COPA
Cutting refrigerant emissions

ROADMAP ON ODS BANK MANAGEMENT

IN GHANA

Implemented by:

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IKI INTERNATIONAL CLIMATE INITIATIVE

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“HIGHEST PRIORITY FOR REDUCING THE ODS BANK AND AVOIDING CORRESPONDING EMISSIONS SHOULD BE GIVEN TO THE DOMESTIC REFRIGERATION AND THE AIR CONDITIONING SUBSECTOR.”

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ABBREVIATIONS

BMUV	German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, formerly BMUB
BMWK	German Federal Ministry for Economic Affairs and Climate Action
CFC	Chlorofluorocarbon
COP	Conference of the Parties
EEE	Electrical and Electronic Equipment
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GWP	Global warming potential
HCFC	Hydrochlorofluorocarbon
HCl	Hydrogen chloride
HF	Hydrogen fluoride
HFC	Hydrofluorocarbon
HPMP	HCFC Phase-out Management Plan
HW	Hazardous waste
IKI	International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
IPCC	International Panel on Climate Change
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MRV	Monitoring, reporting and verification
ODP	Ozone depleting potential
ODS	Ozone depleting substances
RAC	Refrigeration and air conditioning
RAC&F	Refrigeration, air conditioning and foam
RRR	Recovery, Recycling and Reclaiming
UAC	Unitary Air Conditioning
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value added tax
WEEE	Waste Electrical and Electronic Equipment

MANAGEMENT AND DESTRUCTION OF EXISTING OZONE DEPLETING SUBSTANCES BANKS

The Montreal Protocol on substances that deplete the ozone layer (ODS) has been effectively regulating the production and consumption of ODS since 1989. However, large banks of ODS have accumulated globally due to the excessive historical use of these substances. ODS are continuously being released to the atmosphere from these banks – damaging the ozone layer and contributing to global warming. It is important to note that these banks are not regulated under the Montreal Protocol. Adequate collection, recovery and destruction of ODS banks represent a challenge for developing countries.

Various programmes and projects that were promoted and financed by the Montreal Protocol aiming at the reduction and elimination of ODS resulted in the voluntary conversion to technologies free of these substances by large companies. This, together with import and trade controls of ODS has ultimately contributed to an increase in waste stocks and equipment which contain ODS and now require final disposal.

The global project “Management and Destruction of ODS Banks” (2013 – 2021) supported the integrated waste management of ODS and equipment containing ODS. This project was commissioned by the German Federal Ministry of Environment, Nature Conservation, Building and Nuclear Safety (BMUB) (now Federal Ministry of Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)) as part of its International Climate Initiative (IKI) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. This roadmap on ODS bank management in Ghana was developed as part of the ODS Banks project in close cooperation with the Environmental Protection Agency (EPA) of the Ministry of Environment, Science, Technology and Innovation (MESTI), with the aim of providing a strategic action plan for ODS bank management and to reduce emissions from the most important sectors. The activities of the ODS bank management project are being continued by the Climate Ozone Protection Alliance (COPA) from 2022 until 2025, commissioned by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and implemented by GIZ. This report is published by COPA.

1 INTRODUCTION

1.1 BACKGROUND

Ghana has been a Party to the Montreal Protocol since its ratification in 1989. Since then, the consumption and production of ozone depleting substances (ODS) has been effectively reduced in the country. Whilst Chlorofluorocarbon (CFCs) have been phased-out successfully since 2010, Hydrochlorofluorocarbon (HCFCs) are still widely in use, especially in air-conditioning units. The historical and current use of ODS has led to the accumulation of large amounts of ODS, e.g. in old refrigerators, insulation foam or cylinders, so-called ODS banks[1]. This problem has been heightened in Ghana through the import of used and partly broken refrigeration and air-conditioning (RAC) equipment, mostly refrigerators, which have significantly added to the ODS banks. The emissions from these ODS banks contribute not only to ozone layer depletion but also to climate change.

As neither the Montreal Protocol nor any other international environmental convention regulates the management and destruction of existing ODS banks, it is each country's own responsibility to establish a successful ODS bank management to handle this important source of emissions. However, the awareness of the problematic has increased and in 2022, a new funding window was established by the Multilateral Fund[2] for the Implementation of a Funding window to support Article 5 (developing) countries in preparation of a national inventory of banks of used or unwanted controlled substances, and the development of a national action plan for the collection, transport, and disposal, including consideration of recycling, reclamation, and cost-effective destruction.[3]

In Ghana, the National Ozone Unit (NOU) of the Environmental Protection Agency (EPA) is responsible for the design and implementation of the strategies for the phase-out of the ODS to fulfil the commitments under the Montreal Protocol. Therefore, EPA plays a key role for ODS bank management, but many other stakeholders are involved in this multidisciplinary topic too. Within the project "Management and destruction of ozone depleting substances", the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) engaged the EPA and other relevant stakeholders. Visits to Ghana in February 2016, March 2017 and October 2017 led to in-depth discussions with many stakeholders including the private sector. The findings from the engagements and the visits have substantially contributed to the development of this Ghanaian roadmap on ODS bank management.

Regarding the international climate negotiations with the key objective to limit the temperature increase well below 2°C and pursue efforts to limit it even further to 1.5°C, Ghana as a party to the UN Framework Convention on Climate Change (UNFCCC) agreed at the 21st Conference of the Parties in Paris in December 2015 (COP 21) to fight climate change by reducing their greenhouse gas (GHG) emissions. Within this scope, Ghana defined ambitious climate targets laid down in the "Nationally Determined Contribution" (NDC, 2021). For this, 19 policy actions have been developed across 10 priority areas to achieve the NDC goals of reducing GHG emissions by 64 Mt CO_2eq by 2030. Of these, 24.6 Mt CO_2eq are unconditional and a further 39.4 Mt CO_2eq are conditional on support from international and private sector funding agencies to cover the full cost for implementation. Of the 19 NDC policy actions, one is directly targeting the RAC sector.

Even though ODS are not listed as a GHG in the Kyoto Protocol or the Paris Agreement by UNFCCC, an effective ODS bank management may also contribute significantly to climate protection besides

1 Banks are defined as the "total amount of substances contained in existing equipment, chemical stockpiles, foams and other products not yet released to the atmosphere" (IPCC/TEAP 2005).
2 The Executive Committee to the Multilateral Fund decision 91/66 on the provision of a funding window for establishing an inventory of controlled substances and a plan for their treatment.
3 COPA Guideline Inventory for ODS and HFC banks (2023)

protecting ozone layer, for example if the ODS bank management concept also targets substances with high Global Warming Potential.

This 'Ghanaian roadmap on ODS bank management' introduces four key processes to establish good practices in ODS bank management:

- Supporting and introducing a suitable set of laws and regulations,
- a sustainable financing mechanism,
- a functioning recycling and destruction infrastructure,
- an effective collection mechanism.

For each of the key processes the status quo is shortly described for Ghana, followed by specific recommendations and guidance to policy-makers, e.g. national ozone officers and policy-makers from the waste sector. This roadmap focuses on ozone depleting chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC) which have been used in the refrigeration, air conditioning and foam (RAC&F) sectors and accumulated to substantial banks. Hydrofluorocarbons (HFC), which do not harm the ozone layer but contribute to global warming, are mentioned too when relevant.

1.2 THE ODS BANK IN GHANA

A RAC sector inventory was conducted in Ghana in 2016/2017 (Ghana's Greenhouse Gas Inventory and Technology Gap Analysis for the Refrigeration and Air Conditioning Sector (EPA/GIZ, 2018)) based on the Tier 2 method. This means that sales and stock data of equipment containing CFCs, HCFCs and HFCs as well as natural refrigerants was collected. Information on the refrigerant distribution, charge sizes and leakage rates were then used to calculate emissions from the RAC sector. The data from the Tier 2 inventory was here used to calculate ODS banks. More information on the methods and further results can be found in the document, which is available at EPA.

A Tier 1 approach based on consumption data only, neglects CFC and HCFC refrigerant in old or second-hand equipment and HCFC foam blowing agent for Ghana. The country only imports refrigerators, so that the blowing agent is consumed elsewhere. Therefore, this chapter estimates the amount of foam blowing agent based on the number of refrigerators and the Tier 1 approach was not used for this roadmap. Only insulation foam in domestic refrigerators and commercial stand-alone units was considered; insulation in cold rooms, transport refrigeration and similar installations as well as building foam was neglected. This can usually not be reached in a financially feasible manner.

Additionally, an inventory of stored waste refrigeration and air conditioning equipment was conducted in May 2021 for different workshops, as workshops often have large numbers of mainly broken refrigerators and ACs in storage. The inventory was conducted in order to assess the quantities of equipment, CFCs, HCFCs, HFCs and natural refrigerant available for collection and management[4].

Figure 1 shows the highest accumulation of ODS in the unitary air conditioning (UAC) sector and in the domestic refrigeration sector. In the domestic refrigeration sector, CFCs are still present in the form of refrigerant and foam blowing agent. No other subsector shows significant amounts of CFCs. Even when considering the higher ozone depletion potential (ODP) of CFCs, the environmental impact of HCFCs in the UAC subsector is still higher because of the high number of units. The subsectors mobile AC (passenger cars, busses, etc.) and transport refrigeration are not presented as ODS are not used anymore in this sector and consequently no banks of ODS are present.

Clear focus sectors of ODS banks management in Ghana are therefore UAC and domestic refrigeration.

