COPA
Cutting refrigerant emissions

OEWG46 Side Event:

Accelerating the destruction of ODS waste: an open discussion on the role and lessons-learned of the Climate and Ozone Protection Alliance

11 JULY 2024, 1:00PM - 3:00PM UTC-4 (MONTREAL)

AGENDA

Session 1:

Welcome Remarks	Adnan ATWA, UNIDO
The Climate and Ozone Protection Alliance: from vision to action including Highlights video	Ellen Michel, GIZ
ODS/HFC Reclamation and Destruction Technologies	Yunrui Zhou, UNIDO
Policy Framework for the Promotion of Sustainable ODS/HFC Banks Management	Irene Papst, HEAT GmbH
Financing Mechanisms to enable ODS/HFC Banks Management	Laurent Guegan, Climalife

Session 2:

Panel discussion on challenges and lessons learned for the preparation of national inventories of waste-controlled substances and development of a national action plan	Ezzat Lewis, Egypt Tapio Reinikainen, Finland Youssef Hammami, Tunisia Sezin Sönmez Erbas, Türkiye Makoto Kato, Japan
Conclusion and Closing Remarks	Ellen Michel, GIZ

Welcome Remarks

Adnan ATWA, UNIDO

COPA
Cutting refrigerant emissions

The Climate and Ozone Protection Alliance: from vision to action including Highlights video

11 July 2024, OEWG

Ellen Michel

INTRODUCTION

Approach

COPA works jointly with partner countries and diverse actors across private and public sectors to advance the holistic solutions needed to reduce ODS and HFC banks, and ultimately complete the shift in the cooling sector to sustainable refrigerant management.

Implemented by:

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In cooperation with:

UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNDP

Supported by:

Federal Ministry for Economic Affairs and Climate Action

IKI INTERNATIONAL CLIMATE INITIATIVE

on the basis of a decision by the German Bundestag

CLIMATE AND OZONE PROTECTION ALLIANCE (COPA)
Activities

Promoting **international dialogue** and **knowledge transfer**

International Exchange and Collaboration

Positioning sustainable refrigerant management at the **global level**

Global Alliance

Enhancement of policy frameworks to drive the shift to sustainable refrigerant management

Policy Framework

Conception and implementation of **mitigation projects**

Implementation Models

Mobilization of funds for concrete mitigation projects

Financing Mechanism

CLIMATE AND OZONE PROTECTION ALLIANCE (COPA)
Thematic Working Groups (TWG)

Together with partners and members from **academia, the private sector, civil society, finance institutions and policy makers**, we are working on the following topics

Policy Framework

For an effective management of refrigerants and foams at end-of-life, **suitable policy measures are required** like venting bans or mandatory recovery

Technology Solutions

Working towards the **best technical solutions** for ODS and HFC recovery, reclamation and destruction

Financing Mechanism

The infrastructure for and operation of a collection scheme and the destruction or reclamation of ODS and HFCs needs to be based on a **sustainable financing mechanism**

Implementation Models

Putting theory into practice and demonstrating how sustainable refrigerant management can be implemented

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Activities and pilot projects

COPA HIGHLIGHTS JUNE 2023 – JUNE 2024

https://youtu.be/3rI3zA3UCo8

EPA & ZEAL IN GHANA

Mission: Establish local destruction facility for ODS and HFC waste for both substances and foam containing substances

- Once a destruction facility is set up and operational, **collection activities** and **financing sources** can be approached.
- The specific focus of COPA is to procure, install and to operate a continuous emission monitoring system (CEMS) at suitable incineration plant in Ghana.
    - is necessarily required for process control and emission monitoring of certain parameters to comply with **national legislation** and **international standards**.
    - Laboratory analyses of the input waste fractions used are necessarily required to adapt the waste mixture according to the system requirements and achieve a stable operation state.

ROTARY INCINERATION PLANT AT ZEAL

The incineration facility of ZEAL is confirmed by EPA Ghana to be the only with a sufficient capacity for sound incineration of ODS substances.

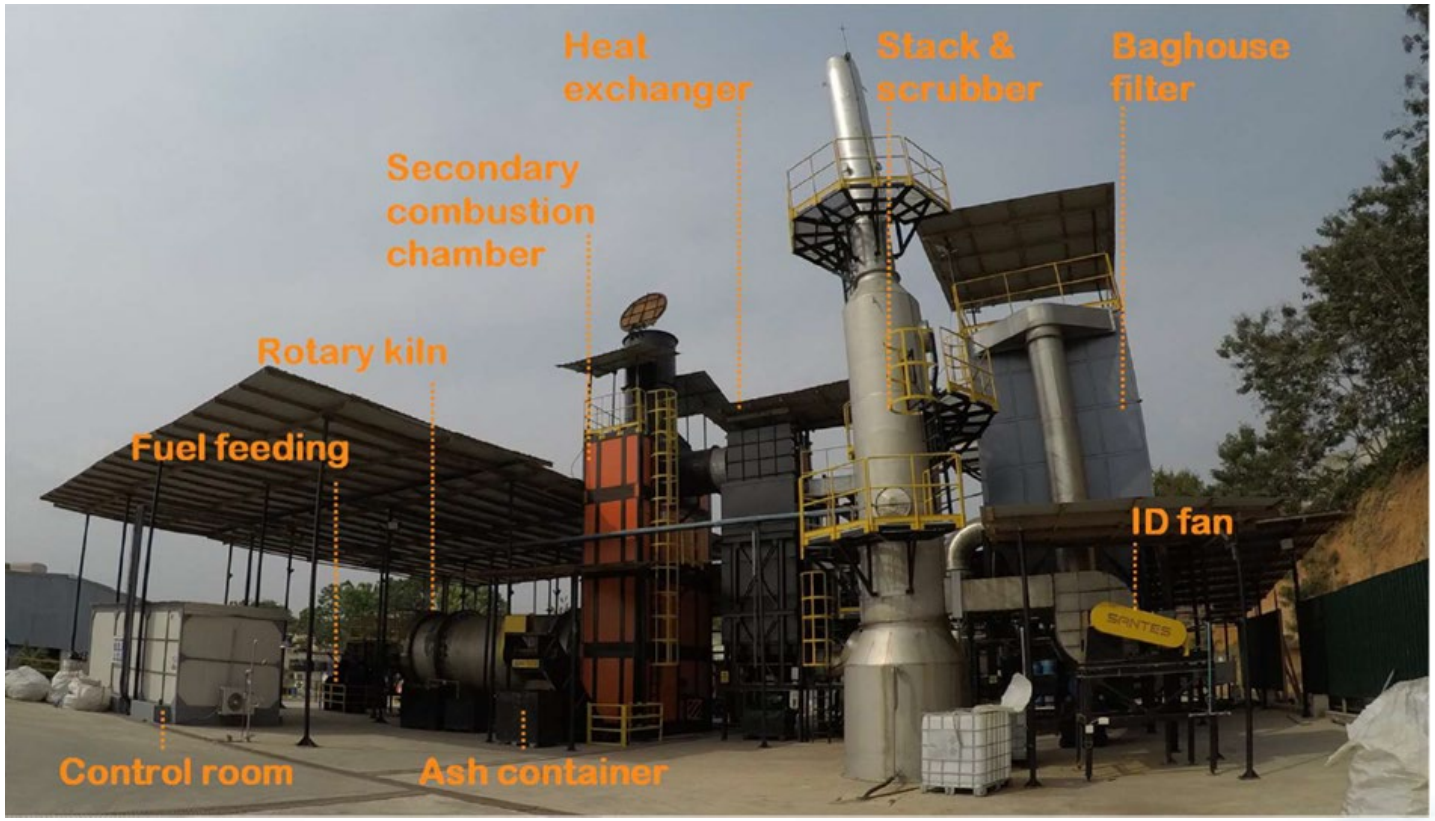
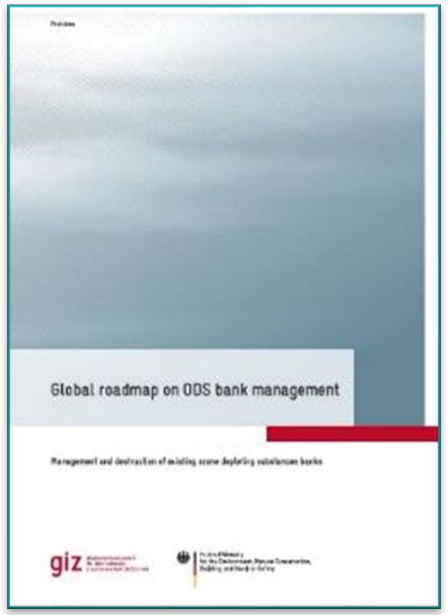


