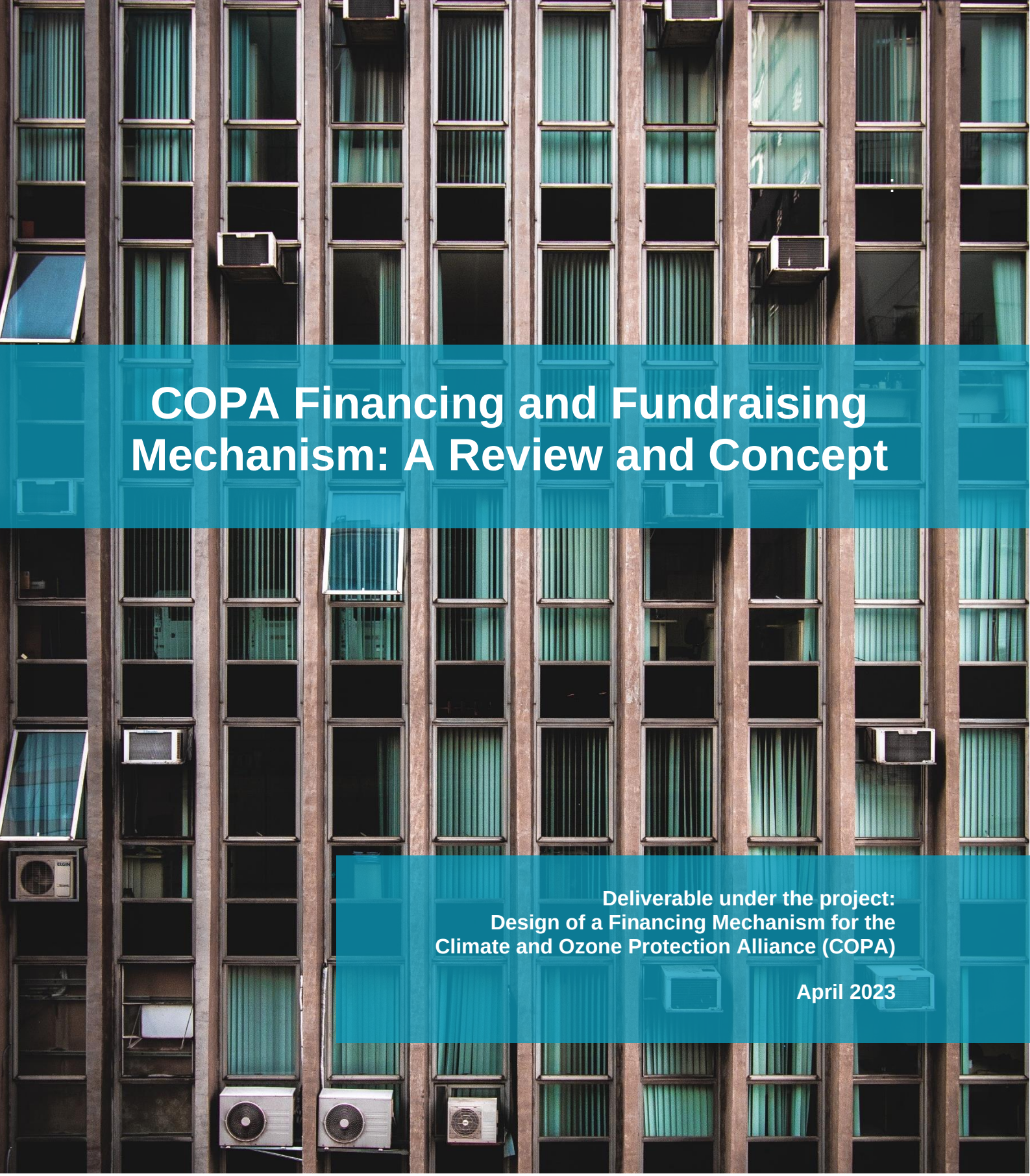

COPA Financing and Fundraising Mechanism: A Review and Concept

Deliverable under the project:
Design of a Financing Mechanism for the Climate and Ozone Protection Alliance (COPA)

April 2023

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Registered offices
Bonn and Eschborn

Dag-Hammarskjöld-Weg 1–5
65760 Eschborn, Germany
T +49 6196 79-0
F +49 6196 79-11 15
E info@giz.de
proklima@giz.de
I www.giz.de/proklima
www.copalliance.org

Project
Climate and Ozone Protection Alliance

Responsible
Ellen Michel (GIZ Proklima)

Authors
Harald Heubaum (SOAS University of London)
Felicia Jackson (SOAS University of London)
Irene Papst (HEAT GmbH)
Manuel Prieto Garcia (Heat GmbH)

Design:
Manuel Prieto García

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Malin Emmerich
Ellen Michel

Heat International Coordination
Dietram Oppelt

Design and Layout
Manuel Prieto Garcia

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Questions and comments should be sent to:

Harald Heubaum (lead author)
SOAS, University of London
10 Thornhaugh Street
London WC1H 0XG
United Kingdom
Email: hh15@soas.ac.uk

Irene Papst
Heat International GmbH
Seilerbahnweg 14, 61462
Königstein Germany
E-Mail: Irene.Papst@heat-international.de

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Acronyms

ACR	American Carbon Registry
CA	Corresponding Adjustment
CARB	California Air Resources Board
CBAM	Carbon Border Adjustment Mechanism
CCC	Clean Cooling Collaborative
CCER	China Certified Emissions Reductions
CCS	Cool Capital Stack
CDM	Clean Development Mechanism
CER	Certified Emissions Reductions
CFC	Chlorofluorocarbons
CIF	Climate Investment Fund
CN ETS	China Emissions Trading System
COP	Conference of the Parties
COPA	Climate and Ozone Protection Alliance
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CSA	Climate-Smart Agriculture
DF	Destruction Fund
DFI	Development Finance Institution
DIB	Development Impact Bond
DKK	Danish Crowns
ELV	End-of-Life Vehicles
EOL	End of Life
EPR	Extended Producer Responsibility
ER	Emission Reduction
ETS	Emissions Trading System
EU	European Union
EU ETS	European Union Emissions Trading System
EUR	Euro Currency
F-gas	Fluorinated gas
FM	Financing Mechanism
FP	Funding Proposal
GCF	Green Climate Fund
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIIN	Global Impact Investor Network
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
Gt	Gigatonnes
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbons
HCPI	Headline Consumer Price Index
HFC	Hydrofluorocarbons
IA	Implementing Agency
IBDR	International Bank for Reconstruction and Development
ICAP	International Carbon Action Partnership
IDA	International Development Association
IFI	International Financial Institutions
IPCC	Intergovernmental Panel on Climate Change
ITMO	Internationally Transferred Mitigation Outcome
K-ETS	Korea Emissions Trading System
KliK	Klimaschutz und CO_2-Kompensation
KP	Kyoto Protocol

LIC	Low Income Countries
LMIC	Lower Middle-Income Countries
LRF	Linear Reduction Factor
LVC	Low-volume Consuming
MLF	Multilateral Fund
MP	Montreal Protocol
MRV	Measurement, Reporting and Verification
NACAG	Nitric Acid Climate Action Group
NBS	Nature-based Solutions
NDC	Nationally Determined Contribution
NGO	Non-governmental Organisation
NMA	Non-market Approaches
ODA	Official Development Assistance
ODS	Ozone Depleting Substances
OECD	Organization for Economic Cooperation and Development
PA	Paris Agreement
PFC	Perfluorochemical
PRF	Preparatory and Readiness Fund
RAC	Refrigeration and Air Conditioning
RBF	Results-based Financing
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RPSP	Readiness and Preparatory Support Programmes
ROI	Return on Investment
SDG	Sustainable Development Goals
SDM	Sustainable Development Mechanism
SIB	Social Impact Bonds
SIDA	Swedish International Development Cooperation Agency
SLCP	Short-lived Climate Pollutant
SME	Small and Medium-sized Enterprises
TEAP	Technical and Economic Assessment Panel
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UMIC	Upper Middle-Income Countries
VCC	Voluntary Carbon Credit
VCM	Voluntary Carbon Market
VCMI	Voluntary Carbon Markets Integrity
VCS	Verified Carbon Standard
WB	World Bank
WEEE	Waste Electric and Electronic Equipment

Executive Summary

Across much of the Global South, outdated or end-of-life (EOL) refrigerants, including foams, are not currently being managed in an environmentally sound manner, leading to the accumulation of so-called banks of ozone depleting substances (ODS) and hydrofluorocarbons (HFC). These banks emit substances that harm and deplete the ozone layer and contribute to anthropogenic climate change. Each year, approximately 1.5 $GtCO_2eq$ are released from improperly managed or disposed refrigerants. This corresponds to the annual greenhouse gas (GHG) emissions of 441 coal-fired power plants. Currently, there are no global agreements or infrastructures in place to address these and there is also a lack of effective financial support to address this challenge.

This study by Heat GmbH on behalf of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is a contribution to the development of a financing mechanism (FM) for the sustainable refrigerant management of ODS/HFC banks in current and future partner countries of the Climate and Ozone Protection Alliance (COPA) which seeks to accelerate the mitigation measures needed to address these amounts.

The study starts by providing an overview of ongoing ODS/HFC bank management activities pursued by the Montreal Protocol (MP), its Kigali Amendment and individual countries. This is followed by cost estimates for the destruction of ODS and HFCs in MP Article 5 countries, calculated for different scenarios and based on real Multilateral Fund (MLF) project costs for similar activities. A review of existing financing approaches in the sustainable cooling and climate finance spaces then reveals there to be no one-size fits all solution for advancing sustainable ODS/HFC bank management. For the COPA financing mechanism to cover the full spectrum of activities necessary for implementing sustainable ODS/HFC bank management, a selection of focused financing elements is required. It is suggested that the COPA FM could deploy three core financial mechanisms elements:

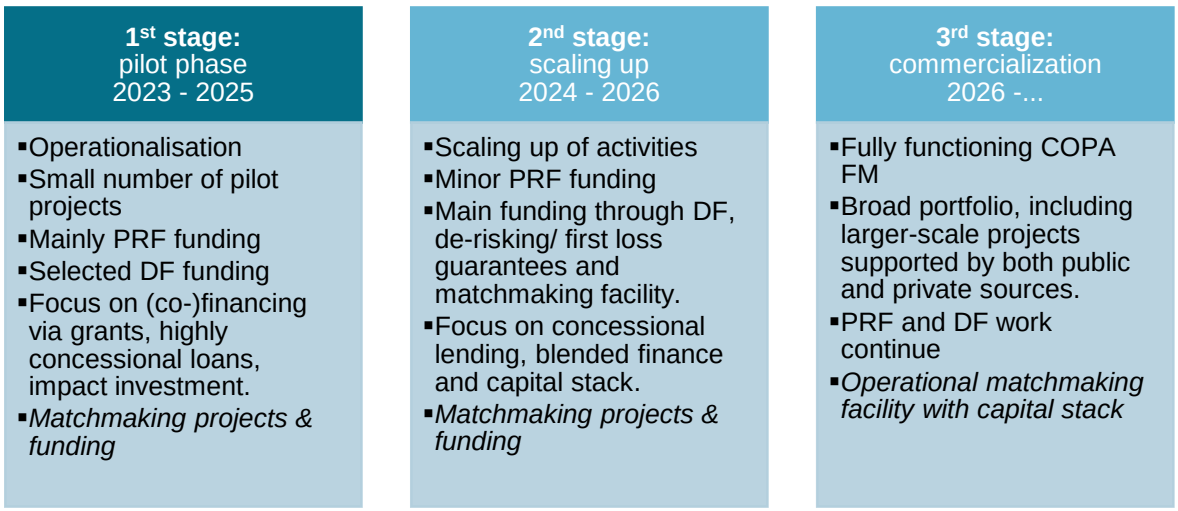
1. **A preparatory and readiness fund (PRF)** to provide support to countries and industry and facilitate the market analysis required to underpin any financial intervention;
2. **A destruction fund (DF)** focused on filling the funding gap for EOL management of ODS/HFC banks left by the MLF; and
3. **A matchmaking facility or capital stack approach** matching the needs of COPA members with appropriate financial interventions.

Circumstances vary across COPA partner countries, including differences in the size of ODS/HFC banks, existing infrastructure for their collection, transport and destruction, financing needs, and regulatory environments. Every country has a complex and fragmented market, which further complicates the provision of finance.

Recognising these particular conditions, the study presents a matrix of potential financial instruments that could be tailored to the specific needs and requirements of each partner country and type of intervention. The matrix distinguishes between interventions by type of finance, the type of actor involved, the level at which they are likely to be effective, including the types of projects they could support, as well as the barriers to their implementation.

In a final step, these interventions are then connected to a proposal for a three-stage mechanism, shown in Figure I, outlining how COPA FM activities may be scaled up. The outline integrates the PRF, DF and matchmaking facility, and makes the case for mobilising investment for ODS/HFC management from initial pilots (1st stage), to scaling up (2nd stage), to commercialization (3rd stage).

Figure I: The three-stage approach for the COPA FM



The proposed FM serves as both a fund and a facility, providing investment as well as serving as a guide and common knowledge platform about existing interventions. It will be facilitating the integration of novel financial schemes in COPA partner countries, while also taking into consideration existing market environments and each country's unique circumstances.

1 Introduction

ODS and HFCs are synthetic chemicals used around the world for refrigeration, air conditioning and a number or other purposes, including fire extinguishers and heat pumps. Excessive consumption has led to the accumulation of these substances which not only harm and deplete the ozone layer but also contribute to anthropogenic climate change. The global warming potential (GWP) of some HFCs, and several of the chemicals commonly grouped under ODS, is several thousand times that of carbon dioxide (CO_2).

Each year, approximately 1.5 $GtCO_2eq$ are released from improperly managed or disposed refrigerants. This corresponds to the annual greenhouse gas (GHG) emissions of 441 coal-fired power plants, making ODS/HFC banks one of the single largest carbon bombs. Currently, there are no global agreements or infrastructures in place to address this challenge and with the Multilateral Fund (MLF) to the Montreal Protocol not financially supporting EOL management of ODS and HFCs, there is a lack of effective financial support, leading to only piecemeal efforts to date.

Mobilising finance is difficult, however, as the current environment for public financial support is challenging. Most governments have multiple calls on their attention and funds, while in parallel struggling to deal with the impact of the Covid-19 pandemic and rising inflation as a result of the war in Ukraine. Therefore, it is critical to engage with as many sources of finance as possible, including leveraging private capital with public finance and de-risking instruments, but also developing approaches that mobilise private capital through a broad range of financial interventions.

There are lessons to be learned from the increase in climate finance, but differences in structure and focus remain. Investment in mitigation is particularly well aligned with the interests of project finance investors and today, renewable energy and energy-efficiency projects make up 95% of private investment into this space. In comparison, ODS/HFC bank management presents a more challenging proposition: the sector is considerably more complex and less well understood, amounts are dispersed and not easily collected, especially across the developing countries of the Global South, and there are fewer opportunities for profitable investments.

This study has been undertaken to establish what a potential financial mechanism for EOL management of ODS/HFC banks could look like, how it could be developed and deployed

to mobilise the investment required to drive a sustainable solution to this challenge. Doing so would help the world remain well below two degrees Celsius of additional warming beyond industrial levels, the main goal of the Paris Agreement.

1.1 The Montreal Protocol and its climate blind spot

Since its adoption in 1987, the Montreal Protocol (MP) has led to the phase-out of nearly 99% of banned ozone depleting substances (WMO et al., 2022). As it stands, the ozone layer is now recovering and is expected to return to 1980 levels by 2040 for most of the world. Scientists estimate that the work done to date will see a reduction of 0.5°C in overall average warming.

The Kigali Amendment, added to the Protocol in 2016, required the additional phase-down of production and consumption of some HFCs developed as replacements for ODS in air conditioning, refrigeration and other sectors. While HFCs do not directly deplete ozone, they contribute significantly to global warming; implementation of the Amendment would avoid another 0.3–0.5°C of warming by 2100 (WMO et al., 2022). However, while the Montreal Protocol is effectively overseeing the phase-out of ODS and HFCs, there are currently no agreements in place for those ODS and HFCs already produced and still in use, leaving a blind spot that needs to urgently be addressed. (More details on the MP in section 2.1.)

This is a particularly significant issue in the Global South as there are not only skill and technical challenges around maintenance, recovery, transportation, storage and reclamation/destruction of ODS/HFC banks, but few such countries have an enabling policy environment in place which could drive action and encourage private investment into the sector. This can be addressed with capacity building around the correct maintenance of existing equipment, market analyses to better understand challenges and opportunities, recovery of old appliances using ODS and HFCs, development and deployment of technologies and equipment that do not use such gases, and the reclamation and destruction of gases in old and retired equipment. However, such interventions require different levels of funding and have different appeals in terms of social, environmental and financial outcomes.

Example financial interventions

- ***Project finance/de-risking instruments: large scale development of infrastructure for the collection, transport, storage, reclamation and destruction of ODS/HFCs.***
- ***Import levies/VAT cuts:*** *directing business and consumer purchasing power towards the use of appliances with non ODS/HFC elements*
- ***Development Finance Institution (DFI) support:*** *capacity building programmes to build an enabling policy environment.*

1.2 Financing for effective ODS/HFCs management

Current funding for ODS/HFC bank management is inadequate, necessitating a new approach to capital mobilisation. The MLF is currently the central source of funding for ODS/HFC management, but its financing capacity is limited to registry development and planning. While countries have committed to cutting the production and use of such gases by 85% by 2050, the focus has been on shifting production, not the management of existing banks.

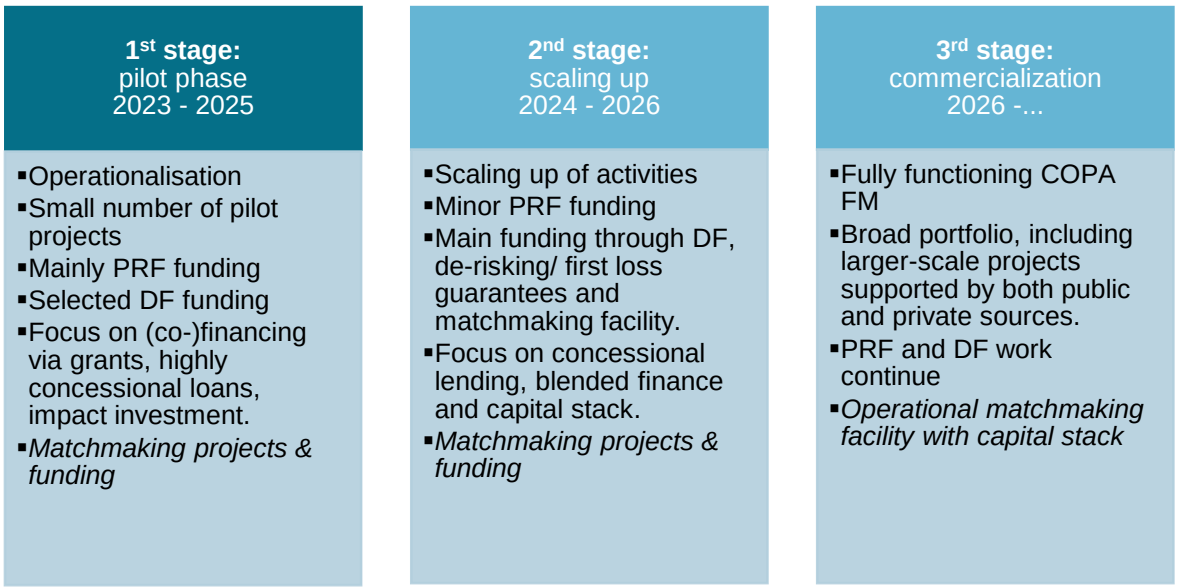
A financial mechanism needs to be able to mobilise finance for one or more elements of ODS/HFC bank management, including early-stage market analyses and feasibility studies, as much as larger projects consisting of efforts to collect, transport, store and destroy or reclaim ODS and HFCs across fragmented markets of the Global South. Each of the elements of the chain can be targeted by different types of finance and the mechanism needs to match types of funding to overcome particular barriers in the process. There is a significant body of work proving best practice approaches and strategies for the sustainable management of ODS/HFC banks. What is required now is a financial mechanism that will enable finance to be deployed (Friedlingstein et al., 2022).

Consequently, this study proposes a FM consisting of three elements: a preparatory and readiness fund (PRF), a destruction fund (DF), and a matchmaking facility to address the various elements of ODS/HFC bank management. The proposed FM will achieve scale in three stages (section 5.1), moving from (1) a smaller number of pilot projects aimed at building the business case for investment (2023-25), to (2) a scaling up of operations with a greater focus on support for destruction, de-risking of investments and matchmaking (2024-26), to (3) a fully functional mechanism (2026-…), able to attract significant private capital to support a broad portfolio geared towards larger scale EOL ODS/HFC bank management projects.

As conceived in this study, the proposed FM serves as both a fund and a facility, providing investment as well as serving as a guide and common knowledge platform about existing interventions. It will be facilitating the integration of novel financial schemes in COPA partner countries, while also taking into consideration existing market environments and each country's unique circumstances.

Main features are captured in the figure below, for full details see section 5.1.

Figure 1: The three-stage approach for the COPA FM



1.3 Outline

The study begins in Chapter 2 with an overview of the state of play of ODS/HFC bank management today, including lessons learned from extended producer responsibility (EPR) schemes and the Waste Electric and Electronic Equipment (WEEE) regulations in the European Union (EU). Importantly, the chapter also provides cost estimates for ODS/HFC destruction in MP Article 5 countries and presents examples for potential activities requiring investment under a COPA FM. Chapter 3 then proceeds with a review of financing opportunities arising from existing sustainable cooling approaches and the extant climate finance literature, ranging from the provisions contained under the Paris Agreement's (PA) Article 6, including both compliance-based and voluntary emissions trading, to innovative approaches such as results-based finance (RBF) and capital stack.

In Chapter 4, we group findings from the research to develop an overview matrix of financing opportunities, with the intention of functioning as a toolbox, addressing key drivers and inhibitors for the financing of effective ODS/HFC bank management. A series of background interviews with stakeholders and finance experts across the public, private and third sectors adds additional insights in this context. Chapter 5 then pulls together the work of the previous chapters and presents a proposal for a potential COPA financing mechanism (FM) to be fully operationalised through a three-stage approach (pilot stage, scaling up, and commercialization). The study wraps up the accumulated findings in the conclusions in Chapter 6, highlighting the design features of the proposed FM and pointing to COPA's opportunity in helping the world achieve the goals of the Paris Agreement.

1.4 Methodology

Establishing the COPA FM and its matrix-toolbox of financial interventions for the effective EOL management of ODS/HFC banks is based on a research methodology combining a quantitative assessment of funding needs with a desk-based review of existing financing schemes and, finally, a set of interviews and background conversations with relevant stakeholders.

First, following an overview of the state of play of ODS/HFC bank management, costs for their destruction were calculated based on two different effort levels, low and medium, and for three different types of countries, based on refrigerant consumption levels (Chapter 2).

Second, information on applicable existing financial schemes, facilities and instruments was collected, assessing them through a range of parameters and drawing lessons for a potential COPA FM (Chapter 3).

Third, a series of interviews and background conversations with stakeholders was conducted. Based on the research and stakeholder input, a matrix of key drivers and inhibitors relevant for COPA partners and members was developed (Chapter 4).

2 ODS/HFC Bank Management: State of Play

After a short introduction to the Montreal Protocol, the Kigali Amendment and the sustainable management of ODS/HFC banks, this chapter will detail what is currently implemented within the Montreal Protocol. Extended Producer Responsibility schemes, at national levels, and the EUs Waste from Electrical and Electronic Equipment (WEEE) directive, at supranational level, are presented as best-practice examples outside of the Montreal Protocol, followed by a short discussion of the necessity of accurate monitoring and enforcement of leakage control policies. The estimated costs for the destruction of these gases in MP Article 5 countries have been calculated for different scenarios, based on data from Technical and Economic Assessment Panel (TEAP) of the United Nations Environment Programme (UNEP). After that, a few examples of activities requiring funding as part of a country's ODS/HFC bank management implementation are summarized in an overview, indicating each activity's suitability for different Article 5 countries. Extensive background material on the technical and policy aspects of ODS/HFC bank management is not included in this report but can be found on the COPA website.[1]

This report adopts the definition presented by the Intergovernmental Panel on Climate Change (IPCC) and the TEAP of ODS/HFC banks 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). ODS/HFCs bank management denotes the concerted action required to reduce ODS/HFC emissions, mainly during servicing and decommissioning at the end of life of a given appliance.

2.1 The Montreal Protocol and its Multilateral Fund (MLF)

The Montreal Protocol (MP) is considered as one of the most successful international environmental agreements up to date. It was adopted in 1987 and has since then been effectively restricting the production and consumption of ozone depleting substances. Since 2016, HFCs are also covered by the MP's Kigali Amendment. Because of the concerted actions under the MP, the ozone layer has not deteriorated further since 2000 and is believed to start recovering (WMO et al., 2022). Further information on MP covered

[1] https://www.copalliance.org/climate-und-ozon-protection/solutions

substances can be found at a glance in the info box (Figure 2) below and in more detail on the MP's website.[2] (Also see section 1.1.)

While Article 5 countries[3] in the MP have successfully completed the chlorofluorocarbon (CFC) phase-out and are progressing well with reducing the consumption of hydrochlorofluorocarbons (HCFC), the phase-down of HFCs is yet to commence, starting with a freeze of consumption in 2024.[4]

Figure 2: Glance at the Montreal Protocol

What is the Montreal Protocol and its Kigali Amendment? Simplified

Overview

- The **Montreal Protocol** (MP) is a multinational agreement to protect the ozone layer signed by **197 countries**, in **1987**.
- The MP has the goal to **stop production and consumption** of ozone depleting substances (ODS), which are chemicals with **fluorine (F)** and **chlorine (Cl)**, that if emitted **destroy the ozone** layer.
- In 2016 the **Kigali Amendment** was signed to include HFCs. It was agreed that the **production and consumption of HFCs** is reduced to a tail use by 2045 (Phase-down).
- Although the countries are categorized in Article 5 and non-Article 5 countries (see Definitions) **all** parties **have equal votes** and decisions are taken by consensus.
- The MP created the **Multilateral Fund** (MLF) to **support** the transition away from these substances in Article 5 countries.
- **80%** of the remaining consumption is within the **refrigeration and air conditioning sector**.