4 The document is available at the Environmental Protection Agency Ghana or GIZ. Aldago, D.A. (2021): Development of inventory of stored waste refrigeration and air conditioning (RAC) equipment and related substances in Ghana

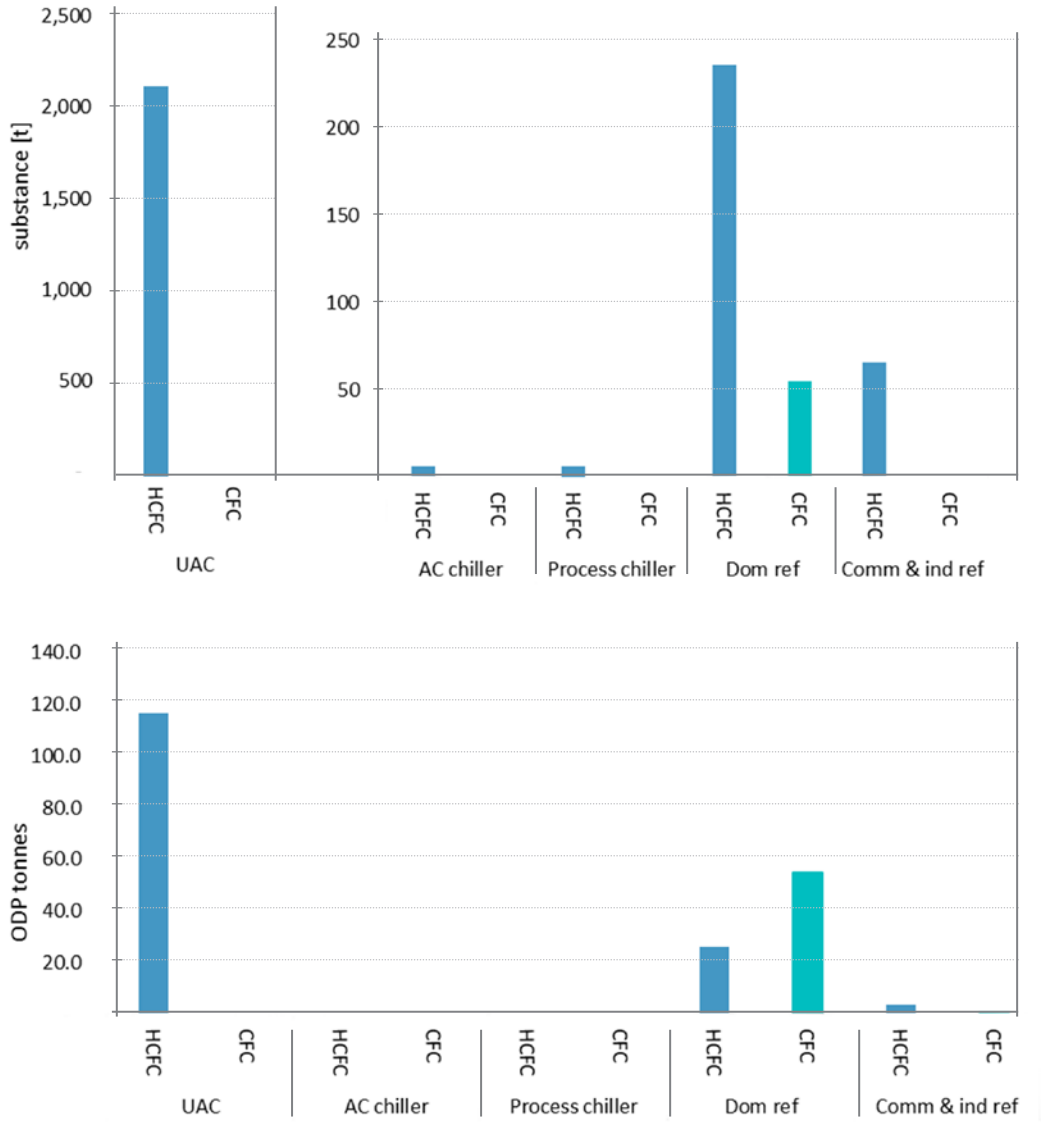

Figure 1: *ODS bank of the RAC sectors in metric tonnes (top) and ODP weighted tonnes (down), for CFCs and HCFCs.*

Based on information from the RAC sector inventory, the following results for ODS banks were compiled for the key sectors UAC and domestic refrigeration. The graphs show per refrigerant

- The number of units in stock
- The bank of substance in tonnes
- The number of units reaching the waste stream
- The amount of substance in tonnes reaching the waste stream in those units – potentially available for management
- The number of units realistically available for management (5% of waste stream)
- The amount of substance realistically available for management (5% of waste stream)

1.2.1 Unitary Air Conditioning

In UAC units, HCFC-22 (R22) is still the dominant refrigerant. It is estimated that in 2015, more than 1.2 million units were installed using HCFC-22, resulting in over installed 2,000 tonnes of the substance. It is estimated that 100,000 units containing HCFC-22 reach the waste stream each year until 2023, so that between 150 and 200 t of HCFC-22 could be potentially available for treatment over the coming years.

In practice, refrigerant is rarely recovered from UAC units in Ghana. Technicians sometimes recycle refrigerant during servicing and repair and immediately reuse the substance in the same unit or the same building. When a unit is disposed of, it is likely that most of the refrigerant has leaked previously or that the refrigerant escapes during dismantling.

Priorities for ODS banks management in the UAC sector are therefore increased recovery and recycling activities of refrigerant as well as a decrease in the use of R22.

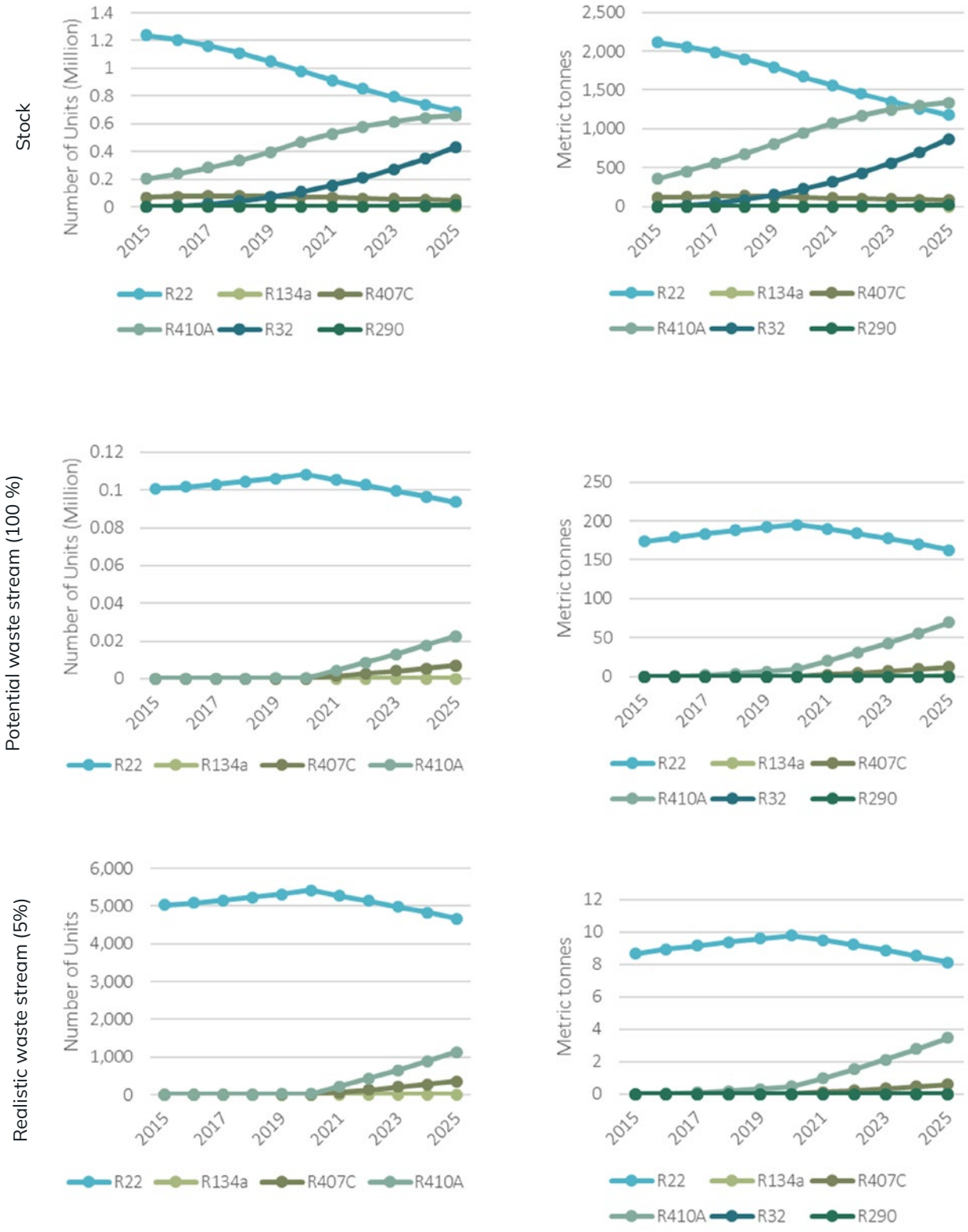

Figure 2: *ODS banks in the UAC subsector.*

1.2.2 Domestic refrigeration

New domestic refrigerators contain HFC-134a or the hydrocarbon HC-600a. In units from the end of the 1990s, CFC-12 is still present to a small extent. As Ghana experienced a high inflow of used refrigerators from developed countries until 2013, units with CFC-12 still reached the country until then.

