOU together with some technicians and the lead consultant undertook a five days data verification and upgrading exercise to enhance the total coverage with reference to the sample size that was selected.

**i. Questionnaire**

The KIP survey questionnaires are shown in Appendix B.

As per the KIP survey and reporting guidelines, the RAC equipment are defined as follows as shown in Table 5.

Table 5: RAC equipment sub sectors

Sub-sector		Equipment type
<b>Refrigeration (REF.)</b>	Domestic ref.	Fridge, Freezer & combined Fridge/Freezer, double doors
	Commercial & Industrial ref.	Stand-alone unit (display cabinet, dispenser unit)
		Condensing unit (cold stores, supermarkets, industry)
		Centralised system (cold storages, supermarkets)
		Process chiller
	Transport ref.	Refrigerator trucks/trailers
Marine ref.	Ashore-based ice plants & fishing vessels and ice making facilities	
		On-board cooling systems
<b>Air Conditioning (AC)</b>	Unitary AC (Stationary)	Self-contained (window) unit
		Single Split unit (non-ducted, ducted)
		Multi split (VRV/VRF)
		Rooftop packaged (ducted)
	Chiller	Comfort AC Chiller
	Mobile AC (MAC)	Small vehicle AC (Saloon car, light commercial)
Large vehicle AC (bus)		

**ii. Interviews:** Interviews were also other approach that was used to gather information from stakeholders.

**2.3 Sample Size Calculation**

The sample size formula is as follows:

Where

$$n = \frac{(z^2 * p * q) + (e^2)}{(e^2) + [(z^2 * p * q)/N]}$$

n is the sample size.

z is the selected critical value of the desired confidence level, which is associated with the level of confidence required for the estimate (often set at 1.96 for a 95% confidence level)

p is the estimated proportion of an attribute present in the population

q Represents the complement of p (i.e., q = 1-p)

e is the margin of error, which indicates the maximum allowed difference between the sample estimate and the true population proportion

N is the size of the finite population

The sample size for collecting end-user data was 3,699,304 covering all RAC sub-sectors. End-User Sample size was based on ground survey of the estimate number of building and facilities. Table 6 provides the end user sample size in the various sub sectors within the scope of this survey.

Table 6: Calculated Sample Size and Surveyed Equipment

Sub Sector		Estimate Stock RAC Equipment	Recorded Surveyed Equipment
Stationary AC	Single Split non ducted	665,451	499,088
	AC/ Chillers	99	74
Domestic Ref		2,668,753	2,001,565
Commercial/ Industrial Ref	Condensing Unit	163	122
	Centralized Systems		
Transport Ref	Truck Ref	65	49
Mobile AC	Small MAC	321,299	240,974
	Large MAC	43,475	32,606
Total		<b>3,699,304</b>	<b>2,774,478</b>

## 2.5. Data Collection Challenges

The following are the challenges faced during the data collection:

- i. The electioneering process repeatedly obstructed the schedule and movement for data collection across the country.
- ii. The heavy down pour of rains during which the survey was conducted was a great challenge.
- iii. The business people and some public institutions find it very difficult to release information concerning their business despite enumerators were given a letter of introduction.
- iv. Fragmented secondary data sources also limited the timely completion of the data gathering.
- v. Time and funds allocated for data gathering was limited.

## 2.6. Data Collection Team

The data collection team were made up of the following persons as indicated in Table 7.

Table 7: Tasks, Compositions, Roles, and Responsibilities of Personnel's

<b>Tasks</b>	<b>Compositions</b>	<b>Roles and Responsibilities</b>
<b>Enumerators</b>	RAC Technicians	To collect primary data from the field
<b>Data Collection Supervisors</b>	Regional Manager of the EPA-SL Regional Offices and Two Senior Staff at the EPA-SL Head Office	To compile completed data gathering tools for onward transmission to the lead consultant. To ensure enumerators gain access wherever they had some kind of restrictions. Also to provide the needed explanation as to why the data collection is important for national development.
<b>Data Collection coordinator</b>	Project Consultant	Coordinating and overseeing all data collection across the country.
<b>Data Analysis</b>	Project Consultant and Project deputy consultant	Master sheets data inputs, data sorted by RAC equipment sector.
<b>KIP Questionnaires and Survey guidelines, Expect technician</b>	International UNEP KIP Consultant	KIP Questionnaires, Survey guidelines, overseeing data collection, review of survey
<b>National Supervisors</b>	Senior Ozone Officer and the Principal Secretary	Assisting and supervising data, reviews
<b>Field Surveyor</b>	Project Consultant and Project assistance consultant	Data collection

## 2.7. Data Collection Source Identified

Information was gathered by distributing questionnaires to importers, distributors, end users, and relevant authorities such as the National Ozone Unit (NOU) and the Energy Commission. This data was then compiled and analysed to formulate an in-depth comprehension of the existing HFC (Hydrofluorocarbon) equipment in the country. The focus is on understanding the HFC-related necessities essential for addressing the maintenance and servicing demands of this equipment inventory shown in Table 8.

Table 8: Source of Data for RAC sector

<b>Description</b>	<b>Source of Data</b>
<b>Self-contained</b>	Large Hotels, commercial buildings with offices, hospitals, importers

<b>Single split, non-ducted</b>	Importers/wholesalers, Residential, Commercial Buildings, hotels, industrial, restaurants, schools, Import Data
<b>Single split ducted</b>	Commercial buildings, RAC Contractors
<b>Roof top ducted</b>	Large Hotels
<b>Multi-Split</b>	Large Hotels, Commercial buildings, hospitals
<b>AC Chiller</b>	Industrial cold storage, large hotels
<b>Domestic Refrigeration</b>	Residential, Importers, hotels, restaurants, supermarkets, Import Data
<b>Commercial/ Industrial Refrigeration</b>	Large Supermarkets, Cold Storages, Industrial level cold storages (fisheries sector), Sierra Leone Fishing Authority (SFA)
<b>Mobile air conditioners</b>	Vehicle Importers, Sierra Leone Licensing Authority (SLA), Vehicles workshops, RAC contractors
<b>Transport Refrigeration</b>	User Companies Wholesalers, SLA
<b>Marine Refrigeration</b>	Data of Fishing vessels was catered from SLA and SFA.
<b>Fire Suppression System</b>	SFRSA, firefighting contractors, hotels, telecommunication companies

## 2.8. Data Validation

The following approach were used to validate the data collected:

- i. A dedicated data validation exercise was conducted by a team comprising of a representative of the NOU, Lead Consultant, RAC Technicians that were not part of the data collectors and a civil society representative.
- ii. Cross reference with existing database sources was done for secondary data sources especially for the socioeconomic data and import data.
- iii. A national validation works was conducted.

### 3.0 DATA ANALYSIS HFC CONSUMPTION 2016-2022

#### 3.1. HFCs Consumption 2016-2022

Sierra Leone relies on the import of refrigerants to fulfil the servicing requirements of the RAC sector. Sierra Leone NOU documented the quantity of imports over the last seven (7) years spanning from 2016 to 2022. Table 9 displays a comprehensive outline of refrigerant imports throughout the past seven years.

Table 9: Refrigerant (HFC & HCFC) Consumption in Sierra Leone (2016-2022)

GWP	Refrigerant	Consumption (Metric Tons)						
		2016	2017	2018	2019	2020	2021	2022
675	R-32	0.00	0.00	0.00	0.00	0.00	0.00	10.50
1,430	R-134A	0.00	0.00	38.30	40.3	65.96	70.58	80.10
3,922	R-404A	0.00	10.30	12.30	12.00	14.65	17.58	21.78
2,107	R-407A	0.00	4.90	5.00	6.30	6.50	10.50	15.00
1,774	R-407C	6.10	3.20	4.40	5.70	5.10	7.16	8.00
2,088	R-410A	0.00	7.40	7.90	8.90	14.50	18.34	19.15
3,985	R-507A	0.00	0.00	0.00	0.00	6.23	7.23	10.80
0	R-290 (propane)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	R-600A (isobutene)	0.00	0.00	0.00	4.50	0.00	0.00	0.00
1,810	R-22	11.00	10.35	10.28	10.25	10.24	10.21	10.19
3,220	R-227ea (FM200)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	R-1233ZD	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6,808	R508B	0.00	0.00	0.00	0.20	3.05	5.20	7.50
0	R717 (Ammonia)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#### Key findings from the analysis in Table 9 are as follows:

- i. **R32:** As one of the newer refrigerants to be introduced into the country, its prevalence has been observed in commercial air conditioning. Over the last seven (7) years its average consumption stands at 10.50MT. This is still relatively low compared to the refrigerant it is gradually replacing, R410A. However, from RAC equipment import data, shows that its usage will continue to increase over the next few years.
- ii. **R134a:** As the most consumed refrigerant in the country, first highest (1<sup>st</sup>). Its consumption has steadily increased as the number of imported equipment has also increased. Its uses is almost in domestic refrigeration systems prevalence in residential and commercial facilities and almost all vehicles as mobile air conditioning. The refrigerant usage in 2022 was 80.10MT.
- iii. **R404A:** The consumption of R404A, is the second (2<sup>nd</sup>) highest consumed refrigerant in 2022. It reached its highest point in 2022, with 21.78MT.
- iv. **R407A, R407C:** These refrigerants were also consumed in relative high quantities compared to others. R407A consumption increased from 10.50MT in 2021 to 15.00MT in

2022. Whereas, R407C consumption remained relatively stable, with the lowest consumption of 8.00MT in 2022.

- v. **R410A:** As the third (3<sup>rd</sup>) most consumed HFC refrigerant in the country, its 2022 consumption was 19.15MT. It is consistent with the widely used number of RAC equipment that consume this refrigerant. It is found in nearly all large cooling systems, such as VRVS, ac chillers, centralized systems condensing units and split units.
- vi. **R22:** Although there is a quota system to control its consumption, R22 are still being utilized in some types of refrigeration and air conditioning (RAC) equipment, primarily in AC systems sourced from RAC technicians. This continued usage is because many of these cooling systems are still in good working condition.
- vii. **R600a:** Has been consumed in very low quantities with a steep increase observed over years this is consistent with the importation of domestic refrigeration which data shows, R600a as the prevalent refrigerant of the overwhelming majority of refrigerator and freezers entering the country. This is also consistent with it being a low GWP refrigerant of 1, there are no levy on its importation, and hence it will stay the refrigerant of choice in the near future.
- viii. **R290:** Also known as propane, is found in commercial refrigeration and some split ACs. Past recorded data shows the refrigerant has not yet penetrated into the Sierra Leone market.
- ix. **R-507A:** As a blend of HFC refrigerants, its prevalence has been found in commercial and industrial level equipment in the country, such as walk in freezers and cold storages and some air conditioning systems. It was found also in laboratory equipment and lab freezers.
- x. **R508B:** classified as an HFC, has been documented throughout the span from 2020 to 2022. While not utilized as extensively as certain other refrigerants, it is notably present in commercial refrigeration systems.