Figure 1: Full view of the rotary incineration plant at ZEAL (Carl K., 2023)

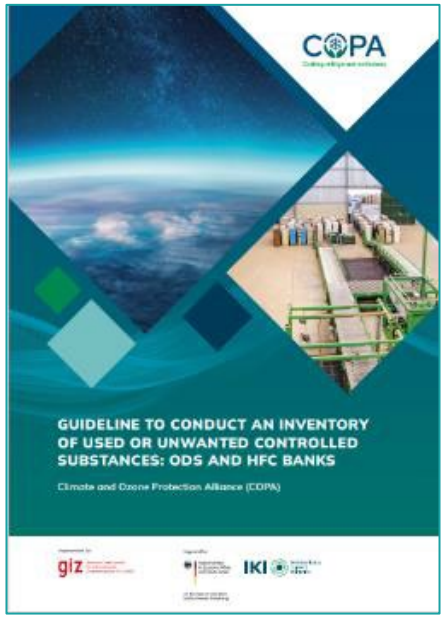
MAIN OUTCOMES OF THE PROJECT ACTIVITIES WITH ZEAL AND EPA

- pilot activities regarding destruction of ODS-gases shall be closely linked with the integrated e-waste management scheme, which is currently being developed by EPA.
- The rotary kiln installed and operated by ZEAL is **suitable for the destruction of ODS gases and disposal of hazardous e-waste fractions**.
- Improvement of proper incineration using laboratory analysis of waste input and the operation of the CEMS.
- Conduction and evaluation of incineration tests for ODS-gases and selected further hazardous e-waste fractions.
- Incineration of agreed quantities of ODS-gases and hazardous e-waste fractions over an agreed period

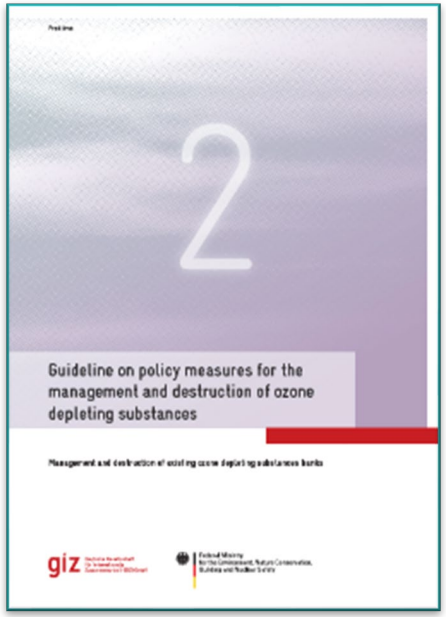
RELEVANT PUBLICATIONS



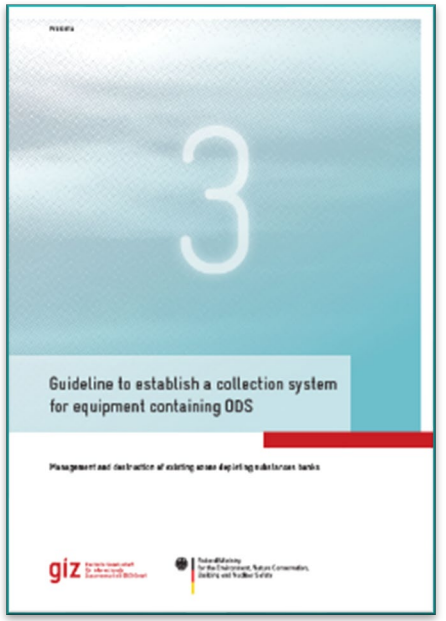
Global roadmap on ODS bank management (Download)



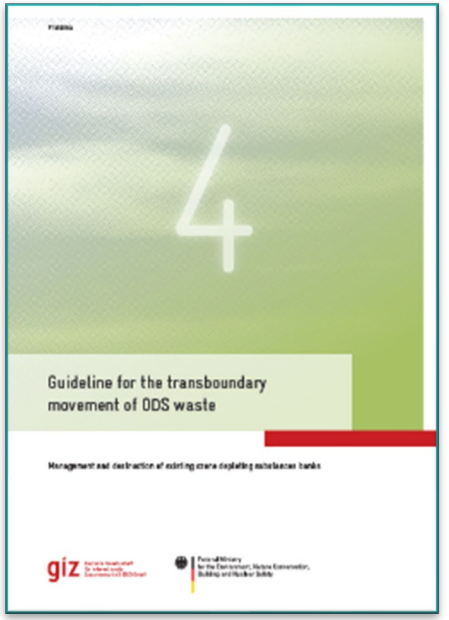
Guideline to conduct an ODS and HFC banks inventory (Download)



Guideline on policy measures for the management and destruction of ODS (Download)

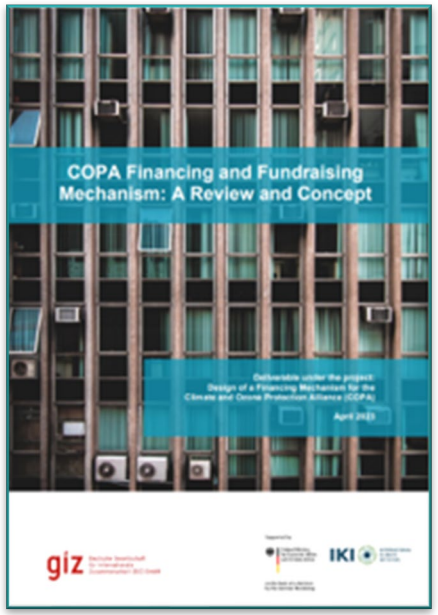


Guideline to establish a collection system for equipment containing ODS (Download)