It is assumed that in 2015, about 15% of refrigerators reaching the waste stream still contained CFC refrigerant and blowing agent[5] (about 45,000 units). In 2025 this is expected to go down to just under 15,000 units. If 5% of these units can be collected, just under 2,000 units could be reached in 2017, going down to about 700 units in 2025 *(Figure 4)*.

It was further assumed that all units containing CFC refrigerant also contain CFC blowing agent and that 40% of HFC-134a refrigerators contain the blowing agent HCFC-141b. Processing not only the refrigerant, but also the blowing agent would result in a considerably higher emission saving potential. *Figure 4* compares the substances, ODP tonnes and t CO_2 eq available in the bank in Ghana. HCFC-141b is still available in high amounts (more than 75% of the total bank) but has a smaller environmental impact due to its lower ODP and GWP, resulting in just over 25% of the total ODP tonnes or t COeq emissions.

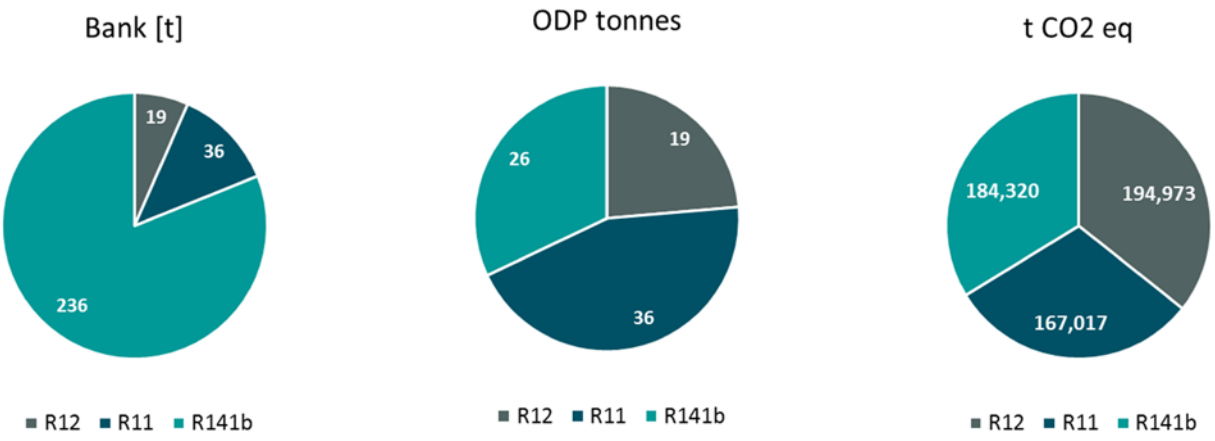

Figure 3: *ODS banks in the domestic refrigeration sector according to substance in t, ODP tonnes and t CO_2 eq. Based on data for 2013-2015*

The priority in the domestic refrigeration subsector is to recover as much ODS refrigerant and blowing agent before these units are completely disposed of without proper processing. Contrary to the UAC subsector, refrigerants are still present at the point of dismantling as the refrigeration circuit is hermetically sealed. About 50% of blowing agent are still present at the end-of-life point, as only about 10% in the first year and a further 2% per year are lost due to outgassing. Further banks will not accumulate as newly sold units do not contain ODS and the majority contains hydrocarbon refrigerants and foam blowing agents with no ODP and negligible GWP.

5 Information received from City Waste Management, June 2015.

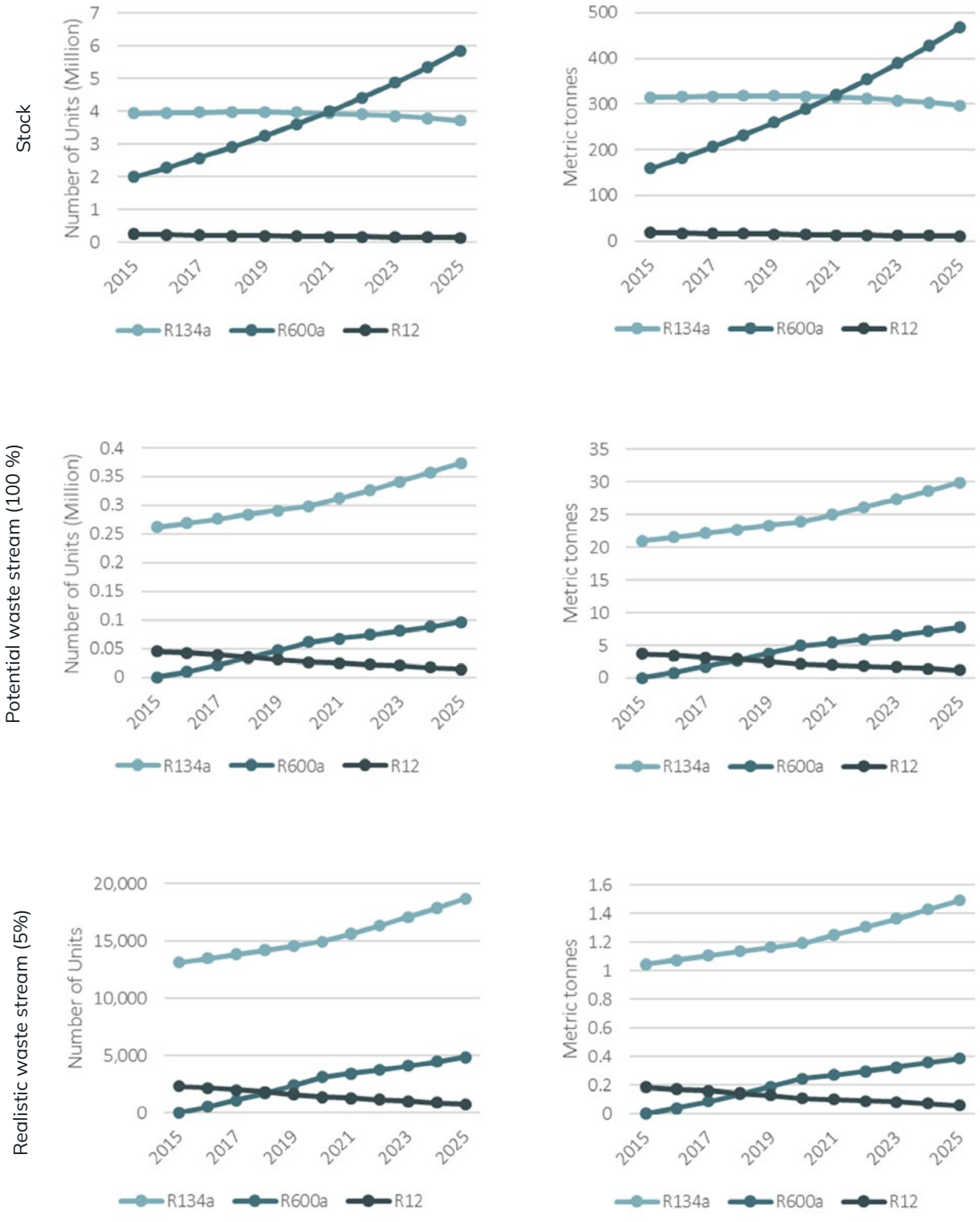

Figure 4: *ODS banks in the domestic refrigeration subsector.*

1.2.3 Stored equipment in workshops

The inventory was conducted in April/May 2021 in 222 workshops in all 16 Ghanaian regions. It used both questionnaires as well as the observation of over 1,000 pieces of domestic refrigerators and ACs to estimate the number of stored equipment in the country and the type and amount of refrigerant and foam blowing agent. It hereby relied on the information on the labels of the equipment. It further looked at the state of equipment (broken/containing refrigerant/compressor available) and ownership (private customer/workshop owner). By applying the observations to the estimated total number of workshops in the country, the inventory calculated the number of stored equipment to be over 250,000 of which 83% are estimated to be domestic refrigerators. About 50% of equipment potentially contained refrigerant, though it was not possible to check the units individually.

Storage time for the equipment in the workshops is on average two years, with the majority being stored for one year or less. 63% of equipment in storage is

owned by the clients only 22% are owned by workshop owners, 11 % are jointly owned and 4 % are owned by different people altogether. The uncertainty of ownership is the main problem in handling this waste equipment as most workshop owners would otherwise dispose of the equipment.

Table 1 shows the number of units per region. The highest numbers are expected in the Greater Accra region, as well as the Bono and Bono East regions and the Ashanti region where the projected number of workshops is seen as too low.