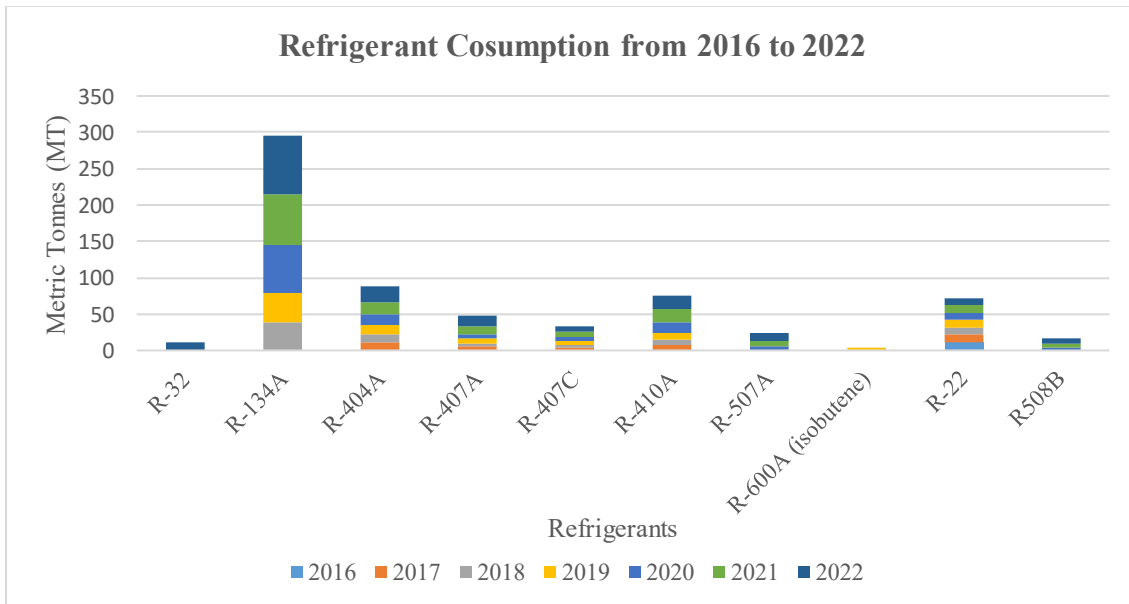


Figure 3: Refrigerant Consumption 2016-2022 in Metric Tonnes

Figure 3 aims to show the highest refrigerant consumption between 2016 and 2022. R404A is the largest consumed refrigerant recorded, this is because R404A are consumed in the Industrial, Marine and Transport Refrigeration sectors. R410A is the second highest refrigerant consumed mainly in the domestic AC sector.

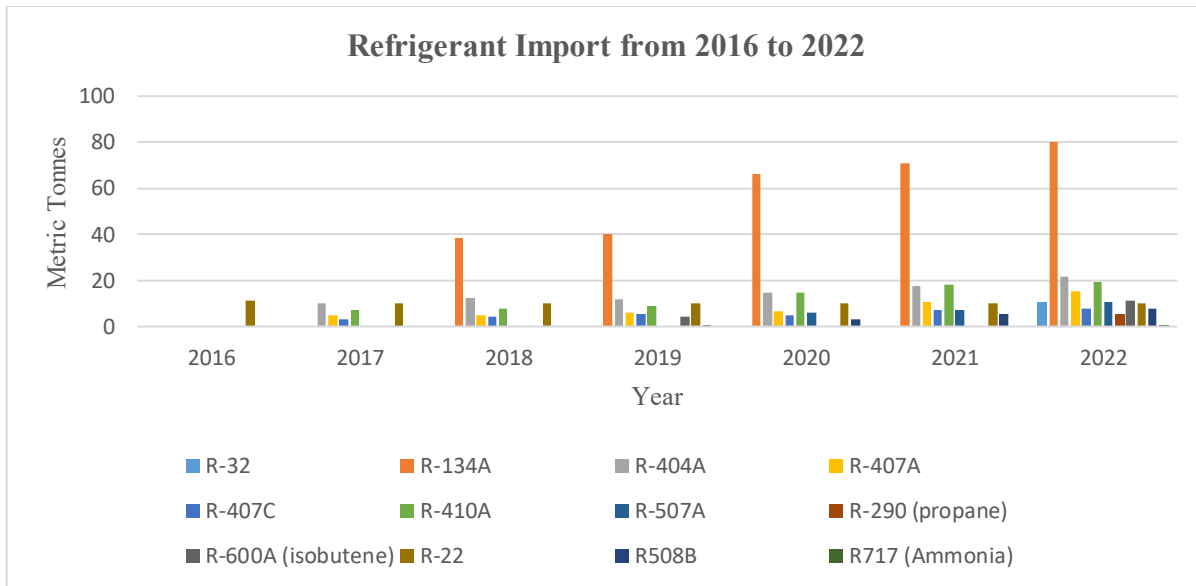


Figure 4: Refrigerant Imports (MT) Source: NOU Dept. of Climate Change

Figure 4 aims to present the annual refrigerant import data spanning the years 2016 to 2022.

The graph indicates that the highest volume of refrigerant imports occurred in 2022, while the lowest was in 2016. While no specific cause has been identified for the low import in 2016, the notable surge in imports between 2016 and 2017 could potentially be attributed to factors such as stockpiling of refrigerants or a rise in the number of new residential and commercial construction projects.

### 3.2. Average Annual Leakage Rate Percentage per RAC Sector

From the survey conducted with technicians, observations, and default assumptions, for some equipment, below are the average annual leakage rate percentage per RAC sector.

Table 8 shows the highest leakage rate sector is Transport Refrigeration followed by Commercial AC, and MAC large and small. The lowest leakage rate per sector is in residential refrigeration.

The average leakage rate of RAC sector calculated using the formula:

$$\text{Average Leakage Rate} = (\text{Total Refrigerant Leaked} / \text{Total Refrigerant Initial Charged}) \times 100$$

Where:

- Total Refrigerant Leaked: The sum of all refrigerants leaked over a specific period (e.g. years)

- **Total Refrigerant Charged:** The total amount of refrigerant initially charged into the RAC systems over the same period.

This formula expresses the leakage rate as a percentage, indicating how much of the initially charged refrigerant was lost due to leaks.

The multiplication by 100 is to convert the ratio to a percentage. This calculation was also in comparison to the average leakage rate of the RAC Inventory 2020 and the Southern African Development Community (SADC) Market assessment Cooling 2021.

Table 10: Average Annual Leakage Rate Percentage per RAC Sector

Sector	Description	Average leakage rate per year (%)	Average No. of leakage servicing per/year
Domestic Ref	Household Fridge	10	0.1
	Household Freezer	10	0.1
Domestic AC	Up to 60,000 BTU	5	0.2
MAC	Large	15	0.4
	Small	10	0.2
Commercial AC	Split Ducted	10	1
	VRV's	3	0.5
	AC Chillers	5	1
Centralized Units	Centralized Units	38	3
Commercial Ref.	Process Chillers	17	2
	Small stand-alone systems	10	0.3
	Condensing units	28	2
Transport Ref.	Vans	30	2.5
	Trucks and Trailers	30	2.5
Marine Ref.	Fishing Vessel, Ice making facility	30	4

### 3.3 HFC Baseline

Under the Kigali Amendment, Sierra Leone has been listed as an Article 5 Group 1 country with respect to the HFC phase down schedule to be followed. The HFC baseline which forms the basis for the phase down of HFC use and was calculated based on the average of HFC consumption reported between the years 2020- 2022 +65% of the HCFC baseline (See Table 11 in which All calculations are CO<sub>2eq</sub>).

Table 11: Calculation of the HFC Baseline

	TCO <sub>2eq</sub> 2020	TCO <sub>2eq</sub> 2021	TCO <sub>2eq</sub> 2022	(TCO <sub>2eq</sub> ) total	TCO <sub>2eq</sub> Average
HFC	250,389.95	307,210.57	386,931.86	944,532.38	314,844.13
HCFC baseline					
65% of HFC baseline					36,450.00
HFC baseline					<b>351,294.13</b>

### 3.4. Fire Suppression

From the survey, though there are use of R227ea (FM200) in the country, there was no recorded data since the end-users were not willing to give out any data due to business reasons.

### 3.5. Aerosol, Solvent and Foam

From the survey, there is no evidence of HFC usage, since all the related companies visited in this sector do not use HFC based substances in their production.

## **4.0 SECTORAL DISTRIBUTION OF HFC**

### **4.1. Sectoral Distribution of HFC**

In Sierra Leone, there is no local assembly or manufacturing of Refrigeration and Air Conditioning (RAC) equipment. The refrigerants used in the country are solely imported to address the maintenance requirements of the existing installed equipment.

In 2022, data collected indicate that Mobile AC use is responsible for **nearly** 43.69% of all HFC used in the country. Domestic AC has a share of 30.69% followed by Commercial and Industrial refrigeration, Domestic refrigeration, Commercial AC, Transport refrigeration and Marine refrigeration at 16.90%, 4.38%, 2.19%, 1.12% and 1.02% respectively.

Table 12: Estimated Refrigerant Consumption in 2022(Source Ground survey and NOU Importation/ Consumptions Data)

Subsector		R32	R410A	R134a	R404A	R407C	R407A	R507A	R508B	Total MT	Share of Consumption %
		Metric Tonnes (MT)									
<b>Domestic refrigeration (includes residential use of refrigerators and freezers)</b>		0.00	0.00	7.71	0.00	0.00	0.00	0.00	0.00	7.71	<b>4.38%</b>
<b>Domestic Air-Conditioning/ AC</b>	<b>Split Non-ducted</b>	10.48	7.49	0.00	0.00	0.00	0.00	0.00	0.00	17.97	<b>10.21%</b>
	<b>Split Ducted/ Roof Top ducted</b>	0.00	10.57	0.00	0.00	9.61	15.85	0.00	0.00	36.02	<b>20.48%</b>
	<b>Multi Split VRV, VRF</b>	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.25	<b>0.14%</b>
	<b>AC Chiller</b>	0.00	3.13	0.48	0.00	0.00	0.00	0.00	0.00	3.61	<b>2.05%</b>
<b>Commercial refrigeration (includes industrial use)</b>	<b>Centralized Units</b>	0.00	0.00	0.19	3.70	0.00	0.00	1.88	0.00	5.77	<b>3.28%</b>
	<b>Process Chillers</b>	0.00	0.00	0.11	6.94	0.00	0.00	3.08	0.00	10.13	<b>5.76%</b>
	<b>Stand-alone</b>	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.56	0.59	<b>0.34%</b>
	<b>Condensing Units</b>	0.00	0.27	0.14	3.41	0.00	0.00	2.73	6.69	13.23	<b>7.52%</b>
<b>Marine Refrigeration</b>	<b>Marine Vessel</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	<b>0.00%</b>
	<b>ICE Making Facility</b>	0.00	0.00	0.00	0.90	0.00	0.00	0.91	0.00	1.81	<b>1.03%</b>
<b>Transport Refrigeration</b>	<b>Refrigerated Truck</b>	0.00	0.00	0.21	1.77	0.00	0.00	0.00	0.00	1.98	<b>1.12%</b>
<b>Mobile AC</b>	<b>Large MAC</b>	0.00	0.00	48.91	0.00	0.00	0.00	0.00	0.00	48.91	<b>27.80%</b>
	<b>Small MAC</b>	0.00	0.00	27.95	0.00	0.00	0.00	0.00	0.00	27.95	<b>15.89%</b>
<b>Total use (MT)</b>		10.48	21.70	85.73	16.72	9.61	15.85	8.59	7.24	175.92	<b>100.00%</b>
<b>% Share</b>		5.95%	12.34%	48.73%	9.50%	5.46%	9.01%	4.89%	4.12%		