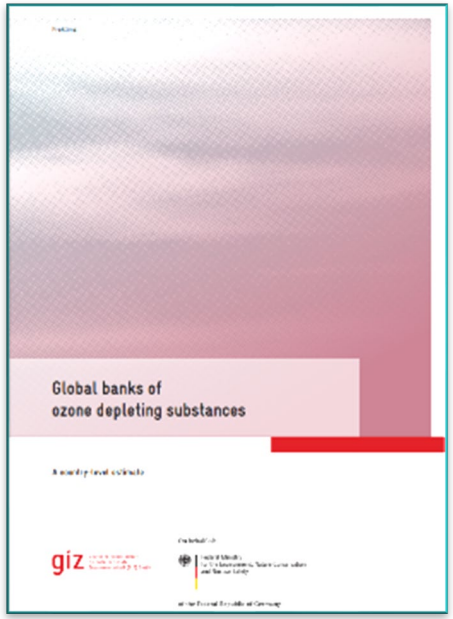


Guideline for the transboundary movement of ODS waste (Download)

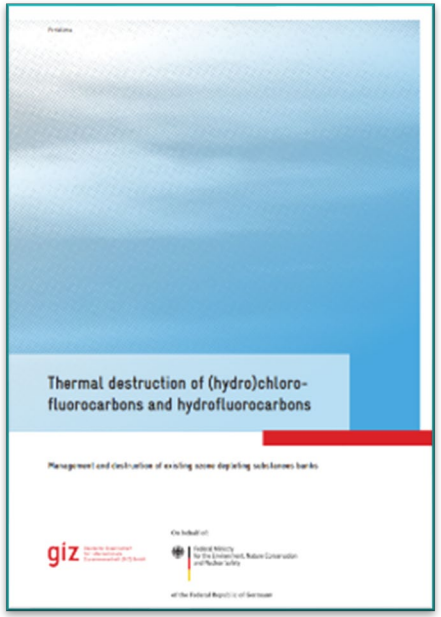
RELEVANT PUBLICATIONS



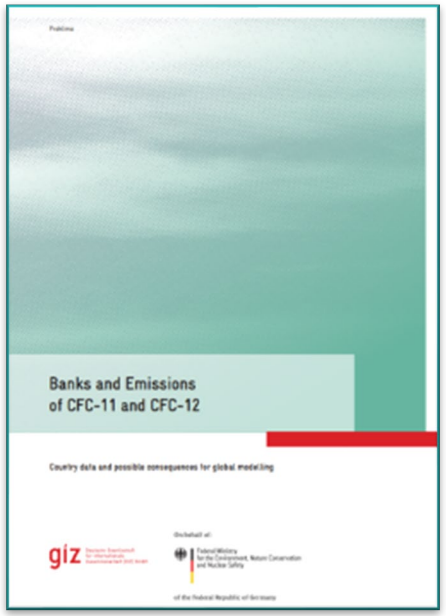
Design of a Financing Mechanism for the Climate and Ozone Protection Alliance (Download)



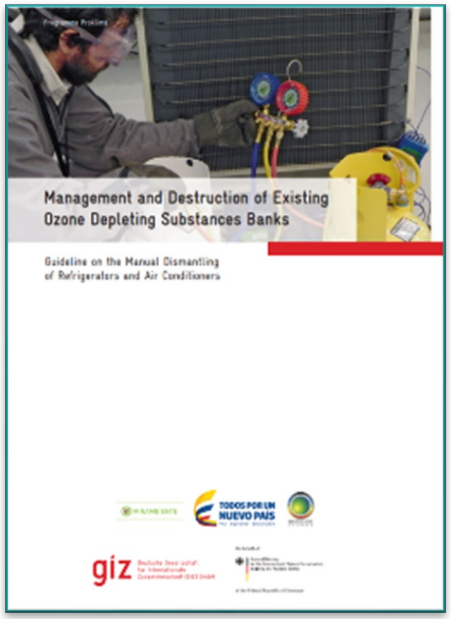
Global Banks of ozone depleting substances. A country-level estimate (Download)



Thermal destruction of (H)CFCs and HFCs (Download)

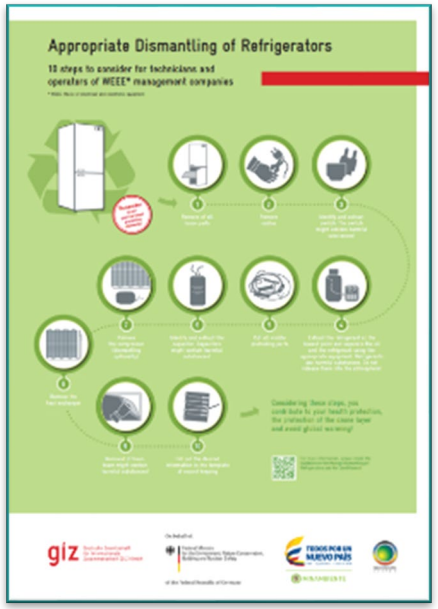


Banks and Emissions of CFC-11 and CFC-12 (Download)

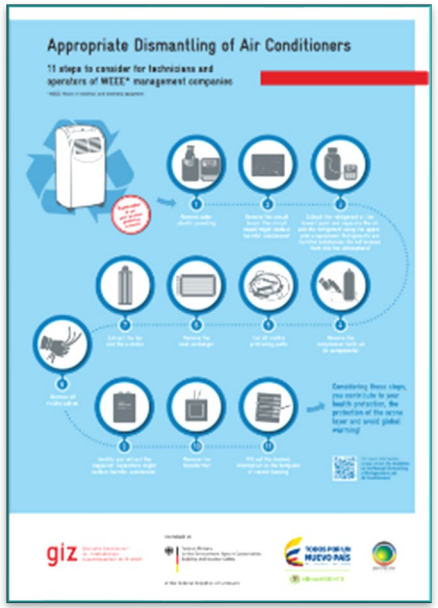


Guideline on the Manual Dismantling of Refrigerators and Air Conditioners (Download)

RELEVANT PUBLICATIONS AND TOOLS



Poster: Appropriate Dismantling of Refrigerators (Download)



Poster: Appropriate Dismantling of Air Conditioners (Download)

Poster: Key processes to manage ODS banks (Download)

Video: ODS Banks – An unseen threat (Download)

Video: A simple step with great impact: The reclaim process of refrigerants (Download)

BECOME A MEMBER

Find more information on our Website

SCAN ME

By joining COPA, members gain access to a global network of knowledge and resources. Match-making between actors will be enabled and a flexible array of services provided.
The network will amplify the reach of actors and enhance the impact of activities in the field of ODS and HFC banks management.
COPA is open to all countries and organisations, willing to support the global shift to sustainable refrigerant management and closing the loop to a circular economy in the cooling sector.

Join COPA and become a member

Learn more about COPA & upcoming events by visiting our website: https://www.copalliance.org

Contact us:

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Head of COPA Secretariat
E-Mail: ellen.michel@giz.de

COPA Secretariat
contact@copalliance.org

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Thank you!