Definitions

Article 5 Countries	**Any** Party that is a **developing country** and whose **annual** calculated level of **consumption** of the controlled substances in Annex A is **less than 0.3 kilograms per capita**. Article 5 countries are usually **receiving funding** from the Multilateral Fund for phase-out/down activities.
Non-Article 5 Countries	**Countries** that are **not categorized under Article 5**, usually **industrialised** countries **providing funding** to the Multilateral Fund
Controlled substances	**Defined** in the **Annexes** to the **Montreal Protocol**, subjected to **production** and **consumption** phase-out schedules (HFCs: phase-down schedule)
GWP	**Global Warming Potential** (measured relative to CO2)
ODP	**Ozone Depleting Potential** (measured relative to CFC-11)

Ozone depleting substances and HFCs — **Phase Out/Down Plans**

	Substance	ODP	100yr-GWP	Non-Article 5	Article 5
Annex A	Chlorofluorocarbons (CFCs)	0.6 - 10	375 – 16 200	1994	2010
Annex B	CFC, CCl4 and Halons	0.1 – 1.1	5 – 7 200	1996	2010 - 2015
Annex C	Hydrochlorofluorocarbons (HCFCs)	0.001 – 0.52	0.03 – 2 300	2020	2030-2040
Annex E	Methyl bromide	0.6	1.51	2005	2015
Annex F	Hydroflurocarbons (HFCs)	0	164 – 14 590	2034 <20%	2045 <20%

Source: UNEP (2020)

The MP successfully focusses on the phase-out of the production and consumption of ODS and HFCs. In order to implement the MP, the Multilateral Fund (MLF) provides funding of incremental costs for eligible countries, supporting their transition to the usage of less harmful substances. However, there is no systematic MLF funding available to collect and

[2] https://ozone.unep.org/

[3] Article 5 countries are a group of members of the Montreal Protocol whose annual consumption of controlled substances was less than 0.3 kilograms per capita at the time of entry into force of the Protocol or at any time thereafter up to 01.01.1999. There are currently 147 countries in this group.

[4] Exemptions apply for countries with high ambient temperatures and Article 5, Group 2 countries.

destroy (or reclaim) ODS and HFCs from equipment at decommissioning. That means, in the case of absence of national regulations, these substances are often simply just emitted. (Also see section 1.2.)

Nevertheless, an MLF funding window was provided between 2008 and 2014 for demonstration projects on ODS destruction. The MLF allocated approx. 11.5 Mio US$ which resulted in the implementation of 12 projects for waste management and disposal of ODS. After the finalization of activities, countries were obliged to report back to the fund and field reviews were conducted. Nine counties reported a total of amount of 389 metric tonnes of gas destroyed. The main refrigerants disposed were CFC-11 and CFC-12 and to a lesser extent methyl bromide, HCFC-22, HCFC-141b and HFC-134a. On average the costs for domestic destruction were between 5.2 and 29.8 US$/kg. This value is relatively high, considering that in the demonstration projects where the countries exported the ODS to Germany and Poland, the destruction cost was around 2 US$ per kg.

Even though the above projects succeeded in collecting and destroying ODS/HFCs, their success relied on the support of the implementing agencies (e.g., the United Nations Industrial Development Organization (UNIDO) and the UNDP), and funding provided by the MLF. A few key lessons in relation to the finance and long-term sustainability of ODS management were drawn from these experiences. The MLF concluded that sustaining these projects in the future requires the creation of a business model in coordination with stakeholders, for example policies such as extended producer responsibility (see section 2.2). Additionally, the sustainability of the collection and destruction of ODS requires close coordination from the government, the cooperation of the collection centres and the creation of destruction polices alongside hazardous waste management. Finally, the MLF found that the co-financing of the projects worked better in countries where these practices were institutionalized, and regulatory and policy measures were applied (MLF, 2022).

Currently, as briefly mentioned in section 1.2, a new MLF funding window is open for Article 5 countries to establish an inventory of banks of used or unwanted controlled substances, together with a plan for the collection, transport, and disposal of such substances (Decision 91/66). Project proposals for this funding window are to be submitted between the 93rd and the 97th meeting of the MLF Executive Committee (roughly between Nov 2023 and Nov 2025), with a required completion of activities within 24 months after approval. The proposed inventories and ODS/HFCs banks management plans shall be coordinated with national phase-out/down plans of controlled substances and take into account the current legislation. They must also contain a description of a potential business model ranging from

waste collection to destruction or export, along with the needed arrangements with stakeholders, required policies and regulations, while detailing the obligations of manufacturers and distributors regarding recovery, recycling and reclamation and destruction, as well as necessary coordination with relevant conventions on transboundary movement of waste (for export).

The funding levels from the MLF for these inventories depend on the national HCFC baseline of the applicant country and range between 70 000 and 100 000 US$. The total budget allocated by the MLF is approx. 13 Mio US$. However, it is worth noting that the funding window only covers the inventory and design of the plans. Currently, no funding is available for the implementation of those national plans. Although this is frequently requested by Article 5 parties, it is highly unlikely that the MLF will agree to fund ODS/HFC bank management on a large scale, as such activities are not relevant for compliance with the MP and Kigali Amendment.

In the following sections, different best-practices of current ODS/HFC bank management will be detailed.

2.2 Extended Producer Responsibility (EPR)

Since their introduction in European countries in the early 1990s, Extended Producer Responsibility (EPR) schemes have become an efficient waste management policy around the world, leading to increasing recycling rates and the avoidance of landfills.

The Organization for Economic Co-operation and Development (OECD) defines EPR as: "*an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle*." This policy aims to integrate signals related to the environmental characteristics of products and production processes throughout the whole production chain, not putting focus on a single point, like another instrument often do (OECD Website EPR).

Through its set-up, EPR means that producers are given responsibility for their products at the end of life. EPR schemes generally 1) increase collection and recycling rates of the products, thereby saving costs and 2) they shift financial responsibility from municipalities to producers who then have to handle potentially dangerous components of the product. By shifting the monetary responsibility to the producer, an incentive to produce environmentally sound products is created. For example, the EOL treatment of refrigeration and air

conditioning (RAC) products, based on natural refrigerants, is less cost intensive than waste treatment of appliances containing ODS or HFCs. This means that the total life-cycle costs of a product are accounted for, influencing development and production decisions, in addition to end-of life treatment.

In order to compensate for the high initial capital requirements for producers to implement EPRs, public concessional financing is often used to incentivize EPR systems, i.e., through government grants or guarantees. The enhanced responsibility of producers and distributors can also be supported by measures such as a levy, e.g., on the sale of new refrigerants and on all new equipment, which then compensates for the mandatory take-back of used refrigerants and equipment. Overall, manufacturers tend to pass on the costs of implementing EPR schemes to the end-user. As a result, the cost of the post-consumer stage of a product's life cycle is borne by consumers and not, for example, by all taxpayers.

In the European Union, there are Directives which recommend the use of EPR policies for packaging, batteries, End-of-Life Vehicles (ELVs), F-gases and Electrical and Electronic Equipment (WEEE)[5] (EC & DG ENV, 2014). Both domestic refrigerators and air-conditioners fall into this last category and are therefore affected by the EPR in Europe.

Considering ODS banks management, the EPR is particularly interesting as part of a general WEEE mechanism because both refrigerants and foam blowing agents in domestic appliances are affected. This is considered often as the most promising solution to reduce unwanted ODS waste at the EOL of domestic RAC equipment that is decommissioned as one piece, such as,

- Residential and commercial air conditioning equipment
- Small chiller
- Domestic refrigerators
- Stand-alone units in commercial refrigeration

A number of countries have introduced EPR schemes (OECD, 2014). In Latin America and the Caribbean: Chile, Mexico, Brazil, Argentina and Colombia; in Asia, the Republic of Korea, China, India and Indonesia have EPR schemes as well as Malaysia and Thailand. In

[5] Development of guidance on Extended Producer Responsibility: https://ec.europa.eu/environment/archives/waste/eu_guidance/introduction.html

Africa, EPR schemes are rare, but one country where it is implemented is South Africa. Further information about individual country cases can be found on the OECD website[6].

EPR schemes could also be introduced to handle waste refrigerant outside of the equipment types mentioned above. For example, substances can be recovered from large installations on-site for treatment. As producers and distributors have the infrastructure to handle and treat refrigerants, they are best suited to also take back the gases from large installations and either reclaim or destroy them. In countries with HFC phase-down schedule and consequently with limited virgin HFC supply, this can be a business case, as reclaimed refrigerant is often required for servicing of RAC equipment.

2.3 EU WEEE Regulation in Germany

There is a strong linkage between ODS/HFC banks management and waste handling, which is both a chance and a challenge. In terms of the infrastructure, the regulations and awareness for handling waste or Waste of Electrical and Electronic Equipment (WEEE) are already developed. It can thus seem as a fairly small step to introduce the proper handling of the ODS and HFCs within the equipment to that. However, this will require strict allocation of responsibilities. Such processes related to the coordination of planning can be a real challenge. A success factor in developing a successful and comprehensive WEEE is therefore to collaborate with the affected industry sectors to identify the ideal specifications within the regulation (ICF, 2008).

The implementation of the EU WEEE Directive in Germany showcases such coordination and burden sharing within the industry. Refrigerators, freezers, air conditioners and clothes dryers potentially containing ODS and HFCs fall under the scope of the German Law on the marketing, return and environmentally sound disposal of electrical and electronic equipment (Electrical and Electronic Equipment Act – ElektroG). It sets out requirements for product stewardship under Section 23 of the Closed Substance Cycle Waste Management Act for electrical and electronic equipment. Its primary purpose is to prevent waste from electrical and electronic equipment. In addition, it prepares the waste for reuse, recycling and other forms of recovery in order to reduce amounts for disposal and thereby improving the efficiency of resource use. In order to achieve these waste management objectives, the law regulates the market conduct of obligated parties.

[6] Further information about the cases studies conducted by the OCED on the EPR schemes can be found under: https://www.oecd.org/environment/extended-producer-responsibility.htm

The stiftung elektro-altgeräte register (stiftung ear, the foundation for old electric equipment) is a foundation under civil law in Germany. It was founded by manufacturers and associations in the electrical and electronics industry and enable them to shoulder the responsibilities and tasks arising from the ElektroG Law in Germany. Manufacturers or their authorized representatives, who have electrical equipment on the market in Germany, must register with the stiftung ear. By law, all registered parties are obliged to contribute to the collection and recycling of WEEE in proportion to their sold appliances and the stiftung ear provides the administrative structure for this, for example it allocates the collected WEEE proportional to the registered manufactures. The manufacturers are then responsible for gathering the equipment from municipal collection sites and undertake an environmentally sound disposal. However, these obligations can also be commissioned to a third party. Customers can bring their WEEE to municipal collection sites free of charge, or return them directly to the shop, e.g., when buying new equipment.

2.4 Monitoring and enforcement of leakage control policies

Any regulation is only as good as its enforcement. Venting bans, mandatory system tightness checks and record keeping as e.g., implemented in the EU F-gas regulation require stringent enforcement to work. In this context, an efficient option could be a registration of equipment operators in an online database, recording all activities performed on the equipment. Delay in action or the non-reporting of recovered refrigerant sent to treatment can automatically alert enforcement officers to investigate and take action accordingly.

Poland was the first country to establish an electronic data base to aid the implementation of the EU F-gas regulation. The electronic database includes a central register of operators running appliances containing F-gas. The reporting to the database is mandatory for all the operators with equipment containing more than 5 tCO_2eq F-gases. The operators track F-gas handling activities including installations, maintenance/servicing, repair, decommissioning, leakage checking, leakage repairs, leakage detections, the type of leakage detection systems and refrigerant recovery. For each type of equipment, one logbook must be maintained. Environmental inspectors carry out spot checks on the proper regular compilation of the logbooks and the related reporting. The data in the database serves as input for the national inventory on emissions of fluorinated GHGs under Article 4 of the United Nations Framework Convention on Climate Change (UNFCCC) (UNEP, 2010).

Such a database system also facilitates data collection and can provide proof of mitigation action implemented through ODS/HFC bank management (tightness checks, due repair, refrigerant recovery). In addition, the database may also, through sending reminders for regular maintenance such as filter cleaning and tightness checks, incentivize and contribute to an efficient and economic operation of RAC equipment and thus reduce operation cost.

In addition, previous sector analysis (GIZ, 2017) has identified several key interventions which might increase the successful implementation of a sustainable ODS/HFC banks management. Potential future leakage control projects should consider those points, summarized below, to promote a sustainable project implementation.

1. **Proper handling of ODS/HFC waste:**
   A key group of stakeholders are the technicians working in the field. For technicians, handling of waste ODS/HFC is often a burden that can be avoided by releasing them into the atmosphere. Two interventions can change that:
   a. venting ban, monitoring and sanctioning of unlawful behaviour.
   b. financial incentives for recovery and return of waste refrigerants.

2. **Appropriate value of reclaimed substances:**
   Regulating the HFC market by a consumption quota and a phase-down schedule on virgin refrigerants increases the value of reclaimed substances and adds to the economic viability of reclamation facilities.

3. **Reusable cylinders:**
   Mandating the use of reusable cylinders to recycle and reuse refrigerants onsite, and to hand in used refrigerants to distributors for take back, reclamation or destruction

4. **Product life-cycle responsibility:**
   Oblige refrigerant distributers to take back and treat used refrigerant.

More specifically, several of the above activities could be implemented by the parties at relatively low cost. For example, regulations could force technicians to use reusable cylinders for the recycling and reuse of refrigerants onsite, and to hand in used refrigerants to distributors for take back, reclamation or destruction. In return, distributors could reward the handing in of the used refrigerants with lower priced refrigerants from reclamation. This kind of cooperation among the producers, importers and distributors is already obligatory in most industrialised countries today.

2.5 Cost estimates for ODS/HFC destruction in Article 5 countries

It is difficult to state the exact cost for the destruction of ODS/HFC in general terms, as there are many variables impacting the costs, such as the type of substance, the actual location, the current infrastructure in place for the recovery, etc. The following cost estimates were calculated using data collected in the report of the Technology and Economic Assessment Panel (UNDP & TEAP, 2009) and are presented in this subchapter as costs in US$/kg of ODS/HFC destroyed. Cost estimates were calculated for two different effort levels, low and medium, as outlined in Table 1 and for three different types of countries, based on refrigerant consumption level (Table 2). Both categories are further explained below. Additionally, the total costs of actual ODS/HFC destruction projects are presented in Table 3.

As already mentioned above, the ODS/HFC destruction strategies for countries differ, as do their corresponding financing needs. For example, for LVC countries, it has been more cost-effective to export the ODS and HFCs for destruction abroad than to construct their own domestic destruction facilities due to the limited amounts of ODS/HFC available. Conversely, most Type 2 countries have enough substances to justify local destruction and/or reclamation of the refrigerants at the EOL. There is even an opportunity to potentially import ODS and HFCs from LVC countries for this purpose for Type 2 countries. China as Type 1 country, on the other hand, due to their abundance of refrigerant available for disposal, has potential for economy of scale and could focus on large policy-related infrastructure projects to achieve sustainable management of these gases.

Due to the above-mentioned complexity, cost estimates for ODS/HFC destruction are consequently better suited for specific scenarios or contexts. The local circumstances, such as availability of infrastructure and technicians in the country and region, is an important factor for the size of investment needed to implement destruction at scale. However, it is possible to cluster different Article 5 countries under the MP based on their level of consumption of ODS/HFC gases.

The Article 5 countries are categorized as following:

- **Type 1:** high-volume consuming countries, currently only China;
- **Type 2:** medium-volume consuming countries, such as Mexico, South Africa, Chile and Malaysia;

- **Type 3:** low-volume consuming (LVC) countries, e.g., Nepal, Costa Rica, Montenegro and Lesotho.

The estimated average cost per kg of destroyed refrigerant for two effort levels are showcased below in Table 1. The level of effort represents the accessibility of the substance for collection, where "low effort" is used for densely populated areas such as metropolitan regions and cities and "medium effort" for sparsely populated areas, e.g., rural areas and small towns, which is likely to require a more elaborate logistic effort. Note that both levels of these cost estimates include transportation and collection fees. The figures are based on data reported by the TEAP in 2009 for each sector (UNDP & TEAP, 2009). To calculate the average across sectors, the Green Cooling Initiative Database[7] was used to derive bank accumulation per sector and calculate a weighted average. Then the aggregated annual global inflation rate from the World Bank was used to calculate the values for 2022 (Ha et al., 2021). The detailed calculations can be forwarded upon request.

Table 1: Average cost per kg of ODS/HFCs destroyed per effort level

Effort level	Costs US$/kg in 2009			Costs US$/kg in 2022		
	Min	Max	Average	Min	Max	Average
Low	12	27	20	18	40	30
Medium	23	41	32	34	62	48

Source: Authors' own calculations

As can be seen in Table 1, the cost per kg of destroyed ODS and HFCs gases varies both within and between the effort levels, and the costs per kg also partly overlap between the effort levels. Since the same annual inflation rate value is used for both low and medium levels, all prices increase at the same pace overtime. Although there are other factors that could affect the costs of destruction of ODS and HFCs, rather than the inflation rate alone, a more detail assessment is needed. Here a simple calculation is made to provide a starting point for these estimations.

Averaged estimation of ODS/HFC waste destruction costs for the two effort levels are further specified and calculated for the three categories presented above (country type 1 ,2 and 3). The cost estimates for each country type and effort level are based on total waste projections (MCTOC, 2022). The waste projections assume that all refrigerant contained in equipment being decommissioned is waste. To date, there are no global estimates on what share of these waste refrigerants could be reclaimed, i.e., reused after chemical treatment

[7] https://www.green-cooling-initiative.org/country-data#!total-emissions/all-sectors/absolute

and testing. As the reclamation of refrigerants can be a business case and is environmentally sustainable, if it replaces new production of refrigerants, actual costs could be lower than the total estimate presented here. The attribution of Article 5 countries to one of the three country types followed an analysis of global HFC use proposed by the Green Cooling Initiative Database. The collected data was then used to conduct a sample calculation to obtain an estimate of the total cost for destruction in year 2022 for each effort level in each country type. This information is presented in Table 2.

It is important to highlight that these cost estimates show the 'end-user perspective', meaning the price an entity has to pay per kg of ODS/HFC destroyed. Costs for building infrastructure, collection centres or destruction facilities are not considered. However, as mentioned at the beginning of this section, approved funds from MLF demonstration projects for ODS/HFC destruction are presented in Table 3 and show examples of real costs for setting up some of the ODS/HFC management infrastructure. In these projects the destruction centres used were already in place, however, most of them needed renovations or adjustment to destroy ODS and HFCs.

Table 2: Estimations of the costs per kg for ODS/HFC collection, transportation and destruction for each country type in the year 2022.

Category	ODS/HFC annual waste per capita	Effort level	Population per effort level (%)	Estimated annual cost of destruction for an average size country	Total annual cost estimate for destruction in (whole country group)
Type 1	0.067 kg	Low	**65%**	**1.9 billion**	**1.9 billion**
		Medium	**35%**	**1.6 billion**	**1.6 billion**
Type 2	0.019 kg	Low	**52%**	**23 million**	**1.2 billion**
		Medium	**48%**	**33 million**	**1.8 billion**
Type 3	0.014 kg	Low	**39%**	**1.6 million**	**135 million**
		Medium	**61%**	**3.8 million**	**340 million**

Source: Authors' own calculations

There are a total of 144 Article 5 countries under the Montreal Protocol and 88 thereof are low volume consuming (LVC) countries. The population of LVC countries differs greatly, from 1 000 people to 124 million people, with the average at approx. 10 million. For non-LVC countries (excluding China), the population range is between 1.3 million and 1.4 billion, with the average at approx. 78 million. To estimate the share of low and medium effort, the urbanisation rate is used, which is 53% on average across all Article 5 countries (39% for LVCs and 52% for non-LVC countries). On the other hand, China has a population of 1.4 billion with 65% living in urban areas.

As already mentioned above, the ODS/HFC destruction strategies for countries differ, as do their corresponding financing needs. For example, for LVC countries, it has been more cost-effective to export the ODS and HFCs for destruction abroad than to construct their own domestic destruction facilities due to the limited amounts of ODS/HFC available. Conversely, most Type 2 countries have enough substances to justify local destruction and / or reclamation of the refrigerants at the EOL. There is even an opportunity to potentially import ODS and HFCs from LVC countries for this purpose for Type 2 countries. China as Type 1 country, on the other hand, due to their abundance of refrigerant available for disposal, has potential for economy of scale and could focus on large policy-related infrastructure projects to achieve sustainable management of these gases.

Table 3: ODS/HFC destruction costs from MLF funded demonstration projects.

Country	Amount (t)	Method	Destruction costs per kg in US $	Approved Funds in US $	
				Project Preparation	Project Implementation
MLF-funded projects that received funding directly from UNIDO, UNDP, IBRD, or a country.					
China	194.8	Rotary kiln Incineration	8 to 12,50	85,000	2,127,885
Colombia	15.1	MSWI/HTI (high temperature incineration)	5.20	40,000	1,195,000
			5.98		
			6.20		
Georgia*	1.5	Export to France – HTI	5.99**	30,000	55,264
Ghana*	1.3	Export to Poland – HTI		30,000	198,000
	1.0	Export to USA – HTI			
Mexico	74.1	Argon plasma arc	7.50	100,000	1,427,915
	39.1	Cement kill	8.00**		
Nepal*	9.1	Export to USA			157,200
Nigeria	1.5	Rotary kiln Incineration	29.82	60,000	911,724
Turkey	9.2	Exported to Poland – Rotary kiln incineration	1.87 to 2.45	60,000	1,076,250
Unido Projects					
Reclamation centre in Santago de Chile					195,000
HFC destruction in a chemical plant in Mexico					537,752

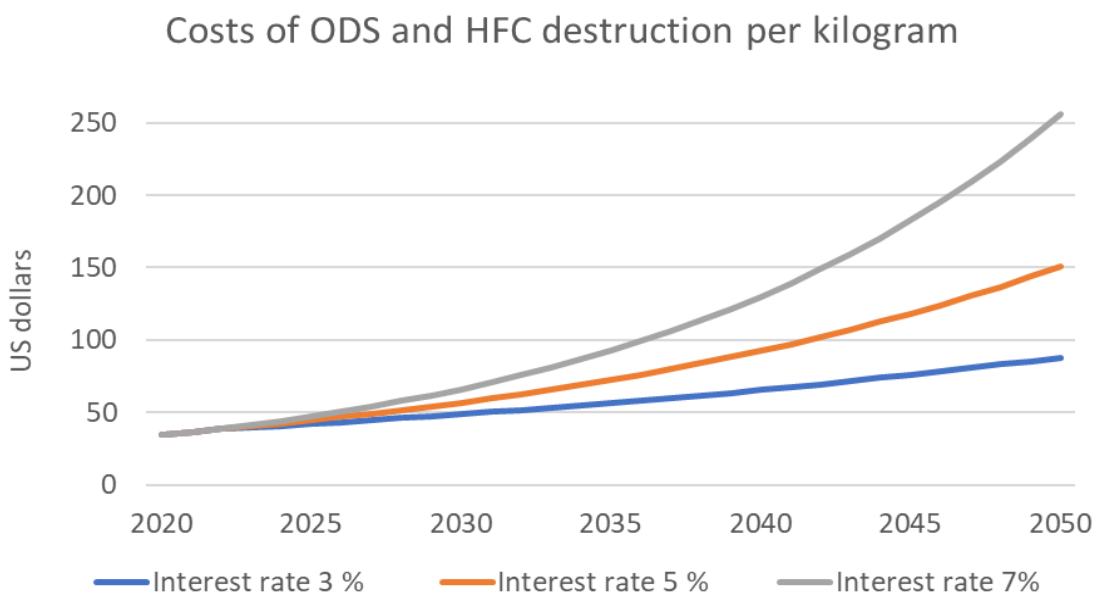
* LVC countries.
** Handling and transportation costs included.
Source: Cerda, 2019; MLF, 2018, 2019, 2022; Savigliano et al., 2017

To arrive at a final cost estimate per kg of ODS/HFC destruction, the average costs for both low and medium effort levels was calculated using the costs of ODS/HFC destruction presented in Table 2. The global urbanisation rate presented in the same table above was also considered in this calculation, providing a final cost estimate average for all Article 5 countries and for both effort levels:

→ (Average) ODS/HFC destruction costs in 2022: 38.56 US$/kg[8]

The above average destruction cost is used as starting point for projecting future costs of destruction in Article 5 countries, from 2022 and up to the year 2050 (see Figure 3 below), using the global headline consumer price index (HCPI) inflation from the Work Bank for the period 2010-2022 (Ha et al., 2021). From the year 2023 and on, three hypothetical scenarios are developed. Scenario 1 assumes a constant inflation rate of 3% until 2050 and scenarios 2 and 3 assume cumulative inflation rates of 5% and 7% respectively.