Table 13: CO<sub>2eq</sub>. Estimated Refrigerant Consumption in 2022

Subsector										Total	Share of Consumption %
		R32	R410A	R134a	R404A	R407C	R407A	R507A	R508B	CO <sub>2eq</sub> .	
GWP		675	2088	1430	3922	1774	2107	3985	6808		
		CO <sub>2EQ</sub>									
Domestic refrigeration (includes residential use of refrigerators and freezers)		0.00	0.00	11,019.62	0.00	0.00	0.00	0.00	0.00	11,019.62	2.94%
Domestic Air-Conditioning/Commercial AC	Split Non-ducted	7,074.57	15,631.44	0.00	0.00	0.00	0.00	0.00	0.00	22,706.01	6.06%
	Split Ducted/ Roof –top-ducted	0.00	22,063.06	0.00	0.00	17,041.04	33,395.74	0.00	0.00	72,499.84	19.36%
	Multi Split VRV, VFV	0.00	522.88	0.00	0.00	0.00	0.00	0.00	0.00	522.88	0.14%
	AC Chiller	0.00	6,528.13	687.83	0.00	0.00	0.00	0.00	0.00	7,215.96	1.93%
Commercial refrigeration (includes industrial use)	Centralized Units	0.00	0.00	268.98	14,508.65	0.00	0.00	7,495.79	0.00	22,273.42	5.95%
	Process Chillers	0.00	0.00	157.53	27,218.99	0.00	0.00	12,291.65	0.00	39,668.18	10.59%
	Stand-alone	0.00	0.00	49.78	0.00	0.00	0.00	0.00	3,791.74	3,841.52	1.03%
	Condensing units	0.00	569.78	195.11	13,378.09	0.00	0.00	10,874.38	45,515.78	70,533.14	18.83%
Marine Refrigeration	Marine Vessel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
	ICE Making Facility	0.00	0.00	0.00	3,529.80	0.00	0.00	3,586.50	0.00	7,116.30	1.90%
Transport Refrigeration	Refrigerated Truck	0.00	0.00	297.64	6,938.66	0.00	0.00	0.00	0.00	7,236.29	1.93%
Mobile AC	Large MAC	0.00	0.00	69,939.00	0.00	0.00	0.00	0.00	0.00	69,939.00	18.67%
	Small MAC	0.00	0.00	39,972.77	0.00	0.00	0.00	0.00	0.00	39,972.77	10.67%
Total use (MT)		7,074.57	45,315.29	122,588.26	65,574.19	17,041.04	33,395.74	34,248.32	49,307.52	374,544.93	100%
% Share		1.89%	12.10%	32.73%	17.51%	4.55%	8.92%	9.14%	13.16%		

Since the HFC use has currently been reported for the refrigeration and air conditioning (RAC) sector, it is evident that this sector is crucial to understand in detail the HFC use in each sub sector. As there are no assembly or manufacturing of RAC equipment in Sierra Leone, all HFC used in the sector is to meet the servicing requirements of the RAC equipment installed in the country.

This section relates to the type of HFC refrigerants that are commonly used in the RAC sector and provides a good indicator of their application.

### Domestic Refrigeration

Domestic Refrigeration, from the survey definition, includes refrigeration equipment such as refrigerators, chest freezers, portable cooling systems that are found in residential households, as well as commercial office buildings, restaurants, supermarkets in the country. RAC equipment in this sector are imported new. Stock data in 2022 for domestic refrigeration stands at 2,001,565 (shown in Table 14). The dominant refrigerant used is R600a, followed by R134a and R22 respectively.

Table 14: Domestic Refrigeration and Refrigerant Use

	STOCK (2022)	% OF EQUIPMENT USING REFRIGERANT			
		R134a	R600a	R290	R22
DOMESTIC ref	2,001,565	35%	50%	10%	5%
REFRIGERANT(Mt)		7.71	11.01	2.20	1.10
TCO <sub>2eq</sub>		11,019.62	11.01	0	1,992.56

### Domestic AC

The domestic AC sector comprise largely of single split units that are prevalent in the country, even in large residential blocks across households, small and large commercial entities. Table 15 shows that R32 for servicing of existing ACs dominates the domestic AC sector.

Table 15: Domestic AC and Refrigerant Use

	STOCK (2022)	% OF EQUIPMENT USING REFRIGERANT			
		R410A	R32	R22	R290
SPLIT NON-DUCTED ACS	499,088	30%	42%	28%	0%
REFRIGERANT USE (MT)		7.49	10.48	3.74	0
TCO <sub>2eq</sub>		15,631.44	7,074.57	6,775.12	0

### Commercial AC

The commercial AC sector refers to Multi splits, ducted splits, roof top ACs, AC chillers and centralized systems. These systems are commonly used to cool commercial buildings, large office spaces, airports, plaza (malls), large hotels, hospitals, large supermarkets in the country. As shown in Table 16, R410 followed by R 22 are the dominant refrigerant use in this sector.

Table 16: Commercial AC and Refrigerant Use

	% EQUIPMENT USING REFRIGERANT											
	MULTI-SPLIT			SPLIT/ROOFTOP- DUCTED					AC CHILLERS			
	Stock (2022)	R410A	R22	Stock (2022)	R410A	R407C	R407A	R22	Stock (2022)	R410A	R134a	R22
	257	50%	50%	9,606	22%	20%	33%	25%	74	65%	10%	25%
<b>REFRIGERANT USE (MT)</b>		0.25	0.25		10.567	9.61	15.85	12.0		3.13	0.48	1.20
<b>TCO<sub>2eq</sub></b>		522.88	452.26		22,063.06	17041.04	33395.74	21733.58		6528.13	687.83	2176.53

### Commercial/ Industrial Refrigeration

Industrial refrigeration comprises of large centralised systems and process chillers which are commonly use in industrial processes. In Sierra Leone, the large users of industrial level manufacturing, process refrigeration in the country are the brewery and fishing related cold storages. Based on the data collected as shown in Table 17, R404A and R507A are the most frequently used refrigerants in this sector.

Table 17: Commercial/ Industrial Refrigeration and Refrigerant Use

	STOCK (2022)	% EQUIPMENT USING REFRIGERANT			
		R134a	R404A	R507A	R22
<b>INDUSTRIALCENTRALISED SYSTEMS</b>	5	3%	59%	30%	8%
<b>REFRIGERANT USE (MT)</b>		0.19	3.70	1.88	0.50
<b>TCO<sub>2eq</sub></b>		268.98	14,508.65	7,495.79	907.90

### Marine Sector

For the survey, the Marine Sector data provided is in relation to fishing vessels and ice making facilities. The common refrigerants use in the ice making facilities are R404A and R507A, whereas the vessels mostly use R717 and R22.

Shown in Table 18, is the refrigerant use in the marine refrigeration.

Table 18: Marine Refrigeration and Refrigerant Use

	% EQUIPMENT USING REFRIGERANT				
	ICE MAKING FACILITIES			FISHING ESSELS	
	Stock (2022)	R404A	R507A	Stock (2022)	R22
	6	50%	50%	16	100%
<b>REFRIGERANT USE (MT)</b>		0.90	0.90		4.80
<b>TCO<sub>2eq</sub></b>		3529.80	3586.50		8688.00

## Transport Refrigeration

Transport refrigeration refers to the technology used to maintain specific low temperatures in the cargo areas of trucks, vans, and trains. This is crucial for the safe transportation of perishable goods, such as food, pharmaceuticals, or other temperature-sensitive materials. From the survey, this sub-sector consumes 85% of R404A, 10% R134a and 5% R22 as shown in Table 19.

Table 19: Transport Refrigeration and Refrigerant Use

	STOCK (2022)	% EQUIPMENT USING REFRIGERANT		
		R404A	R134a	R22
<b>TRANSPORT Ref</b>	49	85%	10%	5%
<b>REFRIGERANT USE (MT)</b>		1.77	0.21	0.10
<b>TCO<sub>2eq</sub></b>		6,938.66	297.64	188.36

## MobileAC

The mobile air conditioning (AC) sector primarily refers to the systems that provide climate control for vehicles, including cars, SUVs, commercial trucks, buses in Sierra Leone. These systems manage the interior temperature and humidity levels, providing comfort for passengers as well as temperature control. Survey data conducted showed, Mobile AC systems consume 100% of R134a as shown in Table 20.

Table 20: Mobile AC Refrigeration and Refrigerant Use

	STOCK (2021)	% EQUIPMENT USING REFRIGERANT	
		R134a	R1234yf
<b>MOBILE AC</b>	273,58	100%	0%
<b>REFRIGERANT USE (MT)</b>		76.86	0.00
<b>TCO<sub>2eq</sub></b>		109,911.77	0.00

## 4.2 HFC use and CO<sub>2</sub> eq. emissions across sectors as of 2022

In summary, it is clear that Mobile AC sector dominates the HFC refrigerant consumption of 43.69MT with CO<sub>2eq</sub> emissions estimated at 29.35%. Also, from the Figure 5, although Commercial and Industrial refrigeration has low HFC consumption about 16.90% its corresponding CO<sub>2</sub> emissions is about 36.40% (high) when compared to the other RAC sectors in terms of their HFC consumption and their respective CO<sub>2</sub> emissions.

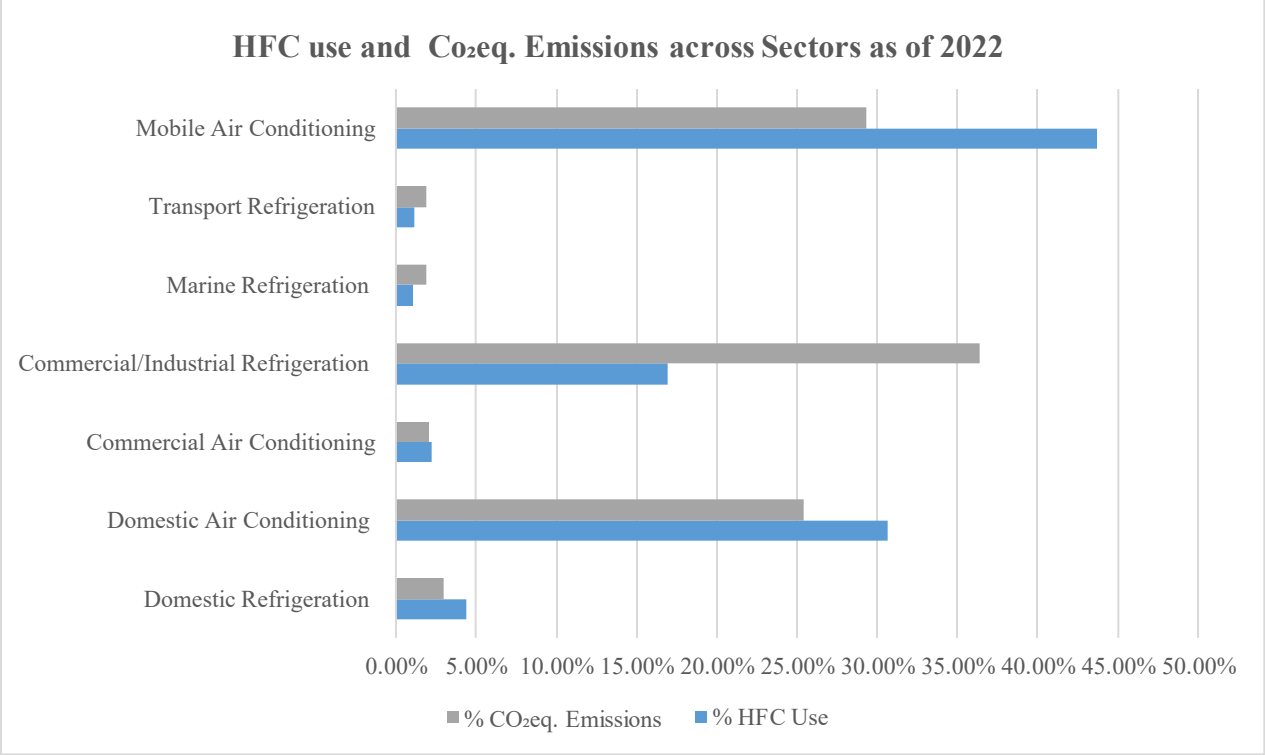


Figure 5: Comparison of HFC use and CO<sub>2</sub>eq emissions across sectors as of 2022