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INDUSTRIAL DEVELOPMENT ORGANIZATION

SUSTAINABLE DEVELOPMENT GOALS

ODS/HFC Reclamation and Destruction Technologies

Dr. Yunrui ZHOU, Industrial Development Officer, Montreal Protocol Unit, UNIDO
11 July 2024 Montreal, Canada

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SUSTAINABLE DEVELOPMENT GOALS

Content

1. Importance of RRR and destruction
2. Recovery, Recycling, and Reclamation
3. Destruction technologies
4. Takeaway message

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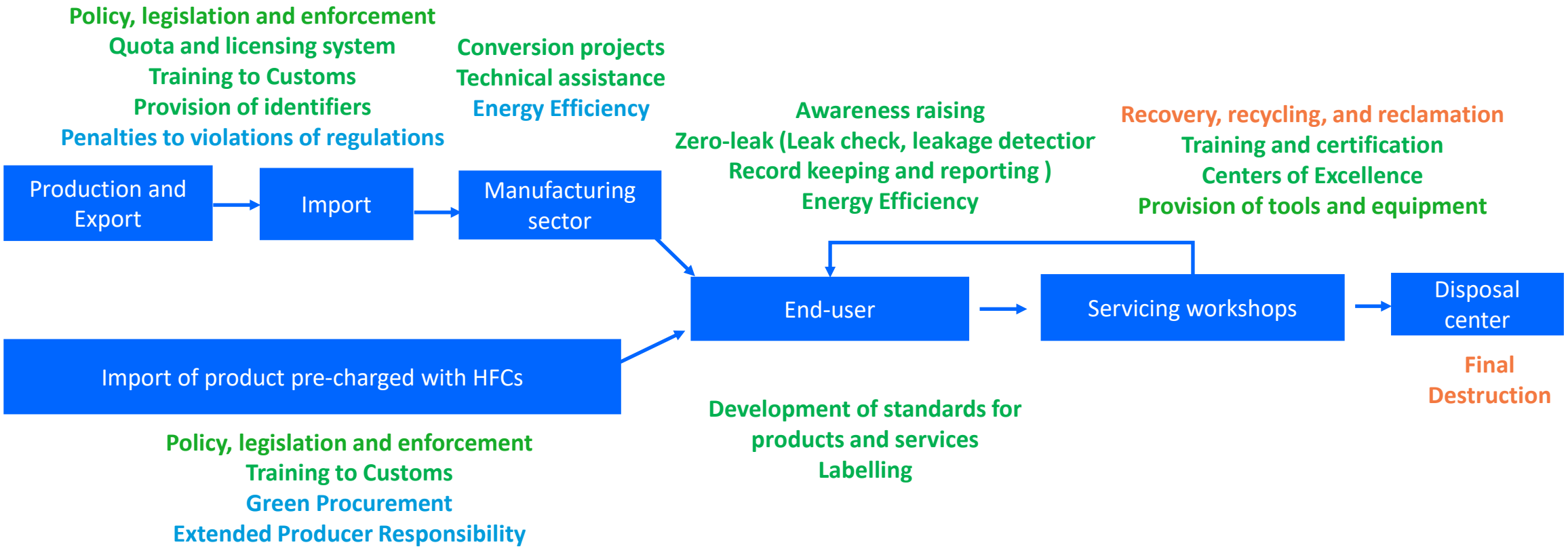
Life cycle management of refrigerants



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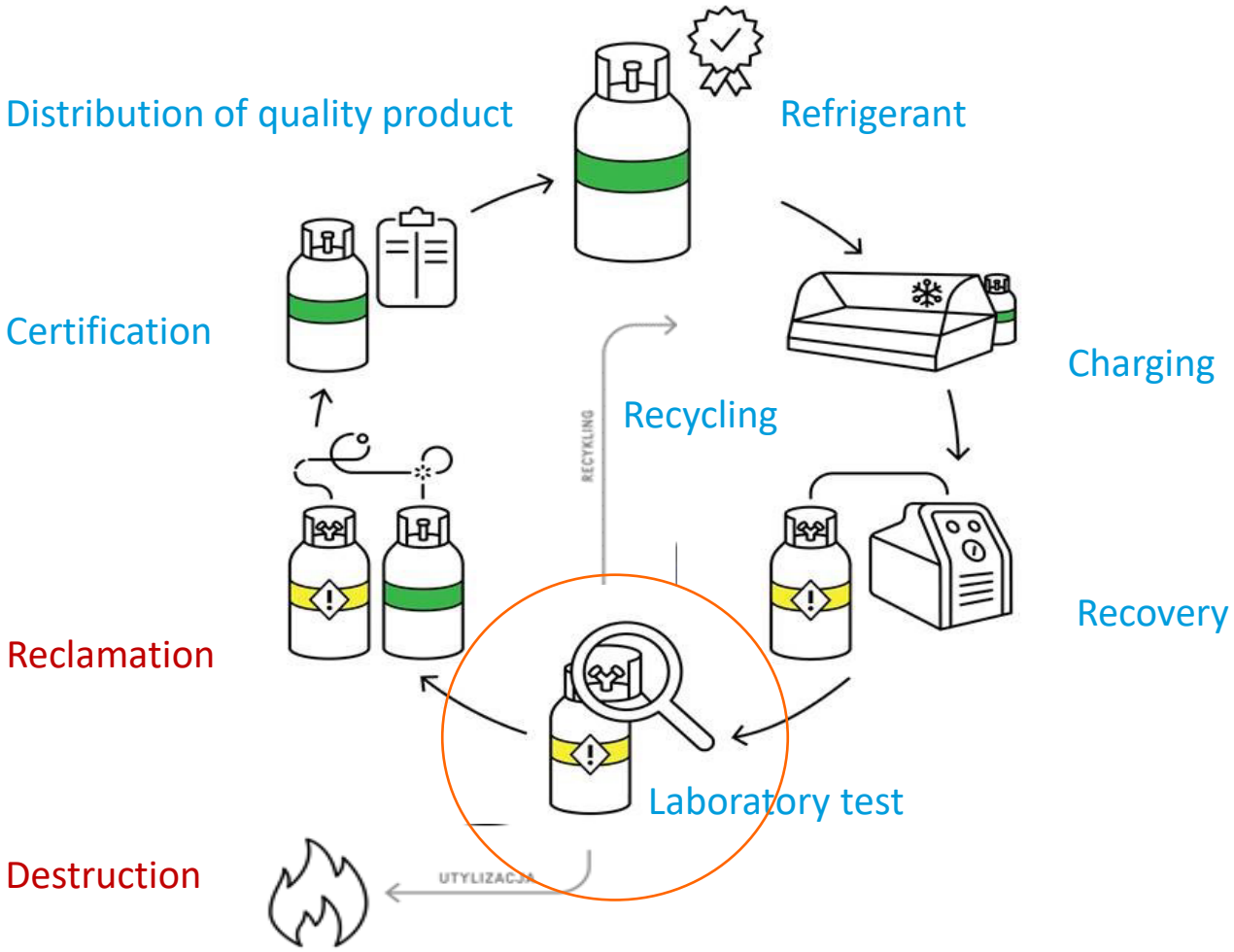
Recovery, Recycling, and Reclamation



Terminology (Decision IV/24)

- **Recovered**: the collection and storage of controlled substances from machinery, equipment, containment vessels, etc., during servicing or prior to disposal without necessarily testing or processing it in any way.
- **Recycling**: The re-use of a recovered controlled substance following a basic cleaning process such as filtering and drying.
- **Reclamation**: The re-processing and upgrading of a recovered controlled substance through such mechanisms as filtering, drying, distillation and chemical treatment in order to restore the substance to a specified standard of performance. (AHRI-700 standard)

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Why should I recover?