Figure 3: Projection of ODS/HFC destruction costs



Source: Authors' own calculations

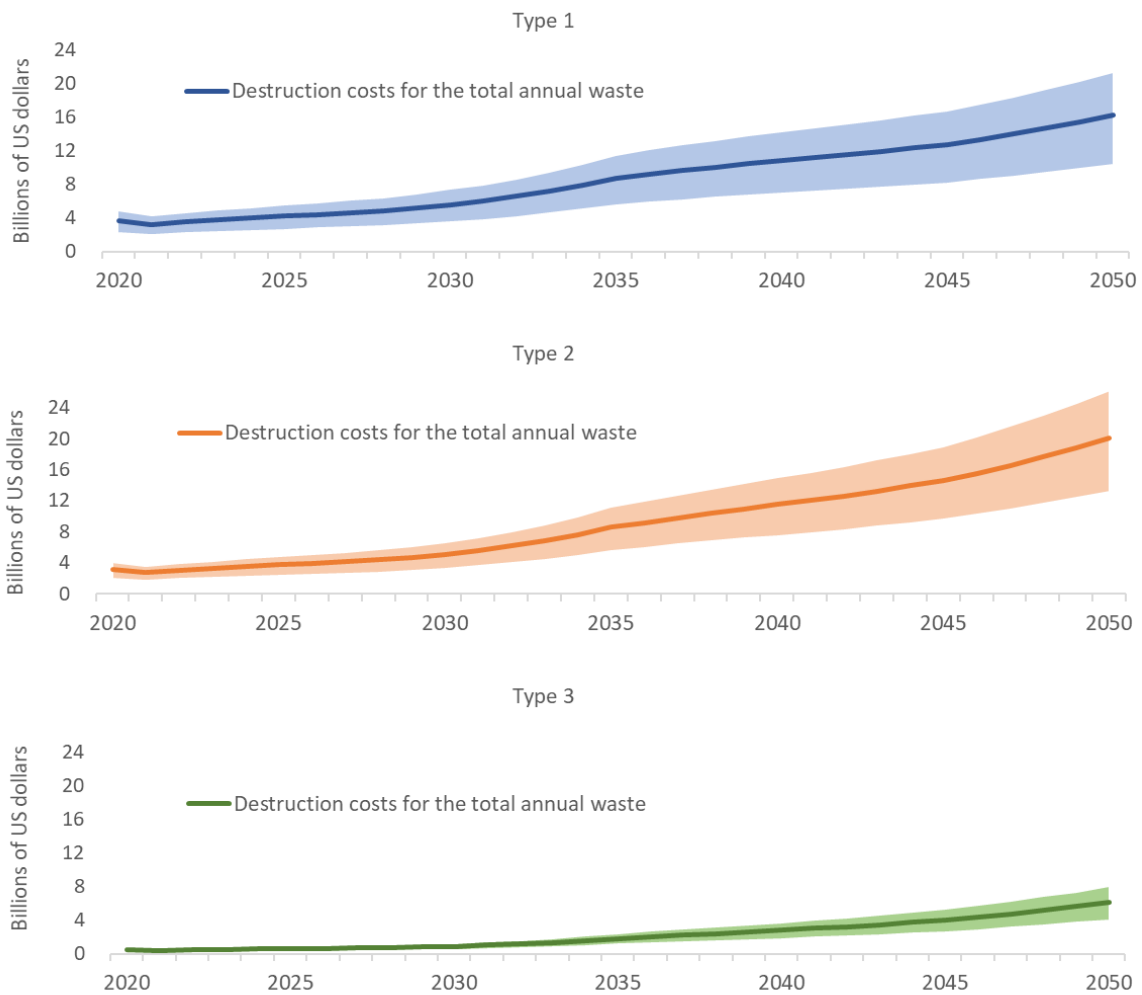
The estimation of the ODS/HFC destruction costs until 2050 presented in Figure 3 revels how uncertain these estimations are. In scenario 1 the price in 2050 is 90 US$ while in scenario 3 it is over 250 US$.

In the following section, the above Scenario 2 projections are further calibrated and adjusted for each country type according to its average urbanisation rate, in order to again make an estimate of the total cost of annual ODS/HFC waste disposal per country type. Basically, this estimate is the cost of destroying all the waste generated in one year in all the countries grouped in each category (see

[8] Estimated average cost for all Article 5 countries for both effort levels of ODS/HFC gas destruction.

Figure 4). These figures are obtained by multiplying the total annual waste of each country group to the totals taken from MCTOC[9] report and attributed to country groups by weighted average distribution derived from the Green Cooling Initiative Database to the projection of the destruction price per kilogram. Based on these calculations, it is estimated that Type 1 and Type 2 countries will have to spend each a total of approximately US$ 20 billion for the ODS/HFC waste disposal coming from the refrigeration, air conditioning and foam (RAC&F) sectors in the year 2050. Type 3 countries (LVCs), on the other hand, will only have to spend a total of up to $4 billion to manage their waste, because their overall consumption is significantly lower.

Figure 4: Costs projections for the total amount of waste of the type 1, 2 and 3 countries.



Source: Authors' own calculations

[9] MCTOC: The Medical and Chemicals Technical Options Committee is one of the five Technical Options Committees of the Technology and Economic Assessment Panel of the UNDP under the Montreal Protocol.

It is important to point out again that these estimates are based on several assumptions, as explained above, and are therefore imprecise. Still, they may provide a baseline or a starting point for future calculations and project development work.

2.6 Potential activities requiring funding

Although the cost estimates from the previous section might give such an impression, destruction of ODS/HFC gases is not the only activity for a sustainable bank management at the EOL of RAC&F appliances. In Table 4, a range of different examples of activities improving ODS/HFC banks management are provided, as a basis for the discussion of different financing options in COPA (see Chapter 4).

The list is by no means exhaustive, it is merely intended to make the discussion on funding sources and adequate instruments more specific. The potential funding cases are informed by the implementation of policies and infrastructure to improve collection and treatment of ODS/HFC waste. The individual activities are usually not stand-alone projects but require support through enabling policy frameworks for a successful implementation. Often a combination of several activities may also be required in order to improve, e.g., the collection of ODS and HFCs and, on the other hand the treatment of these substances. Similarly, one activity may also be broken down into several sub activities, each being a project of its own. Detailing all activities, however, would go beyond the scope of this study. The purpose here is to specify five activities in order to match them with potential financing instruments. The table can be viewed as a starting point for building a common framework for discussions.

The presented exemplary cases can be thought of as pilot projects, in a first step, targeting a specified (metropolitan) area or stakeholder. They can be then scaled up, either to other metropolitan areas (possible also in other regions) or to the whole country. Stakeholders can be end-user groups such as supermarkets, hotels, office buildings, public buildings, etc. but also maintenance companies, individual technicians (formal and informal sectors), refrigerant distributors, equipment manufacturers or importers as well as public entities. Achieving a complete and fully functional sustainable management of ODS/HFC banks in a country requires the combined efforts of the government and the private sector.

The following table describes 5 potential projects, including the key stakeholders involved, the activities required, the type of project, and the type of country for which this project

might be most appropriate. The costs of these projects are not estimated, as they are dependent on a variety of local circumstances, as outlined in detail in the previous subchapter.

Table 4: Example of projects and activities

Nr	Project Title	Stakeholders	Activities / sub-projects	Project Category	Suitable Country Type
1	**Establishing a collection system** of ODS/HFC (in a metropolitan area)	- Municipalities - Waste management and environmental authorities - Local consultants - Technicians - The informal sector doing the RAC disposal	- **Stakeholder analysis** (report) - ODS/HFC **bank estimation** - **Technician training** - **Purchase of equipment** (refrigerant identifiers, re-usable cylinders, recovery machine) - Set up of **storage site** - **Incentive scheme** or **business case** to ensure the return of the used refrigerant - **Inclusion** of the informal sector (more training, equipment and incentives) - **Testing labs** to avoid fraud	Collection of ODS/HFC	1, 2, 3
2	**Export of ODS/HFC** for destruction abroad	- Government agencies - Environmental authorities - Consultant - Transportation company - Export agency or Customs - Collection Centres	- **Feasibility study** (including an analysis of the available gas for destruction) - **Finding** a destruction **facility** abroad - **Administrative cost** for paperwork (including permits and **requirements** under the **Basel Convention**) - **Collection** of the substances - **Storage** prior shipping - **Transportation**	End of life management (destruction)	2, 3
3	Establish an **electronic database or registry for monitoring leakage control** of F-gases	- Governmental Ministry - Consultants - RAC operators - RAC maintenance technicians - Inspectors - Software developer - Service provider for database	- TA to Government - **ToR** for registry - Development or purchase of a **registry system** - **Registration** of staff and acquisition of servers, licenses - **Implementing registry** (collecting of data, set-up) - **Training of inspectors** - **Information campaign** for RAC technicians and operators - **Training of technicians**	ODS/HFC bank management	1, 2, 3
4	Launching a **reclamation centre**	- Investors - Manufacturers of refrigerants - WEEE centres - Environmental authorities - Consumers of reclaimed gas - Technicians	- **Feasibility study** (including an analysis of the available gas for destruction) - **Determine needs** (which refrigerants in what quantities) **and technology.** - **Operating Permit** - **Machinery** (a set of compressors to extract the gas	Circular use of the gases	1, 2

Nr	Project Title	Stakeholders	Activities / sub-projects	Project Category	Suitable Country Type
		- Industry (as a source of used refrigerant)	for reclaim and reclamation equipment) - **Equipment** such as a refrigerant identifier, chromatographer, scale to measure the gas that comes in and out. - **Information campaigns** - **Independent test analysis** for the certification of the reclaimed gas		
5	Open a facility for **domestic destruction** of ODS/HFC	- Investors /owners - Consultants - Environmental authorities - Solid waste management agencies - RAC operators - RAC maintenance technicians - Industry (as a source of used refrigerant) - Collection centres - International companies (potential buyers of carbon credits)	- **Feasibility study** (including an analysis of the available gas for destruction) - **Operating permit** - **Pollution permit** - **Machinery: adapting** an **existing facility** for ODS/HFC destruction (e.g., cement kiln) or **buying** the equipment and materials for **setting up a new destruction facility**. - **Secondary equipment** such as a refrigerant identifier, scales to measure the amount gas, reusable cylinders. - **Setting** a set of **filters** an **equipment** to measure and **control gas emissions**	End of life management (destruction)	1, 2

2.7 Lessons for COPA Financing

The sustainable management of ODS and HFCs is a challenge for most Article 5 countries due to the high costs incurred and the lack of allocation of responsibility for the safe disposal of these substances. On the other hand, it is common in non-Article 5 countries for national authorities to assign responsibilities for EOL ODS/HFC management directly to producers or distributors. However, additional measures such as import bans and restrictions on the sale of virgin refrigerants may offset the additional costs resulting from the mandatory take-back of used refrigerants and equipment. It is also important to remember that any regulation is only as good as its enforcement and cannot be successfully implemented overnight.

Finally, reclamation of used refrigerators is cheaper than destruction, making it the more financially attractive approach. In the light of the high effort required for destruction and the

associated estimated high destruction cost for ODS and HFCs, any measures to reduce the amounts requiring destruction are imperative.

The summary table below provides a quick reference to the main lessons for COPA from this chapter.

Table 5: Summary table of lessons learned for COPA from current state of play

Issue	Remarks and lessons learned
Time horizon for policy implementation	Depending on government dedication: 2 years minimum for leakage control. 3 years minimum for EPR scheme. EPR schemes are a long-term strategy to allocate responsibilities of the EOL management of ODS and HFCs to manufacturers, distributors and end-users of RAC equipment.
Return for donor/funder on ODS/HFC bank management investments	The current funding options are either grant based (e.g., through the MLF) or impose treatment obligations on manufacturers/ importers and operators. No other financing structures apply.
Required framework conditions	Clear responsibilities and incentives for all stakeholders concerning the treatment of used ODS and HFCs is a pre-requisite for successful implementation of WEEE, making use of current logistic structures. Incentive scheme for field technicians to return recovered refrigerant facilitate implementation. Restricting the amount of available new substances through regulation support the business case for reclamation.
Suitability for funding ODS/HFC management	Current MLF funding is not sufficient and not intended to achieve large-scale destruction of ODS/HFC banks. Combined with leakage control measures, EPR exerts a steering effect, as cost directly arises to users and not the general taxpayer. Implementing comprehensive regulations and EPR schemes will require additional financing.

3 Review of Financing Opportunities: Lessons from the Field

This chapter looks in more detail at several different approaches to mobilising finance for ODS/HFC bank management. It begins with an overview of existing climate financing mechanisms and then assesses lessons from climate and sustainable finance, including compliance and voluntary carbon markets, public financial interventions, and innovative financing approaches such as impact investing, results-based finance and capital stack. Some of the approaches reviewed here already play a role in ODS/HFC bank management today whereas others offer theoretical opportunities which have yet to be operationalised and applied at larger scale.

3.1 Existing Funds and Facilities

The MLF is the main financial mechanism to support developing countries' phase out of ODS and phasedown of HFCs as well as their transition to use less harmful substances. However, it does not systematically support EOL management of ODS and HFCs. Similarly, the safe disposal of ODS/HFC banks in the later stages of products is not normally addressed as a key feature of other new financing approaches in the clean cooling space. Instead, these initiatives mainly focus on the deployment of new and innovative, clean cooling at scale, with support provided for the development of market infrastructure, policies and regulations, awareness raising, as well as support for individual projects to demonstrate the viability of the approach.

There are some important insights to be gained from these recent approaches, as similar support environments are needed for both deploying new cooling and for implementing COPA activities needing financing (policies and regulation, market infrastructure, demonstration, awareness).

3.1.1 Financial Support under the MLF

Established in 1990, the MLF is the financial mechanism set up to support the achievement of the goals of the Montreal Protocol. Developed economies of the Global North contribute to the Fund in order to support the phase-out of ODS in the Montreal Protocol's so-called

Article 5 countries,[10] that is those countries whose annual consumption of ODS, and other substances controlled under the Protocol is less than 0.3 kilograms per capita. The Fund is replenished every three years by its non-Article 5 country donors. The budget for the current triennium (2021-2023) stands at $540 million and at the end of 2022, overall contributions to the MLF totalled just over $5 billion (MLF, 2023).

The financial assistance provided by the MLF usually comes in the form of grants for a range of activities that qualify for funding, including regulatory reforms and the development of national phaseout plans, technical assistance and training, and information distribution. Assistance may also be provided via highly concessional loans in cases of short payback periods of up to two years. For example, in 1994 Turkey received grant support from the MLF to undertake its ODS phaseout and decided to use part of the grant as concessional loans to participating companies in the refrigeration, foam and solvents sectors through a revolving fund administered by the World Bank (World Bank, n.d.). The maturity period was two years from completion of the project and companies repaid the loan in four equal instalments.

Funding to Article 5 countries is based on the level of consumption of controlled substances rather than an assessment of funding need and is provided via one of four implementing agencies (IAs): The UN Environment Programme (UNEP), the UN Development Programme (UNDP), the UN Industrial Development Organisation (UNIDO), and the World Bank. Up to 20 percent of contributions can also be administered via non-Article 5 countries' bilateral aid agencies such as the GIZ in Germany and the Swedish International Development Cooperation Agency (SIDA) in Sweden. The Fund is governed by an Executive Committee made up of seven Article 5 recipient countries and seven non-Article 5 donor countries. If a country wishes to request funding for a project, it needs to work with the IA which submits a project document and business plan to the MLF Executive Committee (ExCom), alongside a government endorsement letter, for approval (UNEP, n.d.). Projects are then implemented with IA support, with money released in tranches based on the achievement of targets.

With the Kigali Amendment to the Montreal Protocol in force since 2019, the MLF has been confronted with additional requirements to financially support HFC phasedowns. As discussed in section 2.1, a new MLF funding window is currently open to establish an inventory of ODS/HFC banks and develop plans to effectively manage these (Decision

[10] See Figure 2: Glance at the Montreal Protocol or footnote 3 in p. 12

91/66). However, the Fund's limited resources and mandate do not extend to the actual EOL management implementation, which therefore requires additional approaches.

3.1.2 The Green Climate Fund

Beyond financing provided by the MLF for specifically achieving the goals of the Montreal Protocol, several funds and international accredited implementation entities exist within the framework of the UNFCCC to support climate mitigation and adaptation activities, including the transition towards climate-friendly refrigerants and coolants. Although the Green Climate Fund (GCF) is only one of many such climate finance institutions, it has played an elevated role in terms of deployment of the US$100 billion in climate finance promised to developing countries annually in support of their mitigation and adaptation objectives (Heubaum et al., 2021).

Established in 2010, the GCF had raised roughly US$ 18 billion in confirmed pledges through its initial resource mobilization and first replenishment round (GCF, 2023). Current approved funding stands at US$ 11.3 billion across 209 projects in developing countries, of which roughly equal shares are concessional loans and grants (42 and 41 percent, respectively), followed by equity investment (9 percent), results-based finance (4 percent) and guarantees (3 percent) (UNFCCC, 2022). Generally, private sector projects receive more GCF funding through loans and equity while public sector projects are more frequently funded via grants. Importantly, the GCF also funds so-called Readiness and Preparatory Support Programmes (RPSP) to help countries develop mitigation and adaptation plans and strategies and offer technical support. As of late 2022, 640 requests for funding under RPSP had been approved, with US$ 459 million committed in the form of grants and technical assistance (Ibid.).

As in the case of the four implementing agencies of the MLF, the GCF provides its funding solely through GCF accredited entities, who also oversee, supervise, manage and monitor their respective GCF projects. They work with and through countries to develop strategies and project ideas and submit these as funding proposals (FP) to the GCF Board. Currently, 76 entities have completed their accreditation process, including MDBs such as the World Bank and the Asian Development Bank, national development banks (Fiji, the Philippines and Zambia among others), national ministries of finance, private banks such as HSBC and BNP Paribas, and non-profits such as Conservation International (GCF, n.d.). The GCF portfolio aims to support paradigm shifts in both mitigation and adaptation interventions across the Global South and cannot, therefore, play a key role in assisting the MLF in its

goals. However, it does offer complementary support. For example, in 2021, the GCF approved US$ 157 million as a contribution to the Cooling Facility (GCF FP 177)[11], with the World Bank as accredited entity, benefitting nine developing countries in their transition to low-carbon cooling solutions. The GCF financing constitutes 17.8% of the total facility costs of US$ 879.8 million and is provided in the form of a grant and two senior concessional loans with low (0.75%) or no interest rate.

3.1.3 World Bank Clean Cooling Facility

The World Bank's Clean Cooling Facility supports the adoption of sustainable cooling technologies across different sectors (health, buildings, and agriculture/ rural communities) in developing countries. Its current focus is on Bangladesh, El Salvador, Kenya, Malawi, North Macedonia, Panama, Sao Tome and Principe, Somalia and Sri Lanka. The Facility channels concessional climate finance (concessional loans, a guarantee and grants) received from the Green Climate Fund (GCF) – US$ 157million – and the World Bank in the form of expected co-financing (US$ 722.8 million) to co-finance IBRD and IDA-financed operations. Visit the GCF Clean Cooling Project website to access more details[12].

The Cooling Facility is composed of three complementary components that will be adapted and tailored to each eligible country's context and focus cooling area (FP 177 page 25 ff):

- **Component 1 focuses on policy, regulatory and enabling environment support**, such as strengthening institutional, policy and regulatory frameworks, support programme design and roll-out, raising awareness and stimulating behavioural changes.
- **Component 2 provides financing for cooling investments** through concessional funds, e.g., through financing of climate friendly cooling investment or via credit lines to financial intermediaries. Here, different financing and implementation mechanisms and models might prove to be suitable for different cooling sectors and in different countries and will be based on specific country and sector conditions.
- **Component 3 provides project management** support to the programme through Executive and Project Implementing Entities.

[11] https://www.greenclimate.fund/project/fp177

[12] https://www.greenclimate.fund/

Specifically, the Facility

- supports investments in efficient, affordable and sustainable cooling which are securing at least 20% energy efficiency improvement; and/or at least 20% avoided/reduced GHG;
- catalyse technology, financial and business model innovations across cooling value chains and sectors to reduce barriers for private sector investment;
- help build an enabling environment for sustained long-term systemic changes.
- provides technical assistance and builds capacity of state and non-state actors (commercial banks, private investors and technical companies, and end user beneficiaries);
- awareness raising among end users of the benefits of low-carbon cooling solutions;
- help in accessing affordable sources of financing; and
- provide credit lines to financial intermediaries.

The Facility also supports the goals and requirements of the Kigali Amendment to the Montreal Protocol by helping countries transition to more climate-friendly refrigerants and phasing down HFC refrigerants but takes into consideration that not all sustainable refrigerant alternatives may be available in local markets for all the projects considered (FP 177 page 29).

3.1.4 Nitric Acid Climate Action Group

The Nitric Acid Climate Action Group (NACAG) is an effort launched by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in 2016 to reduce global N_2O emissions from nitric acid production. NACAG provides both financial support for reduction measures and technical support for plant operators and governments. Both existing and new N_2O abatement projects can be supported. N_2O doesn't have relevance for cooling but like ODS and HFC, the sector is compact, with nitric acid produced in around 580 plants worldwide. And like ODS and HFC, N_2O is often not included in country nationally determined contributions (NDC).

Funding to plant operators is provided on the condition that the country in which the plant is located commits to continued abatement of N_2O emissions after 2023. To achieve this, the country needs to issue a formal Statement of Undertaking in which there is an agreement to undertake specific mitigation measures from January 2024, including equipping plants with new N_2O removal technology and putting in place processes for effective monitoring and reporting of emissions reductions. Importantly, governments further commit themselves not

to use any such reductions achieved in international offsetting/ transfer in accordance with Article 6 of the Paris Agreement or international emissions markets (compliance and voluntary). (Section 3.2 contain more details about the operationalisation of Article 6.)

Funding is provided in the form of grants. Plant operators need to complete a Grant Application Notice to qualify. The GIZ, who is supporting the German Government in implementing the NACAG. then conducts a due diligence assessment, evaluating applicants' capacities, safeguards and policy guarantees. A range of activities can receive NACAG grant support, including the purchase and installation of abatement technology, monitoring equipment, and staff costs for environmental management. Details are available on NACAGs website.[13]

3.1.5 Clean Cooling Collaborative (@Climateworks)

The Clean Cooling Collaborative (CCC) seeks to support and speed up the transition to efficient, climate-friendly cooling by financially supporting technological innovation or scaling up the adoption of workable solutions. This support comes in the form of grants to (1) develop project pipelines in the public and private sector and mobilise larger scale investment, (2) raise awareness among stakeholders of the benefits of climate-friendly cooling, and (3) demonstrate the efficacy of projects and gather data to support further adoption (CCC, 2022). CCC grants do not finance risk mitigation, an issue the Collaborative has identified as a significant barrier for commercial investment. To date, US$10 million provided has helped catalyse US$600 million in investment.

The CCC does not run any projects itself but rather supports those with a (seed) financing need. Grantees include the GIZ (for a project exploring sustainable public procurement of cooling in public buildings in Bangladesh; AIIB as an implementing partner), the World Bank (seed funding for the Bank to set up its Clean Cooling Facility later funded by the GCF), and MGM Innova (a US-based private equity and infrastructure investment group pursuing climate-friendly cooling projects in Latin America and the Caribbean).

The CCC is set up by the Climateworks Foundation, which serve as a global platform for philanthropy wanting to innovate and accelerate climate solutions that scale. Details on CCC and Climateworks are available on their website.[14]

[13] https://www.nitricacidaction.org/

[14] https://www.cleancoolingcollaborative.org/

3.1.6 Lessons for COPA Financing

The MLF is the main financial mechanism supporting developing countries' phase out and phasedown of controlled substances. Apart from limited funding provided for the establishment of inventories of ODS/HFC banks, however, it does not currently address their EOL management. The COPA financing mechanism seeks to fill this gap. Similar to the work of the MLF and the GCF's RPSP, the mechanism will likely need to provide funding for policy support, information and technical assistance in the earlier stages of ODS/HFC bank management via a preparatory and readiness fund (PRF), but its role will also need to go beyond this, to achieve its vision.

The World Bank (WB) Clean Cooling Facility offers an opportunity for more direct cooperation and lesson-drawing through its support for an HFC phase-down. There is a potential for co-financing as envisioned for the COPA FM (see section 5.) The Clean Cooling Facility also offers lessons with regards to mobilising initial investment required to jump-start the COPA programme, with the GCF acting as a potential funder for the COPA FM PRF and, potentially, also for a COPA destruction fund (DF) aimed at providing support to smaller countries.

Lessons for COPA on the design of a financing mechanism can also be drawn from NACAG and the CCC. NACAG works by requiring participating countries to commit themselves to ensuring that plant operators undertake specific N_2O abatement measures and that the policy and regulatory environment to do so is in place. Plant operators can then apply for grant funding. The COPA financing mechanism will also require a form of commitment from participating countries in order to provide funding for the mitigation of emissions from ODS/HFC banks (ideally also through inclusion in country NDCs). While initial funding provided may be in the form of grants (as with NACAG), a later scaling of COPA envisions the use of concessional lending and, eventually, private capital. Unlike NACAG, there may be options for additional financial support through international transfers or carbon markets – governments may therefore not be required to rule out the use of emissions reductions in such a way.

Finally, the CCC offers potential opportunities for seed funding for COPA (if the mitigation of ODS and HFCs was to be covered under the areas addressed by the Collaborative) as well as lessons for the COPA financing mechanism in the focus on developing project pipelines and raising awareness.

Table 6: Summary table of lessons learned for COPA from financing opportunities

Issue	Remarks and lessons learned
Time horizon for implementation	Immediate
Return for donor/funder	A functioning COPA FM in its various institutional elements should be able to mobilise investment into ODS/HFC bank management.
Required framework conditions	The COPA FM needs to be operationalised with different institutional elements, similar to the work of the MLF and the GCF's RPSP.
Suitability for funding ODS/HFC management	**High**. Existing funds and facilities provide important lessons for the institutional design and operationalisation of the COPA FM and potential early-stage funding opportunities.
COPA FM Structure	The COPA mechanism likely needs to provide funding for policy support, information and technical assistance in the earlier stages of ODS/HFC bank management via a preparatory and readiness fund (PRF), similar to the work of the MLF and the GCF's RPSP. Direct co-financing of country activities, like by CCC, could be done through a COPA FM destruction fund (DF). The COPA financing mechanism should require a form of commitment from participating countries to provide funding, similar to NACAG.

3.2 Operationalisation of the Paris Agreement's Article 6

The Paris Agreement's (PA) Article 6 supported the notion that (international) carbon markets could help in the achievement of national GHG reduction targets. This would be done through the trade of carbon reduction credits through either compliance or voluntary arrangements. However, how specifically this carbon market was going to work remained open for another six years after the Paris Agreement was approved (Di Leva and Vaughan, 2021). COP26 in 2021 marked a breakthrough in the development of the rules for implementation through the so-called Glasgow Rulebook. The operationalisation of Article 6 is underpinned by the notion that significant cost savings and welfare gains can materialise through the trade of Internationally Transferred Mitigation Outcomes (ITMOs) across parties

and, especially, between the Global North and South (see Strand, 2022). To date, however, more parties, especially low-income countries in sub-Saharan Africa and Latin America, have expressed their interest in selling ITMOs compared to only relatively few interested buyers, creating a supply/ demand imbalance (Michaelowa et al., 2021).

The key elements of Article 6 are Article 6.2, Article 6.4 and, to an extent, Article 6.8. Article 6.2 spells out guidelines for ITMOs between two Parties to the PA, detailed in section 3.2.1. Article 6.4 addresses the new Sustainable Development Mechanism (SDM) to replace the previous Clean Development Mechanism, as explained in section 3.2.3, whereas Article 6.8 addresses non-market approaches (NMAs) such a voluntary action or capacity building measures (not further detailed in this study).