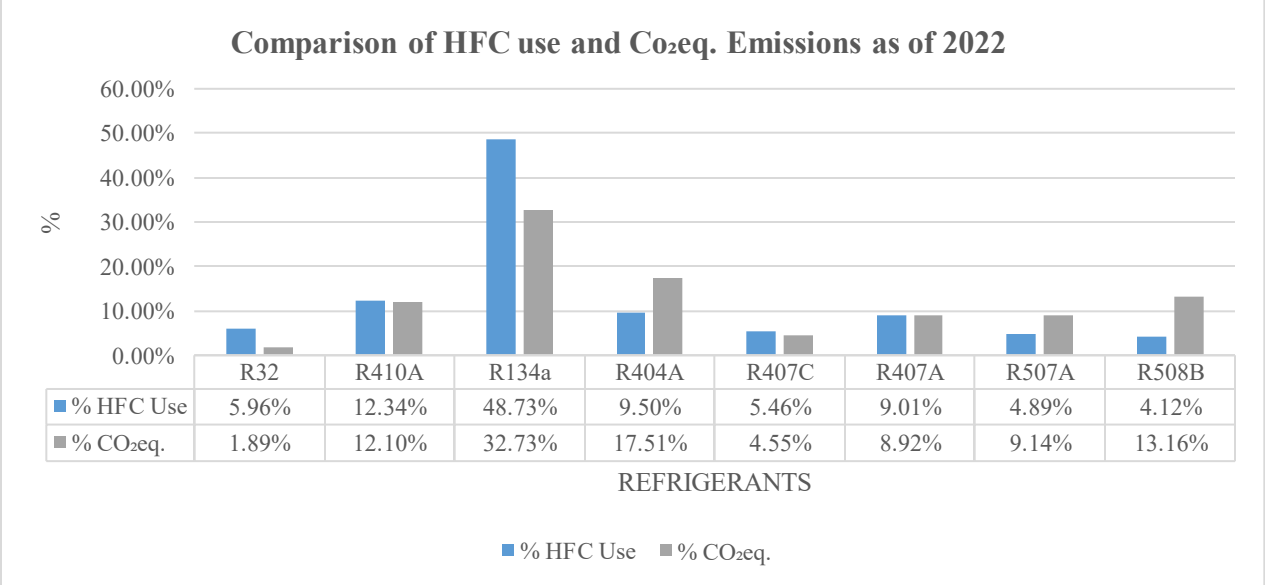


Figure 6: Comparison of HFC use and CO<sub>2</sub>eq emissions as of 2022

**4.3 Projections of HFC consumption, prioritization, and proposed reductions**

In this section, looked at analyzed projections related to Hydrofluorocarbon (HFC) consumption, clarified prioritization strategies, and delineated proposed reductions. This dataset played a pivotal role in comprehending the course of HFC consumption, facilitating the prioritization process, and presenting a structured plan to address the environmental impact linked to these substances.

Within this dataset, we explored anticipated trends in HFC consumption over time, providing insights into the future landscape of HFC usage. This allowed us to anticipate challenges and opportunities associated with their utilization.

The dataset also underscored strategies for prioritizing actions associated with HFC consumption. It emphasized the significance of identifying sectors, applications, or regions where HFC emissions had a notable environmental impact. We employed a prioritization framework to channel efforts and resources toward areas with the highest potential for reducing emissions.

The section also provides a comprehensive presentation of proposed reductions in HFC consumption. These reduction strategies were meticulously analyzed and aligned with international agreements like the Kigali Amendment. We detailed a phased approach to reductions, specifying timelines and targets for curbing HFC emissions. These proposed reductions could play an important role in mitigating the environmental repercussions of HFCs, particularly their contribution to global warming and climate change.

### 4.3.1 HFC use expected to grow under BAU (2022) in Metric tones

In this section, a comprehensive analysis of refrigerant usage was undertaken, focusing specifically on the expected growth in Hydrofluorocarbon (HFC) utilization under the Business-as-Usual (BAU) scenario for the year 2022. The data presented in Figure 7 sheds light on the trends, variations, and implications of HFC usage across various sectors and applications, offering valuable insights into the environmental impact of unchecked HFC consumption.

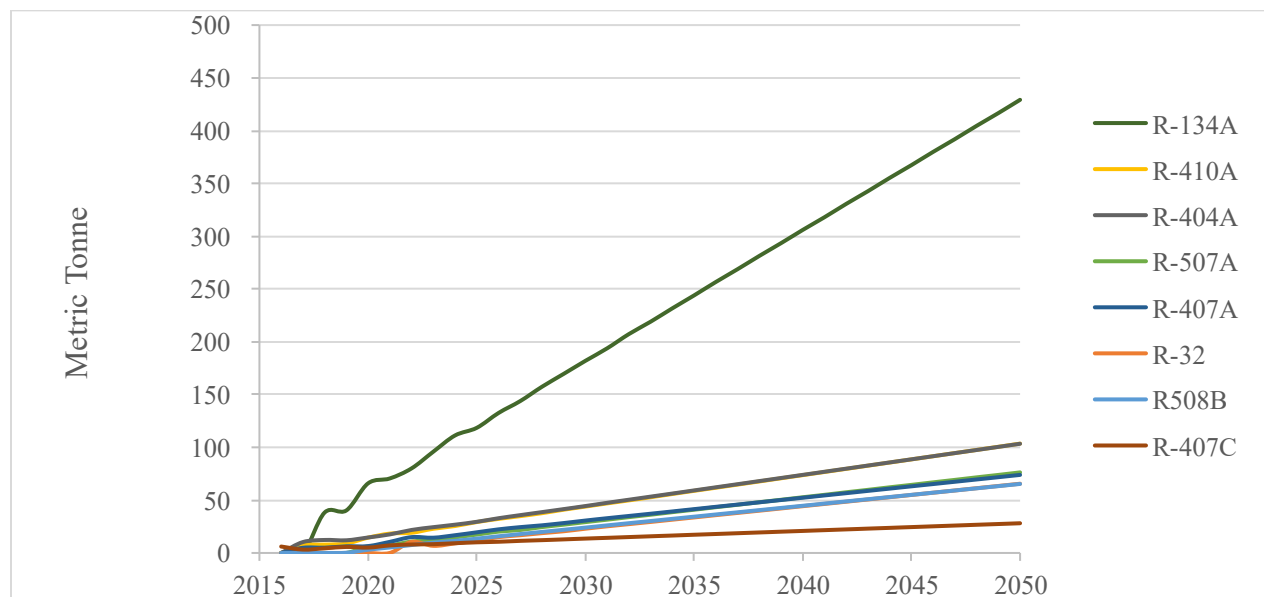


Figure 7: HFC use expected to grow under BAU

The analysis examined the consumption patterns of several key refrigerants, shedding light on their individual trajectories over the years.

- viii. **R507A:** Consumption of R507A remained relatively low and stable for several years before a gradual increase from 2020 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted.
- ix. **R410a:** R410A remained relatively low and stable for several years before a gradual increase from 2021 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted
- x. **R134A:** This refrigerant experienced steady growth from 2016 to 2033, followed by a gradual decline. R-134A was commonly used in automotive air conditioning systems, and its decline may be linked to regulatory transitions towards more climate-friendly alternatives.
- xi. **R32:** The consumption of R32 displayed declination in 2023, then it started growing from 2024. Its adoption might be driven by its lower global warming potential (GWP) compared to some other HFCs, making it a preferable choice for various applications.
- xii. **R404A:** R404A consumption exhibited notable fluctuations over the years. It saw a peak in 2021 and then underwent periodic declines and rebounds. The varying usage may reflect the challenges in transitioning away from high-GWP refrigerants in certain applications.
- xiii. **R407A and R407C:** These refrigerants displayed usage patterns characterized by modest consumption levels, with minor fluctuations. Their usage could be associated with specific niche applications or regions with differing regulatory landscapes.
- xiv. **R508B:** Consumption of R508B remained relatively low for several years before a gradual increase from 2020 onwards. This suggests its continued use in applications where alternatives may not yet be fully adopted.

#### 4.3.2 Comparison between HFC consumption under BAU and Kigali phase down Schedule

The analysis reveals a substantial contrast between Hydrofluorocarbon (HFC) consumption under Business-as-Usual (BAU) conditions and the phase-down schedule outlined in the Kigali Amendment. This contrast is particularly evident due to the significant increase in HFC usage projected under BAU, in comparison to the controlled reduction proposed by the Kigali Amendment. This situation requires drastic measures to bring down HFC usage within acceptable levels in order to achieve the targets proposed by the Kigali Amendment. Under the BAU scenario presented in Figure 8, HFC consumption experiences consistent growth, resulting in a substantial increase in the utilization of these compounds. By 2050, HFC consumption is projected to reach 2,234,814.63 TCO<sub>2</sub> equivalent (CO<sub>2</sub>eq).

The Kigali Amendment provides a structured approach to reduce HFC consumption. This international agreement aims to curtail the production and usage of HFCs to mitigate their adverse environmental impact. The Kigali Amendment establishes a cap for HFC consumption at 351,294.00 TCO<sub>2</sub>eq by 2024 but HFC consumption is expected to decrease to 245,906.00 TCO<sub>2</sub>eq by 2036, while the BAU projection for the same year stands at 1,308,803.30 TCO<sub>2</sub>eq. By 2050, the Kigali Amendment envisions a further reduction in HFC consumption to 70,259.00 TCO<sub>2</sub>eq, in contrast to the BAU projection of 2,234,814.63 TCO<sub>2</sub>eq.