Region	Based on data from workshop owners								Projected number of workshops per region
	Actual data (from participating workshops)				Estimated number of units (using weighted averages and estimated number of workshops)				
	Average AC units per shop	Average Fridges per shop	Intact ACs (%)	Intact fridges (%)	All fridges (foam)	Intact Fridges	Intact ACs	Total intact RACs	
GAR	3	12	43	45	41,054	18,351	4,200	22,551	3,500
AR	7	15	67	38	11,843	4,474	3,712	8,187	777[6]
UER	7	19	69	38	14,608	5,594	3,626	9,220	777
UWR	1	3	27	58	1,650	950	167	1,117	500
NER	1	10	60	19	1,500	285	113	398	150
NR	9	19	75	51	5,727	2,945	2,100	5,045	300
SR	-	29	-	69	432	300	-	300	15
BR	9	19	96	60	14,918	8,936	6,993	15,929	777
BER	8	37	55	36	28,663	10,360	3,497	13,857	777
AHR	12	8	72	30	6,449	1,943	6,734	8,677	777
ER	1	10	100	73	7,705	5,633	486	6,119	777
WR	7	24	32	36	17,800	6,350	1,650	8,000	750
WNR	1	17	100	22	12,821	2,797	583	3,380	777
VR	8	7	90	51	1,530	788	1,620	2,408	225
CR	10	18	5	54	14,297	7,692	389	8,081	777
OTR	3	9	86	98	7,205	7,064	1,865	8,928	777
Total	-	-	-	-	188,201	84,463	37,733	122,195	12,433

Table 1: *Observed units per region and estimated total number of units per region*

6 Projected number of shops in the Ashanti region is likely to be higher than the project as it could have the same number of shops as Greater Accra.

Table 2 shows the estimated quantity of refrigerant in observed units. In refrigerators, 11% of refrigerators still potentially contain the very harmful ozone depleting gas CFC-12 and therefore also the equally harmful foam blowing agent CFC-11. The climate harming HFC-134a and the natural refrigerant HC-600a are equally present in the remaining 89% of units. About 90% of ACs still contain HCFC-22.

ACs have a higher charge size than domestic refrigerants. It therefore appears as if they contribute about 50% of refrigerant available for management and disposal. However, it is far more likely that refrigerators still contain refrigerant at this stage as they are hermetically sealed and have far lower leakage rates. Furthermore, the foam blowing agent makes up at least half of the potential ozone depleting substances for disposal. The estimated quantities for ACs should be considered as a maximum with potentially very little refrigerant remaining in the units in the workshops.

Quantity of refrigerant in refrigerators (kg)					Quantity of refrigerant in ACs (kg)				Overall
CFC-12	HFC-134a	HC-600a	Fridge sub-total (kg)	Fridge % of overall	HCFC-22	HFC-410A	AC sub-total (kg)	AC % of overall	Quantity (kg)
19.3	76.32	79.44	175.06	53.86%	135.28	14.69	149.97	46.14%	325.03
11%	44%	45%	54.38	-	90%	10%	-	-	-

Table 2: *Estimated quantity of refrigerant in observed units*

The inventory study determined the potentially available quantity of refrigerant available for destruction by region and type *(Table 3)*. Please note that for this roadmap, refrigerants with a contribution of less than one percent were not considered. Again, the quantities estimated for ACs should be regarded with caution.

Region	Estimated quantity of refrigerant in refrigerators (kg)				Estimated quantity of refrigerant in ACs (kg)			Overall Total (kg)
	CFC-12	HFC-134a	HC-600a	Fridge Sub-total	HCFC-22	HFC-410a	AC Sub-total	
GAR	423	1,900	1,414	3,737	3,336	472	3,808	7,545
AR	75	261	624	960	2,843	491	3,334	4,294
UER	103	626	445	1,174	3,314	-	3,314	4,488
UWR	25	103	62	190	145	7	152	342
NER	21	24	4	49	-	-	0	49
NR	16	240	416	672	1,800	-	1,800	2,472
SR	-	35	31	66	-	-	0	66
BR	91	937	916	1,944	-	-	0	1,944
BER	169	1,214	791	2,174	2,841	380	3,221	5,395
AHR	-	47	437	484	6,155	-	6,155	6,639
ER	133	568	481	1,182	-	-	0	1,182
WR	35	223	1,279	1,537	1,508	-	1,508	3,045
WNR	100	284	179	563	533	-	533	1,096
VR	28	101	23	152	1,481	-	1,481	1,633
CR	163	835	612	1,610	-	-	0	1,610
OTR	232	624	573	1,429	1,364	365	1,729	3,158
Total	1,613	8,023	8,287	17,923	25,320	1,717	27,037	44,960

Table 3: *Estimated quantity of refrigerants available for destruction by region and type*

Based on the inventory, the number of equipment stored in workshops is sufficiently high to consider the workshops for collection activities. Especially those refrigerators still containing CFC-12 and CFC-11 should be a focus of collection activities. However, the uncertain ownership and compensation for workshop or private owners has to be considered because of the monetary value of the waste equipment.

1.3 PRIORITIES FOR ODS BANK MANAGEMENT

General priorities within ODS bank management are closely related to the technical feasibility. Technical feasibility is defined as the possibility to recover ODS at a reasonable level of effort and cost (ICF 2010). TEAP (2009) assigned three categories of effort levels (low, medium, high) to the reachable bank in the RAC&F subsectors.

- **Short-term actions** (until 2020) should focus on large refrigeration and air conditioning (RAC) systems,
- **Mid-term actions** (until 2025) should focus on the appliance sector (including insulation foam) and
- **Long-term actions**, finally, should focus on the ODS contained in construction foam (until 2030-2050 and longer)[7].

In addition to these priorities, the effort required for managing ODS banks should be considered. The effort to extract ODS is generally lower in urban areas, so these should be considered first. The recovery of blowing agents from construction foam is a complex and expensive issue and is simultaneously not urgent because of the slow release from the foam matrix. It therefore has the lowest priority. Each country has special conditions based on past activities in ODS banks management, the amount of accumulated ODS banks, the geographical situation and involved stakeholders, which can mean an adjustment of the general priorities.

In Ghana, some ODS banks management activities have already been implemented. The short-term actions, i.e. the recovery of ODS from MAC and large RAC systems are to a large extent already addressed by the Ghanaian HCFC Phase out management plan (HPMP), financially supported by the Multilateral Fund for the Implementation of the Montreal Protocol (MLF). Recovery equipment for refrigerant from refrigerators is present in the Greater Accra area, but there is no option of processing foam blowing agent. Collected refrigerants have already been exported for destruction in a one-off activity, financed by the MLF. Since ODS bank management is closely related to the activities of the HPMP, for example training and certification of refrigeration and air-conditioning technicians or developing laws to reduce ODS emissions from equipment, the roadmap also points to overlapping issues.

For the distinct situation in Ghana, the following priorities have been determined during stakeholder consultations:

1) **Collect and properly process refrigerators containing ODS.** Both refrigerant (such as CFC-12 and HFC-134a) as well as foam blowing agent (such as CFC-11 and HCFC-141b) should be considered.
2) **Increase re-use of HCFCs.** As it is still allowed to use these substances, they will not be destroyed. This can be done by reducing leakage rates and implementing a better infrastructure for recycling and reclaim. This is specifically important for UAC units, where the highest amount of HCFC is consumed.
3) **Prevent future banks of HCFCs and high-GWP HFCs by introducing low-GWP/no ODP refrigerants, such as natural refrigerants** and educating technicians in their proper use. A focus subsector is again UAC.

7 The time horizon is not given by TEAP.

2 THE CORE PROCESSES OF ODS BANK MANAGEMENT

For a successful ODS bank management, the core processes (*Figure 5*, light blue colouring) are to establish:

1. a suitable set of policy measures (i.e. laws and regulations, but also fiscal and other non-regulatory measures)
2. a sustainable financing mechanism
3. an effective collection mechanism
4. a functioning recycling and destruction infrastructure

Generally, these processes are embedded in a larger framework or steering process such as the low emission development strategy (LEDS) or other national climate and energy plans. Important accompanying processes (support processes) are:

- the compilation of an ODS bank inventory
- the establishment of a monitoring, reporting and verification (MRV) system
- and capacity building (e.g. technician training to properly recover ODS from equipment)

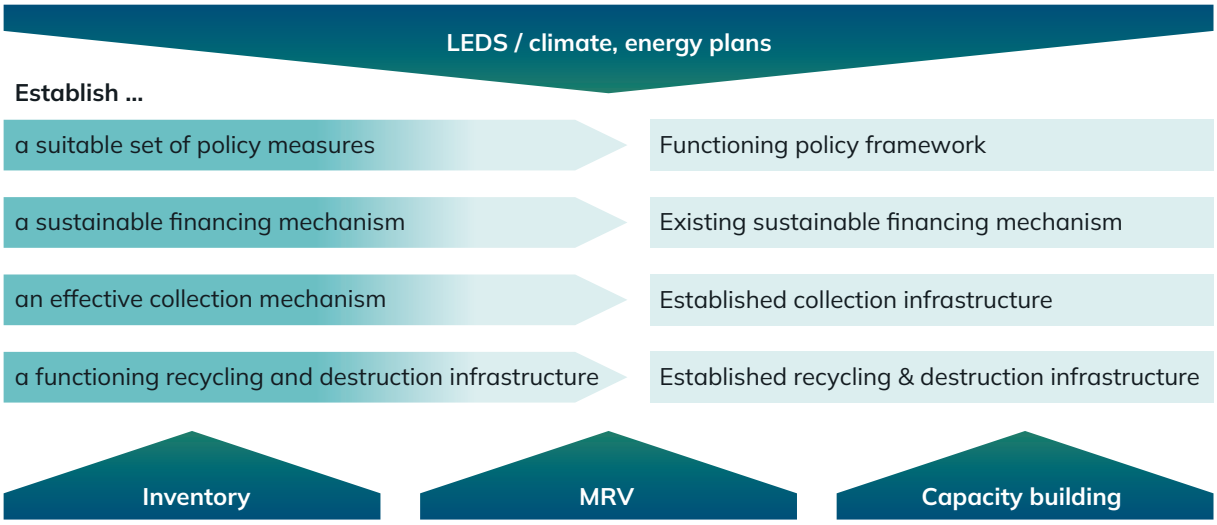

Figure 5: *Core processes for successful ODS bank management (light blue), as well as steering processes (dark blue, top) and support processes (dark blue, bottom)*

For each of the core process, this roadmap describes the situation in Ghana in the following sub-chapters, and formulates specific recommendations based on a gap analysis (Annex II)[8] conducted. Barriers identified during several stakeholder workshops are also considered.