All three articles are understood to be “cooperative approaches” for the achievement of nationally determined contributions (NDCs), which are at the heart of the PA’s more bottom-up approach. The Paris Agreement is available to review on the UNFCCC website,[15] details on the Glasgow Rulebook on Article 6 can be found, e.g., on the *iisd* website.[16]

3.2.1 Article 6.2 – ITMO specifications

Article 6.2 of the PA allows for Parties which over-fulfil their NDCs to trade ITMOs with Parties in under-compliance. This trade can be done either through bilateral or multilateral agreements. ITMOs can be measured in carbon dioxide equivalent (CO_2eq) or in another metric aligned with the NDC submitted and that may be determined by parties, for example as kWh of renewable energy generation. An open question surrounds the use of conversion factors for different metrics.

Following the Glasgow Rulebook, any ITMO needs to be generated from mitigation or removal activities from 2021 onwards and must be both verified and additional. Individual projects implemented through existing agreements require a government authorization but can be implemented by a private sector entity.

ITMOs can be authorised for use towards the achievement of obligations made in a country NDC, or outside the NDC for another international mitigation purpose. Parties make the rules for the bilateral or multilateral transfer of ITMOs themselves. This means that whether

[15] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[16] https://www.iisd.org/articles/paris-agreement-article-6-rules

there is a use for authorisation or not depends on the Parties, which gives Parties the flexibility to include a wider range of mitigation options.

Another key element for ITMOs is the use of registries to enable tracking and accounting of the transfer (in addition to the Article 6 database). These are either national or international electronic registries, for example the World Bank's Climate Warehouse[17] for the tracking and registration of mitigation outcomes. Accounting still represents a work in progress. The goal is to streamline and harmonise registries (and eventually linking them) to ensure proper tracking and reporting, avoid double counting and minimise the cost of participation.

ITMOs can be authorised for use towards the achievement of obligations made in a country NDC, or outside the NDC for another international mitigation purpose. Parties make the rules for the bilateral or multilateral transfer of ITMOs themselves. This means that whether there is a use for authorisation or not depends on the Parties, which gives them the flexibility to include a wider range of mitigation options and provides leeway in how to operationalise authorisation (Lo Re et al., 2022).

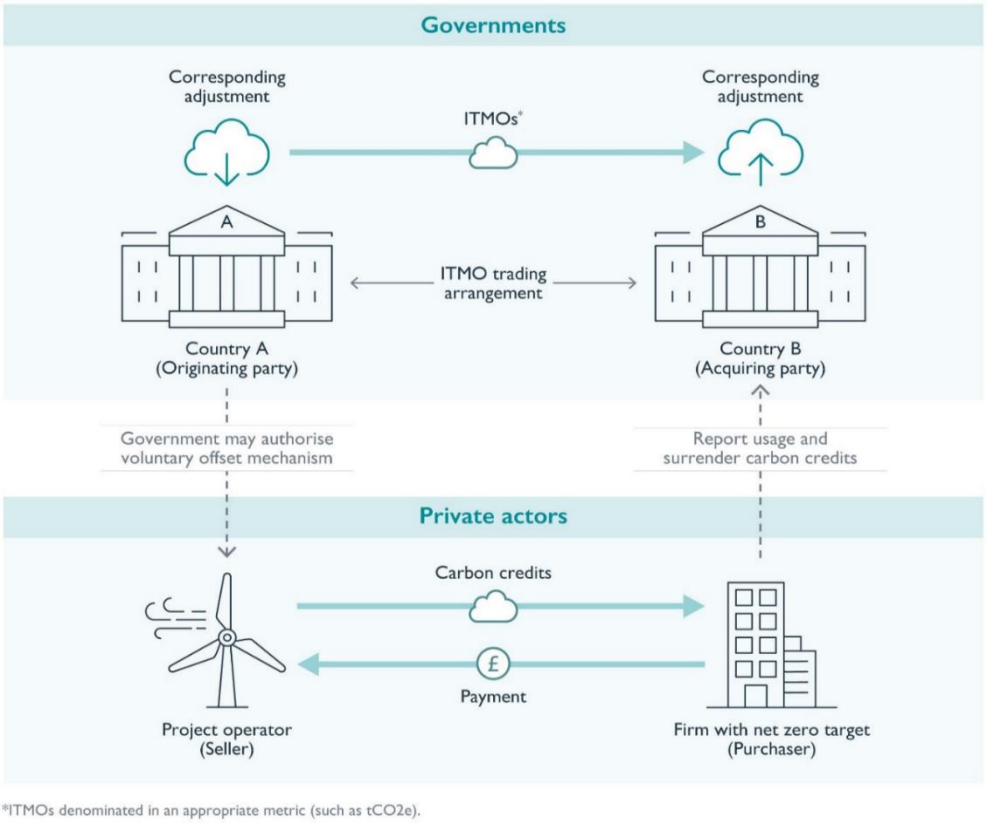
3.2.2 Corresponding Adjustments (CA)

An important innovation in the operationalisation of Article 6 is agreement on the so-called "corresponding adjustment" (CA). This refers to situations in which Parties transfer climate change mitigation outcomes internationally to be counted towards the pledge of another Party and then un-count these for their own use. Such an arrangement is necessary to avoid the issue of double counting which arises in situations in which two countries try to claim a GHG emissions reduction (ER) as their own. Such double counting artificially inflates the level of climate action undertaken by Parties and disincentivises more ambitious action.

The choice of CA for the transferred mitigation outcome is with the host country (originating party) and cannot be decided unilaterally by the relevant standard (verification standards are set by the IPCC and UNFCCC) so there is room for different options. For example, the metrics in which CAs are made depends on the host country, since ITMOs can also be defined in metrics other than CO_2eq. There are then questions around the correspondence of the adjustment and when CAs have to be performed and whether they are performed simultaneously by the host and the buyer (acquiring party).

[17] https://www.theclimatewarehouse.org/about

Figure 5: Scheme of the corresponding adjustment under Article 6



Source: Slaughter and May (2021)

3.2.3 Article 6.4 – Sustainable Development Mechanism (SDM)

The Clean Development Mechanism (CDM) was developed as one of the flexibility tools to achieve emissions reductions under the Kyoto Protocol (KP). The CDM has been plagued by controversy ever since it began its operation in 2000, e.g., with questions over the verification of emission reductions and whether projects receiving financial support were really additional (Jackson, 2009). In short, the CDM allows climate mitigation projects in developing countries to earn saleable certified emission reduction (CER) credits which developed economies covered under Annex I could count towards their KP reduction targets. The Sustainable Development Mechanism (SDM) covered in the PA Art. 6.4, shall replace the previous CDM and has been adjusted in a number of ways. In addition, under the new rules only a limited number of past CDM credits can be carried forward to be counted under a country's NDC.

The SDM aims to achieve mitigation outcomes that are additional, including through the reduction of emissions, the increase of carbon removals/ sinks and through mitigation co-benefits of adaptation actions and/or economic diversification plans. The goal is to achieve

genuine, transparent and credible reductions that avoid negative environmental and social impacts. All projects falling under Article 6.4 need to be approved by a Supervisory Board and the mechanism is administered by a Secretariat housed in the UNFCCC Secretariat. Approval is based on metrics developed further from the CDM or those developed by individual Parties or other non-state stakeholders.

In addition to stakeholder consultations with local communities and indigenous groups, Article 6.4 activities must also be approved by the host country that is a Party to the PA, has an NDC in place, and has a designated national authority to oversee such activities. Following approval, such an emission reduction unit (ERU) becomes an ITMO authorized for use towards achievement of NDCs and/or authorized for use for other international mitigation purposes. ERs generated under Article 6.4 further attract a 5% proceed levy, benefiting the UN Adaptation Fund.

3.2.4 Lessons for COPA Financing

The operationalisation of Article 6 represents an opportunity for the mitigation of emissions from ODS/HFC banks and can also enable the mainstreaming of such mitigation measures in country NDCs. ER outcomes achieved through the safe disposal of ozone and climate-damaging substances could be authorised by Parties as ITMOs and then CAs. These would be high quality ERs when verified and authorised for use in the achievement of NDCs, but even without use authorisation they could play an important role outside the NDC for another international mitigation purpose. They could also be purchased by voluntary buyers.

There is no established mechanism to determine the price of bilaterally or multilaterally traded ITMOs and there will be different prices across trades. The willingness of buyer countries (across the OECD) to pay for ITMOs is likely to remain below domestic carbon price levels if these prices are low, because the purchase of ITMOs means that important co-benefits of domestic mitigation actions, such as job creation and economic growth and development, or the reduction of air pollutants are not achieved. However, with the current EU Emission Trade System (ETS) allowance price of above EUR 80/tCO_2eq, ITMOs could be an attractive option for EU member states and the UK (who's own ETS is closely aligned). (More on EU ETS in section 3.3.1)

A 2019 assessment of potential ITMO prices sees them in the range of 10 – 50 US$/ tCO_2eq, with 15 – 30 US$/$tCO_2eq$ as the likely range for most transactions out to 2030

(Schwieger et al. 2019). This incorporates expected ITMO generation costs, buyer's willingness to pay, and experience with Article 6 pilots to date. The trade of ITMOs derived from the mitigation of ODS/HFC bank emissions could therefore serve as an important incentive to either mobilise further financing into ODS/HFC measures, or as an investment in other domestic climate mitigation and adaptation interventions.

There is, currently, much uncertainty about the ability of markets defined under Article 6 to be able to support ITMO trading at scale. Providing climate finance, such as results-based finance (RBF), convertible to ITMO transactions, would be a way for donors and international financial institutions (IFIs) to address this uncertainty (Oppermann and Strand, 2022). If paid as a concessional loan, the RBF can be repaid from the proceeds of the sale of ITMOs derived from a project such as ODS/HFC bank destruction.

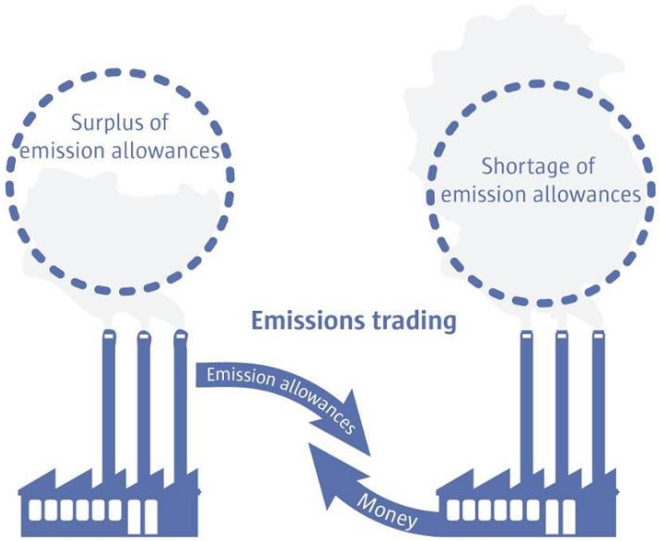
Table 7: Summary table of lessons learned for COPA from the operationalization of the Parties Agreement Article 6

Issue	Remarks and lessons learned
Time horizon for Article 6 implementation	Over the next 3-5 years, depending on progress between countries to achieve ITMO trading at scale.
Return for donor/funder	Buyers of ITMOs receive emission reduction benefits. Sellers of ITMOs can use the proceeds to repay concessional loans. More ITMOs sellers compared to relatively few interested buyers, currently creating a supply/ demand imbalance.
Required framework conditions	Bilateral/ multilateral ITMO trading regimes must be set up between Parties, as ITMOs must be both verified and additional.
Suitability for funding ODS/HFC management	**Moderate-High** if the necessary framework conditions can be established within a reasonable time horizon. ITMOs can be generated from both mitigation and removal activities. There is an open question regarding the conversion factors for different metrics. There is a need to specify what registries to use to enable tracking and accounting of the ITMO transfer.

3.3 Market Mechanisms – Emissions Trading Systems

Markets can play an important role in putting a meaningful price on carbon, enabling market participants to efficiently allocate capital toward low-carbon solutions and delivering the kind of emissions reductions necessary to avoid the worst impacts of a runaway climate emergency. Well-designed markets can be cost-effective and can crowd in private finance, which can be especially important for countries emerging from the Covid-19 pandemic with strained public finances and increased public debt (Mikolajczyk and ‘t Gilde, 2020).

Figure 6: Emission Trading System



Source: Dutch Emissions Authority (n.d.)

According to the International Carbon Action Partnership (ICAP), there were 25 operational emissions trading systems (ETS), also referred to as compliance schemes, active in 2021, covering 17% of global emissions. Emissions trading is a relatively simple way to create a market for carbon which would, if well designed, generate an effective carbon price to help drive down GHG emissions within participating sectors (Eden et al., 2018).

The largest and most prominent ETS in terms of the overall traded volume is the European Union Emissions Trading System (EU ETS), whereas the Chinese national ETS (CN ETS) cover more emission volumes. However, the South Korean ETS was first in Asia to launch a nationwide mandatory ETS. The California cap-and-trade programme is one of two programmes for GHG emissions in the United States and the only one who include ODS projects under certain circumstances. Details follow in the next sections.

When establishing an ETS, governments normally begin by setting a cap on the maximum overall emissions allowed, before determining which industries are to be covered by the ETS. Next step is then to create allowances for each tonne of CO_2 that can be emitted under the set cap by these industries. Allowances are then either given away for free or, increasingly, auctioned off. After full implementation, the firms covered by the ETS are obliged to obtain and report an allowance for each tonne of CO_2 they emit. To meet the demand on allowances, firms can either reduce emissions or purchase (additional) allowances. In other words, there is a cost imposed on emission, equal to the price of buying or selling an allowance.

Some firms may be able to reduce emissions easier or more cost effectively than others and will therefore be able to sell their excess allowances or keep them for future use. Others will not be able to reduce their emissions as easily and will need to buy these surplus allowances. The reduction in emissions in the ETS market is set by the cap, the price of the allowance (carbon price) is caused by the required cut in emission (Web-article: The Conversation).

Ideally, the emission cap should decline over time, ensuring an overall reduction in emissions and preventing situations in which too many surplus emissions allowances drive down allowance prices and incentives to reduce emissions. The global financial crisis 2008/09 and the Covid-19 pandemic showed how reduced economic activity reduced GHG emissions and created a lower demand for both fossil fuel and emission allowances. This had a negative impact on carbon markets, requiring targeted policy intervention (OECD Policy Responses to Coronavirus (COVID-19)).

3.3.1 The EU ETS

The EU ETS is one of the cornerstones of the EU's policy to combat climate change and the main tool for reducing GHG emissions cost-effectively, thereby supporting the EU’s target to become climate neutral by 2050 and achieve at least 55% net reductions in GHG emission by 2030. As mentioned above, the EU ETS is the world's first major international carbon market and still the largest, accounting for roughly 90% of the total value of the global carbon market in 2021 (Refinitiv, 2022).

The EU launched its first ETS phase 1 in 2005 as the EU's main joint approach to meeting its Kyoto Protocol obligations and is now in the middle of phase 4, running from 2021 until 2030. The EU ETS has overcome several fundamental challenges in its development,

including, most prominently, an over-allocation of emissions allowances and subsequent collapse in prices in its early years (Sato et al., 2022). In the summer of 2022, allowance prices rose to above €90/tCO_2 and future years may see further market tightening as a consequence of more aggressive EU climate targets, for example through an increase of the linear reduction factor (LRF) used to reduce the total number of emissions allowances each year (Zaklan et al., 2021). During the EU ETS phase 4, the overall number of emission allowances will decline at an annual LRF of 2.2% from 2021 onwards. (EC Website; Emissions cap and allowances)

However, while higher carbon prices are generally seen as necessary for more rapid emissions reductions in line with the goals of the PA, lower prices have still been found to incentivize investment in climate-friendly technologies and practices and, thus, to contribute to cutting emissions (Bayer and Aklin, 2020). While carbon offsets played a role in the EU ETS's earlier phases, especially through the use of Clean Development Mechanism (CDM) credits derived from projects in developing countries, concerns over double counting, lack of additionality and questions about the projects' environmental benefits ended this practice for the current phase 4 running until 2030 (Galdi et al., 2022).

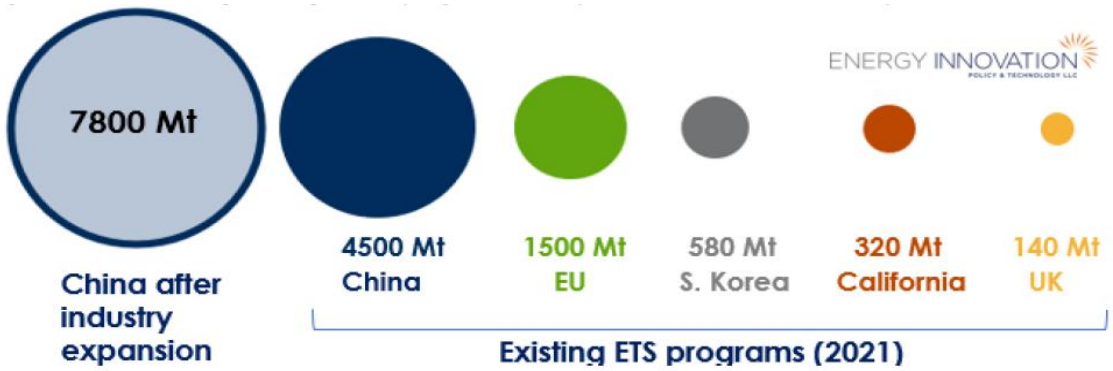
For further reading, the European Commission has collected all relevant information about the EU ETS on a web platform.[18]

3.3.2 The Chinese ETS

China launched its national ETS in July 2021 (CN ETS) but collected experiences from eight regional carbon markets pilots beforehand, which are now transitioning into the national system. The national ETS is in alignment with and support Chinas dual climate targets to peak emissions by 2030 and achieve carbon neutrality by 2060. It currently only covers the domestic power sector, equivalent to ca 40% of national emissions and around 12% of global emissions (4.5 gigatonnes of CO_2). The CN ETS is expected to expand to other sectors in the future but is already globally the largest ETS in terms of covered emissions (Nogrady, 2021).

[18] https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

Figure 7: China's carbon market compared to other programmes



Source: Busch et al. (2022)

However, due to the size of the Chinese economy and the large number of installations (2100+) included in the ETS, the potential market scope is larger, covering substantially more CO_2 emissions than the EU ETS. That said, the overall traded volume was only 412 million in 2021 compared to 12 billion in the EU ETS that same year. The Chinese allowance price is dynamic and varies, at the end of 2021 it stood at roughly US$ 8.50.

Importantly, the cap is set bottom-up rather than top-down and adjusts according to actual production levels. This means it can incentivise the running of more efficient coal-fired power stations as much as a shift to renewables or other low carbon technologies (Energy Monitor, 2022).

China Certified Emissions Reductions (CCERs)

An important addition to the Chinese market are the so-called China Certified Emissions Reductions (CCERs), essentially carbon credits that can be traded in the domestic carbon market. They refer to emissions reduction activities that have been conducted on a voluntary basis by companies and are then certified by the Chinese government. Examples of such activities include forestry, waste-to-energy or renewable energy generation projects. The ETS regulation allows companies to use CCERs for 5% of their reduction obligation. The volume traded as CCERs has been healthy with around 170 million tonnes sold over the counter in 2021 and prices fluctuating between 30 yuan ($4.72) and 59 yuan ($9.27) per tonne (China Dialogue, 2022). The CCER scheme launched in 2012, was then suddenly halted in 2017 and has been expected by several market actors to be relaunched during 2022, but that did not happen yet (as of January 2023). There is, however, currently no arrangement for the use of international offsets within the domestic carbon market although the operationalisation of Article 6 and opportunities for international emissions trading may change this.

3.3.3 The South Korean ETS

Though China has a larger and more prominent ETS, the Republic of Korea (South Korea) was first in Asia to launch a nationwide mandatory ETS (K-ETS) as early as 2015, which is now running in its third phase for the trading period 2021-2025. The K-ETS is a core policy within Korea's Roadmap for 2030 national GHG reduction targets and is constructed as a nationwide cap-and-trade programme covering about 73,5% of the national GHG emissions today. The ambition is to reduce GHG emissions by 37% by 2030, which gives the ETS a prominent role for reaching Korea's updated NDC targets. Starting with free allocation of allowances and no auctioning, the K-ETS has stepwise reduced the free allowance distribution and initiated auctioning in each period. Since Phase 3, domestic financial intermediaries and other third parties may also participate in exchange trading. It is also allowed to use international offset credits for up to 5% of an entity's emissions submissions (Ecoeye and ICAP Websites).

In August 2022, the South Korean Ministry of Environment publicly announced it had started a major stakeholder consultation process for implementing improvements and increase vitality of its emissions trading system, while also considering the European Commission's proposal to introduce a carbon border adjustment mechanism (CBAM) for EU imported goods. The changes are likely to be implemented in the programme's Phase 4, starting in year 2026 (ICAP Website).

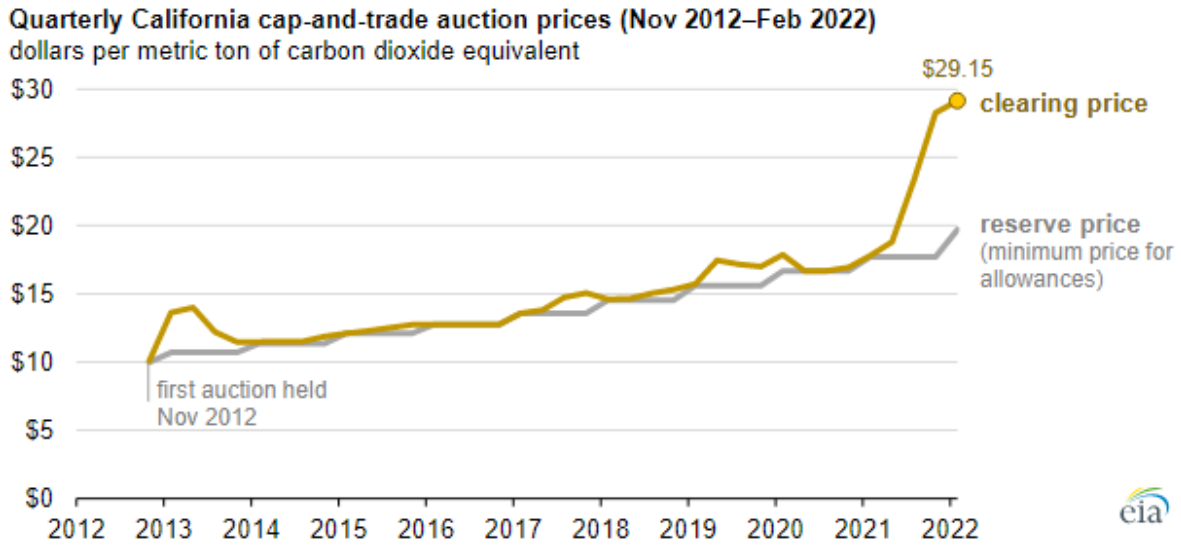
3.3.4 The California ETS

As with most other emissions trading schemes, the California ETS, also referred to as the California Cap-and-Trade Programme, sets an overall declining limit on emissions and covers electrical power plants, large industrial polluters and fuel distributors. Emissions covered by the programme include CO_2, CH_4, N_2O, SF_6, HFCs, Perfluorochemicals (PFCs), NF_3, and other fluorinated GHGs. The majority of emissions allowances are sold at auction, but some are allocated freely, depending on the industry and efficiency of each facility. Auction revenues are deposited in California's Greenhouse Gas Reduction Fund and then appropriated to various state agencies administering GHG emission reduction programmes.

By November 2021, a cumulative US$18.3 billion had been appropriated of which US$10.5 billion had been implemented, leading to a cumulative reduction of 75 $MtCO_2eq$. Priorities for investment of revenues include: reducing air toxic and criteria air pollutants, promoting low- and zero-carbon transportation, sustainable agriculture, healthy forests and urban

greening, reducing short-lived climate pollutants (such as HFCs), promoting climate adaptation and resilience, and supporting climate and clean energy research.

Figure 8: Historic Cap-and-trade Prices in California



Source: EIA (2022)

In 2021, the average auction price stood at US$ 22.43 but in its first quarterly auction of 2022, emissions credits sold for $29.15 per metric tonne of CO_2eq, or nearly $10 per metric tonne more than the minimum price for allowances.

It is worth mentioning that the California cap-and-trade programme is one of two major cap-and-trade programmes for greenhouse gas emissions in the United States. The other programme is the Regional Greenhouse Gas Initiative, which has been operational in the north-eastern United States since 2009. One difference is that the latter only applies to the electric power sector, whereas California's cap-and-trade programme covers nearly all sources of emissions within the state, including electric utilities, industrial facilities, and distributors of natural gas and gasoline (EIA Website).

Carbon Offsets

An offset is simply the reduction (or avoidance) of a tonne of CO_2 in a sector not covered by an emissions cap. In the broadest terms a carbon offset (or an environmental offset) refers to a reduction in CO_2eq emissions (or potentially an increase in carbon storage) that is used to compensate for emissions made elsewhere. They are predominantly used by companies to offset their own carbon footprint as part of a 2050 net zero commitment. A 2023 briefing paper from the WEF and Bain described carbon offsets as: "the essential "net" in net zero to balance carbon accounts between emissions and reduction.