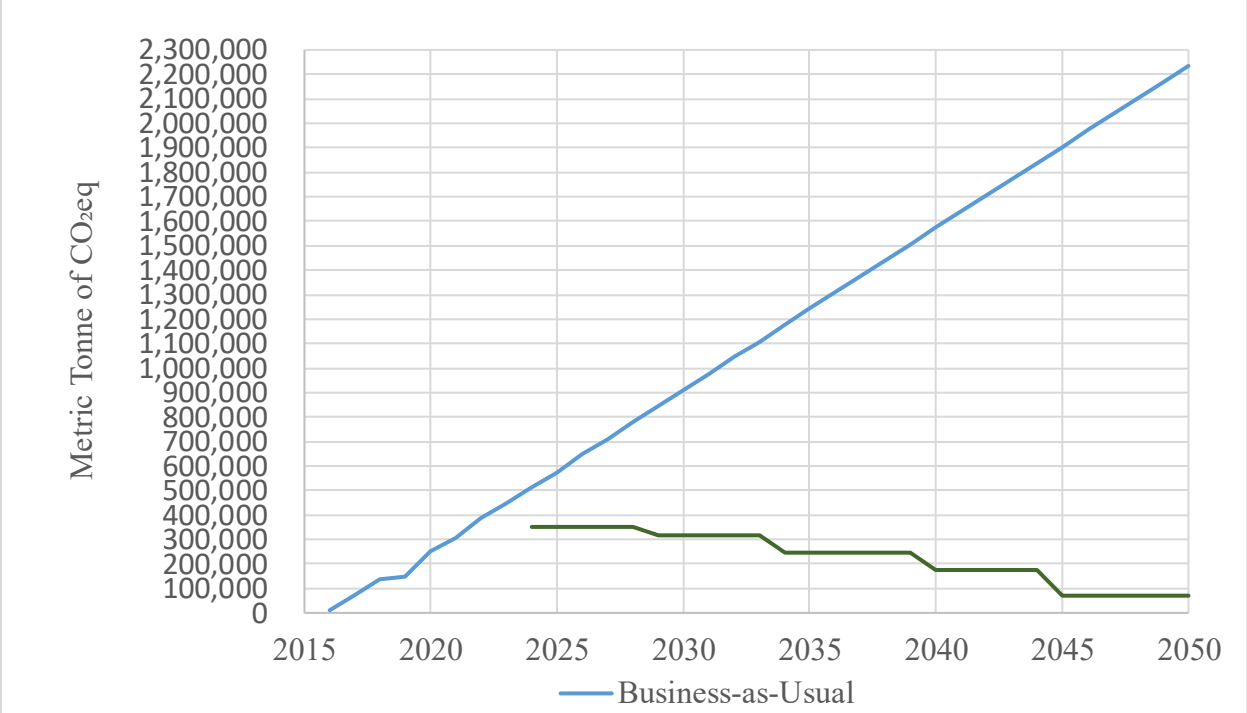


Figure 8: Comparison between HFC consumption under BAU and Kigali phase down schedule

## **5.0 DISCUSSION ON OTHER DATA GATHERED**

### **5.1 RAC Servicing Companies**

As of 2022, there were a total of 24 licensed RAC servicing companies and individuals operating in the country (See Appendix C). Majority of these companies include commercial/industrial, hotels (both large and small), leisure boat vessels, mobile air conditioning, and residential properties. The industry landscape varies, with a few large RAC servicing companies and the majority being smaller, one or two-person operations on a smaller scale.

In addition to the licensed contractors, the survey data indicated the presence of an unknown number of unlicensed refrigeration technicians operating within the sector. These technicians provide services to commercial and residential end-users. The reasons behind their lack of licensing are not known, but it highlights the importance of ensuring proper regulation and compliance within the industry.

### **5.2 RAC Associations**

Presently, Sierra Leone has one Refrigeration and Air Conditioning (RAC) Association named *Refrigeration Engineers and Technicians Association (RETA)*. Appendix D provides more details on RETA. The association was established in 1992. The association has a sub-office in all the five (5) divisional zone of the country. However, the association has been working with the NOU for the past twenty (20) years on climate change related assignments. The association has a total number of 1,299 members.

### **5.3 Training Institutes**

As of Year 2022, the total number of RAC graduate technicians in the country were 204. Out of the 204 technicians, 183 were males and 21 females (See Appendix E).

Also, the survey established that there were about 2,408 RAC technician across the country.

### **5.4 Certification of RAC Technicians**

In Sierra Leone, before one can practice as a RAC technician, one need to obtain any of the following level of certification in RAC;

- i. National Technical Certificate I (2 years)
- ii. National Diploma (3 years)
- iii. Higher National Diploma (Refrigeration and Air conditioning option) (5 years)

### **5.5 Prices of Refrigerants**

In order to understand the market dynamics of the refrigerants, the survey considered the prices of all the refrigerants consumed in Sierra Leone for the period 2016 to 2022. Figure 9 shows the average prices of refrigerants from 2016 to 2022. It is worth noting that most importers of HFC refrigerants are for their own consumption, or for RAC servicing contractors.

Prices were taken from four (4) retailers selling HFC refrigerants in the country. To note they are also licensed contractors as well.

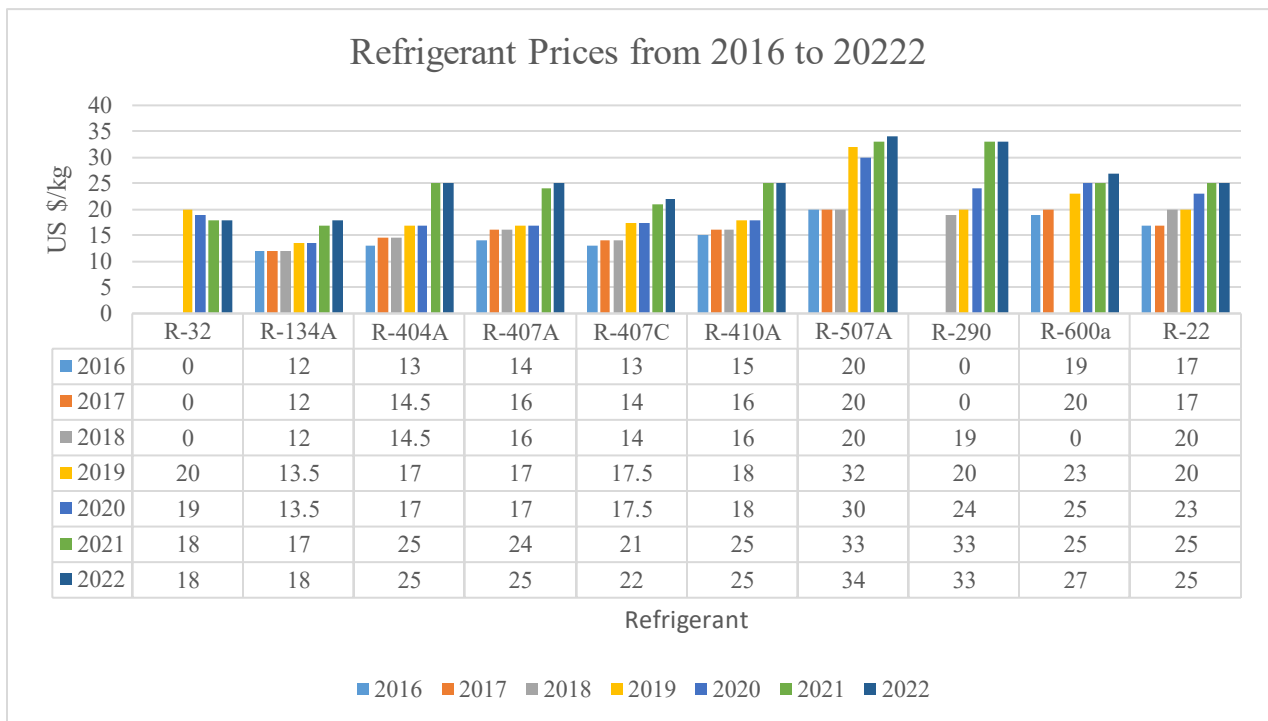


Figure 9: Prices of Refrigerant

## 5.6 Customs

Customs Officers from the Customs Division within the Sierra Leone Revenue Commission (SRC) have played a crucial role in enforcing regulations related to the management of controlled substances governed by the Montreal Protocol. In Sierra Leone, there are seven (7) main ports of entry, namely Gbalamuya new custom, Baidu crossing point, Bailu crossing point, Dogoloya border post, Jendema border post, Kelema border post and Sanya border post. Currently, there are 750 Customs Officers.

Over the years, the significance of their role has been recognized, and approximately 280 customs officers have received Montreal Protocol trainings since 2009 from NOU records have shown. This includes some of the current customs officers. With the ratification and implementation of the Kigali Amendment, which aims to phase down the use of HFCs, the role of customs officers becomes even more critical. Their expertise will be instrumental in identifying and distinguishing various HFC refrigerants, thereby ensuring compliance with the new regulations (See Appendix F).

## 5.7 Standards

The Standards used in the RAC sector in the country are Sierra Leone National Building Code and Freetown Improvement Act cap66.

## 6.0 OTHER ALLIED PROJECTS

### 6.1HPMP Overview

Sierra Leone's consumption of Hydrochlorofluorocarbons (HCFCs) is in the servicing of refrigeration and air conditioning (RAC) equipment.

The HPMP Stage-I for Sierra Leone was approved at the 65th Meeting of the Executive Committee with a total funding of US\$210,000 plus implementing agencies support cost for the period 2011 to 2020 to reduce consumption of HCFCs by 35% of the baseline. The established baseline consumption of HCFCs for Sierra Leone was 30 metric tons.

The Government of Sierra Leone (GoSL) had made tremendous progress on the implementation of activities under stage I of the Hydrochlorofluorocarbon Phase-out Management Plan (HPMP). The HPMP Stage-I has successfully enabled Sierra Leone 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.

Sierra Leone had already achieved more than 35% HCFCs consumption reduction before 2020 agreed target under the Montreal Protocol. The HPMP Stage-I has successfully phased out a total of 0.58 ODP tons of HCFCs in the country as of 2020.

Furthermore, the successful implementation of HPMP Stage-I has achieved a net direct emission reduction of 18,907 tons of carbon dioxide equivalent per year. The stage II implementing activities of the HPMP commence in January 2023.

### 6.1.1Lessons Learned from HPMP

The following are the lessons learnt from the HPMP stage I implementing activities:

**i. Policy Update and Enforcement:**

The Prohibition of Ozone Depleting Substances Regulation 2010.

Change in Political Administration, Limited knowledge on Part of Judiciary and Parliament on some of the key terminologies and chemicals of interest in the Montreal protocol.

**ii. Customs and Trade Authorities Training:**

The Country successfully built the capacity of 487 Customs and other law enforcement Officers who have been trained in combating illegal trade, Identification of refrigerants, facilitating legal trade etc.

The frequent changes of Customs and other law enforcement officers always creates the pressure or gaps in knowledge.

**iii. Training of Refrigeration Good Practice:**

About 379 RAC technicians has benefited from Trainings under the stage I and their capacities were built in the provision of the Montreal Protocol, Good Refrigeration Practices, Flammable Refrigerants handling , Environmental Impacts associated with bad refrigeration practices, retrofitting etc.

The availability of centers of excellence in most part of the country for technicians to access critical tools remains a major challenge.

**iv. Certification of Servicing Technicians:**

A total of 197 technicians were trained and Licensed under this tranche

The initial challenge has to do with the centralized nature of the training for certification and licenses which was only in the Capital city, but the NOU in recent years has decentralized its trainings to the regions which has created attraction and participation

**v. Establishing RRR Scheme:**

Few RRR equipment's were procure and deployed in two of the training centers.

**vi. Updating National Standards:**

The only standards developed was the certification standards for RAC practitioners: Gold, Silver and Bronze. This has to do with their level of educations experience in the sector etc. It was developed in 2018.

Delay in approval due to changes in the administration, also funding was limited to support the addition of other standards.

**vii. Technical and Technological Awareness:**

Several Technical and Technological Awareness activities (e.g. TV & Radio Programs, Community Engagements , Stakeholder Sensitization event were undertaken under the Stage I)

Accessibility during the raining season remains an historic challenge as some of the areas of interest have poor road networks.

**viii. Support to National Associations:**

The NOU via the support of the MP provided basic tools and also provided technical support through trainings to National Associations like the RAC, Importers, and other Enforcement Bodies - Traders Union. In addition, equipment like recovery Machine, Recovery cylinder, RRR Machine, Refrigerants Identifiers were provided to RAC Technicians Association in Kono, Bo, Freetown and Makeni.

**ix. Incentive schemes and demo/pilot projects:**

There was an Incentive Scheme which was extended to the people in the Fishery sector and Supermarket etc. However, there was no Demo Project.

The funds for the implementation of the incentive scheme was limited.