Legislation
1. You have to recover!
2. Need to have a certificate

Equipment available
1. Recovery unit
2. 2 way valve cylinders
3. Reclamation & incineration places

Social responsibility
1. To understand ozone layer
2. To be professional

Customers expectations
1. Green card advantages
2. Public contracts under rules
3. Industry standards

Incentives
1. Avoid penalties
2. Earn money - $/kg
3. Cover incremental capital cost and incremental operational cost
3. Get valuable product

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Reclamation technologies

Technologies	Distillation	Adsorption	Subcooling
Accessibility	High, most common reclamation method worldwide	Medium	Low, mainly in USA
Degree of operational complexity, reclamation rate	Compressor needed The reclamation rate is lower, therefore, it takes more time to process the refrigerant	High requires a laboratory and advanced technology	Can reclaim any type of refrigerant without main changes in the setup of the equipment High reclamation rate Low risk of leakage
Type of refrigerants	HCFC, HFC But not effective for Blends	Technology design for one type of refrigerant	HCFC, HFC Not effective for Blends
Cost	Low Low energy consumption	low	High High energy consumption

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Montreal
Protocol Unit

Core pillars

1. Supporting legislation
2. Dedicated Laboratory
3. Reclamation Center
4. Incineration facility
5. Pull of equipment for recovery
6. Collecting points network
7. Good logistic
8. Technical training for personnel
9. Public awareness

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Overview of the pilot ODS disposal projects

	Country	Amount (t)	Destruction technologies	Cost (USD/kg)	Refrigerants destroyed
1	China	194.8	Rotary kiln incineration	8-12.50	CFC-11, -12
2	Colombia	15.1	MSWI/High-temperature incineration (HTI)	5.20-6.20	PU foam CFC-11 CFC-12
3	Georgia	1.47	Export to France – HTI	5.99	CFC-12
4	Ghana	1.27	Export to Poland – HTI	-	CFC-12
		1.0	Export to USA – HTI	-	Methyl Bromide
5	Mexico	74.1	Argon plasma arc	7.502	CFC-11, -12, -114, HCFC-22, -141b, HFC-134a
		39.1	Cement kiln	8.00	R-407
6	Nepal	9.1	Export to the USA--	-	CFC-12
7	Nigeria	1.5	Rotary kiln incineration	29.82	CFC-12
8	Türkiye	9.2	Exported to Poland – Rotary kiln incineration	1.87-2.45	CFC-12
9	Region ECA	41.8	Exported to Germany and Poland – Rotary kiln incineration	1.87-2.45	CFC-12 HCFC/HFC

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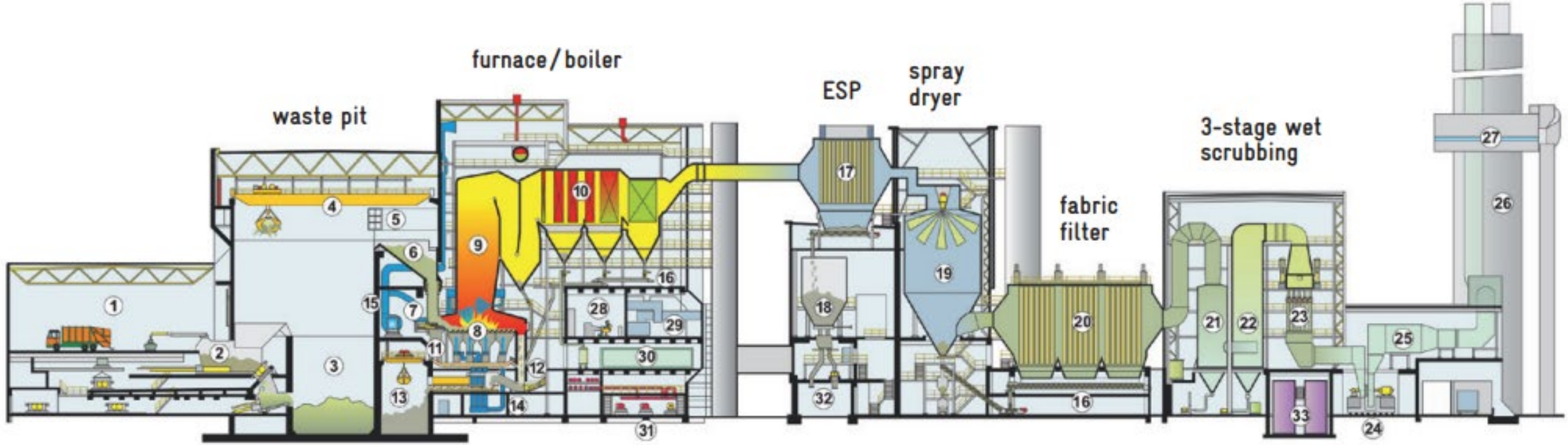
Technology 1: Municipal solid waste incineration (MSWI)



MSWI is an established technology for disposing of residual waste in many industrialized countries.
The prerequisites, however, are high efforts to guarantee its environmental compatibility, in particular to guarantee an efficient cleaning of the flue gas. Hence, the air pollution control system is a very important, complex, and expensive part of a waste incineration plant.

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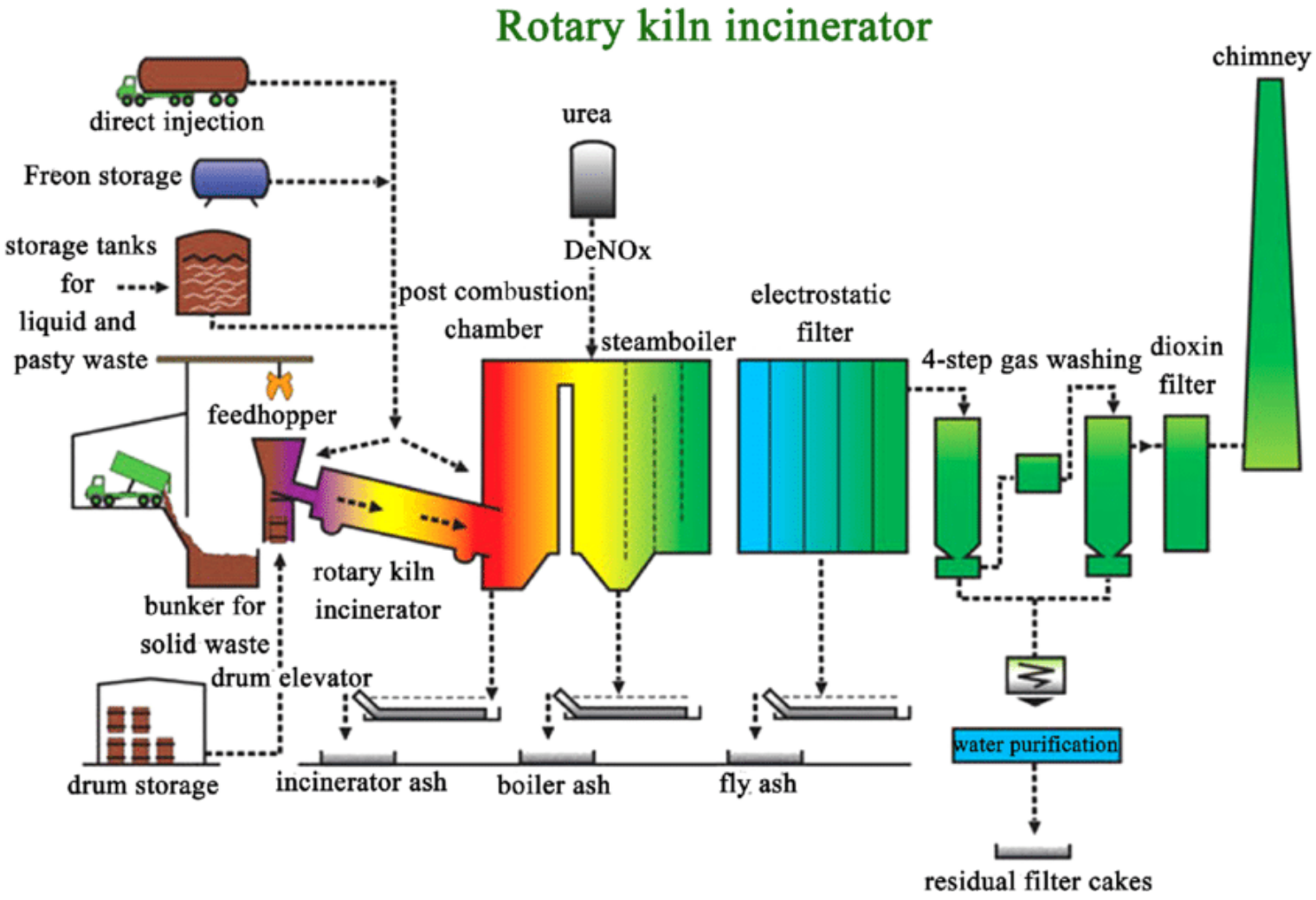
Technology 2: Rotary kiln incineration/furnace