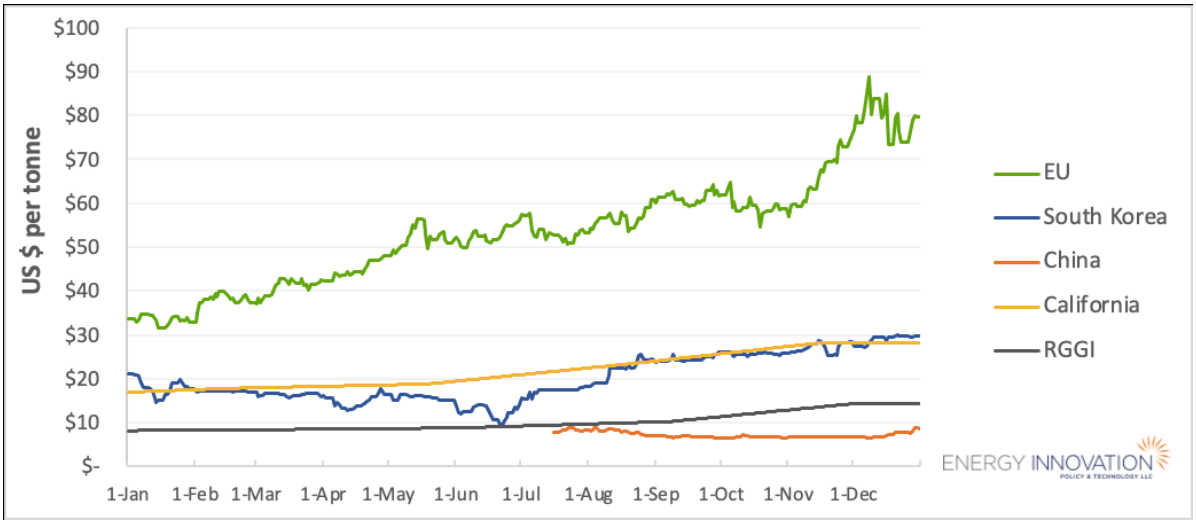
The California ETS currently allows for offsets to account for 4% of the compliance obligation (until 2025) and 6% from 2026-2030. Half of this must be from projects that directly benefit California and all offsets must be approved by the California Air Resources Board (CARB). Compliant offsets do include ODS projects, but these must come from projects located in the US, although there is a placeholder for international sectoral offset protocols. California has links with the Mexican state of Chiapas and the Brazilian state of Acre to develop specific (forest) sector-based offsets, but more concrete steps have yet to be taken.

3.3.5 Lessons for COPA Financing

Within compliance-based emissions trading systems around the world, limited opportunities for the mitigation of emissions from ODS/HFC banks exist. ODS and HFCs are not always directly included among the sectors covered by an ETS, even though California does include HFCs but not ODS. Only in some cases is it possible to purchase emissions reductions achieved in these sectors as equivalent to emissions reductions achieved in the ETS itself (i.e., they can be used as offsets). The EU ETS, for example, does not currently have any offset provision until 2030, whereas the Chinese, Korean and Californian systems allow it to a certain extend.

In the case of the California ETS, in addition to reducing HFCs, offsets from ODS projects may be used but they must be generated within the US and there has to be a direct benefit for California. In the Chinese case, the mitigation of emissions from ODS/HFC banks may produce CCERs, if certified by the Chinese government when the project relaunch. These could then be traded in the domestic carbon market or also abroad (in the form of ITMOs) although given the need for China to reduce its own emissions, the latter would be unlikely to happen unless a sufficiently high price can be achieved. There are also no official communications on when, or if, the CCERs scheme will be relaunched.

Figure 9: Carbon prices in major ETS programmes in 2021



Source: Busch et al. (2022)

The carbon price and the volatility in carbon prices are also to be considered when looking for financial opportunities for ODS/HFC banks management in the ETS markets. Different ETS have different approached and have often matured and adjusted price factors during several phases of implementation, for example, the EU ETS utilize an increase of the linear reduction factor (LRF) to accelerate reduction of the total number of emissions allowances each year in its currents fourth phase and so secure a sustainable carbon price.

Finally, the compliance enforcement and measurement, reporting and verification (MRV) of the ETS must be secured, or the cost-efficient reduction of GHG emission will not materialize.

Table 8: Summary table of lessons learned for COPA from market mechanisms

Issue	Remarks and lessons learned
Time horizon for implementation	Currently no clear pathway except in limited instances (see e.g., the California ETS).
Return for donor/funder	Trading ODS/HFC destruction-derived credits could yield high returns if existing trading schemes included relevant provisions.
Required framework conditions	ETS markets would have to either: 1. Include ODS/HFC EOL management as a viable way to derive carbon credits traded in the ETS; or: 2. Include offset provisions to enable the purchase of emissions reductions achieved in the ODS/HFC sectors as equivalent to emissions reductions achieved in the ETS itself.
Suitability for funding ODS/HFC management	Low under current conditions, limited opportunities for the mitigation of emissions from ODS/HFC banks exist. Existing legal and regulatory arrangements would need to be adjusted. The EU-ETS, by far the largest compliance market globally, does not allow offsets until at least 2030.

3.4 Market Mechanisms – Voluntary Carbon Markets

The following sections focus on the challenges, drivers and requirements for voluntary carbon markets (VCMs) to function alongside of and as an alternative to compliance schemes. They allow participants – predominantly companies but also involving a range of not-for-profit organizations and sub-national levels of government – to purchase voluntary carbon credits (VCCs) such as those generated from nature-based solutions (NBS) or renewable energy generation.

Emissions allowances versus carbon offsets

The differentiation between compliance and voluntary markets can most easily be understood through the differentiation between emissions allowances (compliance market) and emissions offsets (voluntary carbon markets), which may both result in carbon credits. For both markets, one carbon credit normally represents 1 tCO_2eq.

- ***An emissions allowance** is a permit to emit within a regulated market, for example the EU ETS. An emission allowance is usually issued by a government, where there is a legal requirement to trade such allowances to meet caps (as explained in section 3.3.1).*

- ***A carbon offset** (see box in section 3.3.4) can also be issued by a government but is more usually issued by a standard setter or certification body. It is traded on a purely voluntary basis in voluntary markets.*

There are three core aspects to the carbon markets today:

1) The mandatory or compliance markets (such as the EU-ETS, CARB, CORSIA) which trade government issued/permitted emissions allowances within a structured market;
2) Sovereign carbon markets (Article 6.4 ERs, REDD+, ART Trees and Verra JNR) which act at a national level for emissions reduction and removal);
3) Voluntary carbon markets (VCMs); which trade credits based on carbon offsets for emissions avoidance, reduction or removal on a voluntary basis.

VCMs trade credits based on offsets, which are not specifically mentioned within the Paris Agreement. The market-led approach of the VCMs exists because compliance markets have not been implemented in all jurisdictions and are not scaling up fast enough to meet the goals enshrined in the Paris Agreement (Miltenberger et al., 2021). VCCs, or carbon offsets, can be used to help companies meet voluntary corporate climate targets for emissions reductions or removal in support of the low-carbon transition.

Unlike the highly regulated compliance markets such as the ETSs, VCMs do not currently benefit from direct government or regulatory oversight. VCCs are instead issued by so-called carbon standards and certification providers, non-governmental issuing bodies with their own rules and procedures (ISDA, 2022). These include the Verified Carbon Standard (VCS or Verra), the Gold Standard, the Climate Action Reserve (CAR) and the American Carbon Registry (ACR). In addition, several different registries function as centralized record-keeping systems, keeping track of how VCCs are generated, issued, transferred, retired and cancelled (Ibid.). When a registry cancels or retires a VCC, it is permanently removed from circulation in the VCM and cannot be traded and used any longer.

3.4.1 VCM Challenges

VCMs may also support financial flows to the Global South, as voluntary GHG emission reduction activities in low- and middle-income countries might provide a cost-effective source of carbon credits traded in the market (McKinsey, 2021). While this may help reduce costs for emerging low-carbon technologies, challenges remain in assuring the high integrity of emissions reductions produced in VCMs and their accounting.

To address concerns about double counting emission reductions under Article 6.2, a successful trade and market will require, among other things:

- a public, centralized registry,
- mandated periodic reporting
- transparency and integrity, and
- an adjustment mechanism, to ensure that the benefit of the emissions reduction or removal would be reflected in an official transfer.

These challenges are currently (partly) met in the VCM through the voluntary carbon standards, but there are still some details to be agreed on for double counting. Also, additionality remains central to the creation of any carbon credit (see Section 3.4.4).

3.4.2 Drivers for VCM Growth

VCMs grew historically alongside the Kyoto Protocol's Clean Development Mechanism (CDM), as detailed in section 3.2.3, but declined in the early 2010s, following the global financial crisis and concerns over the quality of VCCs. The lack of an effective oversight mechanisms further enabled gaming activities by a number of market participants (EDF, 2021). In recent years, VCMs have grown rapidly again and between the years 2020 and 2021, the global market for VCCs grew nearly fivefold to around $2 billion. Analysis by Bain suggests that the voluntary markets could provide demand for up to 2.6 $GtCO_2eq$ by 2030, or about 13x higher than the market in 2021 (Brechenmacher et al., 2023).

This renewed VCM growth has been driven by several developments:

- increasing carbon emissions,
- corporate commitments to net zero,
- increasing national commitments to net zero targets,
- increasing demand for high integrity solutions and
- the establishment of the first global sector market, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

More specifically, with global CO_2 emissions on the rise and climate change impacts materialising on the ground, both countries as well as many private actors are committing themselves to net zero goals. This mean there is a greater demand for carbon offsets as part of the rapidly scaled up GHG mitigation activities (Gros, 2022).

Further to the above, there is also an increased confidence in the development of VCMs thanks to a number of guideline initiatives such as the Voluntary Carbon Markets Integrity Initiative (VCMI),[19] a collaboration between the UK government, investment funds and non-governmental organizations (NGOs) launched in 2021. In 2022, VCMI published a provisional Code of Practice to guide the behaviour of VCM participants with regards to high integrity carbon credits and avoid greenwashing (Azizuddin, 2022). VCMI also requires companies to commit themselves publicly to science-aligned net zero targets and to use offsets in addition to – not in lieu of – decarbonization efforts across their value chains (VCMI, 2022).

Finally, as briefly mentioned in the previous section, the operationalisation of Article 6 under the PA has given another boost to the development of VCMs. (For details, see section 3.2.) At COP26, the Glasgow rulebook agreed that under Article 6.2 of the Paris Agreement, countries could trade sovereign carbon offsets under a co-operative approach. The idea is that such approaches should go beyond baseline NDCs and encourage deeper, faster action on emissions mitigation efforts, whereby such offset credits could be traded to either countries or corporations. Under the new rules, a host country that is a Party to the PA can draw on Articles 6.2 or 6.4 but also on the VCMs to generate financing. Voluntary Emission Reductions (ERs) can be entered into a national registry, but there is no legal requirement to do so. Voluntary buyers can decide if they wish to buy ITMOs under Article 6.2, Article 6.4 ERs with use authorisation, Article 6.4 ERs without use authorisation or one of the different types of voluntary credits.

The breadth of options available under Article 6 is thus driving the development of the sovereign carbon market. For example, credits can be issued by countries built on the concept of ‘results-based payments’, using policy and positive incentives. This can result in the issue of sovereign ‘offsets’ which can be sold either internationally to other countries, or to private actors. This practice is currently allowed under Article 5.2 and Article 6 of the

[19] https://vcmintegrity.org/

Paris Agreement and has to date focused on forestry related credits such as the REDD+ credits being allowable. (REDD+ is a framework created by the UNFCCC Conference of the Parties (COP) for Reducing Emissions from Deforestation and Forest Degradation.[20]) There is currently a debate about whether or not REDD+ credits should be included in the scope of 6.4 as a means of emissions reduction or possibly removal. Post 2021, other types of projects are increasingly expected to also qualify as sovereign offsets.

3.4.3 Integrity, Additionality, Permanence

There is increasing pressure on companies and their investors to only use high quality, high integrity credits in reaching their net zero goals – which means credits that demonstrate emissions reductions that are additional and permanent. While there are a plethora of carbon reduction commitments and standards, the definition of best practice remains unclear although a growing consensus seem to be taking form.

At COP27, the newly established UN High-Level Expert Group on Net-Zero Commitments of Non-State Actors published a report on Integrity. In the report "*Integrity Matters: net zero commitments by businesses, financial institutions, cities and regions*",[21] the experts among other things outline what a credible use of offsets should look like for corporation action. The report states that, for the avoidance of greenwash, VCCs must be seen to be additional and permanent to have integrity. That mean that they cannot be double-counted, and they should be used to address emissions beyond the buyers own supply chain. At the same time, the use of VCCs should not result in carbon leakage, a situation where the reductions in emissions in one region is simply replaced as the emitter/emissions move elsewhere.

The nascent carbon removal market is building on this approach, with the idea that CO_2 removal from the atmosphere is, by definition, beyond the supply chain, as well as permanent (with storage lasting from decades to centuries to millennia) and additional, as such removals are outside actions that can be taken on operational and supply chain emissions. There are a growing range of new approaches to creating financial mechanisms to drive particular behaviour in the removal context, such as the KliK Foundation's carbon offset mechanism for motor fuels described in the box below.

[20] https://redd.unfccc.int/

[21] https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf

Same as for carbon destruction, the destruction of ODS/HFC gases should qualify for additional and permanent reductions, as long as those credits are sold outside the ODS/HFC value chain and operating entities continue to phase out ODS and HFC. Companies such as Tradewater, for example, generate offset credits from refrigerant destruction and mine methane. The credits are developed in line with standards developed by the California Air Resources Board, American Carbon Registry, and VERRA, and each of the projects the company works with is independently audited to ensure full compliance with those standards. The credits themselves are sold directly to buyers or through credit markets such as California ETS or platforms such as the supply chain platform Requis.

The KliK Foundation – carbon offset mechanism example

The KliK Foundation was established by the Swiss Petroleum Association to function as a carbon offset mechanism operating on behalf of domestic mineral oil companies. The Swiss CO_2 Act requires these companies to offset a share of the GHG emissions resulting from the use of those motor fuels, through offsets in Switzerland or abroad (the so-called 'obligation to compensate'). Emissions reductions that meet certain standards are registered by the Swiss federal agencies and given so-called 'attestations' once verified. These attestations can then be traded. To finance the offsets, oil companies pay the KliK Foundation a monthly fee which may not exceed more than 5 cents on every litre of fuel sold (costs apportioned to motor fuel sales have so far only amounted to roughly 1 cent). Between 2013 and 2021, more than 12 million emissions credits were purchased (each representing 1 tonne of CO_2) at an average cost per tonne of CHF 90 (currently roughly €92). These emissions reductions (attestations once verified) are derived from various programmes, ranging from road to rail projects in Switzerland to improved cook stoves in Peru. There are currently 19 international programmes in operation in 8 countries. International attestations can only be issued for ITMOs (Art 6 PA) from countries which have a bilateral agreement with Switzerland covering the recognition of emissions reductions. The countries are currently Dominica, Georgia, Ghana, Peru and Senegal (these countries already have a bilateral agreement with Switzerland) as well as Malawi, Morocco and Thailand (which have declared their willingness to issue ITMOs for the projects). While there are currently no projects addressing the disposal of ODS/HFC banks, there is a project on climate-friendly cooling operated in Switzerland. Given a significant shortfall of attestations out to 2030, the Foundation is actively searching for more investable projects at home and abroad. More details are available on the KliK Foundation website.[22]

[22] https://www.klik.ch/en/

3.4.4 Lack of trust and perverse incentives

Increasing climate risk and a growing focus on sustainability are leading to a rapid growth in demand for credits in both the private and public sector, but there are continuing challenges deriving from a lack of trust in market integrity for carbon credits. The voluntary carbon markets are currently criticized due to a recent analysis of REDD+ credits certified by Verra published in January 2023, which suggested that over 90% of the carbon offsets issued were worthless – or had no appreciable effect on global emissions (Guizar-Coutino et al. 2022; Thales et al., 2023). Not only does this result undermine trust in existing standards and certification but it also means a more general suspicion of the use of offsets.

This is challenging given the history of carbon offsets and the distaste many environmental activists have for their use. The argument against offsets has historically been that global polluters were continuing to pollute while 'offsetting' their emissions elsewhere, which practically has little to no effect on global emissions overall (Jackson, 2009). This was exacerbated in the early days of the CDM where perverse incentives led to the inadvertent creation of more GHGs (Burston, 2010).

These incentives were created through a by-product of an acceptable air-conditioning and refrigerant gas (HCFC22); the HFC23. HFC23 is a GHG with a GWP 14,800 times more damaging than CO_2. Given the focus on reducing GHGs, the CDM market for HFC23 gas destruction exploded and, given the high credit level such GWP offered, provided a perverse incentive for the ongoing production and use of HCFC22 (EIA, 2013), feeding HFC23 into the market. The scandal resulted in the EU-ETS banning HFC23 credits from its compliance market in 2013 but not before large amounts of capital had been transferred to fund the cheap destruction of the gas. This resulted in a suspicion around refrigerant destruction, which has cast a shadow over the market in the long term.

The issue with ODS and HFCs today is very different, however. Under the Montreal Protocol and its Kigali Amendment, CFCs, HCFCs and HFCs are either banned or in the process of being phased out. It is, therefore, not a question of funding destruction of gases still being created, but rather funding destruction of existing gases that cannot be allowed to be released into the atmosphere if there is to be any chance of reaching the GHG emissions reductions demanded under the Paris Agreement.

3.4.5 Lessons for COPA Financing

The rapid growth of VCMs alongside efforts to establish commonly accepted guidelines and achieve greater market integrity and transparency, creates opportunities for ODS/HFC bank management and thereby, by extension, for COPA financing.

Responsibility for the phase out of the use of ODS is regulated within the Montreal Protocol (MP), but while there is provision for market analysis, collection and storage of old cylinders and the gases they hold, there is no funding available for the destruction of such gases through the MP. The VCMs provide a clear and seemingly natural fit for the destruction of GHG gases with significant GWP potential, a process which results in permanent removal. As no current NDCs refer to the destruction of ODS and HFCs, they would also qualify as an additional (emission removal) activity in this context.

That means that if accepted under the Paris Agreement, the destruction of ODS/HFC gases could qualify for additional and permanent reduction credits, if those credits are sold outside the ODS/HFC value chain, while existing operating entities continue to phase out ODS and HFCs. Without a redefinition allowing the destruction of such gases (such as provided by CARB and the Verra/ACR standards) within the framework of the Paris Agreement however, the demand for such credits may be slowed.

Many ODS have a higher GWP than CO_2, which makes their collection and destruction an imperative in addressing the climate challenge. At the same time, their GWP impact means that they can play a weighty role in addressing the global GHG emissions overall. It will be important to ascertain the extent to which ODS and HFCs can be included in plans to address climate change through the Paris Agreement, or to which their GWP has been ignored in light of the jurisdiction of the Montreal Protocol.

For several years, large international refrigerant management companies such as Tradewater and A-Gas have been selling carbon credits generated through the destruction of ODS/HFC banks into the VCM, providing a proof of concept for this market-based approach. These credits are verified by independent registries as both additional and permanent, with compliance standards set for destruction and environmental monitoring set by the MP. As most compliance markets around the world do not currently have provisions for the purchase of carbon credits derived from ODS/HFC management or exclude domestic and international offsets, VCMs are currently the only viable way to mobilise sufficient private finance to enable the collection, transport and destruction of such gases.

It is also worth noting that there are two central approaches to the removal of CO_2 from the atmosphere: nature-based solutions and direct air capture. In the case of ODS and HFCs, once the gases have escaped into the atmosphere there is no technology available to capture them. The stockpile of such gases, and their potential global warming impact, exist today and the only way to address the risk is through their destruction before escaping their containment.

COPA has a unique opportunity to develop a framing for how to address GHG emissions in an additional, permanent, transparent and monitored way. While further research needs to be undertaken to understand the relationship between ODS/HFC banks and mainstream understanding of the make-up of the global carbon budget to 2050, there is an important role to be played.

There are opportunities for ODS/HFC bank management projects under COPA to receive funding from the KliK Foundation, especially those in countries already covered by a bilateral agreement with Switzerland regulating the use of ITMOs (including current COPA partner country Ghana). Each of the current KliK projects are based on assumptions over the estimated delivery of ITMOs by 2030.

While a case can be made for ODS/HFC projects to be considered from an environmental and climate perspective, the lack of direct reference to these substances in many NDCs presents a hurdle for financing and is a barrier for a wider understanding of the importance of these substances for the ongoing climate change.

Table 9: Summary table of lessons learned for COPA from VCMs

Issue	Remarks and lessons learned
Time horizon for policy implementation of ODS/HFC into VCM	Potential expansion of VCM trading of ODS/HFC credits over the next 3-5 years. VCMs are currently the only viable way to mobilise sufficient private finance to enable the collection, transport and destruction of such gases.
Return for donor/funder	A marginally profitable investment – the volume and value of carbon credits traded in the VCMs are currently below those traded in most ETS markets.
Required framework conditions	Better oversight, transparency, integrity and liquidity of VCMs.

Issue	Remarks and lessons learned
	Compliance with clear, Paris-aligned standards is necessary. Redefinition of ODS/ HFC destruction as equivalent to CO2 removal (Carbon capture).
Suitability for funding ODS/HFC management	**Medium-high** dependent on sufficient growth of and improvements in VCMs. There are opportunities for ODS/ HFC bank management projects under COPA to receive funding from the KliK Foundation, especially those in countries already covered by a bilateral agreement with Switzerland regulating the use of ITMOs.

3.5 Public Financial Interventions

The public sector has a number of tools at its disposal to incentivise effective ODS/HFC bank management beyond EPR rules and waste and efficiency regulations such as the WEEE, discussed in chapter 2. These range from dedicated funds to legislative frameworks or mandates for procurement or portfolio percentage requirements, which can have dramatic impacts and create tipping points for actions in particular sectors (Systemiq, 2022).

Through the provision of such incentives, governments are investing public resources to encourage private investments in solutions. These can range from encouragement to invest in major infrastructure projects, to changing product pricing in such a way as to encourage consumer uptake. In many ways, the thinking is similar to that used by impact bonds in that the expenditure is made with the view of reaching specific goals based on a range of outcomes.

These desirable goals and solutions are normally identified using a cost-benefit analysis, where a particular public body can assess medium- and long-term impacts in economic, social and environmental terms. Often, this approach also requires an economic impact study to be undertaken. Here, there is still work to be done to ensure that concepts such as net zero, and climate and biodiversity risk are factored into such analysis.

The types of incentive on offer are also usually related to the reach or area of responsibility of an agency or public body. Energy agencies might focus on energy subsidies for example,

parties responsible for housing might focus on property taxes or rebates, while governments might focus on job creation and provide frameworks or incentives for new industry development and/or skills and capacity building. Municipalities have a unique position in that they can set policies across several different sectors (e.g., housing, energy, waste management, education, health etc) and take a more effectively integrated approach.

A selection of available public financial interventions, such as the examples mentioned above and with a potential relevance as financing opportunity for COPA activities, is presented in the following sections.

3.5.1 Import Levies, Tax Incentives and Buybacks

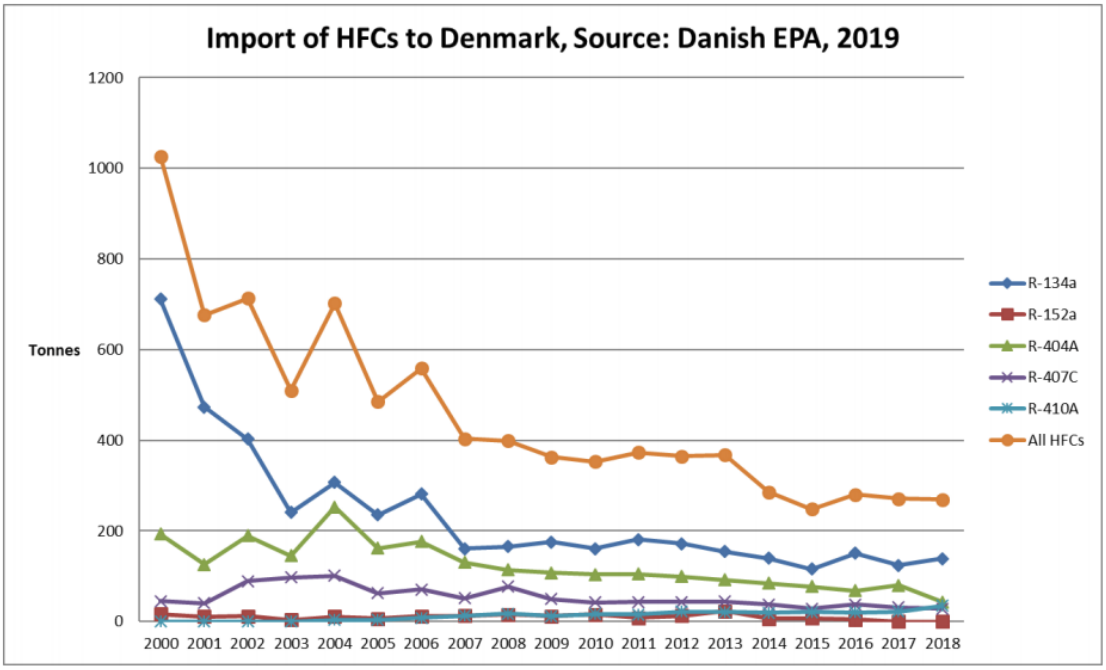
One prerequisite for successful refrigerant collection and treatment is the behaviour of the individual technician working on the refrigerant circuit, as already noted in section 2.7. This means that if technicians see value in the recovery of refrigerants, recovery is more likely to occur. Consequently, payments for recovered refrigerants can increase collection rates of these substances, as this benefits the technician handling the recovery. Technicians' sustainable behaviour can be further supported by the introduction of reusable cylinders, enabling service technicians to recycle and reuse refrigerants onsite. It also facilitates handing in used refrigerants to distributors for take-back, reclamation or destruction.

Payment for returned refrigerants could be a result of the increasing value of reclaimed refrigerants in countries where HFC phase-down schedules are already well under way. Where this is not yet the case, governments may choose to introduce a tax and refund scheme where the import of virgin refrigerant is taxed, and then a part of the tax collected is returned upon the submission of the used refrigerant. It is important to state that such a taxation scheme requires a strong (gas) testing infrastructure in order to avoid fraud.

Denmark's HFC tax – example of tax incentive

In 2000, the government of Denmark adopted an HFC tax which is estimated to have saved (avoided) approx. 5.3 tCO_2eq until 2020. The underlying standard regulates the price per tCO_2eq which was initially set at 150 Danish Krones (DKK) (US$ 21.6). Alongside the decline of HFC imports over time, the government decided to increase the tax again in 2020. Besides, the persisting tax ceiling of DKK 600 (US$ 86.4) has been removed with the revision of the legislation. The tax is complemented by a ban of HFCs in new equipment which was put into effect in 2006 and leads to HFC imports only being made for servicing purposes (Stausholm 2020). The figure below shows the impact of the Danish HFC legislation for the period 2000 – 2018.