**x. Green Public Procurement:**

The country benefited by participating in a workshop organized by UNEP in Dakar, Senegal during which the NOU and a representative from the National Public Procurement Authority attended.

Limited knowledge of our public procurement Institutions and practitioners is affecting Green Procurement especially RAC Green Procurement.

**xi. Gender mainstreaming activates:**

The NOU has engaged via its public sensation activities topic of Gender mainstreaming within the RAC and has placed more emphasis over the years on Female obtaining to be RAC technicians by provided scholarship for them.

The topic itself is new and cultural acceptability serves a strong opposition. Government support in motivating the weaker gender has been low.

## **7.0 RECOMMENDATIONS**

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

- i. 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.
- ii. Government should put in place strategies that would promote quick uptake of Low GWP and energy efficient technologies in the country.
- iii. 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.
- iv. 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.
- v. 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.
- vi. The NOU should continue collaborating with Standard Authority to ensure timely approval of the certification standards and MEPS. Enforcement officers should be oriented on these standards for effective implementation.
- vii. Support awareness raising campaign among end users to promote natural refrigerants

## **REFERENCE**

[1] <https://www.worlddata.info/africa/sierra-leone/index.php>

[2] <https://countryeconomy.com/gdp/sierra-leone>

[3] <https://www.bing.com/search?q=population+of+seirra+leone+as+of+2022&cvid=b7b1e4f9823749eb824909f57d4b58f2&aqs=edge..69i57.16124j0j4&FORM=ANAB01&PC=U531>

[4] [https://energypedia.info/wiki/Sierra\\_Leone\\_Energy\\_Situation](https://energypedia.info/wiki/Sierra_Leone_Energy_Situation)

## APPENDIX

### Appendix A: Regulatory Frameworks Checklist

TYPE OF ACTION / LEGISLATION		Exist (YES/NO/PLAN)	Since when (Date)	If yes, provide brief about the legislative requirements	If No, provide comment and if/when expected
<b>OVERVIEW OF HCFC RELATED POLICY OPTIONS</b>					
<b>1</b>	<b><i>Establishing general guidelines to control import, production, and export of HCFCs</i></b>	Yes	2010	The guidelines is embedded into the regulations that provide application checklist, who should apply and where to store and under what conditions	
<b>1.1</b>	Regulatory procedures for HCFC data collection and reporting in place	Yes	2010	The National Revenue Authority should provide the relevant import/export data on ODS and refrigerant depending equipment	
<b>1.2</b>	Registration of HCFC importers/exporters	Yes	2010	The regulation stipulate that all import/exporter must register with NOU in the Environment Protection Agency	
<b>1.3</b>	A shared database on import quotas and actual imports/exports between ozone office and customs	No			
<b>1.4</b>	Mandatory reporting by HCFC importers/exporters	Yes	EPA Act 2008 Part V and EPA act 2022 Part VI ( Available on Line)	The Legislation requires all importer/exporter of HCFCs to report on all their activities	
<b>2</b>	<b><i>Banning/restricting import or placing on the market of bulk quantities of:</i></b>				
<b>2.1</b>	HCFC-141b (pure substance and in mixtures)	Yes	EPA Act 2008 amended 2010 and the ODS Regulation 2010	As provided for in the Prohibition Of Ozone Regulation 2010 there is a restriction on the import of HCFC 141b. Hence , such importation follows strictly the quota system like in the case of R-22	

2.2	HCFC-22 (for certain applications or total ban)	Yes	EPA Act 2008 amended 2010 and the ODS Regulation 2010	As provided for in the Prohibition Of Ozone Regulation 2010 there is a restriction on the import of HCFC 141b. Hence , such importation follows strictly the quota system like in the case of R-23	
3	<b><i>Banning/restricting import or placing on the market of equipment/products using high-GWP HFCs and HFC blends</i></b>	The regulation do not ban or restrict import or placing on the market of equipment / products using high-GWP HFCs and HFCs blends			
3.1	Residential air conditioners	No			
3.2	Commercial/Industrial refrigeration units/application (Cold Chain)	No			
3.3	Commercial A/C (chillers, packaged units, central units)	No			
3.4	Refrigerated trucks, marine vessels and off-shore fishing equipment	No			
3.5	Used products/equipment containing any HCFC or HCFC blends	No			
3.6	Use of HCFC or HCFC Blends in production of some or all types of foam	No			
3.7	Use of HCFC or HCFC Blends as solvent	No			
4	<b><i>Record keeping</i></b>				
4.1	Mandatory HCFC logbooks	There is a provision within the ODS Regulation 2010 for record Keeping HCFC Logbooks and Equipment Logbooks	It is mandatory for keeping records and reporting annually on HCFC equipment and HCFC logbooks Section 8 (sub section 11)		

4.2	Mandatory HCFC equipment logbooks	There is a provision within the ODS Regulation 2010 for record Keeping HCFC Logbooks and Equipment Logbooks	It is mandatory for keeping records and reporting annually on HCFC equipment and HCFC logbooks Section 8 (sub section 11)		
<b>5</b>	<b><i>Training and certification programmes</i></b>				
5.1	Legislative basis for training of customs officers	YES	2008 and 2010	The EPA Act 2008 and 2022 Part VII and the Prohibition of the ODS regulation 2010	
5.2	Legislative basis for training of refrigeration service technicians on HCFCs	YES	2008 and 2010		
5.3	Legislative basis for certification of refrigeration service technicians	YES	2008 and 2010		
5.4	Legislative basis for system for monitoring and evaluation of training programmes	YES	2008 and 2010	The EPA Act 2022 Part VII and the Prohibition of the ODS regulation 2010 ( Attached is the soft copy of the EPA Act 2022 and ODS Regulation 2010	
<b>6</b>	<b><i>Preventing HCFC emissions</i></b>				
6.1	Mandatory recovery and recycling of HCFCs during equipment maintenance	No			
6.2	Monitoring system for reporting on recovered and recycled HCFCs	No			
6.3	Ban on venting of HCFCs	No			
6.4	Mandatory leak checks for large capacity equipment	No			
6.5	Mandatory recovery of refrigerants from the equipment at the end-of-life	No			
<b>7</b>	<b><i>Other policies</i></b>				
7.1	Fiscal incentive/disincentive (Tax subsidies)	No			
7.2	Labelling of HCFC cylinders and containers	No			
7.3	Ban on non-refillable HCFC containers	No			
7.4	Penalties for not conforming to Regulations	Yes	There are Penalties in the ODS regulation 2010 for defaulter		

	<b>OVERVIEW OF HFC RELATED POLICY OPTIONS</b>				
<b>1</b>	<b><i>Establishing general guidelines to control import, production, and export of HFCs</i></b>				
<b>1.1</b>	HFC import/export licensing system in place for import of bulk HFCs	No			
<b>1.2</b>	Regulatory procedures for HFC data collection and reporting in place	No			
<b>1.3</b>	Requiring permits for import/export or sale of bulk HFCs	No			
<b>1.4</b>	Quota system in place for import of HFCs (in tons of CO <sub>2</sub> equivalent)	No			
<b>1.5</b>	Registration of HFC importers/exporters	No			
<b>1.6</b>	A shared database on import quotas and actual imports/exports between ozone office and customs or other relevant agencies	No			
<b>1.7</b>	Mandatory reporting by HFC importers/exporters	No			
<b>2</b>	<b><i>Banning/restricting import or placing on the market of bulk quantities of:</i></b>				
<b>2.1</b>	High GWP HFCs	No			
<b>3</b>	<b><i>Banning/restricting import or placing on the market of equipment/products using high-GWP HFCs and HFC blends</i></b>				
<b>3.1</b>	Domestic refrigerators/freezers/coolers	No			
<b>3.2</b>	Residential air conditioners	No			
<b>3.3</b>	MAC systems	No			
<b>3.4</b>	Commercial refrigeration units/application (Cold Chain)	No			
<b>3.5</b>	Industrial refrigeration units/application (Cold Chain)	No			
<b>3.6</b>	Commercial A/C (chillers, packaged units, central units)	No			

3.7	Refrigerated trucks, marine vessels and off-shore fishing equipment	No			
3.8	Used products/equipment containing any HFC or HFC blends	No			
3.9	Use of HFC or HFC Blends in production of some or all types of foam	No			
3.1	Use of HFC or HFC Blends as solvent	No			
3.11	Use of HFC or HFC Blends for firefighting	No			
4	<b>Record keeping</b>				
4.1	Mandatory HFC logbooks	No			
4.2	Mandatory HFC equipment logbooks	No			
5	<b>Training and certification programmes</b>				
5.1	Legislative basis for training of customs officers	YES	As provided for in the Prohibition of ODS Regulation and the EPA Act of 2022 it is a requirement for customs and other law enforcement officers to be trained regularly on the provisions of the Montreal protocol		
5.2	Legislative basis for training of refrigeration service technicians on HFCs	YES	As provided for in the Prohibition of ODS Regulation and the EPA Act of 2022 it is a requirement for customs and other law enforcement officers to be trained regularly on the provisions of the Montreal protocol		
5.3	Legislative basis for training of refrigeration service technicians in alternative technologies (with safety, toxicity and high-pressure considerations)	YES	As provided for in the Prohibition of ODS Regulation and the EPA Act of 2022 it is a requirement for customs and other law enforcement officers to be trained regularly on the provisions of the Montreal protocol		

5.4	Legislative basis for certification of refrigeration service technicians	YES	As provided for in the Prohibition of ODS Regulation and the EPA Act of 2022 it is a requirement for customs and other law enforcement officers to be trained regularly on the provisions of the Montreal protocol		
5.5	Legislative basis for system for monitoring and evaluation of training programmes	YES	As provided for in the Prohibition of ODS Regulation and the EPA Act of 2022 it is a requirement for customs and other law enforcement officers to be trained regularly on the provisions of the Montreal protocol		
6	<b>Preventing HFC emissions</b>				
6.1	Mandatory recovery and recycling of HFCs during equipment maintenance	No			
6.2	Monitoring system for reporting on recovered and recycled HFCs	No			
6.3	Ban on venting of HFCs	No			
6.4	Mandatory leak checks for large capacity equipment	No			
6.5	Mandatory recovery of refrigerants from the equipment at the end-of-life	No			
7	<b>Other regulations</b>				
7.1	Fiscal incentive/disincentive (Tax subsidies)	No			
7.2	Labelling of HFC cylinders and containers	No			
7.3	Ban on non-refillable HFC containers	No			
7.4	Penalties for not conforming to Regulations	No			
	<b>Other regulations, (please specify - Environment, Chemicals, Firefighting, Public Procurement, Consumer Protection, Labor, Gender, etc.)</b>	YES	The EPA Act of 2022 encourage incentive for proponents who are taking actions to minimize impact on the environment of which the control of consumption of ODSs are part of such compliance benefits		

## Appendix B: Sample Questionnaire

### i. End-user

#### SEYCHELLES- KIGALI IMPLEMENTATION PLAN (KIP) HFC SURVEY

##### END USERS: STATIONARY AC

Name of company:	Island:	District:
Email:	Street address:	Date:
Respondent Name:	Rank:	Tel. no.:

#### 1. Please provide the following information about your facility

Type of facility*	No. of facilities data is reported on
-------------------	---------------------------------------

\*1: example of facility - Homes, Hotels, offices, etc.