8 More general information is found in the "Global roadmap on ODS bank management" (GIZ 2017) and the guidelines which are referred to in the document.

Within the project, the following key activities were identified together with the Ghanaian partners to support successful ODS bank management. Due to administrative complications, there was a project delay and the originally planned technology transfer was not possible anymore. The project was then further delayed due to the Corona Pandemic (2020/2021). The total project duration is 8 years:

1) Compilation of ODS bank inventory
   a. review of existing data and information
   b. using data from the Green Cooling Africa inventory (equipment data for conducting a detailed Tier 2 inventory approach) to determine ODS banks in Ghana
2) Technology transfer: Detailed analysis of technical needs for foam/blowing agent destruction. Technical and financial assessment of planned local rotary kiln for foam destruction. Piloting of foam destruction containing ODS and HFC, with environmental lab analysis of residues.
3) Series of trainings for e-waste sector and other stakeholders on the proper dismantling of refrigerators, ODS bank inventories and sustainable alternatives.
4) Inventory of potentially ODS waste containing equipment in local workshops
5) Stakeholder workshop on Ghana roadmap
6) Regional workshop on transboundary movement of ODS waste

2.1 CORE PROCESS 1: ESTABLISH A SUITABLE SET OF POLICY MEASURES

The responsible ministries have different policy options for guiding and advancing a national ODS bank management to reach the required goal of reducing emissions, including regulatory, fiscal and non-regulatory measures. Policies can aim at different RAC subsectors, e.g. domestic refrigerators, or refrigerant collection overall. For comprehensive ODS bank management, both waste electrical and electronic equipment (WEEE) containing ODS and the ODS themselves need to be considered.

To establish a suitable set of policy measures, generally the following steps are recommended:

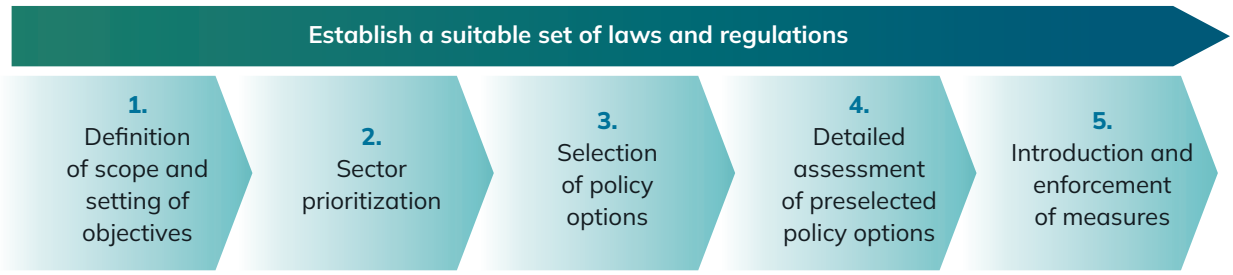

Figure 6: *Step approach to suitable laws and regulations of ODS bank management*

2.1.1 Status quo

In 2016, Ghana has introduced Act 917 on "Hazardous and electronic waste control and management". Act 917 prohibits the export and import of hazardous waste, unless it is necessary because there are no local treatment options. Both export and import can only be conducted according to the formalities of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The second part of Act 917 stipulates that an advance eco levy has to be paid at the point of import of electrical equipment. This fund is at least partly to be used for the proper processing of e-waste. The act is being implemented through L.I. 2250. Refrigerators and ACs as well as foam containing CFCs and HCFCs are covered, but there is no definition yet on the proper processing of these equipment types, which shall be done through agency-issued guidelines. Waste refrigerants are also classified as hazardous substances. L.I. 2250 also stipulates that producers of electrical and electronic equipment are required to set up a collection centre or take-back system.

Previously, Ghana had introduced laws that affected e-waste and ODS. From 1994 onwards, importers need clearance from EPA and a permit before importing ODS-based refrigerants as well all other refrigerants and chemicals. From 2005 onwards, under L.I. 1812, the "Management of ozone depleting substances and products regulation" is used to regulate imports of ODS and set phase-down targets. Because of the high import of used and often broken refrigerators, L.I. 1932 banned the import of used refrigerating appliances from June 2013 onwards. The amended law currently uses the minimum efficiency performance to regulate imports of appliances.

9 More information about this process can be found in the COPA Publication *"Potential Policy Framework for the Promotion of Sustainable ODS/HFC Banks Management."* (GIZ 2023).

As part of the HPMP, Ghana wants to introduce mandatory technician training and certification. The EPA, the NACODS sub-committee on training and certification and GIZ have overseen a consultant team of the Kwame Nkrumah University of Science and Technology (KNUST) tasked with the development of a draft LI mandating certification of refrigeration practitioners, a national RACHP standard (code of practice) for certification, a syllabus and training concept as well as a comprehensive guidelines and information material for technicians. The standards have been reviewed and gazetted by the Ghana Standard Authority (GSA) in 2024. The LI has been drafted and is to be expected to go through parliament by mid-2025. A concept for training content and course has been developed as the requirements of all RAC technicians (formal and informal) as the basis for examination for domestic level 1A and level 1B and commercial/industrial (level 2) certifications. This includes a concept guideline for apprentices, master technicians to use in education of apprentices as entry level for any level. The examination concept (report) has been developed to describe of examination process, involved actors, and relevant needs (necessary tools, consumables, infrastructure and personnel capacities) for a cycle of examination. Furthermore, an implementation plan document including short-term and long-term budget has been developed.

Relevant stakeholders from the sector have been invited to awareness workshops in three regional capitals Accra, Takoradi and Kumasi to understand the green cooling agenda and make them aware about related environmental and ozone protection benefits and revealed their roles and responsibilities for market availability and acceleration of R290 ACs in Ghana.

A review of the legal framework for the management of HCFCs is planned under the HPMP.

Highest priority for reducing the ODS bank and avoiding corresponding emissions should be given to the domestic refrigeration and the air conditioning subsector *(Figure 7)*.

CFCs are only present in refrigerators and to a very small extent in commercial stand-alone units, both as refrigerant and foam blowing agent. Especially the AC sector is dominated by HCFCs. Recovery of these substances is difficult as leakage rates are high and most gases are released into the atmosphere.

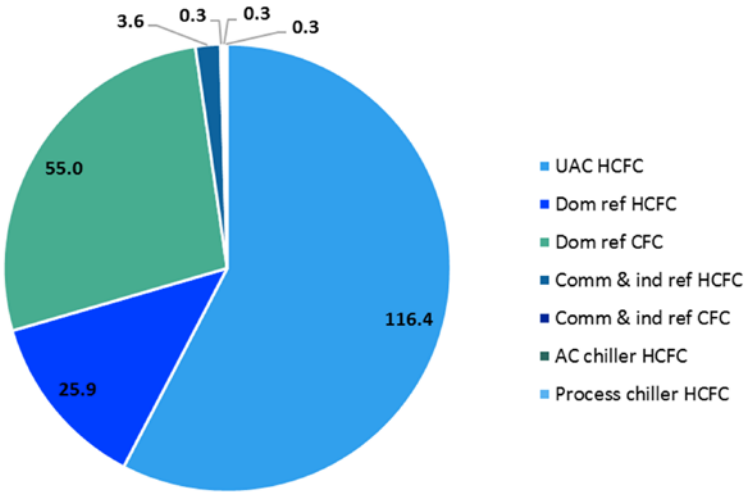

Figure 7: *ODS bank of the refrigeration and air conditioning subsector in ODP weighted tonnes , which corresponds to the mitigation potential in these sectors (data based on "Ghana's Greenhouse Gas Inventory and Technology Gap Analysis for the Refrigeration and Air Conditioning Sector" (EPA/GIZ, 2018)). ODS bank for domestic refrigeration and commercial stand-alone units includes blowing agent.*

2.1.2 Key actions for future ODS bank management[10]

The table below shows key actions for future ODS bank management, indicating the relevance for the most relevant RAC subsectors and indicating the urgency of implementation (short-, medium- and long-term action). As a rule of thumb, short-term actions should be implemented within the next years (until 2025), mid-term actions until 2030 and long-term actions afterwards. However, the planning and design of all actions must be initiated as early as possible.