Figure 10: Import of HFCs to Denmark 2000-2018



Source: Danish EPA (2019), Stausholm (2020)

3.5.2 Concessional Lending and Grants

Concessional finance is a below-market-rate finance, usually by a major financial institution such as a national or multilateral DFIs like the KfW or the World Bank, provided to a developing country to achieve certain development outcomes. It enables, among other things, many projects in climate mitigation or adaptation, which would otherwise not be able to attract the necessary investment.

Concessional finance is commonly provided to Lower Middle-Income Countries (LMIC) and Upper Middle-Income Countries (UMIC) in the form of concessional loans, loan guarantees, or, occasionally, equity investments. Concessional loans need to be repaid, although both the interest rate and the repayment length are significantly more generous than those of

comparable market loans. For example, the current interest rate on an IBRD loan to a developing country is around 2.5% on long maturities of up to 35 years.

It is important to note that while concessional lending is generally understood to mean at lower or very low rates of interest, it can also mean a longer maturity of debt, longer grace periods for repayment, lower collateral requirements etc. It also often comes alongside some form of subordinated debt or other form of finance, as well as complementary technical assistance grants.

Grants are typically issued by government, or philanthropy, as aid and even disaster risk reduction investments, to support programmes that do not have an investment return element. This usually means in support of capacity building objectives in policy, technical and financial development.

Grants are typically reserved for Low Income Countries (LIC). They do not come with the expectation of repayment but eligibility for grant funding is usually predicated upon a clear commitment by the LIC to achieve or work towards specified development criteria. Grants may also be used to provide research and development or limited early-stage project support elsewhere.

3.5.3 Blended Finance

Blended finance has dominated the discourse in the development finance marketplace for some time. It is an approach to structuring deal finance which allows states, agencies and organisations that may have different objectives to invest together. The goal is to blend the goals of different approaches to finance (financial return, environmental impact, social benefit) into one vehicle that enables a project with multiple outcomes to achieve funding (Convergence, 2022). It has been the main development and climate finance collaboration approach to date, incentivizing commercial capital to flow to projects that contribute to sustainable development, while also providing financial returns to investors.

The OECD (2018) describes blended finance as: "*the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries*." It has traditionally been a blend of national finance, official development assistance (ODA) and sustainable development goals (SDG) focused finance, combining risk transfer mechanisms such as guarantees, concessional loans and insurance to leverage private sector involvement.

Seychelles - Blended finance example for climate finance

The Government of the Seychelles drew on different types of funding (philanthropic, public loan guarantees and private investment) to raise $15 million through the world's first sovereign blue bond and convert $22 million of government debt into conservation funding to protect 13 marine areas (Climate-KIC, 2023).

The focus on risk transfer and the leveraging of private sector involvement in blended finance approaches means that it has predominantly targeted relatively investable SDGs such as SDG8 (decent work and economic growth) and SDG13 (climate action), where financial return can be quantified, rather than goals such as SDG16 (peace justice and strong institutions).[23]

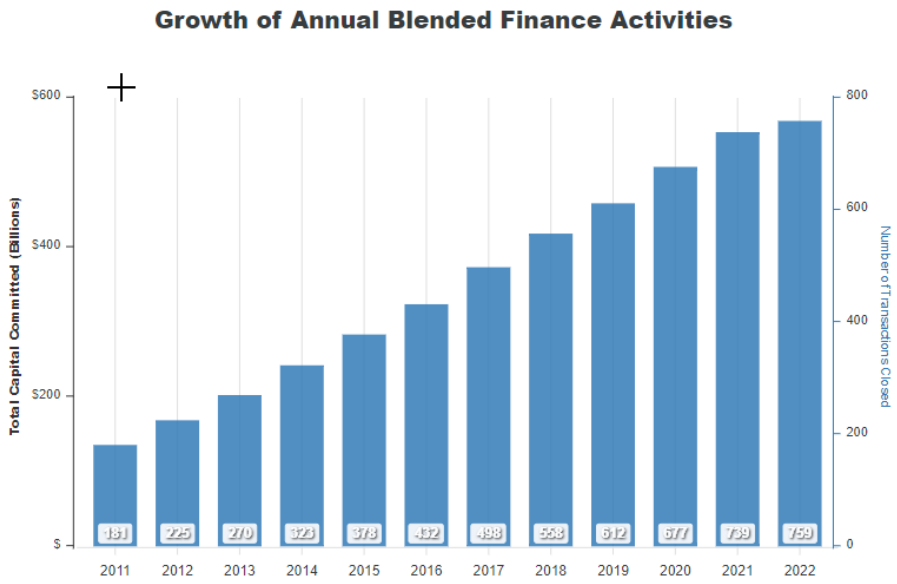
There is an estimated $4.2 trillion funding gap per annum to realize the SDGs in developing countries alone, but since 2011 only $171 billion in flows have been identified, though there is a growing trend, as illustrated in Figure 11 below. Concessional loans, guarantees, risk insurance, technical assistance funds, design state or programme support and results-based financing have all been deployed, with concessional finance making up the majority of interventions. The utilized instruments have included:

- tools to address currency and interest rate risk;
- small scale finance tailored to specific organisations (such as combining loans, or providing guarantees and technical assistance);
- a blend of commercial and concessional finance into a private equity fund;
- and a pay as you save programme for cleaner transit.

As a rule, blended finance is considered a publicly driven investment intervention intended to de-risk development investments. Climate finance is the area where this is beginning to be extended, as the gap between required and available funding (estimated at between $2.5-4 trillion for climate finance, dependent on boundaries and definition) means that no one source can achieve the overall goals. This is leading to a greater focus on the needs and interests of private capital as a means of more effectively leveraging other forms of capital to fill the investment gap.

[23] Further information about the SDGs can be found under: https://sdgs.un.org/goals

Figure 11: Growing trend of blended finance



Source: Convergence (2019)

Within blended finance structures, the strategic roles of concessionary capital will likely need to include the following four types of approaches, as well as modifications and mixtures of these approaches, depending on the context (Havemann et al., 2022).

Table 10: Blended finance approaches

1. Permanent blended finance	Financial structures that will always need to rely on concessionary finance within the capital mix
2. Transitional blended finance	Concessionary capital element that can taper down as the investment moves past proof of concept
3. Adjustable blended finance	Inclusion of concessionary capital varies based on relevant risk or impact creation
4. Impact monitoring and verification blended finance	Concessionary capital covers the cost of monitoring or verifying impact

3.5.4 Lessons for COPA Financing

Targeted public financial interventions can play an important role in supporting effective ODS/HFC bank management through the provision of grants and concessional loans, import levies or taxation. As the Danish example shows, HFC taxes can be effective, especially when coupled with another regulatory intervention such as a ban on HFCs in

new equipment. Financial incentives for the return of old refrigerants need to be targeted to be effective, however, and require effective testing regimes to avoid fraud.

The use of blended finance has proven successful in sustainable development and there is no doubt that the use of public and development finance to de-risk projects has been very successful. It also highlights that blended finance is specifically focus on the provision of concessional finance and is concentrated on the interests of development finance institutions. This means that large scale projects are more commonly considered, as the transaction and opportunity costs are often too high for smaller scale interventions to be considered by the institutions. Interventions targeting small and medium-sized enterprises (SMEs) or individuals may thus not be considered by DFI's, leaving a major gap in the market, which is of particular concern given the fragmented nature of the EOL management of ODS and HFC.

Table 11: Summary table of lessons learned for COPA from public financial interventions

Issue	Remarks and lessons learned
Time horizon for implementation	Over the next 3-5 years.
Return for donor/funder	The use of grants, concessional loans and blended finance is well established. Only minimal to no financial return for the public sector but potentially healthy financial returns for private investors as part of a blended finance approach. Taxes and levies can generate returns but need to be well-considered to work well.
Required framework conditions	Well defined projects at different levels required to attract grant funding, concessional loans or blended finance. Tax and levy schemes coupled with other regulatory interventions such as bans bring stronger and faster impact / results.
Suitability for funding ODS/HFC management	**High** suitability if financial instruments are effectively matched to relevant interventions and if tax and regulatory schemes are well-designed and implemented. Blended finance might be able to channel private capital to COPA activities and leverage the public funding. The strategic role of concessionary capital within the blended finance structures should be acknowledged to maximize impact.

Rather than replace the more traditional financing outlined above, innovative financing approaches can provide additional value and add potential new elements to ODS/HFC bank management. They include results-based finance as interventions, functioning on the basis of agreed and verified outcomes, impact investment with its focus on positive environmental and social outcomes rather than merely financial returns, and the capital stack approach, which specifically targets interventions at multiple scales. Philanthropy is closely connected to impact investing, and although green bonds might not be novel anymore, it may still be labelled an innovative green finance approach.

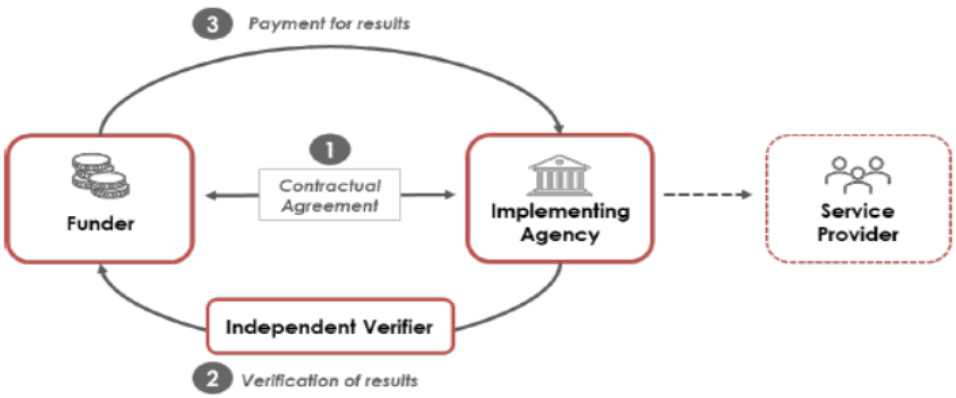
3.6 Innovative Financing Approaches

Rather than replace the more traditional financing outlined above, innovative financing approaches can provide additional value and add potential new elements to ODS/HFC bank management. They include results-based finance as interventions, functioning on the basis of agreed and verified outcomes, impact investment with its focus on positive environmental and social outcomes rather than merely financial returns, and the capital stack approach, which specifically targets interventions at multiple scales.

3.6.1 Results-based Financing (RBF)

Results-based financing (RBF), also sometimes referred to as performance-based finance or pay-for-success finance, is a financial instrument under which a donor or investor disburses funds to a recipient or debtor upon the achievement and independent verification of a pre-agreed set of results. Payments and the continuation of the project are usually decided ex-post achievement and independent verification (see Figure 12).

Figure 12: Results-based financing scheme



Source: Escalante & Orrego (2021)

RBF can be tied to the achievement of either outputs or outcomes. Outputs are the direct and more immediate results produced by the project that are identifiable and measurable, for example megawatts of energy produced from wind or solar or a specific number of local jobs created in the renewables industry. Outcomes are more long-term changes in an environment that are affected by the project outputs, for example the mitigation of CO_2 or the growth of a sector or industry. A further important difference lies in the verification of results, as outputs are more easily verified than outcomes, which can also be impacted by other external factors.

It is possible to structure an RBF instrument either as output- or outcomes-based. Take the example of concessional lending. Either type (outputs- or outcomes-based) of lending would describe a debt arrangement in which the contractual conditions of the loan vary depending on the achievement of certain climate-related goals. If the recipient or debtor achieves certain project outputs/ outcomes, the interest rate may be lowered or there may be additional payments made, incentivising compliance. If project outputs/ outcomes are not achieved, there may be a financial penalty, or the recipient/ debtor may have to pay a higher interest rate, disincentivising non-compliance.

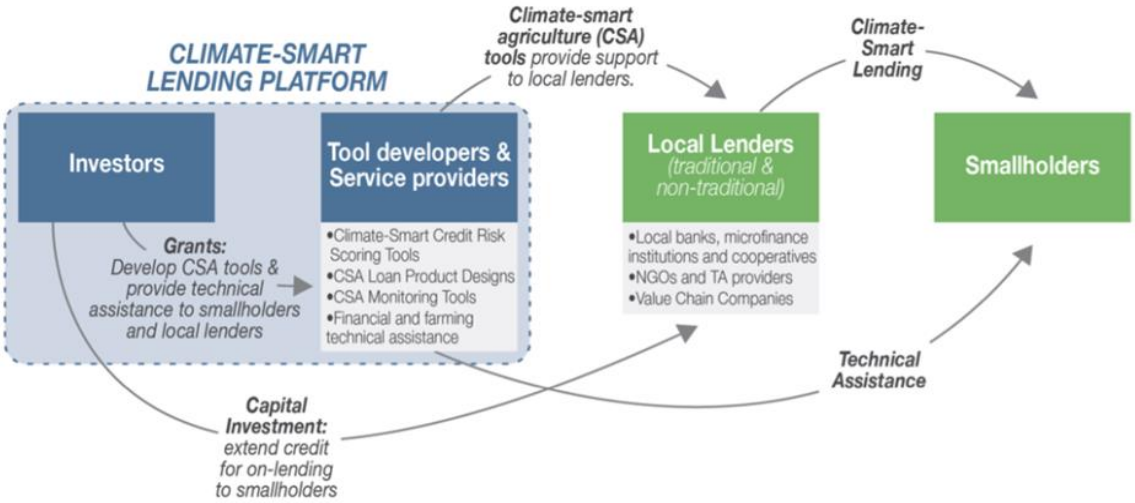
Two real examples of RBF drawn from the Global Innovation Lab for Climate Finance and the World Bank are provided in the boxes below.

Climate-smart lending platform (CSLP) – RBF Example 1

The climate-smart lending platform (CSLP) helps lenders incorporate climate risk into their loan portfolios while incentivizing the adoption of climate-smart farming methods by African smallholders (Global Innovation Lab for Climate Finance, 2020). The challenge it seeks to address is that traditional credit channels do not have the proper tools to assess climate-related lending to smallholder farmers and fail to price in the negative externalities of unsustainable farming activities. There is, therefore, only very little investment forthcoming.

The solution is to provide credit funding and technical assistance to local lenders, targeting climate-smart agriculture (CSA). Smallholders receive the necessary finance and support, and lenders incorporate climate risk into their loan portfolios, all of which contributes to the mainstreaming of such risk understandings into credit scoring systems (Ibid.).

Figure 13: CSLP Scheme



Source: Global Innovation Lab for Climate Finance (2020)

The lending platform is structured in phases. In Phase 1 (2017-2021), a number of projects are developed in partnership with different financial institutions and implementing partners. Project results are then used to prove the lending case. The goal is to then raise grants and concessional loans to fund the CSA loan products as well as the monitoring tools to enable evaluation and risk-scoring. A key point here is that many of the projects falling under the platform will be developed together with pre-existing lending and funds, which enables the use of existing structures to get projects off the ground. No concessional financing is envisioned for Phases 2 and 3 (commercialisation and mainstreaming) but Phase 2 includes first loss guarantee backing for commercial finance providers.

A small amount of grant funding helps to facilitate coordination and cooperation across projects, build a project pipeline, establish project partnerships, raise funding for new CSA projects and act as a repository of expert knowledge on loan products and relevant tools. The Rwandan national climate fund FONERWA has declared its intention to support a project in Rwanda with support of the International Union for Conservation of Nature (IUCN) and the Netherlands Foreign Trade and Development Cooperation (Ibid.).

Source separation of solid waste in China and Jamaica – RBF Example 2

In Ningbo, China, an RBF approach was used in 2013/14 to address the issue of behaviour-change and incentivizing household solid waste separation (World Bank, 2014). While this is not a climate-related project, it nevertheless helps to illustrate key issues also relevant to the disposal of ODS. Financial incentives (here: cash) were given to communities if they successfully separated waste. Verification was based on pre-determined quality and quantity measures. Based on this, neighbourhoods would then receive a score and an incentive payment based on this score (with both a predetermined minimum score and a maximum payment ceiling). Each programme cycle lasts for six months, with implementation running from the first to the fifth month, evaluation starting in month two and final scores and incentive payments determined in the final month. Payments are then made as cash grants by the municipal governments. Key lessons from the Ningbo project include, first, an understanding that RBF schemes require additional measures such as education and outreach (including through local television, radio and newspapers) to succeed. These need to be locally owned to ensure buy-in (Ibid.).

In a similar project in Jamaica (SUPER 18), behavioural change was achieved through targeted community engagement activities. An evaluator was brought in early and held regular stakeholder meetings to engage the community in the project and build trust. Environmental wardens (members of the community) were hired to educate other community members and enforce waste collection and separation practices. Financial incentives were provided to the wardens in the form of bonuses. A second important lesson is that waste separation may not always be accomplished through financial incentives or education as it is a complex problem which takes time to be understood and effectively addressed (Ibid.).

3.6.2 Impact Investment

The Global Impact Investor Network (GIIN) describes impact investment as ""*investments made into companies, organizations and funds with the intention to generate measurable social and environmental impact alongside a financial return.*" More details are available on the GIIN website.[24]

While it is also a form of results-based financing, it usually provides up front capital to a service provider or infrastructure developer and generates a return from the public sector based on payments for services delivered or infrastructure provided.

Impact bonds are the most well-known vehicles for impact investment. However, while overall there are 222 impact bonds contracted globally, there were 222 social impact bonds (SIBs) and 17 development impact bonds (DIBs) too. Only a very small proportion of these went to the environment and/or agriculture (Brookings Institution Global Impact Bond Database, 2023).

[24] https://thegiin.org/

Impact investment may have a critical role to play in financing the reclamation or destruction of ODS and HFCs, because the return focus is on positive environmental and social outcomes, rather than purely financial return.

3.6.3 Impact and philanthropy

It is important to note the close relationship between philanthropy and impact investment, as many see the latter as an evolution of the former. Philanthropic capital has a large amount of flexibility in terms of what it finances, and it can provide frameworks for deploying entirely different types of capital. In the early stages of project development, analysis can even generate venture capital for experimental research designs. At later stages, government actors can step in and scale-up new approaches if proven effective. This makes philanthropy a supplementary and complementary financial partner.

While philanthropy has traditionally targeted areas such as housing, education, welfare and poverty, the last few years have seen a major focus on climate, with Marc Benioff's Trillion Tree Initiative, $5 billion for the "Protecting our Planet" programme and Jeff Bezos' $10 billion Earth Fund. Nevertheless, environmental philanthropy only accounted for about 8% of giving in a survey conducted in 2020 by the Rockefeller Philanthropy Advisors. In 2019 and 2020, the amount of tracked philanthropic funding for climate change mitigation was between $5-9 billion and $6-10 billion, respectively (Desanlis et al., 2021).

Philanthropic capital, which combines independence with long term horizons, can support a wide range of climate initiatives that might otherwise not receive funding, from awareness building to innovative financial programmes, especially in support of local non-profits.
In the US for example, climate philanthropy has been deployed to influence climate friendly policies at the local or state level, support for grassroots organisations and educational programmes around climate change, justice and adaptation. It can also be used to accelerate other forms of private and public capital, from supporting research and development (R&D) as well as policy development, to exploring new mechanisms and models for finance.

Scaling up philanthropy - GEAE Example

The recently launched initiative Giving to Amplify Earth Action (GEAE) from the World Economic Forum has been set up specifically to increase the use of philanthropic capital in addressing climate finance. Philanthropic financing for climate mitigation has risen in recent years, but still represents less than 2% of total philanthropic giving, estimated at $810 billion in 2021. More details about GEAE are available on the WEF website.[25]

3.6.4 Green bonds and corporate impact investing

In 2022, the Global Impact Investor Network (GIIN) reported $ 1 trillion in assets under management in its *Sizing the Impact Investing Market* report (Hand et al., 2022), reflecting an increasingly comprehensive measurement of impact investments globally and ongoing growth in the market. It also showed increasing appetite from both financial and corporate investors, which is key to opening up new sources of finance. Specifically, the report highlights two major areas of development relevant to the ODS/HFC market: green bonds and corporate impact investing practices.

Since their inception in 2008, green bonds — a typical bond instrument where the proceeds are specifically used to finance or re-finance projects that are labelled as green — have become increasingly widespread among public and private institutions alike. By September 2022, cumulative global green bond issuance had surpassed $2 trillion (CBI, 2022). Meanwhile, shareholder pressure in recent years to invest cash reserves productively, coupled with stakeholder demands for corporations to help address major global challenges, has led to the rise of corporate impact investing.

Impact investments can be made in both emerging and developed markets and target a range of returns from below market to market rate, depending on investors' strategic goals. Such investments tend to target sectors such as sustainable agriculture, renewable energy, conservation, microfinance, and affordable and accessible basic services including housing, healthcare, and education.

Given the critical importance of cutting short-lived climate pollutants (SLCP) as soon as possible, to allow time for the effective decarbonisation of the global economy, it seems there would be significant appetite for such investments in the impact sector. Transferring

[25] https://www.weforum.org/press/2023/01/new-initiative-to-help-unlock-3-trillion-needed-a-year-for-climate-and-nature

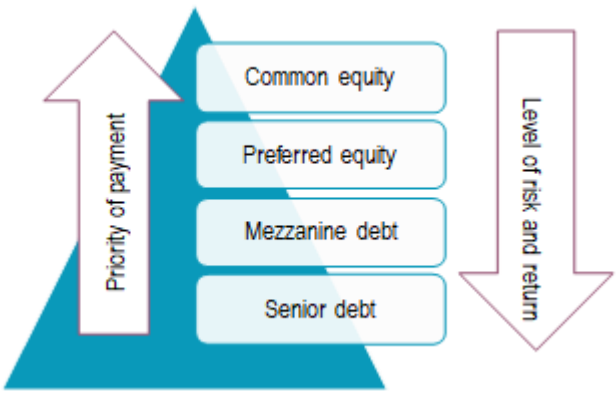
established approaches to cutting CO_2 emissions could be facilitated through a mass-balance equation, directly relating to the destruction of ODS and HFCs.

3.6.5 Capital Stack Approach

The Capital Stack (CS) approach can be considered a form of blended finance, but it is much more explicit regarding the breakdown of different types of capital that can be deployed at different points of the value chain. It is based on the capital stack breakdown, a methodology traditionally used in real estate or project finance for the allocation of return (Tapp, 2019). The capital stack framework enables investors to know who gets paid/repaid, at what point in the investment cycle, and how much risk each party carries.

The traditional capital stack is typically made up of four types of capital in the following order: common equity, preferred equity, mezzanine debt, and senior debt. Although common equity is listed first in the stack, it holds the lowest priority, meaning common equity lenders are paid last if there is a problem with the project. Senior debt, at the bottom of the capital stack, holds the strongest priority, meaning senior debt lenders are the first to be paid. If a project or property doesn't generate enough of a return to pay all investors or debtors, the property's income is distributed from the bottom up, starting with senior debt and then mezzanine debt. Any funds remaining would then flow up through the preferred equity and common equity positions (see Figure 14 below).

Figure 14: Standard Capital Stack Approach



Source: Authors' design based on Tapp (2019)

While each investment level comes with its own risk and reward, the higher positions in the capital stack typically earn higher returns due to their higher levels of risk. Most commercial real estate or project finance deals typically have a sponsor, which is the person or company responsible for finding, acquiring, and managing the property on behalf of the

overall partnership. This could be a lesson for COPA as the body responsible for the assessment and allocation of capital structure.

Within real estate, the capital is normally only separated into debt and equity, but the term has become increasingly widely used. All types of finance are usually required to raise the necessary finance for real estate or project finance, and they are effectively 'stacked' in order to reach the level of finance required by the project. The extension to the Capital Stack approach for innovative funding is focused on identifying a range of different types of funding that might have appetite at particular points in a project or development's lifetime.

It specifically targets financial interventions at multiple scales. While there is an increasing recognition of the need for multiple types of capital to facilitate action on the sustainable development goals (SDGs), it is arguably necessary to look beyond the focus on development and address the needs of capital from a different perspective, mainly the private sector.

The list below identifies some potential funding elements, which could be included in capital stack, thereby illustrating the range of this instrument.

- Bonds
- Impact bonds
- Equity funds, debt funds, and funds-of-funds
- Credit lines
- Concessional loans
- Subordinated loans
- Credit guarantee
- Insurance
- Payment for performance
- Securitisation
- Technical assistance
- Performance based grants
- Challenges and prizes
- Blockchain tokenisation

Expanding the use of the capital stack is a means of expanding finance options beyond the development focus of most blended finance investments. The approach concentrates on the construction of a capital structure that blends private investment capital, seeking risk

adjusted returns, with development concessionary funding that targets below market returns or even just a return of principal, alongside other forms of capital from municipal bonds, corporate capital investment, insurance and more.

While blended finance is often supported by direct grants for technical assistance, using the capital stack structure allows for a mechanism which includes investment at every scale, from sovereign finance to individual credit. It allows for a new narrative about the sharing of risk and the facilitation of investment at different points in the value chain, as illustrated in the below examples.

Capital stack for sustainable agriculture - Example

Some research has also been done as to the utility of a CS approach in sustainable agriculture. This is an investment area with multiple challenges, as it is expected to address issues ranging from poverty inequality, rural depopulation, ageing and obesity to soil degradation and inadequate access to inputs, technology, and infrastructure.
Climate Smart Agriculture (CSA) is "an approach to developing the technical, policy, and investment conditions to achieve sustainable agricultural development for food security under climate change." It may be seen as an example of result-based financing (see section 3.6.1) but it has also been identified as a possible key vector for stacked investments. What makes it a useful model for clean cooling interventions is the breadth of site-specific requirements which differ across a range of concerns, not just by country but by region, developmental stage, etc. (Havemann et al., 2022).

The Cool Capital Stack (CCS) - Example

The Cool Capital Stack (CCS), launched by Arsht-Rock and partners in 2022, was developed to address the finance gap in acting on extreme heat. It grew out of an initial discussion about the use of parametric insurance[26] to address extreme heat. It offers a useful framework for exploring how a new financing mechanism might be created.
The idea is that it will draw from "the full capital stack". The CCS takes the traditional project stack one stage further to explore all the options in climate-related finance. This includes philanthropy, concessional and blended finance, parametric insurance, disaster risk reduction capital (DRR) as well as traditional debt and equity capital. Aligning with the concept of risk and exposure, the CS /capital structure outlines the legal rights and obligations to certain assets and income for a business or real asset.

Marsh McLennan, parametric insurance provider, is a founder member of the CCS alliance and says that the approach offers an opportunity to look at finance in a different way. The CCS enables an approach to systemic risk interventions in a way that has been previously hard to do by using different forms of capital with different return expectations. The innovation consists in bringing in all these different types of finance – that come into play at different times, where payments are triggered by different metrics – together to create new financial mechanisms, creating administrative efficiencies across the continuum of capital.