Annual electricity consumption, kWh/yr
--

#### 2. Provide Technical specification of UNITARY AC units in facility

(System types: Self-contained / Single split non-ducted / Single split ducted / Roof top ducted)

Index No.	System type	Qty**	Model/ Brand	Cooling capacity, CC		Running hours/yr*4	Rated power input,	Year of Installation	Type of refrigerant	Initial refrigerant charge	
				Unit**	Value**					Value**	kg or lb
1											
2											
3											
4											
5											
6											
7											
8											
9											
11											
12											
13											
14											
15											

\*2: Only units of same Brand, CC and refrigerant may be entered on one row and the quantity stated; else use different row for different units.

\*3: Unit of CC is either Btu/h or kW. If these are unknown but hp rating of system is known, enter "hp" under unit and the hp value under "Value".

\*4: For Qty > 1, values entered in these columns are average value for the units and not the sum for all units. (Energy use = annual energy consumption).

**NB:** Use more sheets if more data on Units have to be recorded.

**3. Refrigerant consumption**

**3a. System servicing and refrigerant top-up**

System type	Service Interval	Average refrigerant top-up per servicing		
	in months.	kg	lb	% of full charge
Refrigerator (single door)				
Freezer (single door)				
Combination refrigerator/freezer				

**4b. Refrigerant consumption per year, 2016 - 2022**

Year	Unit, enter kg or lb	HCFC-22	HFC-134a	HC-600a	R-410A	R-407C	R-404A	HC-290	Others		
2022											
2021											
2020											
2019											
2018											
2017											
2016											

**4. Servicing Companies/ Personnel.: Who services the equipment**

a. In-house technicians

How many in-house technicians	Male(s)	Female(s)

OR

b. External servicing company  
(provide contact details: name, etc)

No.1		
Name:		
Address:		
Tel No:		
No. of Technicians:	Male(s)	Female(s)

No. 2		
Name:		
Address:		
Tel No:		
No. of Technicians:	Male(s)	Female(s)

**5. Average life span of RAC equipment**

System type	Refrigerator (single door)	Freezer (single door)	Combination refrigerator/freezer
Years			

**6. Provide company names of local suppliers of your RAC equipment**

RAC equipment local suppliers

	No. 1		No. 2		No. 3		No. 4		No. 5	
Name										
Address										
Tel No.										
No. of Technicians:	Male(s)	Female(s)	Male(s)	Female(s)	Male(s)	Female(s)	Male(s)	Female(s)	Male(s)	Female(s)

## ii. Sale and Import

### SEYCHELLES- KIGALI IMPLEMENTATION PLAN (KIP) HFC SURVEY

#### SALES-DISTRIBUTORS-IMPORTERS: STATIONARY AIR CONDITIONERS

Name of company:	Island:	District:	
Email address:	Street address:	Business type*1:	
Respondent Name:	Rank:	Tel. no.:	Date:

\*1: business type - Importer, reseller, etc.

#### A. Import/sales: type and capacity distribution for 2022

##### A1. Self-contained, single split and rooftop ducted units

Cooling Capacity, CC			Self-contained Units	Single split		Rooftop, ducted
hp	Btu/h (k=1000)	kW		non-ducted	ducted	
	< 8 k	< 2.3				
1	8.0k ≤ CC < 10k	2.3 ≤ CC < 2.9				
1.5	10k ≤ CC < 15.5k	2.9 ≤ CC < 4.5				
2	15.5k ≤ CC < 20k	4.5 ≤ CC < 5.9				
2.5	20k ≤ CC < 25k	5.9 ≤ CC < 7.3				
3	25k ≤ CC < 30k	7.3 ≤ CC < 8.8				
4	30k ≤ CC < 40k	8.8 ≤ CC < 11.7				
5	40k ≤ CC < 50k	11.7 ≤ CC < 14.6				
6	50k ≤ CC < 63k	14.6 ≤ CC < 18.5				
7 ≤ CC < 11	63k ≤ CC < 96k	18.5 ≤ CC < 28.1				
11 ≤ CC < 20	96k ≤ CC < 180k	28.1 ≤ CC < 52.7				
20 ≤ CC < 33	180k ≤ CC < 300k	52.7 ≤ CC < 87.9				
33 ≤ CC < 80	300k ≤ CC < 720k	87.9 ≤ CC < 211				
CC ≥ 80	CC ≥ 720k	CC ≥ 211				

##### A2. Multi-split VRV/VRF unit

hp	Btu/h (k=1000)	kW	Units
12 ≤ CC	108 ≤ CC	31.6 ≤ CC	
CC > 12	CC > 108	CC > 31.6	

##### A3. Chiller AC unit

TR	kW	Units
CC < 16	CC < 50	
16 ≤ CC < 32	50 ≤ CC < 100	
32 ≤ CC < 80	100 ≤ CC < 250	
80 ≤ CC < 160	250 ≤ CC < 500	
160 ≤ CC < 222	500 ≤ CC < 700	

**B. Summary of number of units imported/sold for each type from 2016 - 2022**

Year	Self-contained	Single split,		Rooftop, ducted	Multi-split	Chiller AC
		non-ducted	ducted			
2022						
2021						
2020						
2019						
2018						
2017						
2016						

**C. Refrigerant type - provide percentage type of refrigerant charge for each product type**

Type	HCFC-22	HFC-32	HFC-134a	R-407C	R-410A	HC-290/1270
Self-contained						
Single split, non-ducted, residential						
Single split, non-ducted, commercial						
Single split, ducted, residential						
Single split, ducted, commercial						
Rooftop, ducted						
Multi-split, VRV/VRF						
Chiller AC						

**D & E: Order of importance of brands sold and Average unit price**

Type	D. Order of importance (sales volume) for various brands				E. Average unit price
	No.1	No.2	No.3	No.4	\$
Self-contained					
Single split, non-ducted, residential					
Single split, non-ducted, commercial					
Single split, ducted, residential					
Single split, ducted, commercial					
Rooftop, ducted					
Multi-split, VRV/VRF					
Chiller AC					

**F. Country of origin of imported AC units**

**F.1., Unitary AC: Self contained, Single split (all types), Rooftop ducted, Multi-split VRV/VRF**

Country 1	Country 2	Country 3	Country 4	Country 5

**F2. Chiller AC**

Country 1	Country 2	Country 3	Country 4	Country 5

**G. How do you see future annual growth in AC imports/sales over the next 5 years (tick one only for each group) .**

AC Group	0 - 2.5%	2.5 - 5%	5 - 7.5%	7.5 - 10%	>10%
Unitary AC					
Chiller AC					

## Appendix C: Refrigeration Servicing Sector for 2022

Group	Name of Company	Sector	RSS Personnel						Annual Refrigerants Use (Kg)					Servicing Equipment (% of population)				
			Engineer		Senior Technician		Technicians		% Of Trained/ Certified	R-134a	R-410A	R-407A	R-32	Other (Specify) R22	Vac. Pumps	Charge Scale	Leak Detect	Recovery Unit & Cylinder
			M	F	M	F	M	F										
Contracting Companies, Importers and after sales	LG Company	Importer, After Sales & Servicing	1	0	1	0	6	0	0	5,000	3,500	1,500	2,000	2,450	2	2	3	1
	Raju's( SL) Ltd	Importer	0	0	1	0	2	0	67%	0	0	0	0	0	0	0	0	0
	Harry's (SL) Ltd	Importer	0	0	2	0	0	0	50%	0	0	0	0	0	0	0	0	0
	Chinodu Investment	Importer	0	0	1	0	1	0	0%	0	0	0	0	0	0	0	0	0
	International Cooling	Importer, After Sales & Servicing	1	0	3	0	4	0	57%	4,567	2,500	3,675	3,657	1,546	2	3	2	3
	King's SL	Importer & After Sales of RAC systems	0	0	1	0	3	0	0%	0	0	0	0	0	0	0	0	0
	Ok Global Fishing Company	Importer	0	0	1	0	2	0	50%	1,598	547	400	78	4,347	0	0	0	0
	Sierra Fisheries Company	Importer	0	0	1	0	3	1	60%	2,433	1,532	56	87	2,500	2	3	2	2
	Universal Ventures	Importer	0	0	2	0	5	0	0%	799	896	200	59	1,600	1	2	1	1
	Koussa Group	Importer	0	0	1	0	4	0	20%	600	80	0	0	856	0	0	0	0
In-house Servicing	Marampa Mining Company	In House servicing	0	0	3	0	5	0	63%	2,431	1,654	234	1,265	1,534	1	3	2	2
	Kombora Fishing Company	In House servicing	0	0	2	0	2	0	50%	756	235	154	0	1,300	0	1	0	0
	Koidu Holding Limited	In House servicing	1	0	3	0	5	0	67%	1,200	549	60	345	1,400	2	2	2	2
	Red Sea Fishing	Contracting technicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Sierra Mining Company	In House servicing	0	0	2	0	4	0	50%	675	1,000	45	0	1,000	1	2	1	0
	Sea Wright Mining Company	In House servicing	1	0	2	0	3	0	33.30%	854	352	160	50	899	1	2	1	0
	Meya Mining Company	In House servicing	0	0	2	0	4	0	67%	1,348	632	825	0	1,634	1	1	1	0
	Vimetco Mining Company	In House servicing	1	0	3	0	5	0	44.40%	730	458	754	0	1,600	1	2	2	0
	Sierra Rutile Mining Company	In House servicing	2	0	4	0	5	0	70%	2,010	874	782	150	2,450	2	3	2	2
Servicing Workshops	Southern Region (Bo, Pujehun, Bonthe & Moyamba Districts, Total Workshop 14 Workshops )	Servicing, Installation etc.	0	0	89	0	367	8	9%	2,178	1,542	875	65	2,421	0	40	1	1
	Eastern Region (Kailahun, Kenema & Kono Districts, Total workshop= 19 Workshops)	Servicing, Installation etc.	0	0	76	0	567	10	6.70%	2,897	1,324	987	30	2,567	0	0	0	0
	North Western Region ( Port Loko, Kambia & Kerena Districts ) Total Workshop = 8)	Servicing, Installation etc.	0	0	30	0	230	0	0.40%	699	324	278	20	1,039	0	0	0	0
	North Region ( Makeni, Magburaka, Koinadugu & Falaba Districts Total Workshop = 16)	Servicing, Installation etc.	0	0	70	0	483	8	9.20%	346	298	245	70	1,890	0	0	0	0
	Western Ural & Urban Total Workshop 43)	Servicing, Installation etc.	2	0	200	2	1,254	24	16.30%	2,345	657	678	345	4,658	0	0	0	0

## Appendix D: Refrigeration and Air-Conditioning Societies and Associations

Name of Society or Association	Coverage	Type	Description			
	(National/Local)	(Science, Engineering/Professional, Technician, Trade, Mixed)	Number of members	Society Mandate	Society/ Association Activities	Work experience with NOU, Potentials)
<b>RETA West &amp; National</b>	Western Rural & Urban Area	Technicians & Engineers	1, 109	Coordinates RAC Technicians and Engineers within the Western Area, Enforce Ethics and Well fare issues among its members	Training , Liaise between its members and state institutions , provide support like basic intervention during work - solving problems	20 years
<b>RETA South</b>	Southern Region	Technicians	479	Coordinates RAC Technicians and Engineers within the Southern Area, Enforce Ethics and Well fare issues among its members	Coordinates RAC Technicians and Engineers within the Southern Area, Enforce Ethics and Well fare issues among its members	Over 10 years
<b>RETA East</b>	Eastern Region	Technicians	368	Coordinates RAC Technicians and Engineers within the Eastern Area, Enforce Ethics and Well fare issues among its members	Coordinates RAC Technicians and Engineers within the Eastern Area, Enforce Ethics and Well fare issues among its members	15 years
<b>RETA North</b>	Northern Region	Technicians	354	Coordinates RAC Technicians and Engineers within the Northern Area, Enforce Ethics and Well fare issues among its members	Coordinates RAC Technicians and Engineers within the Northern Area, Enforce Ethics and Well fare issues among its members	16 years
<b>RETA North Western</b>	North Western Region	Technicians	98	Coordinates RAC Technicians and Engineers within the North Western Area, Enforce Ethics and Well fare issues among its members	Coordinates RAC Technicians and Engineers within the North Western Area, Enforce Ethics and Well fare issues among its members	6 Years