10 Policy instruments focusing on equipment containing ODS are found in chapter 2.2 and 0.

Key actions	Time frame	Relevance in key sectors			Recom-mendations and status of implementation
	Short-term / Medium-term / Long-term	Dom Refrigeration	Unitary Air Conditioning	All RAC subsectors	
Implementation of Act 917 for domestic refrigerators and air-conditioning units.	Short-term	✓	✓		
Mandatory recovery and venting ban of ODS together with reporting obligations on the quantity of recycled, reclaimed or destroyed ODS. The legislation must include the requirement that recovered substances are either subject to reclaim, recycling or destruction.	Short-term			✓	As part of the guidelines that implement Act 917 and L.I. 2250.
Mandatory recovery of foam blowing agent.	Short-term	✓			As part of the guidelines that implement Act 917 and L.I. 2250.
Mandatory use of standard technical guideline on the processing of e-waste.	Medium-term	✓	✓		
Develop information for workshop owners on how they can limit the storage time of refrigerators in their workshops. Distribute as part of training and certifi-cation activities.	Short-term	✓			As part of the guidelines that implement Act 917 and L.I. 2250. (180 days period) and/or training/certification of RAC technicians.
Develop guidelines on the Environmentally Sound E-Waste Management for equipment containing ODS and F-Gases as part of the implementation of Act 917.	Short-term	✓	✓		
Anchoring the certification of RAC technicians in leg-islation to make it mandatory. Amend existing legisla-tion for electrical technicians or ODS management.	Short-term			✓	
Develop an overall ODS and F-gas regulation containing all relevant aspects, from mandatory recovery for reclaim, recycling or destruction but also a robust monitoring scheme.	Long-term			✓	
Review recovery practices of technicians and end-users and how these are part of the mandatory training. Discuss enforcement strategies.	Short-term			✓	
Establish fiscal measures such as GWP-weighted taxes on refrigerants[11] and a rebate system[12] to increase the return of refrigerants and implement incentives schemes for end-users to use natural refrigerants.	Long-term			✓	

11 A tax on refrigerants based on their GWP raises the price of harmful substances. Companies can choose whether to pay higher prices for refrigerants or to convert to more environmentally friendly solutions

12 Part of the tax (or fee) on refrigerants is recovered when refrigerants are returned for recycling, reclaiming, or destruction. This generates a strong incentive for refrigerant consumers and the servicing sector to return the recovered refrigerant

2.2 CORE PROCESS 2: ESTABLISH A SUSTAINABLE FINANCING MECHANISM

ODS bank management requires financing and should ideally be based on a sustainable financing mechanism.

Financing is not only necessary for the destruction of ODS but also for other activities such as establishing the infrastructure and operation of a collection scheme, including transport of ODS and equipment containing ODS. The appliance market (e.g. refrigerators) and the non-appliances market – where refrigerants will be recovered on site (e.g. air conditioning chillers and centralised systems in supermarkets) – must be considered separately.

Possible financing mechanisms to consider for ODS bank management are:

- Extended Producer Responsibility (EPR) scheme: EPR requires manufacturers to bear the financial and organisational responsibility for their products throughout their life and is particularly suitable for the appliances market (including those containing ODS).
- Import tax or levy: suitable for import countries who do not have manufacturing capacities
- Advanced disposal fee: Fees are imposed for purchases of appliances containing ODS (and HFC) to fund the cost of ODS bank management
- Operators of large RAC appliances (owners) are responsible for their equipment at decommissioning including the containing hazardous waste. They have to pay for the proper management of the recovered substances
- Use of carbon dioxide allowance auction revenues
- Voluntary carbon market
- Support through industrialised country's contributions to climate financing and ozone layer protection

COPA has taken a closer look at the opportunities and barriers for accessing finance for cooling mitigation projects involving ODS and HFC emission reductions, with a special focus on financing streams available through carbon markets and participation in Paris agreement Article 6 activities. The resources can be found and accessed through the COPA website. [13]

2.2.1 Status quo

The hazardous and e-waste regulation that was recently introduced in Ghana through Act 917, includes a levy that has to be paid at the point of import and is to be used for the proper management of e-waste. Implementation of the act is expected in the next years through the development of the relevant legislation.

In the past, ODS banks management was financed through the MLF or internationally funded projects.

13 COPA Financing Mechanisms Page

2.2.2 Key actions for future ODS bank management

The table below shows key actions for future ODS bank management.

Key actions	Time frame	Relevance in key sectors			Recom-mendations and status of implementation
	Short-term / Medium-term / Long-term	Dom Refrigeration	Unitary Air Conditioning	All RAC subsectors	
Implementation of Act 917	Short-term	✓			
Include commercial refrigerators into the scope of Act 917.	Short-term	✓			
Integration of informal sector. Resellers should have to accept old units when new units are purchased.	Short-term	✓	✓	✓	
Use international funding from MLF, KfW, GIZ (and others) to • Increase collection activities • Demonstration projects in the e-waste sector • Certification of technicians • Recovery equipment for technicians	Short-term	✓	✓	✓	
Encourage end-users to recover refrigerant by introducing a levy on refrigerants at the point of sale. This is refunded when refrigerant is handed over for reclaim or destruction. Oblige end-users (owners) of large RAC equipment to bear the financial responsibility for the recovered ODS. The owner has to pay for the recovery and the dismantling.	Medium-term		✓	✓	

2.3 CORE PROCESS 3: ESTABLISH AN EFFECTIVE COLLECTION MECHANISM

The steps to establish an effective collection mechanism range from the analysis of an e-waste policy framework over capacity building to the endorsement of the sector plan. More general information about this process is found in the "Global roadmap on ODS bank management" (GIZ 2017).

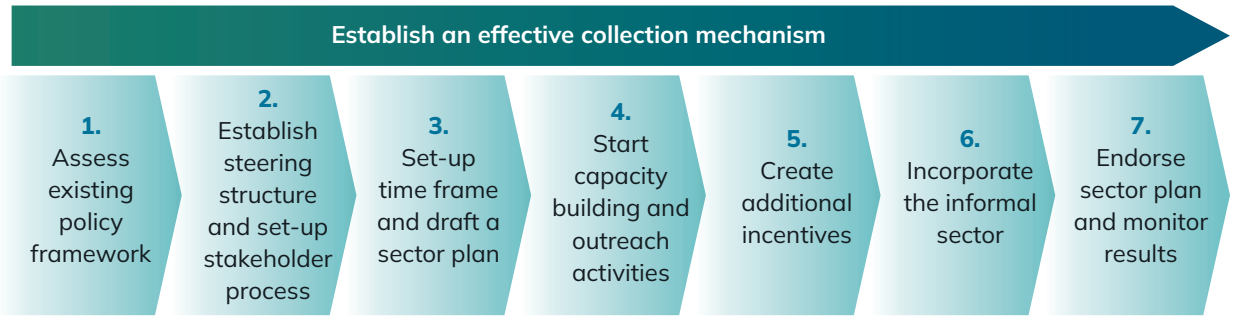

Figure 8: *Step approach to an effective collection mechanism*

2.3.1 Status quo

As part of the ODS management under the refrigerant phase-out plan and later the HCFC phase-out plan (HPMP), Ghana has trained many technicians and handed out equipment for recovery and recycling. There were only two private companies which sites where ODS are collected on a regular basis in a professional manner by degassing domestic refrigerators. However, only one of these plants is operational. This plant is in principle suitable for destruction of ODS/HFC and disposal of hazardous e-waste fractions. However, the proper operation of the plant requires further measures to be implemented. For example, a continuous emission monitoring system (CEMS) is required for process control and emission monitoring of certain parameters to comply with national legislation and international standards. Furthermore, a dosing station for the refrigerant gas must be installed to ensure environmentally sound destruction of ODS and HFC refrigerant gases. Also, foams are collected but not processed so far because of a lack of a necessary plant for this in Ghana. Formal activities are mainly restricted to the Greater Accra area.

Refrigerators and other RAC equipment is mainly collected and processed by the informal sector. The informal sector in Ghana is currently able to work at lower costs as they are not bound by good working practice and the need to comply with national legislation.

L.I. 2550 includes several paragraphs about the collection, storage and transport of hazardous as well as e-wastes that will have to be implemented.

There is no detailed sector plan yet for the e-waste sector.

Environmental awareness campaigns and training programmes are crucial for the successful implementation of a collection scheme, specifically important for RAC service technicians[14], waste managers and regional or local environmental authorities.

14 Training and certification of RAC technicians are covered in this chapter, other aspects related to the RRR network are found in chapter 2.4

2.3.2 Key actions for future ODS bank management

To improve ODS bank management regarding the collection of equipment containing ODS, the following activities are recommended.

Key actions	Time frame	Relevance in key sectors			Recommendations and status of implementation
	Short-term / Medium-term / Long-term	Dom Refrigeration	Unitary Air Conditioning	All RAC subsectors	
Elaboration of detailed sector plan for dealing with WEEE including equipment containing ODS with responsibilities for all involved players. Include specific concept for the inclusion of the informal sector.	Long-term	✓	✓	✓	
Establish country wide official collection centres for WEEE that are bound by good working practice.	Short-term	✓	✓		
Capacity building regarding the following: • Regional and local authorities to inform end-users on possibilities to return WEEE, including equipment containing ODS.	Short-term	✓	✓		
Include informal sector by implementing financial incentives to hand over WEE at official collection centres. Training on the environmentally sound dismantling of e-waste.	Short-term	✓	✓		
Mandatory certification of RAC technicians, see also chapter 0, including also: • Intensification of RAC technicians training on natural refrigerants including information on best practice recovery equipment with piercing pliers and oil-recovery • Awareness on options to handle recovered gas, determine quality and proper handling of blends.	Short-term	✓	✓	✓	
Provide financial support for RAC service technicians for the purchase of recovery equipment and rechargeable cylinders.	Short-term	✓	✓	✓	
Capacity building for e-waste managers on the proper dismantling of ODS containing equipment • state-of-the art recovery equipment with piercing pliers and oil recovery. A bottle neck is the time-consuming recovery of the refrigerant • Proper recovery of hazardous substances other than refrigerant / blowing agent (e.g. capacitor, circuit board, mercury switch) • Proper storage and transport • Valorisation of equipment containing ODS for marketing opportunities both within Ghana and on the global market.	Short-term	✓		✓	
Introduce direct incentives for the return of refrigerants.	Short-term	✓	✓	✓	

2.4 CORE PROCESS 4: ESTABLISH A FUNCTIONING RECYCLING AND DESTRUCTION INFRASTRUCTURE

An ODS bank inventory enables a robust estimate of the available ODS amounts and is therefore the basis to establish a functioning recycling and destruction infrastructure under this core process. In May 2023, COPA published an updated version of a guideline on how to conduct an inventory on ODS and HFC bank. The report is accessible on the COPA Website. [15]

A suitable recycling and reclaim infrastructure should be part of the activities for this core process too: In ODS bank management, re-use of ODS should be a priority, reducing the need and accumulation of new virgin refrigerants. Refrigerants can be re-used many times without deterioration of their quality as long as different refrigerants are not mixed or contaminated otherwise. Afterwards a detailed cost assessment based on the available ODS supports the decision for either the local destruction of ODS or the export of ODS for destruction. (See the COPA Publication on policy framework for promoting sustainable ODS/HFC bank management references in chapter 2.1 for more details.)