- ✓ Rotary kiln furnaces are mainly used for the incineration of hazardous waste and have found wide applications, especially in industrialized countries.
- ✓ It comprises a rotary kiln furnace followed by a high-temperature post-combustion chamber, a boiler for energy recovery, and a system for emission control.
- ✓ Rotary kiln incinerators are operated at 1,200 °C and a residence time of 2 s.



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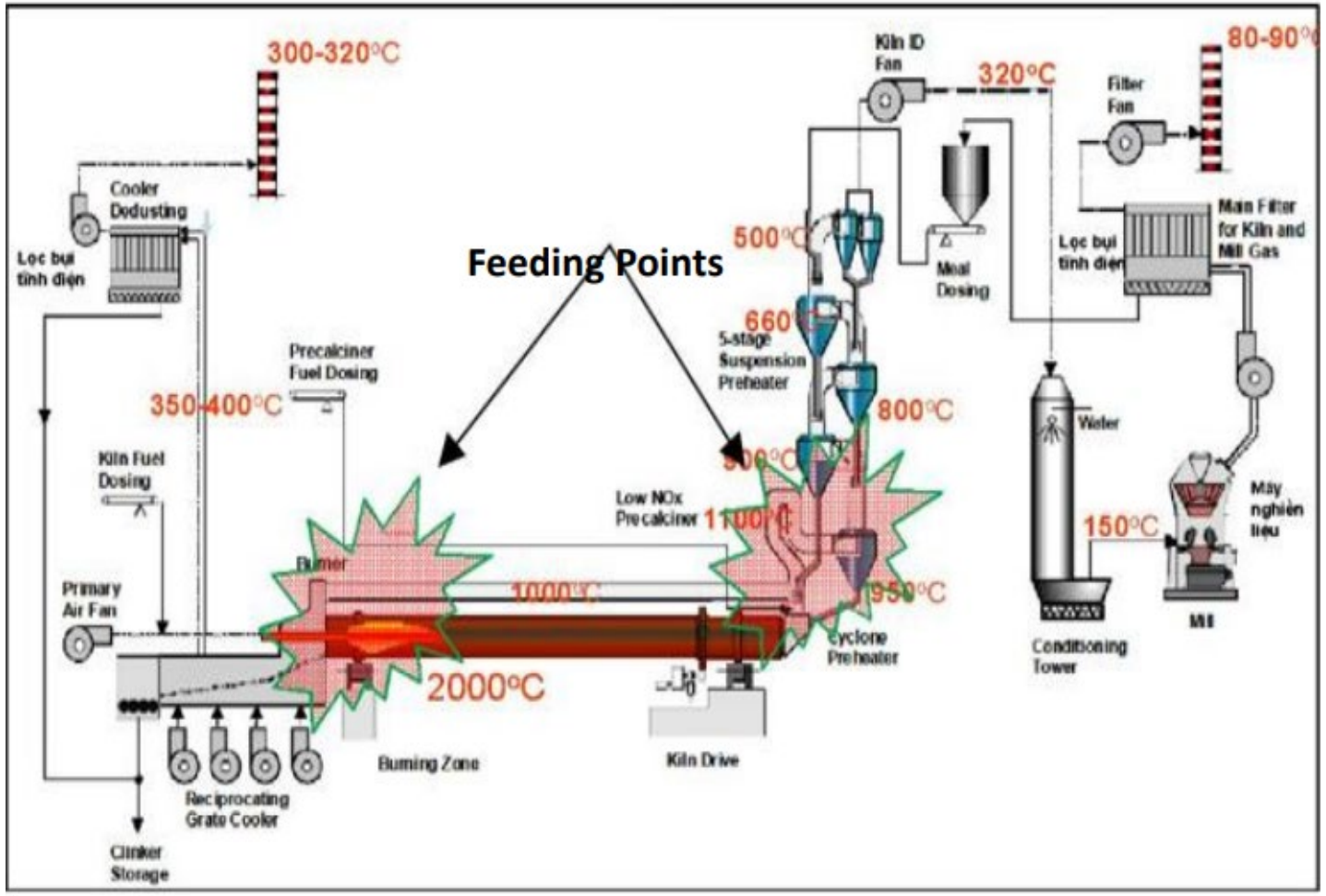
Technology 3: Cement Kiln

- ✓ Advantages:
  - ❖ High temperatures,
  - ❖ Long residence time,
  - ❖ Good supply of oxygen during and after combustion
  - ❖ Dry scrubbing of the exit gas,
  - ❖ No generation of by-products such as slag, ashes, or liquid residues
  - ❖ High capacity

- ✓ Adjustments
  - ❖ Safe storage of the cylinders
  - ❖ Dosage Control System
  - ❖ Emission monitored and controlled



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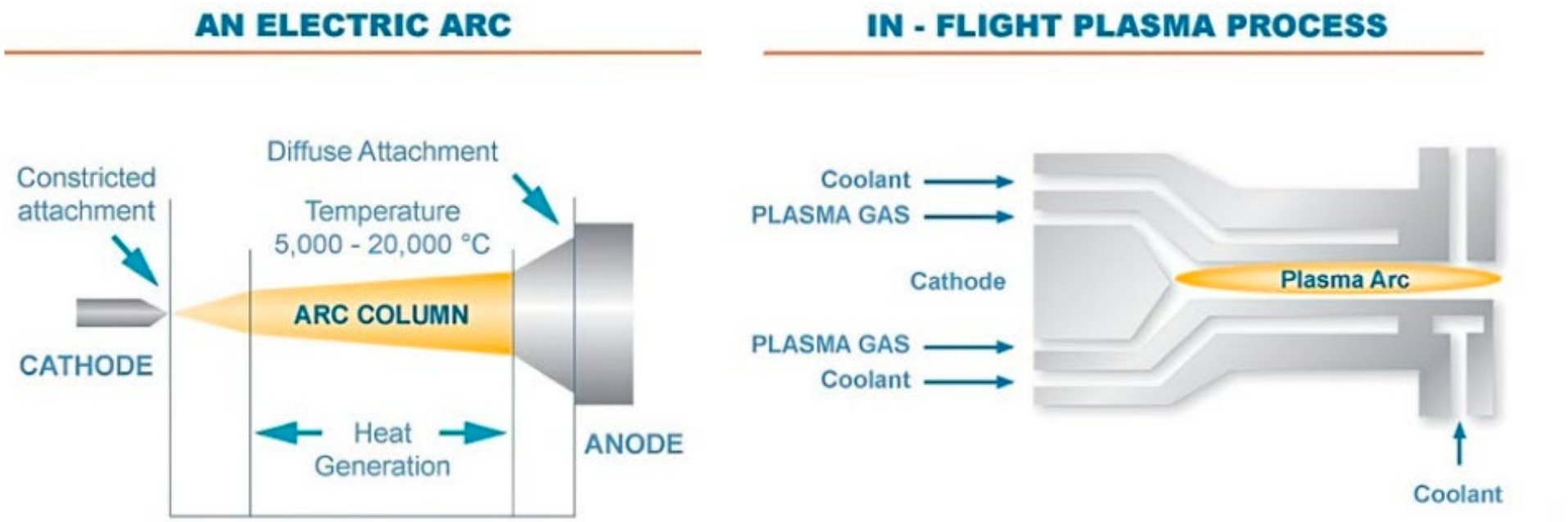
Technology 4: Argon plasma arc