## Appendix E: Refrigeration Training Centre for 2022

	Name of School	Location	Description	Personnel				Training Labs Equipment (average number of units per lab)								
				Senior Instructors		Trainers		Students		Vac. Pumps	Manifold Gauges	Charge. Scale	Leak Detector	Recovery Unit & Cyl.	Tubing Tools	Brazing Kits
	(Province or Region)	(Authority, Type of Certificates)	M	F	M	F	M	F								
TVET (Technical Schools, Collage)	GOVERNMENT TECHNICAL INSTITUTE	KAMBIA	NTC	1	0	1	0	8		0	1	1	0	0	0	1
	GOVERNMENT TECHNICAL INSTITUTE	KONO	ND	1	0	1	0	18	1	0	1	1	0	0	0	1
	GOVERNMENT TECHNICAL INSTITUTE	MOYAMBA	NTC	1	0	1	0	10	0	0	1	1	0	0	0	1
	OIC Bo	Bo	NTC	2	0	1	0	10	0	1 faulty	1	1	1	0	1	1
	OIC Makeni	Makeni	NTC	2	0	2	0	15	0	0	1	2	1	0	1	1
Technical Universities	Eastern Technological University	Kenema	HND	2	0	3	0	18	1	1	2	1	2	1	1	1

Milton Margai Technological University	Freetown	HND	2	0	1	0	19	0	1	2	2	3	1	1	1
FREETOWN POLYTECHNIC	KISSY CAMPOUS FREETOWN	HND	2	0	4	0	63	7	4	4	2	6	3	6	2
ARMFORCES TECHNICAL COLLEGE	WILBERFORCE FREETOWN	HND	1	0	2	0	22	12	1	2	1	1	1	2	1

## Appendix F: Customs and Enforcement

Legislative Framework	Yes/No	Since when?	List of legislative acts	Relevant provisions
Customs Legislation in place	Yes	Customs Act 2011 and The National Revenue Act (NRA Act 2022)	<a href="https://nra.gov.sl/sites/default/files/NRA-Act-2003.pdf">https://nra.gov.sl/sites/default/files/NRA-Act-2003.pdf</a> and <a href="http://www.sierra-leone.org/laws.html">http://www.sierra-leone.org/laws.html</a>	
Trade legislation in place (if relevant)	Yes	2010	Sierra leone Trade Policy <a href="https://faolex.fao.org/docs/pdf/sie152220.pdf">https://faolex.fao.org/docs/pdf/sie152220.pdf</a> and Sierra Leone Web - The Laws of Sierra Leone ( <a href="http://www.sierra-leone.org">sierra-leone.org</a> )	
Enforcement legislation in place (if relevant)	Yes	2008	EPA ACT , 2008 AS Amended 2010 and Prohibition of Ozone Regulation 2010 <a href="http://www.sierra-leone.org/laws.html">http://www.sierra-leone.org/laws.html</a>	
Overview of the sector (exact data or best estimates)	Total number	Gender-disaggregated data		
		Female	Male	
Customs officers	750	230	420	
Trained Customs on the Montreal Protocol	280	80	200	
Other Enforcement officers (e.g. Environmental inspectors, market inspectors, police, Republic of Sierra Leone Armed Forces (RSLAF) at the Boarder points etc.)	2,760	360	2, 400	
Customs border checkpoints and Posts	9			
Customs inland check points	1			
Local customs training centres	1			
Description of customs/enforcement officers training program	Training has been focus on Identifying ODSs - Counterfeits and Banned substances , Illegal trade of ODSs, Enhancement of trade facilitation of controlled substances that have permits, The Environmental Significance and Legal provisions as per the Prohibition of the Ozone Depleting Substances Regulation 2010 and its Parent Act i.e. EPA Act 2008 now the EPA Act, 2022 and also safety measures in handling, storage of controlled substances that has been confiscated etc.			

<b>Description of training materials/tools used</b>	Training has been both theoretical and practical in nature i.e. Presentation and hands on training sessions e.g. like the use of Refrigerants identifier
<b>Mainstreaming Montreal Protocol issues in customs training curricular</b>	As a way of easily mainstreaming Montreal protocol issues into the activities, programs and action of the National Revenue Authority (Customs Department), The EPA-SL via the National Ozone Unit (NOU) has customs as one of its Steering Committee members, and also working on a new training plan to be incorporated into the training programs during the recruitment of customs officers
<b>Description of collaboration between NOU and Customs in enforcement of licensing system and other registration.</b>	The collaboration between NOU and Customs has been in the following areas: Trainings, enforcement of the quota system and permit. However, manual sharing of data, the coming years will see the two institutions having a single window system and also joint raids along porous borders as well as undertaking common projects.
<b>Challenges encountered by customs on enforcement of the Montreal Protocol</b>	The frequent change of customs officers that have been trained on the provisions and requirements of the Montreal Protocol, Limited refrigerant identifiers, Several un porous borders without customs presence, Most customs officers are not having scientific background which limits their interest in ensuring compliance etc.

National Codes		
<b>HVACR</b>	Refrigeration	
	Air-Conditioning and Ventilation	
	Refrigerants	
	District Cooling	
<b>Building</b>	Building	
	Energy Efficient Buildings - Low Rising	
	Energy Efficient Buildings - High Rising	
	Insulation and or Building Envelope	
	Building Rating OR Sustainability	

## Appendix G: Relevant Experience Gain from HPMP

HPMP implementation achievements		Stage I	Stage II	Challenges and lessons learned
Implementation period				
HPMP achievements so far	Description			
<b>Policy Update and Enforcement</b>	The Prohibition of Ozone Depleting Substances Regulation 2010.		The Review of the 2010 ODS Regulation	Change in Political Administration, Limited knowledge on Part of Judiciary and Parliament on some of the key terminologies and chemicals of interest in the Montreal protocol
<b>Customs and Trade Authorities Training</b>	The Country successfully built the capacity of 487 Customs and other law enforcement Officers who have been trained in combating illegal trade, Identification of refrigerants , facilitating legal trade etc.		As of to date an addition 40 customs and other law enforcement Officers have been trained	The frequent changes of Customs and other law enforcement officers always greats the pressure or gaps in knowledge.
<b>Training of Refrigeration Good Practice</b>	379 RAC technicians has benefited from Trainings under the stage I and their capacities were built in the provision of the Montreal Protocol, Good Refrigeration Practices, Flammable Refrigerants handling , Environmental Impacts associated with bad refrigeration practices, retrofitting etc.		A total of 50 RAC technicians has been trained so far in the first Tranche of Stage II	The availability of centers of excellence in most part of the country for technicians to access critical tools remains a major challenge.
<b>Certification of Servicing Technicians</b>	A total of 197 technicians were trained and Licensed under this tranche		Under the Stage II First tranche The NOU has trained, certified and Licensed 173 Licensed Technicians out of which 7 are Female RAC Technicians. The increase in the number of technicians that has been trained in 2023 is due to the funds provided under this current tranche.	The initial challenge has to do with the centralized nature of the training for certification and licenses which was only in the Capital city, but the NOU in recent years has decentralized it trainings to the regions which has created attraction and participation
<b>Establishing RRR Scheme</b>	Few RRR equipment's were procure and deployed in two of the training centers		There is an ongoing Procurement Process for the establishment of a standard RRR Scheme under stage II	The procurement process on the stage II has been delayed
<b>Updating National Standards</b>	The only standards developed was the certification standards for RAC practitioners: Gold, Silver and Bronze This has to do with their level of educations experience in the sector etc. It was developed in 2018		In the Future standards would be developed under this stage such as MEPS , Ethical Standards for practitioners	Delay in approval due to changes in the administration, Also funding was limited to support the addition of other standards

<b>Technical and Technological Awareness</b>	Several Technical and Technological Awareness activities (e.g. TV & Radio Programs, Community Engagements , Stakeholder Sensitization event were undertaken under the Stage I)	In this present Stage II first tranche implementation there has been three (3) engagements so far	Accessibility during the raining season remains an historic challenge as some of the areas of interest have poor road networks
<b>Support to National Associations</b>	The NOU via the support of the MP provided basic tools and also provided technical support through trainings to National Associations like the RAC, Importers, and other Enforcement Bodies - Traders Union. In addition, equipment Like recovery Machine, Recovery cylinder, RRR Machine, Refrigerants Identifiers were provided to RAC Technicians Association in Kono, Bo , Freetown and Makeni	There is an ongoing Procurement Process for the	Funds allocated by development partners is limited and Government must ensure they also increase their own commitment
<b>Incentive schemes and demo/pilot projects</b>	There was an Incentive Scheme which was extended to the people in the Fishery sector and Supermarket etc. However, there was Demo Project	It is anticipated that incentive will be provided and a demo project undertaken for the first time	The funds for the implementation of the incentive scheme was limited.
<b>Green Public Procurement</b>	The country benefited by participating in a workshop organized by UNEP in Dakar, Senegal during which the NOU and a representative from the National Public Procurement Authority attended	There is a planned activity under this stage tranche II that will provide trainings on Green Procurement	Limited knowledge of our public procurement Institutions and practitioners is affecting Green Procurement especially RAC Green Procurement
<b>Gender mainstreaming activates</b>	The NOU has engage via its public sensation activities topic of Gender mainstreaming within the RAC and has placed more emphasize over the years on Female obtaining to be RAC technicians by provided scholarship for them	The NOU like all Other Institution has incorporated issues of gender mainstreaming into it activities and programs. More particularly , the NOU is enforcing as a key Government Directives the idea of 30% inclusion of Female in its activities and programs like trainings , workshop etc. In addition, the NOU has included specialized, trainings of FEMALE RAC Technicians into its annual activities and also provided budgetary line for equipment. Also NOU provides has made free of cost the License and certification scheme for all Female RAC technicians and disable technicians	The topic itself is new and cultural acceptability serves a strong opposition. Government support in motivating the weaker gender has been low
<b>Capacity building under the MP projects</b>		<b>Total Number</b>	<b>Gender-disaggregated data</b>

		<b>Female</b>	<b>Male</b>
<b>Customs and Enforcement</b>			
Customs officers trained in prevention of illegal trade	984	200	784
Customs officers trained in import/export data collection and analysis	100	30	70
Other enforcement officers trained	500	113	387
Refrigerant identifiers procured	8	-	-
Customs posts equipped with identifiers	3	-	-
Sierra Leone Standards Bureau	1	-	-
Compliance inspections performed	4	-	-
Cases of illegal trade identified/reported	0	-	-
RAC Servicing sector		-	-
Refrigeration technicians trained in good practices	Over 379	-	-
Refrigeration technicians trained in alternative refrigerants	289	-	-
Training centers equipped with training equipment	3	-	-
Servicing kits provided to trained technicians	55	-	-
Reclamation centers established	0	-	-
Recovery units provided/operational	10	-	-
Certified technicians	370	363	7