Figure 9: *Step approach to a functioning recycling and destruction infrastructure*

15 COPA Guideline Inventory for ODS and HFC banks (2023)

2.4.1 Status quo

As part of the recent Green Cooling Africa RAC sector inventory (See Ghana's Greenhouse Gas Inventory and Technology Gap Analysis for the Refrigeration and Air Conditioning Sector (EPA/GIZ, 2018)), the amount of available ODS in the different RAC sectors has been estimated. The results are part of this roadmap *(Chapter 1.2)*.

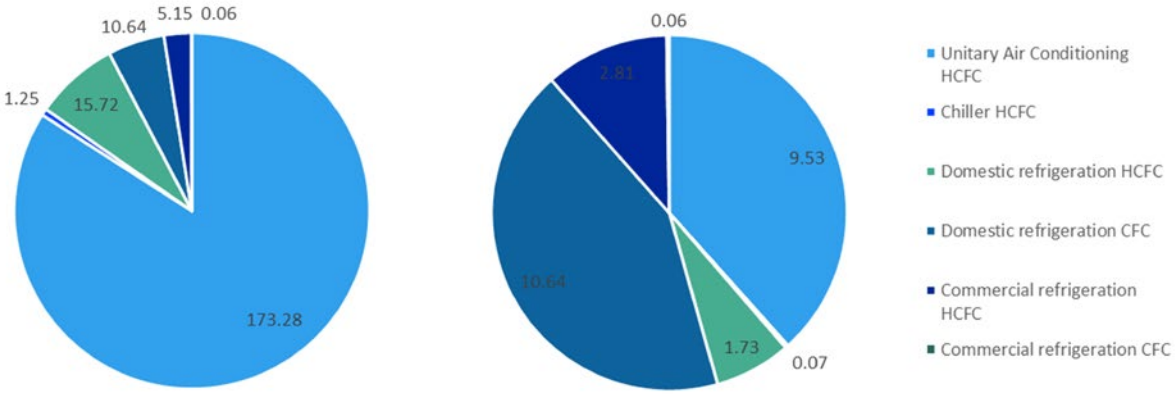

Figure 10: *ODS reaching the waste stream in 2015 in t (left) and ODP tonnes (right).*

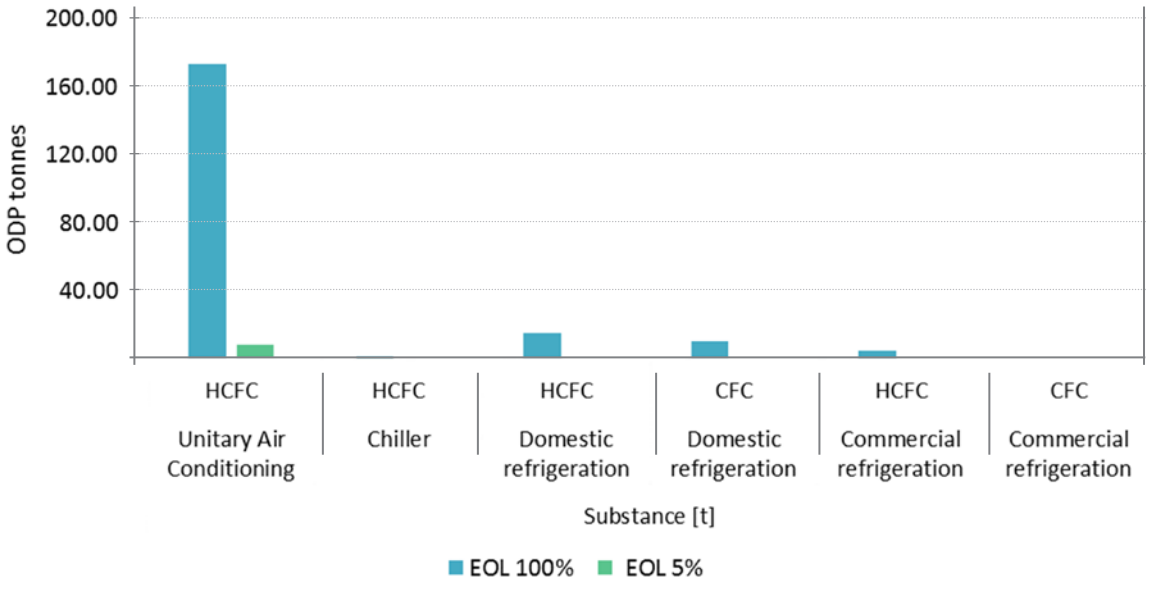

Figure 11: *Comparison between ODS reaching the waste stream potentially and realistically in 2015.*

Within the GIZ ODS bank management project, a feasibility analysis was conducted about the local destruction of ODS and the processing of foam containing blowing agent. It was found that the amounts potentially available for ODS bank management are not sufficient to justify investing in a local destruction plant. At the point of the study, there was no local destruction facility available in the country.

In 2016, the feasibility analysis suggested the planning and implementation of a small-scale plant that relies heavily on manual dismantling. The advantages are relatively low costs for investment and operation and maintaining jobs for people currently active in manual dismantling. The concept included a shredder where manually dismantled foams are shredded under nitrogen atmosphere and the blowing agent is transported to an activated carbon filter by the nitrogen flow. The activated carbon including the blowing agent is exported for destruction. Due to administrative difficulties, it was not possible to implement the proposal.

In 2019, it was announced that a rotary kiln was to be built in Ghana. A rotary kiln incinerator is a high-temperature furnace designed to significantly burn to ash a variety of waste including hazardous waste through incineration using a large cylindrical furnace that rotates slowly. Due to the Covid-19 pandemic, there have been considerable delays, but the rotary kiln was installed and commissioned in early 2022 at the site of ZEAL Environmental Technologies Limited (ZETL)[16] in Takoradi.

Based on its technical parameters the incinerator is suitable for the incineration of ODS, HFCs or foam containing these substances:

- LPG fuel
- Combustion efficiency of over 99.99% for organic substances
- Hourly capacity of 1,000 kg/hour
- Primary combustion chamber with temperatures of up to 1000°C
- Secondary combustion chamber with temperatures of up to 1100°C with gas residence time of 2 seconds to minimise organic pollutants in the flue gas.
- Gas cleaning unit, with activated carbon to adsorb heavy metals and PCDD/F and lime reacting with acid gases such as HCl, HF and sulphur dioxide. Additional wet scrubber with flue gas being quenched with a mixture of water and sodium hydroxide to reduce the remaining gaseous acidic pollutants.
- Solid and liquid waste treatment

While the rotary kiln is suitable, it is recommended that chlorine and fluorine is kept at a proportioning rate of < 2 wt.-% in accordance with the recommendations of the Technical and Economic Assessment Panel (TEAP, 2002) of the United Nations Environmental Programme and further F-Cl-containing fractions are not included during co-processing with other wastes.

The rotary kiln is currently in preliminary operation. It is planned in 2025 to set up experiments and test burns for the incineration of ODS- and HFC-containing foams and gaseous and liquid ODS and HFC substances within the COPA project and the installation of a continuous monitoring system.

Refrigerant collection and foam processing outside of Greater Accra is not yet implemented.

16 https://www.zealenvironmental.com

2.4.2 Key actions for future ODS bank management

To improve ODS bank management, regarding recycling and destruction infrastructure, the following activities are recommended.

Key actions	Time frame	Relevance in key sectors			Recommendations and status of implementation
	Short-term / Medium-term / Long-term	Dom Refrigeration	Unitary Air Conditioning	All RAC subsectors	
Set up experiments and test burns for ODS- and HFC containing foams and ODS/HFC substances.	Short-term	✓	✓	✓	As part of the ODS banks project/ follow up project
Develop business plan for the operation of the hazardous waste incinerator regarding ODS.	Short-term	✓	✓	✓	As part of the ODS banks project
Increase number of equipment available for recovery of refrigerant in the country.	Short-term	✓	✓	✓	
Expand infrastructure for collection of ODS and foams containing ODS to the whole country.	Short-term	✓	✓	✓	
Increase of possibilities to return refrigerants without additional costs, for example at the places where new refrigerants are put on the market.	Medium-term	✓	✓	✓	
Promote the distribution of state-of-the-art mobile recovery units with oil-separation to RAC technicians.	Medium-term	✓	✓	✓	
Introduce a rebate scheme: Every supplier adds a fee on the sales price, which is refunded (depending on the quality) when recovered refrigerants are returned.	Long-term	✓	✓	✓	

3 REFERENCES

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COPA Websites:

Home: *https://www.copalliance.org/home*
Financing Mechanism: *https://www.copalliance.org/our-activities/financing-mechanism*
Results and Resources: *https://www.copalliance.org/resources*

4 ANNEX I: ODS BANK FACT SHEET

Updated version 2017. Not included to facilitate editing process.