The goal of the CCS is to flatten the risk curve through combining philanthropic and humanitarian (disaster risk reduction) capital, development capital with low interest rates, low return private capital (such as impact funds to work on maintenance or refrigerant maintenance) and government funds. Interviewees made clear that a massive scaling of risk reduction and adaptation is needed, and that awareness of the temporal and parametric approach to risk management could be a good fit for ODS/HFC reclamation and reduction. What is needed is a more effective categorisation of capital, identify that one form of capital is intended to do x, while another is intended to do y.

Cities have an important role to play in the CCS approach to extreme heat, as cities can use federal, state and municipal funds to invest in much needed adaptation finance. Cities can quantify the impact of extreme heat and therefore provide a business case for the investment where needed, and track outcomes where needed. These can include

- *Heat impacts on labour productivity*
- *Productivity impacts on worker income*
- *Increased vulnerability to extreme heat among the poor*
- *Gendered impacts of extreme heat*

Investment opportunities for extreme heat include cool and green roofs, reflective surfaces, urban forests and greening, water infrastructure, and technologies and tools for cooling and protecting people from heat.

[26] Parametric insurance is insurance that pays out on specific triggers. It is increasingly used as specialised insurance against climate change and extreme weather, whether traditional approaches to insurance are no longer fit for purpose. It is called parametric because parameter are selected to act as indicators or triggers and can be anything from a certain water level for flooding, soil moisture for droughts, temperature for working environment.

3.6.6 Lessons for COPA Financing

Under an RBF approach, the mobilisation of finance through concessional lending would depend on the achievement of safely disposing pre-agreed quantities of ODS and HFCs as well as establishing the capacity and behavioural readiness to do so.

Similar to CSLP, an initial Phase 1 for COPA FM could be to develop projects to prove the lending/ financing case and then raise further grants and concessional loans to fund a scaling up and support an appropriate monitoring infrastructure in the following phases. A question is whether funding and finance should flow in exchange for concrete regulation or only once such regulation has been successfully implemented (initially through the pilot cases), that is, the actual return of refrigerants. This calls for a clear definition and understanding of goals/ outputs and outcomes.

In the case of an RBF approach, payments or support in the form of concessional lending could be provided in exchange for the collection and return of refrigerants based on pre-determined quantity/ quality measures. The parallel support for locally owned education, outreach and advocacy as part of the financing mechanism will be critical, as success of the project depends on buy-in and support from local communities, as the two RBF examples illustrate.

In terms of impact investment, there is potential for impact funds to be targeted for a range of potential outcomes. Capacity building, design and planning and the return of refrigerants would all have a role to play in such a scenario. There is also clearly room for exploration of the role of philanthropic capital in funding market analysis, needed to identify which financial interventions are possible, and which could be combined at different scales to deploy effective action.

Elements of the capital stack, from municipal funding and directives, insurance, individual and small business credit lines for particular behaviours could all be explored for ODS/HFC bank management purposes, for example as a means of creating an overall approach on a per country, or even per region basis.

While the CCS model has not explored the HFC/ODS market yet, there is a clear path for other risk-oriented projects in community spaces. For example, in metropolitan areas, as cities are often where a large number of legacy HFC and ODS banks end up, represented as low effort level in terms of accessibility for collection of the substances in the calculations

in section 2.5. Given the fragmented nature of refrigerants and old air conditioning units, cities could play a pivotal role in implementing widespread return and replacement programmes, as well as acting as hubs for larger infrastructure programmes.

Table 12: Summary table of lessons learned for COPA from innovative financing approaches

Issue	Remarks and lessons learned
Time horizon for implementation	Over the next 4-6 years.
Return for donor/funder	Mobilisation of private capital can ensure long-term viability of financing interventions in the EOL management of ODS/HFC banks. Philanthropic capital has a large amount of flexibility in terms of what it finances, suitable for readiness and destruction activities, as the return expectations is measured in impact. For the same reason as for philanthropy, both RBF and impact investing are suitable for ODS/HFC bank management activities.
Required framework conditions	The verification of results is a key component of RBF and impact investing, requiring adequate MRV processes to be available before any activity can start.
Suitability for funding ODS/HFC management	**High** if the capital stack approach can be brought to bear, allowing for a new narrative about the sharing of risk and the facilitation of investment at different points in the value chain. The Capital Stack approach can be deployed at different points of the value chain. It specifically targets financial interventions at multiple scales, which match with larger infrastructure projects, such as ODS destruction and collection facilities. There is a growing appetite for both green bonds and corporate impact investing, which might be aligned with COPA country activities.

4 COPA Financing Opportunities: A Matrix

This chapter pulls together findings from the literature review and expert interviews in the previous sections to develop an overview matrix of potential financial interventions supporting effective ODS/HFC bank management. It distinguishes between interventions by type of finance, the type of actor involved, the level at which they are likely to be effective, including the types of projects they could support, as well as the barriers to their implementation.

The matrix is intended to help decision makers understand both the different financial appetite of different funding sources, and the availability and range of interventions to address the ODS/HFC market. Functioning somewhat like a toolbox, helping identify what tool is needed in what situation. Firstly, it is important to understand the match between the two sides of the funding equation, but secondly there is an opportunity to explore how to build out a more systemic financing approach to ODS/HFC reclamation and destruction. In effect, the matrix can assist decisionmakers in matching desired outcomes with appropriate interventions.

4.1 Overview Matrix

A potential COPA financing mechanism should be able to identify the interventions needed to effectively manage ODS/HFC banks, link these interventions to appropriate financial tools, and determine ways in which existing barriers to finance may be removed. Table 13 spells out a matrix of financing opportunities across different types, scales and levels of impact.

There is variation between the levels of impact, from sector- or economy-wide application in the case of tax interventions or import levies, to specific project-level support for grants and concessional loans. Beyond financial interventions specific to the public sector (including DFI's) or private sector, blended finance and RBF present opportunities for both. Not strictly financial interventions themselves, blended finance and RBF are ways to combine or structure the former.

Table 13: Matrix of Financing opportunities

Type of finance	Type of actor	Level of impact and suitable activities	Barrier to implementation
Import levies	Public	Have country-/ sector-wide application with revenue used to support specific projects, such as in ODS/HFC identification, collection, transport and disposal.	Import tariffs are highly politicised and can cause pushback internationally.
VAT/ tax reductions and/ or bonus payments	Public	Country-/ sector-wide application to incentivize the purchase of sustainable appliances or return of old appliances alongside the purchase of new units.	Establishing the correct level of tax reduction or bonus payment can be difficult and governments may be unwilling to forego VAT income.
Concessional loans	DFI's (bi- and multilateral)	1) Project-lending to (co-) finance specific infrastructure and/ or management projects (collection, transportation, storage or destruction of ODS/HFC). 2) Policy-lending to (co-) finance specific policy reforms supporting more effective ODS/HFC bank management.	Concessional loans are often used to support development of enabling conditions. Projects need to be well-defined with clear goals.
Grants	DFI's (bi- and multilateral)	Early-stage/ pilot project/ policy support, including market studies, technical support, capacity enhancement and information campaigns.	Most finance now requires evidence of (impact or financial) return. Projects need to be well defined.
Carbon finance	Private	Activities such as identification, collection, transport and disposal of ODS/HFC banks could be financed through the sale of offsetting credits into the (US) voluntary carbon market.	The compliance markets are still to be finalised and the voluntary markets are small, and subject to criticism. Adequate MRV system must be selected.
Carbon finance	Public	Identification, collection, transport and disposal of ODS/HFC banks could be financed through the trade of ITMOs between parties to the PA or via the SDM.	Few examples of bilateral agreements between parties exist to date and there are concerns over both liquidity and sufficient demand for ITMOs. Currently a supply/ demand imbalance for ITMOs.
Impact investment	Private, public	These are investment made to achieve measurable environmental and social impacts (ODS/HFC bank destruction) as well as financial returns. Suitable	Data, clearly defined outcomes/outputs, MRV, capacity and focus on measurable (financial) return must be available.

Type of finance	Type of actor	Level of impact and suitable activities	Barrier to implementation
		for (philanthropy) investors with focus on specific sectors / impacts.	
Results-based finance	Public, DFI's, private	Funds disbursed to recipient or debtor upon the achievement and independent verification of a pre-agreed set of results. Suitable for activities with short timeline and very measurable outputs, such as tCO2eq mitigation e.g., through exchanging old appliances, destruction of ODS or reclamation of used gases.	Require identifiable and measurable outputs. Lack of implementation pathways; lack of transparency, monitoring, evaluation and scaling.
Blended finance	DFIs, private, philanthropic	This is typically country-wide or project specific impact activities, bringing together different type of capital providers for a large-scale project investment through one vehicle. Suitable for publicly driven investment interventions intended to de-risk development investments.	Well defined projects at different levels required, linking project to needs of financial investors.

There are other interventions than the above, which can help make a difference but are not covered in the matrix. One such example is the EPR policy approach (explained in section 2.2), which can provide a key policy mandate alongside such interventions as, e.g., a renewables obligation requiring utilities to source some of their energy from non-fossil sources. EPR can also play a critical role in terms of societal and infrastructure development plans.

However, while it is a key lever in terms of realigning corporate capital investment towards particular outcomes, it is not in itself a financial intervention and therefore not included in the matrix above. In addition, EPR is one important environmental policy approach, but there are also other policy instruments available targeting sustainable EOL management of RAC appliances, such as import / export regulations or substance bans (see section 3.5.1).

4.2 Expert Feedback on Financial Opportunities

Feedback from several experts in the earlier stages of this study as well as on its first draft revealed a number of key insights. In addition to specific findings outlined in the previous

section of this study, the collected expert insights can be broadly clustered into six challenges for COPA in accessing financial opportunities. These challenges are explained and detailed in the following sections.

4.2.1 "Lost in translation" - Definitions and financial understanding matter

Common understanding and clear definition of the issues under discussion is critical to effective communication and the development and deployment of a financial mechanism. It is important to understand the framework within which action is being discussed e.g., is COPA's approach being framed as mainly a climate engagement or a waste engagement? This distinction is important, as COPA can be framed as both a 'climate' problem (the 1.5 Gt yearly emissions) and/or a chemical / electronical 'waste' problem (with reference to the 10-15 Gt+ of banked emissions and growing).

Where policy interventions, leak management, containment and recovery efficiency are effectively implemented, the climate challenge may have been addressed. This, however, could result in a waste management problem, which could require alignment with environmental waste management approaches. This matters, because the framework used might affect the choice of approach to financing in each country, at what stage, and which parties are involved.

While the definition of the approach to the ODS/HFC management is important, shared definition of financial terms and understanding is critical in the development of any financial approach. Developing an effective FM that can support the delivery of finance at all stages of the ODS/HFC bank management chain depends on a shared understanding of terms such as finance and investment, which are currently used by different groups to mean different things.

Finance as an overall term does not always mean investment (and therefore requiring a return on investment) but through this research, including expert interviews, it has become clear that most actors assume the terminology to refer to their own definition and understanding of a term. It is thus important to clarify the meaning of "finance" as understood by all involved parties early in the process, to avoid misunderstanding and confusion during later stages of interventions.

Each element of the process towards the destruction of ODS/HFC under COPA will require different types of finance, deployed in different ways, requiring different project and financial

structures. Even the word "*fund*" covers a wide variety of types: at one end of the spectrum, for example, a fund could be created to finance market analysis, capacity building, training, etc. Such an effort could be funded by donors and finance could be deployed in the form of grants. At the other end, a fund could be created to invest in major infrastructure projects on a commercial basis, requiring a set return on investment over time based on revenues from the voluntary carbon markets, for example.

At the same time, there is also the potential for different approaches to driving finance to work against each other, such as where the deployment of an EPR would result in lower levels of HFC/ODS available for accreditation and sale within the carbon markets or, at the very least, in less credible arguments on additionality. There are trade-offs between approaches which need to be managed, not only in terms of finance but in terms of the interests of COPA members.

An understanding of different public and private financial interventions, their roles and functions, as well as their respective challenges and opportunities can be helpful in identifying new funding opportunities and thinking through the role a potential COPA FM could play.

4.2.2 Return on investment is required for any non-grant funding

Feedback from development bank representatives has made clear that an understanding of the potential return on investment (ROI) is a requirement for the deployment of capital. It does not matter whether this is for investment in a particular project, or to enable a line of commercial credit for local banks to deploy on a domestic industrial basis. All respondents involved in the 'investment' of capital require quantifiable ROI so there is a data/analysis requirement in every investment scenario.

This means that for any deployment of capital to happen, investors will require an in-depth understanding of the market, including a complete assessment of its size and accessibility, as well as market specific challenges and opportunities. Normally, the pre-requisite for considering any deployment of capital for these investors is a thoroughly conducted market assessment. Based on such an assessment, a consideration of investment, e.g., for a specific project or credit line, can then be initiated.

4.2.3 No data, no (private) finance

There are two main data gaps regarding ODS/HFCs. These are the lack of accurate and up to date information on: 1) amounts of ODS/HFCs in circulation or use, existing banks that require destruction etc. and 2) robust monitoring, reporting and verification (MRV) of leaks, storage and destruction.

The lack of market data makes capital investment challenging, while the lack of standardised recording of gases on the ground and their management and destruction could undermine efforts to use the carbon markets as a driver of finance.

Larger scale investment from the private sector, beyond that which is currently provided in the destruction of ODS/HFC banks and sale of the resulting credits into the VCMs, will not be forthcoming without transparency about market position and accurate data. There is an open debate about the actual size of the ODS/HFC market, with some estimates putting the market size at over double what is generally accepted.

Overall, data is the basis that underpins the ecosystem of finance – every financial intervention at any level has an impact on the wider investment/financial appetite and opportunity and is based on an evaluation of benefit and/or ROI. For example, sovereign debt might be used to buy a stake in a large-scale project, providing an exit for an existing commercial or institutional investor. Such an ecosystem can be driven by a recognition of both financial returns, or by other benefits such as addressing climate change, contribution to economic growth, skills development etc.

That means there needs to be clarity about how the interventions will be financed or supported – even if actions at a domestic scale are implemented by a sovereign state, they still need to provide some kind of return. (See the previous section 4.2.2.) Accurate assessment of the benefits of action as well as the cost of in-action should be clear to countries, donors and investors, to support effective long term and holistic decision making. Such decision making should integrate both policy and investment planning, but accurate data remains hard to find.

4.2.4 Limited role for traditional donor funds

Traditional donor fund approaches are ill-equipped to meet the needs of effective global ODS/HFC bank management. There are two reasons for this:

- First, donors are already contributing to the MLF and requesting donor funds for a new fund could prove challenging.
- Second, while experts agreed that there is a limited role for a potential fund to support country and industry readiness for ODS/HFC bank management as separate from the MLF, a potential COPA FM would need to go beyond direct funding and aim to catalyse significantly greater levels of investment at various different levels.

4.2.5 One size does not fit all

There is no one financial instrument or global approach that can provide the breadth of funding types, or sufficient financial support, for the wide spectrum of actions required for EOL management/destruction of ODS/HFC banks. Interviewed experts argued that a range of financial and non-financial challenges need to be addressed to move the dial on ODS/HFC EOL management. These include:

- unique national circumstances, including differences in the size of banks, available infrastructure, policy and regulatory support, etc., in recipient (or project) countries,
- different types of funding provision and return requirements among donors and private finance providers,
- different scales/levels at which interventions are undertaken (from technology support at project level to readiness support at national government level).

The above listed circumstances, requirements and intervention levels make it necessary for COPA to first focus on tailor-made solutions. The lack of data mentioned above is a contributing challenge, which successful (tailored) pilots in financing, policy or technical solutions could also help to overcome.

4.2.6 Financial instruments are evolving

Experts shared their views on more established financial interventions such as grants and concessional lending but also pointed to more recent innovations in sustainable finance, such as the capital stack approach, as playing a potentially significant role in the financing of ODS/HFC bank management.

While development finance as a whole is getting more comfortable with the concept of blended finance, it remains at relatively low levels. There is an important role to be played

in building a financial system approach which ensures the flow of capital throughout the ODS/HFC system, potentially from sovereign bonds through all types of commercial, philanthropic, semi-commercial and grant finance.

Through using relevant types of capital at appropriate intervention stages, the overall development of the market can be achieved. This could, for example, include capacity building grants, market analysis support, support for commercial banks to deploy debt for action locally, government or philanthropic interventions for training and/or the deployment of incentives for action, to commercial and project finance for the collection, storage, transportation and destruction of gases.

4.3 Funding matrix implications

The funding matrix approach in section 4.1 has a number of implications for a potential COPA FM, including the role of the mechanism, its scope, scale, and type of finance required, and the stakeholder engagement required for the mechanism to be effective. These roles are further detailed in the following sections.

4.3.1 Role of the COPA FM

There is no one-size fits all solution for advancing a sustainable ODS/HFC bank management, neither for projects, solutions, nor finance, as concluded in previous sections. The COPA financing mechanism will need to cover the full spectrum of activities included for implementing a sustainable ODS/HFC bank management (see section 2.6), requiring a selection of focused financing elements. The below suggestions are not exhaustive but serve as a starting point for a coherent COPA FM, discussed in more detail in the following section 5.

The COPA FM could deploy three core elements:

1. **A preparatory and readiness fund (PRF)** to provide support to countries and industry and facilitate the market analysis required to underpin any financial intervention;
2. **A destruction fund (DF)** focused on filling the funding gap for EOL management of ODS/HFC banks left by the MLF; and
3. **A matchmaking facility or capital stack approach** matching the needs of a COPA member with appropriate financial interventions. This could begin as a simple

matchmaking service, guiding projects towards useful sources of funding. Over time this learning process could evolve to where COPA is acting as facilitator/arranger of a package of different financial interventions to fund a project or programme.

Preparatory and Readiness Fund (PRF)

Similar to the MLF and the GCF's RPSP (section 3.1), the COPA FM's PRF will likely need to provide some support to developing countries for designing and implementing conducive policy environments, help prepare quality projects and programmes, facilitate in-country dialogues, support the implementation of national plans, and ramp up private sector capacities. The requirements for these will differ from country to country and will depend on thorough needs assessments. Where the FM acts as a PRF, resources may be used to support early-stage measures, especially among those Article 5 countries in greatest need of technical and financial support.

Destruction Fund (DF)

The COPA FM's role will need to go beyond readiness and preparation and should also provide focused support for destruction (and potentially reclamation) via a DF. Where the FM acts as a DF, it will draw private finance into the overall system for collecting, managing, storing and destroying the relevant gases by providing a financial return for destruction.

Matchmaking facility with capital stack approach

Given the complexities and scale of the challenge, as well as limits to available public funding, the potential FM may also be understood as a matchmaking facility with a role in identifying the interventions needed to effectively manage ODS/HFC banks, linking these interventions to appropriate financial tools presented in the matrix, and determining ways in which existing barriers to finance may be removed. Where the FM acts as a matchmaking facility, it will provide support alongside other public and private sources and help de-risk higher impact projects that would otherwise not be feasible.

One way to achieve this would be through deployment of the capital stack approach (see section 3.6.5). Effective EOL management of ODS/HFC banks will require different types of financial interventions at different scales, something which the capital stack structure provide by facilitating financial support through different actors and at different points in the value chain. The COPA FM could initially facilitate connections between the points and help mobilise the kind of investment the public sector alone is unable to provide. Over time it

could evolve to become an independent facility arranging such capital stack packages.

4.3.2 Scope and scale of finance

The elements that provide the greatest challenge for COPA lie in understanding both the scope of global investment required to address the ODS/HFC challenge, and the scale at which the most effective types of financial intervention can be deployed. For both, the investment required will differ depending on the country in question. Basically, for each country, and each level of intervention, the type of finance – whether it be debt, equity, grant, credit generation or something else – will differ and the COPA FM will need to determine the appropriate intervention together with its partners and stakeholders.

For example, Article 5 countries which lack the infrastructure, technical capacities and financial means to manage ODS/HFC banks will be in need of more extensive support and country-wide interventions, initially drawing more heavily on the preparatory and readiness support arm of the COPA FM, including for pilot projects.

More advanced countries will draw on the matchmaking facility for more targeted help in securing project-level finance or for more advanced, larger-scale training and educational measures. There will be different types of policy intervention in place, or needed to deploy, in order to structure the financial ecosystem for HFC and ODS management in the most effective way.

4.3.3 Stakeholder engagement

To be able to effectively play a matchmaking role, but also when deploying financing through a fund for readiness or destruction, the success of a COPA FM depends on active collaboration and partnership. This, in turn, needs to be underpinned by wide-ranging, meaningful engagement with stakeholders such as national governments, MDBs, private sector entities and financial institutions, UN agencies, industry, and other finance and development partners.

A gap identified in the background conversations conducted for this study has been the lack of understanding of different financing approaches and the opportunities they hold by large parts of the technical staff involved in issues surrounding ODS/HFC bank management to date. Simultaneously, there is a failure to grasp the funding needs, importance and opportunities for investment in ODS/HFC management by large parts of the financial

community (also see 4.2.1). Filling this knowledge gap is therefore a key contribution for a potential COPA FM.

Success will not develop in a vacuum; the COPA FM will need to determine the appropriate intervention together with its partners and stakeholders for each project to assure sustainable results. That mean that the COPA FM will need to actively build ownership for each intervention through active collaboration with, and contributions from, partners and involved stakeholders.

4.4 Overcoming Limitations

By concentrating its financial support on a number of strategic key interventions, a potential COPA FM may overcome the barriers to implementation and accessing finance mentioned in the matrix in section 4.1. The below undertakings also take the considerations provided by the contributing experts in section 4.2 into account, while keeping within the proposed framework of a COPA FM presented in section 4.3.

1. **Selection of focused financing elements:** To cover the full spectrum of activities included for implementing sustainable ODS/HFC bank management, a selection of focused financing elements seems most viable. It is important to recognise that while a COPA DF could address one part of the ODS/HFC challenge, such an approach would fail to address the complexity inherent in the ODS/HFC markets at both a global and national level. While a potential COPA FM aims to address the problem of ODS/HFC banks holistically, it cannot function as the sole funder of the kind of interventions necessary to effectively address the issue. Acting as a facilitator and matchmaker would enable larger scale interventions.

2. **Build understanding:** Together with its partners and stakeholders, the FM should invest in building a shared understanding of different public and private financial interventions, their roles and functions, as well as their challenges and opportunities for the EOL management of ODS/HFC banks. This can be achieved through information and advocacy campaigns, targeted publications, as well as in-country and international dialogues and workshops. A COPA FM advisory board of leading public and private financial organisations could ensure communication on this issue adequately addresses the needs and requirements of the wide variety of stakeholders.

3. **Close data gaps:** The FM should utilise funds via its PRF to gather up to date information on 1) existing ODS/HFC banks that require destruction, and on 2) robust monitoring, reporting and verification (MRV) of leaks, storage and destruction. The MLF is currently seeking to financially support the establishment of ODS/HFC bank inventories, but complementary support could help close existing data gaps sooner and produce more detailed, decision-useful information. The provision of such data would go a long way in facilitating greater capital investment, as market assessment is a pre-requisition for investments.

4. **Build strategic partnerships:** The FM should identify and work with impact partners to promote effective ODS/HFC bank management. Impact partners are leading stakeholders from the public, private and not-for-profit sectors with an interest in supporting the low-carbon transition and addressing the enormous GWP of ODS and HFCs. They may include government officials, MDBs, impact investors, financial advisors, businesses and representatives from NGOs and academia. Impact partners leverage their networks to drive investment into EOL management of these substances.

5. **Broad spectrum of large-scale activities:** The FM should financially support ODS/HFC bank management on a larger scale through activities not currently addressed by the MLF. This support could come through multiple channels, both via direct interventions in the form of a COPA DF, e.g., drawing on member country contributions. It could also be indirect contributions provided through a COPA FM matchmaking facility. A DF would play a complementary role to the MLF and other funds, such as the GCF, GEF and CIFs, which currently do not provide funding for EOL treatment of ODS/HFC gases. Given the range of requirements dependent on country needs however, COPA's FM might be most effective in the provision of a matchmaking facility catalysing public and private investment into ODS/HFC bank management.

5 The COPA Financing Mechanism: A Proposal

To effectively address the SDGs and goals of the Paris Agreement, development and climate finance need to be quickly scaled up to help a wide range of interventions move from pilot stage to commercialization. Yet such scaling up does not occur automatically. Rather, a strategic approach, including focused attention, strategic planning and management, as well as effective resource allocation is required.

This chapter outlines a proposal for a three-stage mechanism through which COPA FM activities may be scaled up. It also sets out the necessary steps to be taken to operationalise the COPA FM, build a project pipeline, how to access funding and lays out the governance and management rules the facility should consider implementing.

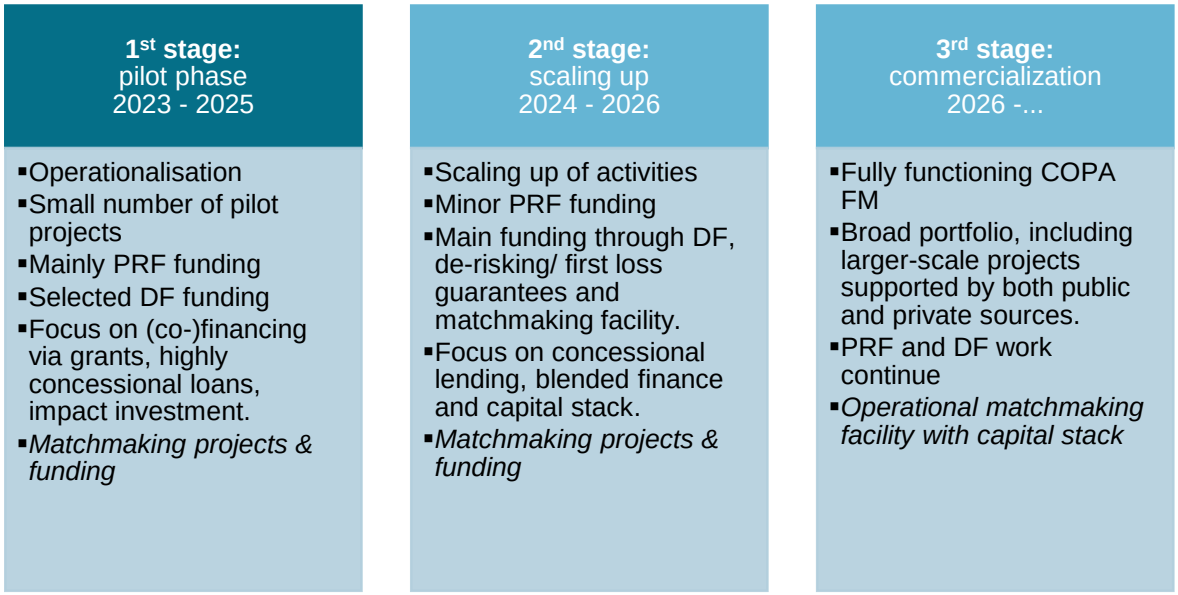
5.1 A Three-Stage Approach

The following sections outline a three-stage approach for mobilising investment into EOL management of ODS/HFC banks, from proof of concept to scaling up to economy-wide application. The approach incorporates the lessons learned for COPA from the chapters 2 - 4 and is constructed around the three core elements identified as vital for a successful and holistic approach for implementing a sustainable ODS/HFC bank management:

- Preparatory and Readiness Fund (PRF)
- Destruction Fund (DF)
- Matchmaking facility with capital stack approach

The below figure provides an overview of the activities in each of the stages. Each stage is then explained in further detail in the following sections.