- ✓ In the Plasma method, electricity is applied to a medium of argon, creating a torch with temperatures between 5,000 to up 20,000°C in the core, destroys the substances that are directly shot into it. It is known as pyrolysis, an anoxic process. The by-products from this destruction process are CO2 and CO, water, and salts that are easy to dispose of.

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Technologies for the Destruction of ODS/HFCS

Approved destruction technologies		Advantages for developing countries	Disadvantages for developing countries
Thermal Oxidation technologies*	Cement kilns	Already exist in many countries. Already established for hazardous waste treatment. Adjustments are easy and relatively cheap.	Low to high emissions, Measuring the emissions can be challenging.
	Municipal solid waste incineration (MSWI)-High temperature incineration (HTI)	Useful if there are already operating plants in the country/area.	High investment and operational cost for new plants. Not very effective as destruction method for ODS/HFCs. Risk of high emissions
	Rotary kiln incineration	Already exists in developing countries. Only approved technology for the destruction of all ODS/HFCs**. Low emissions.	Useful only if already established (e.g., by chemical companies). High investment and operational costs.
Plasma technologies	Argon plasma arc	Compatible with the chemical industry. Effective destruction method.	Very low emissions. High costs and high requirements Low availability for acquisition, including spare parts

* Previously called “Incineration Technologies”.

** This technology was approved for the destruction of all molecules under the Montreal Protocol except for methyl bromide.

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Technical overview of the technologies

Technology	Cement Kiln	MSWI	Rotary kiln Incineration	Argon Plasma Arc
Accessibility	High	Low	Low to medium	Low to medium
Degree of operational complexity	Low	High	High to medium	High
Building/adjustment costs	Low (liquid feeding lines to kiln, storage facilities)	High	High (Ghana – Zeal over 3 million USD)[1]	High (4.2 million USD + installation and transportation)[2]
Destructions Costs USD/Kg	6.0	5.2-6.2	1.9-2.5 (non-Article 5) 8.0-29.8 (Article 5)	7.5

[1] From exchange with the chief operations officer of Zeal Environmental Technologies Ghana
[2] Cost for a PDU in 2008 bought by Quimobasicos.

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Takeaway messages:

- Recovery, recycling, and reclamation and destruction are the last two important steps to reduce/minimize emissions from the existing equipment before being replaced.
- Incentives needed for a successful RRR center in Article 5 countries, including policy support, financial support, and technical support among others.
- Four technologies have been demonstrated in the previously approved pilot projects, which are technically feasible for the destruction of the ODS and HFCs waste.
- High-temperature incineration (HTI) and Rotary kiln incineration are the best available technologies if these technologies are in operation in Article 5 countries. If these two technologies are not available in Article 5 country, the cement kiln is a cost-effective technology for the destruction of ODS waste when there is a new dry cement plant.

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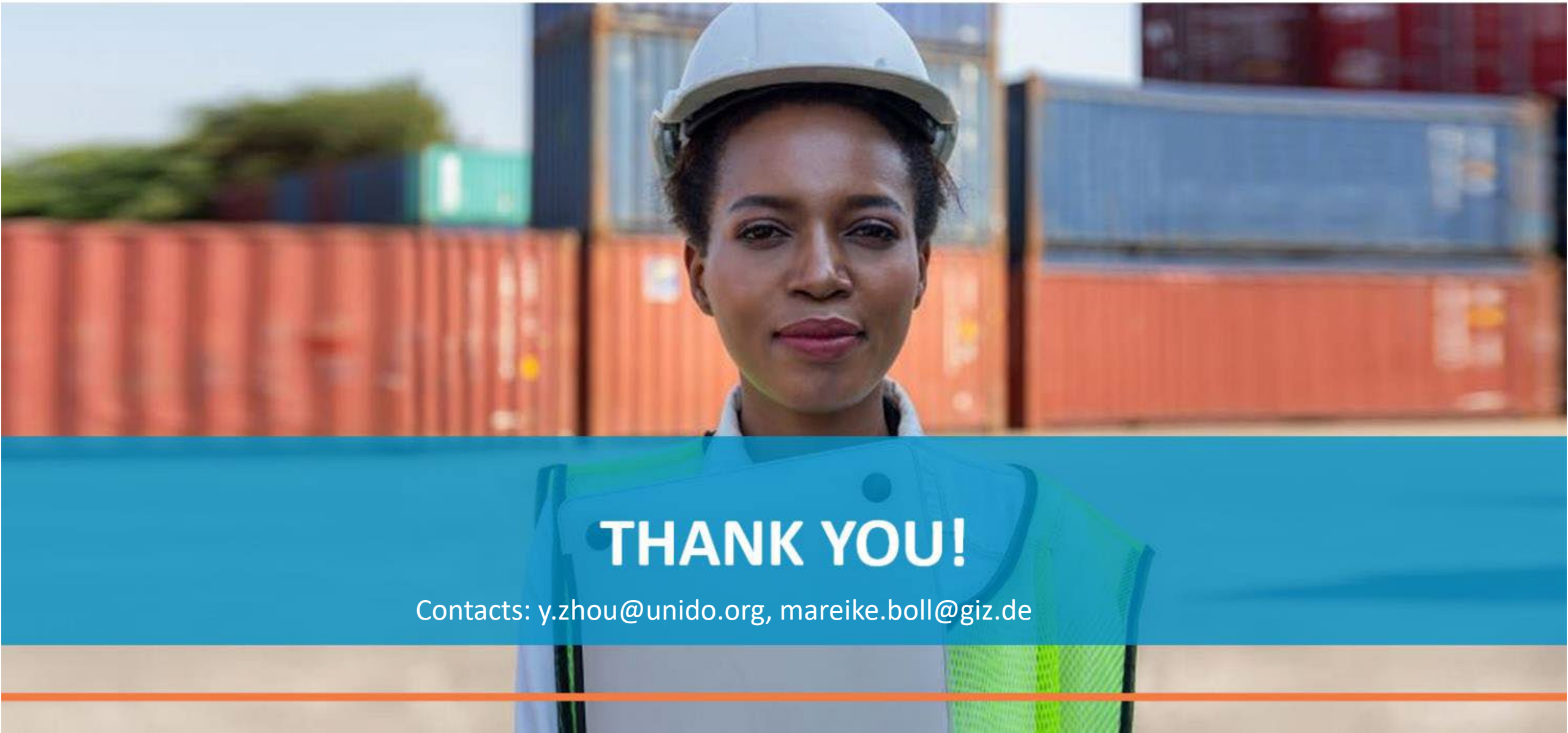

THANK YOU!