5 ANNEX II: GAP ANALYSIS

The colour shading indicates progress and implementation status in the country (traffic light scheme). Green means “fairly progressed”, orange is “intermediate”, red indicates deficiencies/action needed.

5.1 FUNCTIONING POLICY FRAMEWORK

Milestone	Current state	Further activities needed
ODS or HFC venting prohibited	None	Include section in LI 1812 MANAGEMENT OF OZONE DEPLETING SUBSTANCES AND PRODUCTS REGULATIONS (2005) about the installation and servicing of equipment. Synergies with mandatory certification of technicians.
Regulation of ODS or HFC management during the lifetime of equipment (proper servicing without leakage)	None	Include section in LI 1812 about the installation and servicing of equipment. Synergies with mandatory certification of technicians.
ODS or HFC treatment at decommissioning of equipment (recovered substances subject to destruction, recycling or reclamation)	None	Include section in LI 1812 about the installation and servicing of equipment. Synergies with mandatory certification of technicians.

Milestone	Current state	Further activities needed
Mandatory certification of technicians	Preparatory activities by NACODS sub-committee with support by GIZ – Green Cooling Initiative II: • Development of Ghanaian LI and national standard for the introduction of mandatory certification. Certification will be possible for two levels: Domestic technician (level 1) and commercial/industrial technician (level 2). • Development of guidelines and information material for RAC technicians, trainers, examiners, policy makers and RAC customers • Development of a qualification concept and syllabus synchronised with the standard and LI • Support stakeholder consultation activities and official meetings of the NACODS sub-committee • Assessment of further requirements regarding gender equality, needs of technicians with regard to training and tools, available training centres and equipment, etc. • Development of awareness campaign for directly affected stakeholders, such as technicians, trainers etc.	Legislation and implementation

Milestone	Current state	Further activities needed
Development of technical standards: • best servicing, operation and installation practices • introduction of sealed system design characteristics • containment and reduction of ODS emissions from existing equipment and decommissioned equipment • Environmental safe waste management of RAC equipment at EOL	Some international refrigeration standards have been adopted: • Refrigerating Technology - Refrigerators - Recovery and/or Recycling Equipment (ISO standard was last revised in 2014) (see also AHRI standard 740-2015) • GS IEC 60335-2-24: 2007 Household and Similar Electrical Appliances - Safety - Part 2-24: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances and Ice-Makers • GS ISO 5149: 1993: Refrigerating Technology -Mechanical Refrigerating Systems - Cooling and Heating - Safety Requirements • Standards IEC 60355-2-40 and -89 are developed but not yet operationalised.	• Knowledge about standards by technicians is very low or on-existent. Standards are not incorporated in current training activities. • Developed standards should be operationalised. • Develop further standards regarding the Environmental safe waste management of RAC equipment at EOL. • Standards have been updated internationally. Update of national standards on a regular basis ensures that the latest technical knowledge is included.

Milestone	Current state	Further activities needed
Monitoring scheme of recovered ODS: • consumers (commercial and industrial end-user) • technicians (servicing, decommissioning) • recycling, reclaiming, destruction Monitor schemes for: • Importers, distributors • HW management companies • E-waste management companies	LI 1812 includes reporting requirements persons who import, export, distribute or sell controlled substances. LI 1932 Energy efficiency (prohibition of manufacture, sale or importation of incandescent filament lamp, used refrigerator, used refrigerator-freezer, used freezer and used air-conditioner) regulations, 2005 forbids the import of used units. Act 917 (Hazardous and Electronic Waste Control and Management Act, 2016) requires reporting of imported or exported used or discarded electrical or electronic equipment after permission of EPA.	Monitoring of servicing, installations, recycling, reclaiming and destruction
WEEE regulation with take-back obligations of ODS or HFC containing equipment and EPR schemes	Act 917 requires importers and manufacturers to pay an eco-levy on imported units that is to be used for the managements of WEEE. Manufacturers, distributors or wholesalers of electrical or electronic equipment shall take back	Implementation of regulation necessary.

Milestone	Current state	Further activities needed
Assess implementation of further policy measures: • information campaign • GWP-weighted taxes on refrigerants • rebate system refrigerants • incentives for end-users • voluntary industry agreement		Incentives for end-users are currently focusing on retrofitting of units instead of new units.
Enforcement of existing regulation	Import of units is monitored regularly and the harbour authority is confiscating second hand equipment. Import of refrigerants is reported regularly	

5.2 EXISTING SUSTAINABLE FINANCING MECHANISM

Milestone	Current state	Further activities needed
Sustainable financing mechanisms are established for the RAC sectors: • EPR scheme is established for the appliance sector or end-users of large systems are obliged to pay for the recovery and management of ODS • import tax or levy is introduced • advanced disposal fee in place • carbon dioxide allowance auction revenues are used for financing	• Act 917 describes an eco-levy used for the proper handling of e-waste. • Collection and dismantling of some refrigerators is financed via the sale of recycled materials (limited)	Implement Act 917. Describe proper recycling techniques for refrigerators and ACs in Ghana in legislation.
International, multilateral or national climate financing programmes are used for ODS bank management: • MLF • national climate programmes such as the IKI • GCF • GEF • World Bank	• MLF funding has been used for the export and destruction of collected ODS from refrigerators. • Cylinders and analysers, collection of ODS, training of customs officials is funded under the HPMP. Training about reclamation for end-users. • GIZ project Management and destruction of existing ozone depleting substance banks	
Voluntary carbon market	Assessment during MLF project was negative	Not recommended

5.3 ESTABLISHED COLLECTION INFRASTRUCTURE

Milestone	Current state	Further activities needed
A sufficient infrastructure for the collection of recovered ODS is in place with sufficient financial support from the MLF		
Appropriate policy framework is in place, requiring collection and financing mechanisms of WEEE containing ODS → for more details see also 'Functioning policy framework'	No implementation has been done yet. Specific requirements are not yet formulated.	
An appropriate steering structure is in place (for WEEE appliance sector) including a leading government entity, a technical advisory group together with a well-defined stakeholder process	Ongoing	
Existing sector study and sector plan, considering for example: • available waste stream (inventory) • infrastructure and technology for ODS management • economic feasibility • responsibilities of reverse logistic systems • co-benefits (for WEEE appliance sector)	Inventory of waste RAC appliances conducted	
Installing collection and return points for equipment containing ODS (part of sector plan)	2 formal collection points for refrigerators are available.	Regional concept for collection points is necessary.
Capacity building and awareness raising for technicians and end-users dealing with RAC equipment containing ODS, but also for ministerial departments and third parties with responsibility for monitoring the flow of WEEE: • seminar, training, workshop • helpdesk • seminars • news, radio, TV • brochures and flyers • etc.	Reclamation training	• Reclamation and treatment of refrigerants as part of mandatory certification and offered training courses.

Milestone	Current state	Further activities needed
Indirect or direct incentives are in place to increase the recovery of ODS and collection rates of WEEE containing ODS	©	
Initiatives for the transition from informal to formal waste management (e.g. WEEE manager and scrap collectors), including RAC technicians	Initiative of City Waste Management: Informal sector workers receive health insurance if they submit a certain amount of refrigerant	
If a sector plan is established, endorsement and monitoring are taking place		
Monitoring of ODS or HFC substances flow (appliance and non-appliance sector)	No	

5.4 ESTABLISHED RECYCLING AND DESTRUCTION INFRASTRUCTURE

Milestone	Current state	Further activities needed
Assessment of ODS amount available for management (inventory)	Included in this report.	
Installation of sufficient recovery and reclaim facilities	Degassing equipment for refrigerators available at 2 locations No reclaim facilities available.	Provide more equipment for technicians to conduct proper recovery and reclaim of refrigerant
Cost assessment for ODS that need destruction: comparing export and local destruction costs • Relationship between available amounts and costs • Include destruction facilities in adjacent countries for the export option	Assessment was done for blowing agent as part of this report. No collected amounts of ODS were reported at the beginning of the project. It was therefore not included.	
Assess local destruction options when sufficient ODS is available • dedicated destruction facility, rotary kiln, cement kiln, municipal waste incineration etc. • national legislation on air pollution control	Local destruction option is currently being built and assess by national and international experts as part of this project.	
Assess local policy regarding export when small quantities of ODS are available • member of Basel Convention? • contact local focal point of Basel Convention • check local definition of hazardous waste • Import or export bans of hazardous waste	Ghana is a member of the Basel Convention and has to follow the procedures for waste export. Act 917 and L.I. 2550 includes further details on the specifics.	
Assess financing options for most cost effective and sustainable solution → see sustainable financing mechanism		
Implement facility or initiate export	Ongoing as part of this project.	

COPA
Cutting refrigerant emissions

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