Figure 15: Three-stage approach for COPA



5.1.1 Stage One: Proof of Concept

In the first stage (2023-2025), a smaller number of pilot projects are developed in collaboration with different types of implementation partners. Their results will inform the business case for further investment through the various different interventions listed in the funding matrix (section 4.1). Projects can receive support from the COPA FM PRF and/ or its DF, dependent on the type of project and funding required. Due to the smaller scale and earlier-stage nature of the projects, matchmaking support, to the extent it is provided, would primarily be focused on mobilising co-financing via grants, highly concessional lending or some impact investment.

5.1.2 Stage Two: Scaling Up

Both the number and size of projects under development are expected to increase in stage two (2024-2026). The preparatory and readiness fund continues to be open for applications but projects supporting implementation of EOL management plans for ODS/HFC banks are gradually scaled up beyond initial pilots. This may include both projects supported during stage one as well as new projects identified as the COPA FM ramps up its activities. Stage two places greater focus on support through the DF to de-risk projects and provide first-loss guarantees, drawing on member country contributions and, importantly, the matchmaking facility to secure greater project level finance. For more developed, larger scale projects,

the focus shifts from grants to concessional lending, blended finance and financing options such as the capital stack.

5.1.3 Stage Three: Commercialization

In stage three (2026-…), the operations of the preparatory and readiness fund, destruction fund and matchmaking facility continue but the weight of the COPA FM portfolio shifts towards securing financial support from both public and private sources for the implementation of more fully developed, larger scale EOL ODS/HFC bank management projects. On the basis of greater data on existing ODS/HFC banks that require destruction, and robust measurement, reporting and verification (MRV) of destruction activities, as well as the work of impact partners bearing fruit, the FM is able to attract greater private investment alongside public finance.

5.2 Volume of COPA FM

Considering the three core elements to the COPA FM, the level of finance required for a readiness fund, a destruction fund and a COPA matchmaking/capital stack approach need to be identified. Beyond the readiness fund, the interventions necessary to develop and deploy infrastructure resulting in the destruction of ODS and HFCs in chapter 2.6 suggest a mosaic approach to funding as the most effective way forward.

5.2.1 Project pipeline volume

Drawing on the calculations used in Chapter 2.5, the financing need for the destruction of the annual ODS/HFC waste in Article 5 countries, excluding China (the only Type 1 country), range from an annual cost of US$135 million to US$1.8 billion (see Table 14).

These estimates are calculated as the cost of destroying all ODS/HFC waste generated annually in all Article 5 countries. Although these ranges are outside the scope of COPA, they are presented here to provide an overall picture of the financial needs of Article 5 countries. This section examines the financial requirements for both a preparedness fund and a destruction fund.

Table 14: Estimated destruction cost per country type and effort level. (See Table 2 on page 25 for more information)

Category	Effort level	Estimated annual cost of destruction for an average size country	Total annual cost estimate for destruction in (whole country group)
Type 1	Low	**1.9 billion**	**1.9 billion**
	Medium	**1.6 billion**	**1.6 billion**
Type 2	Low	**23 million**	**1.2 billion**
	Medium	**33 million**	**1.8 billion**
Type 3	Low	**1.6 million**	**135 million**
	Medium	**3.8 million**	**340 million**

Source: Authors' own calculations.

Both these funds could play a critical role for countries looking to take action on ODS and HFCs and could act as leveraging factors to facilitate increased private sector investment into action.

The existence of a PRF to support initial market and technical analysis would provide the basic data necessary for the development of policy interventions, project finance for infrastructure and a capital stack approach.

The existence of a DF to finance the destruction (and/or reclamation) of ODS/HFC banks would in many ways replicate the existence of climate/carbon finance where its use is unclear, or used to specifically support countries where there is a lack of infrastructure and capital for action and draw private sector finance into the system, providing an exit (or return on investment) for private finance.

By taking on an additional operational role as a matchmaker, COPA could usefully engage across the supply chain to explore potential new capital stack approaches to facilitate larger scale investment in action.

If the COPA FM is to provide both finance from donor funds and act as a capital stack matchmaker, it will need to be set up as a separate legal entity to ensure independence and transparency. A standing Decision Panel should decide which funding applications are granted, for external applications and for COPA FM led capital stack applications.

The COPA FM should consider whether applications to the DF are to be submitted under an open window or follow a more strategic approach focussing on specific interventions and/or geographies with time-bound calls for applications. For both the PRF and the DF,

parts of the application and screening process should be automated, via self-assessment checklists to exclude inappropriate, incomplete or ineligible applications.

5.2.2 Selected project pipeline by type

A diverse set of actions is required at various stages of ODS/HFC bank management, dependent on specific country circumstances. The distinction between MLF-funded activities directed to enable ODS phase-out and HFC phase-down and EOL management is not always possible, especially when it comes to training and providing equipment for servicing technicians. The COPA FM is not intended to duplicate MLF funded activities, but steps in where additional action is required to enable ODS/HFC destruction or reclamation. Table 14 provides examples of activities requiring financing, including their possible funding sources.

Table 15: Examples for activities requiring financing and possible funding sources

Activities sub-projects	Type of finance	Provider / source of finance
Stakeholder analysis (report)	Grant funding or element of a project structure	Government, municipality, development bank, COPA FM, philanthropy
ODS/HFC bank estimation /determine needs	Grant funding	Government, municipality, development bank, COPA FM, philanthropy
Technician training for management of gases	Grant funding or concessional loans to drive corporate training	Government grant, corporate debt, impact investment fund, philanthropy
Training of inspectors	Grant funding for government to implement regulations and standards; parametric insurance	Government grant, government/state/municipal budget, sustainability bond, capital stack integrating training into performance metrics
Feasibility study (including an analysis of the available gas for destruction)	Grant funding or element of a project structure	Government, municipality, development bank, COPA FM, philanthropy
Purchase of equipment for collection (refrigerant identifiers, re-usable cylinders, recovery machines)	Commercial debt or project finance	Private debt and/or equity as part of an overall project, corporate debt or operating capital, government incentives
Incentive scheme or business case to ensure the return of the used refrigerant	Grant funding for incentives, climate finance, sovereign debt	Government policy and associated funding

Activities sub-projects	Type of finance	Provider / source of finance
Collection of the substances	Project and/or finance	Municipal procurement, project debt/equity, corporate capex
Storage prior to shipping	Project and/or climate finance	Municipal procurement, project debt/equity, corporate capex
Transportation	Project and/or climate finance	Municipal procurement, project debt/equity, corporate capex
Equipment such as a refrigerant identifier, chromatographer, scale to measure the gas that comes in and out.	Commercial or project finance	Government funding, grant, municipal procurement, project debt/equity, corporate opex
Independent test analysis for the certification of the reclaimed gas	Government funded or commercial testing for compliance	Government funding, grant, municipal procurement, project debt/equity, corporate capex, impact investment fund, COPA FM, philanthropy
Machinery: adapting an existing facility for ODS/HFC destruction (e.g., cement kiln) or buying the equipment and materials for setting up a new destruction facility.	Project and/or climate finance	Government funding, grant, municipal procurement, project debt/equity, corporate capex, impact investment fund, COPA FM, philanthropy

5.2.3 Preparatory and readiness fund

Identifying what the PRF might cover will play a critical role in estimating the amount of finance required. Table 3, Chapter 2.5 explores the different stages that must be undertaken for a project to be successfully deployed, with any approach underpinned by a feasibility study.

A market analysis will be a requirement for any investment intervention. This should include:

- Information about use of ODS and HFCs within the market, likely to be a combination of statistical information and research.
- Information about the markets where ODS and HFCs are in use, e.g., current industry standards.

- Information about barriers to action within the market, from existing regulations, common practice, market understanding about the impact of ODS/HFC banks and how they are regulated and managed.
- Size of the market in terms of ODS/HFC banks and potential waste.
- Gaps in management of ODS and HFCs within the country and potential market for such gases in the export market (as, e.g., where the gas is exported for destruction).
- External market factors including laws and regulations, new technologies, and economic and social change.

A PRF, with pledges by donors, should be able to provide grant funding for several different purposes, such as capacity building, market analysis or technical analysis. Such a fund could also be used for grants to develop specific project implementation plans, from capacity building, policy development and deployment.

Capacity building: the first would help governments or projects to identify the most effective way to achieve the destruction of ODS/HFC banks through the use of government policy interventions, project finance in infrastructure or carbon market finance. Each project should identify the return on investment, either through financial return, industrial development, training and education and/ or overall benefit of the destruction of such high GWP gases. Where possible it should identify where revenue can be produced to attract and repay investment, with an investment model that can be scaled up and reproduced.

Building the business case (national): $100,000 for either/both market analysis or technical analysis to enable a country to plan its approach to the reclamation or destruction of ODS/HFC banks. For each pilot country this would require circa $200,000. Where such funds are already available, such as through BMWK, such funds could be used for specific project implementation. If six countries are to be in the pilot this would set an upper limit of the fund at $1.2 million.

Grants could also be used in getting support from professional advisors to develop the project, address barriers to investment and present an attractive case for potential investors. They could also be used to build capability to attract financial investment into ODS/HFC collection, storage and/or destruction projects.

Technical/market analysis (urban): Low effort interventions are those in urban areas, where it will be easier to set up collection, transportation, storage and reclamation/destruction infrastructure. That being the case, it may be more productive to attempt to initiate action at

the municipal level with selected countries. This would require lower grant funding for local action, either using the COPA FM municipal funds, project finance or capital stack.

The overall goal of such a fund is to provide information necessary to stimulate private investment and market-based mechanisms resulting in the destruction of ODS and HFCs through making countries and projects ready for investment.

Upper-level funding requirement for country pilots: $1.2 million
Minimum-level funding requirement for municipal pilots: $300,000

5.2.4 Destruction fund

The development of a destruction (and/or reclamation) fund would be complementary to the work of the MLF, which does not currently financially support EOL measures for ODS/HFC banks.

The fund could operate on two levels, one of which is to replicate the role of carbon finance/climate finance where carbon offsets are not yet integrated into the relevant compliance markets. There is the potential for relevant ODS/HFC credits to be used on a bilateral basis at ITMOs, as well as potential for them to be included in other compliance markets from the EU-ETS to CORSIA, even in the future in NDCs (where to date, none have introduced the role of ODS and HFCs.

Given the immediacy of the impact of such gases, the deployment of such a fund would both accelerate action in the short term and provide an immediate and permanent climate relevant impact for potential donors.

If the fund were primarily grant based, it could be used to drive investment in reclamation and collection infrastructure development through providing end stage finance for destruction – providing a stable return on investment for the private sector. Alternatively, it could be used to facilitate the development of market mechanisms to finance the destruction of ODS/HFC destruction.

It is critical that any destruction/reclamation fund provide a stable figure to leverage private finance, at a level likely to encourage further private sector finance into action. Current prices for ODS/HFC credits in the voluntary markets are around $18/t$CO_2$eq but in order to drive funding in regions where market solutions are less likely, it seems appropriate to set

the destruction/reclamation price at a level equal to the cost of destruction in projects funded to date.

The sample calculation uses the destruction of HFC-134a as a conservative example, as its GWP (1430)[27] is not on the high side compared to other common refrigerants. Thus, the destruction of 1 tonne of HFC-134a is equal to the destruction of 1430 tCO_2eq. Based on the calculations made in subchapter 2.5, page 23, sample calculations for the destruction cost and potential carbon credit revenue are presented in Table 16. In a small size type 2 country with a population of 10 million people, 99t of refrigerants are expected as the maximum quantity to be available for destruction, resulting in approx. 140 000 tCO_2eq.

Table 16: Sample calculation for exemplary Type 2 countries (waste per capita 0.019kg) – with small and large population

Population	Effort level	Population per effort level	Gas potentially available for destruction (t)	Gas potentially available for destruction tCO_2eq	Carbon credits sold at 18 US$/ tCO_2eq	Carbon credits sold at 30 US$/ tCO_2eq	Destruction costs 30 US$/kg
10m	Low	**5.2m (52%)**	98.8	141,284	**$2.5m**	**$4.2m**	**$2.9m**
130m	Low	**67.6m (52%)**	1284.4	1,836,692	**$33m**	**$55m**	**$38.5m**

Source: Authors' own calculations.

The average cost for low effort destruction is $30 per kg HFC. At a $18/$tCO_2eq$ of carbon credits for HFC destruction in the voluntary carbon markets, this would result in a DF requirement of $400.000 for a country with a population of 10m. If we were to set the tCO_2eq price at $30 then there would be a generated credit value of $1.3m.

For a higher population, say 130m, the DF would require $5.5m at a credit cost of $18/$tCO_2eq$ and at $30/$tCO_2eq$ it would generate a revenue of $16.5m. The size of the DF will therefore be dependent on COPA's decision on where to price the credits, and how many countries to include in the pilot project.

The recommendation is to create a DF for smaller countries where the help is more urgently required, create a pilot of six countries (equivalent to six small countries) and deploy municipal pilots within the DF as a starting point. In order to generate a lower and an upper

[27] According to IPCC's Forth Assessment Report, which is commonly used for greenhouse gas inventories.

limit for the size of the DF, calculations have been made on the pricing of the tCO_2eq credits at \$18/tCO_2eq at the lower end and \$30/tCO_2eq at the upper end.

Upper-level funding requirement for country pilots: \$5.5 million per country
Minimum-level funding requirement for municipal pilots: \$400.000 per country

5.2.5 Matchmaking facility

The COPA FM could not only fund feasibility studies and support destruction and reclamation activities as discussed above, but also play a role in helping members understand and assess the policy or financial approach that might be most useful for each specific project. For example, there may be an opportunity to define a capital stack approach that crosses national borders. This could potentially include:

- creating standardised approaches for cost/benefit analysis of ODS/HFC destruction,
- shared approaches to first loss guarantee for infrastructure development,
- insurance investment in effective management of ODS and HFCs (for example within hotel or supermarket chains),
- standardised approaches to underwriting commercial loan portfolio for collection, storage and EOL management for ODS and HFCs.

There could also be a role within the COPA FM matchmaking facility to develop a market for climate finance services (such as project MRV, investment or trading platforms, codes for verifying benefits, aggregator vehicles and integration into the carbon markets).

The matchmaking facility could be operated as part of COPA's existing structure, which would provide independence from the operation of the RPF and the DF. It would, however, need to be funded separately. However, simple matchmaking in the early stages of the COPA FM can begin immediately and does not require a separate facility. The matchmaking of finance and projects can begin without explicit COPA finance available. In the same way an independent capital stack facility, while needing operational funding to create different packages, would have no floor or ceiling for finance, as it would be accessing existing financial options.

Upper-level funding requirement: 0
Minimum-level funding requirement: 0

5.2.6 Criteria for COPA support

Underpinning any form of financial intervention is accurate information about the market. All financial investments will therefore require an accurate assessment of the size of ODS/HFC banks and sources, local market barriers and opportunities, current market framework and relevant policies.

Any proposed activity must present clear value for money (or amounts of CO2 avoided) – minimising costs, maximising resources, processes for effective project management and plans for assessing success. Ideally, the project includes the establishment of a favourable policy framework enabling continuing ODS/HFC EOL management after the project has ended.

All recipients of grant funding must agree to share products and knowledge gained through the fund openly available for the benefit of others.

Financial support provided through the COPA FM should enable additional EOL management of ODS/HFC bank projects rather than support those already agreed and for which funding has already been secured.

5.3 Operationalisation of the Financing Mechanism

A number of steps need to be taken to make the FM a reality and operationalise it in its three elements. The first step is to develop a board for governance of any financial mechanism or fund, the COPA FM Board, which will be responsible for governance and financial decisions. This needs to outline and confirm COPA objectives and guiding principles, as well as the role and function of the Board. It also needs to agree on the modalities of intervention, through the PRF, the DF and the matchmaking facility.

Setting up the Board will include decisions on its composition, board membership and terms of office, as well as responsibility to the COPA membership – for example that the Board should be accountable to member countries in support of programmes, policies and projects which result in the destruction of ODS and HFCs. The decision-making process (consensus or otherwise) must be agreed and approved, including what constitutes observers, if they should be allowed and other forms of interaction with donor bodies, international agencies etc.

In a second step, once the Board has been set up, a series of operational documents need to be developed to outline proposed activities and agreements in order to facilitate a smoother working deployment of funds raised. This should include processes for the assessment of proposals, deployment of capital and reviews of the effectiveness of such deployments. Together, these should form a framework composed of policies, strategies, targets, and criteria to inform the design, assessment, and approval of funding decisions within the FM.

Third, following the creation of the Board, decisions should be made as to whether the FM will play a role in positioning the destruction of ODS and HFCs in the international carbon markets and within national NDCs. It will also be necessary to agree on the differentiation of size of project and scope of investment. The FM should clearly identify the types of interventions of interest: these could include transformative planning (the design and implementation of policy interventions), investment proof of concept (building a framework for the use of destruction credits in the carbon markets in the short term), de-risking investment for infrastructure projects.

In all of the above, the FM needs to be clear on whether or not it sees country members as leading action on investments in the sector, or whether the FM will play a matchmaking role in bringing together different parts of the capital stack. Deciding on the allocation of resources to the PRF, DF and matchmaking facility will also require the development of investment and risk management policies and frameworks in order to guide the overall investment frameworks.

5.3.1 Criteria for accessing funding

Countries wishing to access COPA technical support and/or funding must be COPA Partner Countries, eligible for Official Development Assistance (ODA) and who have signed both the "Declaration of Enrolment"[28] and the "Statement of Undertaking"[29] on making the shift towards sustainable refrigerant management.

[28] The recent version of the Declaration of Enrolment is available on the COPA website under https://www.copalliance.org/imglib/downloads/Country%20Docs/Declaration%20of%20Enrollment_COPA_clean%20member.docx

[29] The most recent version of the Statement of Undertaking is available on the COP website under https://www.copalliance.org/imglib/downloads/Country%20Docs/Statement%20of%20Undertaking_COPA_clean.docx

Projects requesting support from the COPA FM must be able to demonstrate one or more of the following, dependent on the type of project proposed:

- Impact on the shift towards sustainable refrigerant management, e.g. market analysis leading to effective selection of policy and/or financial intervention
- Project proposals should outline how they were developed in consultation with relevant stakeholders.
- Project proposals should describe the expected reductions in ODS and HFCs and the resulting CO2eq reduction from the COPA intervention. Proposals should also include the cost per tCO2eq.
- Proposals should reference the degree to which the project is supported by a country's enabling policy and institutional framework or includes policy or institutional changes
- Proposals should also refer to the number of direct and indirect beneficiaries of the project.
- The proposal should outline how the proposed project can catalyse impact beyond a one-off investment. This should include a robust and convincing theory of change for replication and/or scaling up of the project results, including the long-term sustainability of the results, or by a description of the most binding constraint(s) to change and how it/they will be addressed through the project.
- Project proposals should describe the country's financial, economic, social and institutional needs and the barriers to accessing domestic (public), private and other international sources of finance for ODS/HFC destruction. The proposal should outline how the proposed intervention will address the identified needs and barriers.
- Project proposals should include how the project will prevent double counting (in case collected amounts are destroyed in another country and both want to claim the emission reduction
- Project proposals should include how to prevent the deployment of perverse incentives to increase the consumption quota due to destroyed amounts.
- Project proposals should clearly describe how the proposed activities align with, or improve upon, the country's NDC and other relevant national plans, and how the funding proposal will help to achieve the NDC or these plans by making progress against specific targets defined in national climate policies and strategies. The

proposals should also outline how the project will help to achieve national climate, waste management or development goals

- Project proposals should include sustainable project design that includes the set-up of frameworks that support the continuation of activities after the funding has ended.

5.3.2 Procedural steps for pledging and drawing of funds

Pledging of funds

Donors must first make a pledge of funds and/or support to the COPA FM.

The donor funds should be aligned within the different programmes of the COPA FM (readiness fund, destruction fund or matchmaking facility) which should be for readiness, destruction or de-risking to develop capital stack approaches.

Drawing of funds

Funds may be drawn from the readiness or destruction fund directly, or the funds may provide de-risking capacity for the deployment of a capital stack approach.

In order to be taken into consideration for COPA financing, a project proposal has to fulfil the following criteria:

- It is undertaken in an eligible country and is consistent with country's national climate priorities and programmes.
- It addresses the need for a shift towards sustainable refrigerant management and/or a reduction in the risk of such gases leading into the atmosphere.
- It is consistent with COPA FM financing approaches.
- It is endorsed by the government(s) of the country/ies in which it will be implemented.
- Project concepts may be developed by governments, non-governmental organizations, communities, the private sector, or other civil society entities, and must respond to both national priorities and COPA objectives.
- Project proponents work closely with COPA to develop concepts and move through the project cycle, and will be approved by the COPA FM Board.

5.3.3 Procedural steps (adapted from the GEF)

- COPA FM approves a programme document which contains eligible projects and enabling activities.
- Once approved, the project can start implementation.
- Upon completion of implementation, the project will provide terminal evaluation and financial closure.
- Lessons learned and best practice deployed to be shared amongst COPA members.

5.3.4 Fund governance and management

The COPA Steering Committee will oversee COPA FM Governance, supported by the COPA Secretariat. See the COPA Governance Statues available under the website: https://www.copalliance.org/our-work/governance

6 Conclusion

Improperly managed or disposed of refrigerants carry an enormous GWP, corresponding to the annual greenhouse gas (GHG) emissions of 441 coal-fired power plants. Currently, only limited knowledge and insufficient financial support are available to address this challenge. The proposed COPA FM seeks to fill this gap.

Based on cost estimations for the destruction or reclamation of ODS/HFC banks and assessments of funding needs (chapter 2) as well as a non-exhaustive review of existing financing approaches in the sustainable cooling and climate finance spaces (chapter 3), this study has proposed a FM in three stages (chapter 5). To cover the full spectrum of activities included for implementing sustainable ODS/HFC bank management, three core financing elements have been identified (chapter 4).

The three elements of the COPA FM – a preparatory and readiness fund (PRF), a destruction fund (DF), and a matchmaking facility – should be operationalised during the first stage, with the focus gradually shifting from early-stage interventions through the PRF, to support for destruction through the DF in stage two, to investments in later-stage activities via the matchmaking facility in stage three.

All three elements of the FM respond to clearly identified needs, including, but not limited to, the following:

- significant knowledge gaps about the size of ODS/HFC banks and their location, as well as uncertainty about market conditions;
- the importance of ODS/HFC destruction and a lack of supportive policy environments necessitate early-stage support for countries and industry via a PRF;
- the lack of financial support for EOL management of ODS/HFC banks left by the MLF requires a degree of intervention to support infrastructure and techniques required for destruction and, to a degree, reclamation; and
- the lack of available public funding at scale and inability of the COPA FM to act as sole funder point to the need for private capital to play a role, which may be brought in through a capital stack approach via a separately funded matchmaking facility.

A potential COPA FM should be able to identify the interventions needed to effectively manage ODS/HFC banks, link these interventions to appropriate financial tools, and determine ways in which existing barriers to finance may be removed.

Each of the elements of the FM therefore draws on a matrix of financing opportunities (section 4.1), ranging from grant funding, to blended finance, to both public and private carbon finance. While financial support through the PRF for activities such as market analyses, feasibility studies or early-stage capacity building may draw more heavily on grant-based support or highly concessional loans, financial support for smaller countries through the DF as complementary to the MLF may either be primarily grant-based or function through the provision of relevant ODS/HFC credits. The COPA FM matchmaking facility would then define a capital stack approach aimed at attracting various sources of private funding to larger scale EOL ODS/HFC management projects.

This study outlined the steps which need to be taken to operationalise the proposed three elements of the COPA FM during the first stage (2023-25) and further scale up the FM's activities in the years to follow through the following two stages.

The immediate focus should be on the establishment and operation of the PRF, supported with pledges by donors. In light of the rudimentary state of preparation and lack of readiness among developing countries, the PRF is the initial key to unlocking further interventions. The PRF should be able to provide grant funding or highly concessional loans for different purposes, including market analyses, technical analyses or feasibility studies but also support the development of specific project implementation plans, including policies and deployment. Both the DF (for smaller countries) and the matchmaking facility (for all COPA partners) will then need to follow suit. They will both depend on buy-in from a wider variety of stakeholders, including, importantly, the private sector. This puts into sharper focus the need for effective stakeholder engagement as well as for COPA FM impact partners to leverage their networks and help drive investment into EOL management of ODS/HFC banks (see section 4.4).

A three-pronged approach, relying on both more traditional early-stage support via the PRF, and innovative funding through the DF and the matchmaking facility with its novel take on effectively structured finance in the form of the capital stack, can enable the COPA FM to play precisely the complimentary role to the work of the MLF needed to fill existing funding gaps and reduce the GHG emissions contained within unmanaged ODS/HFC banks across the Global South.

A fully functioning COPA FM can be a major step in the world's efforts to transition towards zero carbon and remain well below two degrees Celsius above pre-industrial levels, the main goal of the Paris Agreement, while fulfilling its vision: A global shift to sustainable refrigerant management and closing the loop to a circular economy in the cooling sector.

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