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Potential policy framework for the promotion of sustainable ODS/HFC banks management

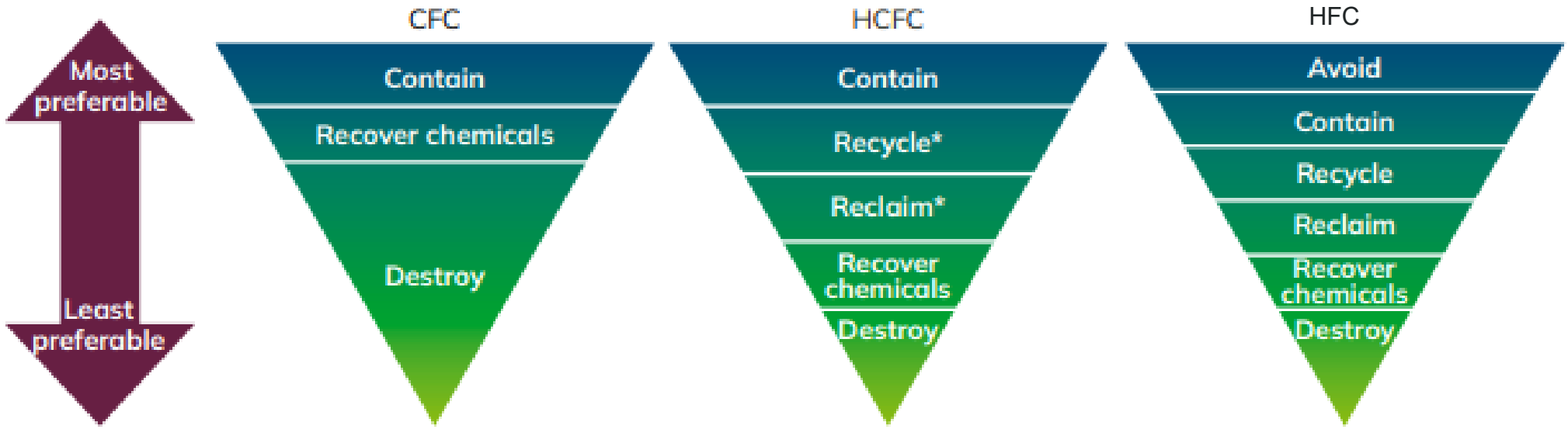
Irene Papst, HEAT GmbH, 11.07.2024

COPA PUBLICATION

Consultancy services
provided by HEAT GmbH

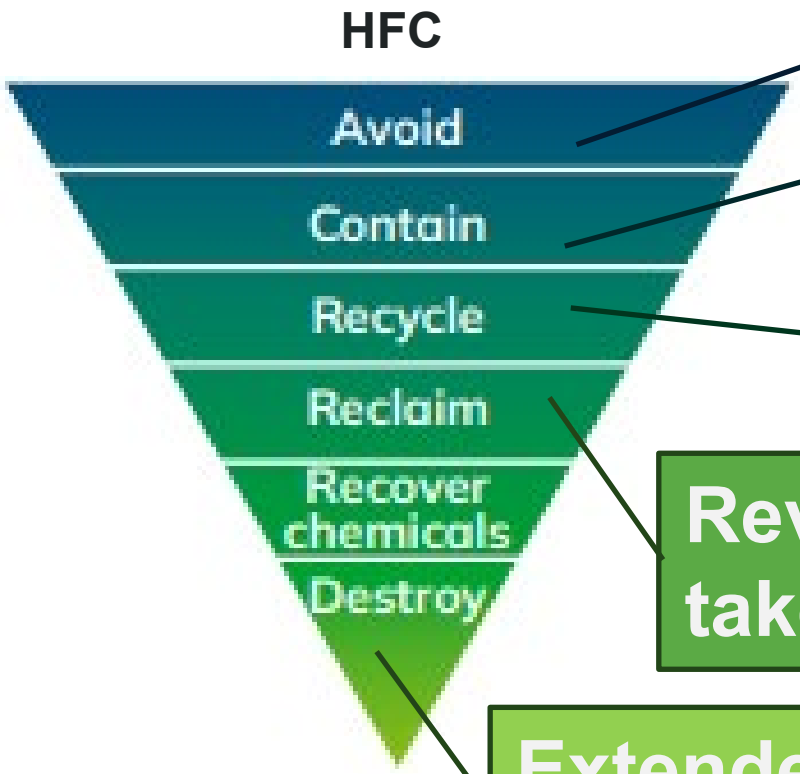
ODS/HFC BANKS MANAGEMENT HIERARCHY

***Figure 1**. ODS/HFC Bank Management Hierarchy.*



**Recycling and Reclaim of HCFCs should be subject to a cutoff date that is aligned with the phase-out of HCFCs*
Source: HEAT 2023

POLICIES SUPPORTING THE ODS/HFC BANKS MANAGEMENT HIERARCHY



Promote alternatives

Venting ban, Operators' obligation for leak prevention, Technician certification

Price signal for refrigerant reuse

Reverse logistics, Obligation for distributors to take back used refrigerant, Support economics

Extended producer responsibility for appliances, Operators' obligation to pay for treatment

THANK YOU FOR YOUR ATTENTION

Irene Papst
Member of COPA's Steering Committee

Senior Consultant at Heat GmbH
Irene.Papst@heat-international.de

THE FINANCING MECHANISMS TO ENABLE ODS

2024.07.11 Laurent Guégan

climalife®

climalife.com

dehon group

Family business company founded in 1874

climalife®

climalife.com

A strong brand of the Dehon group

THE CONCEPT OF A CIRCULAR ECONOMY, THE VERY ESSENCE OF OUR BRAND

The environmental responsibility is at the heart of our technological innovations

IN FIGURES

75% of fluorinated greenhouse gas waste are recovered.

More than 30 millions t. Eq. CO_2 **avoided** by our action in Europe in RACHP

R&D Investment : + **10%** TO

Introduction of bio-sourced materials in the formulation of heat transfer fluids

CLIMALIFE, A KEY PLAYER IN WASTE MANAGEMENT

30 years of Climalife expertise

Climalife has established its activities over the years by developing a unique global offer and a tailor-made service for its customers thanks to its presence in growth markets.

The strength of an international presence

- **The Climalife network for second life**
  - Contractors and wholesalers
  - Facility management companies
  - Automotive workshops and distributors
- **Climalife, the specialist in waste collection**
  - Management of recovery containers
  - Recognised laboratory
  - Collection points in the main countries
  - Agreement with the waste carrier

Our territorial coverage allows us to be even closer to our customers. The cultural and linguistic diversity of our employees enriches our brand and strengthens our ability to respond locally to the specific needs of industries.

15 Climalife subsidiaries on three continents

40 A network of distributors in over 40 countries around the world

14 production sites and logistics centres

200 Over 200 local depots in Europe

+than **12,000** customers trust Climalife

"We want to extend our positioning and our expertise by offering more local services through our existing distribution network and by deploying our key success factors in new territories distribution network and by deploying our key success factors in new territories.

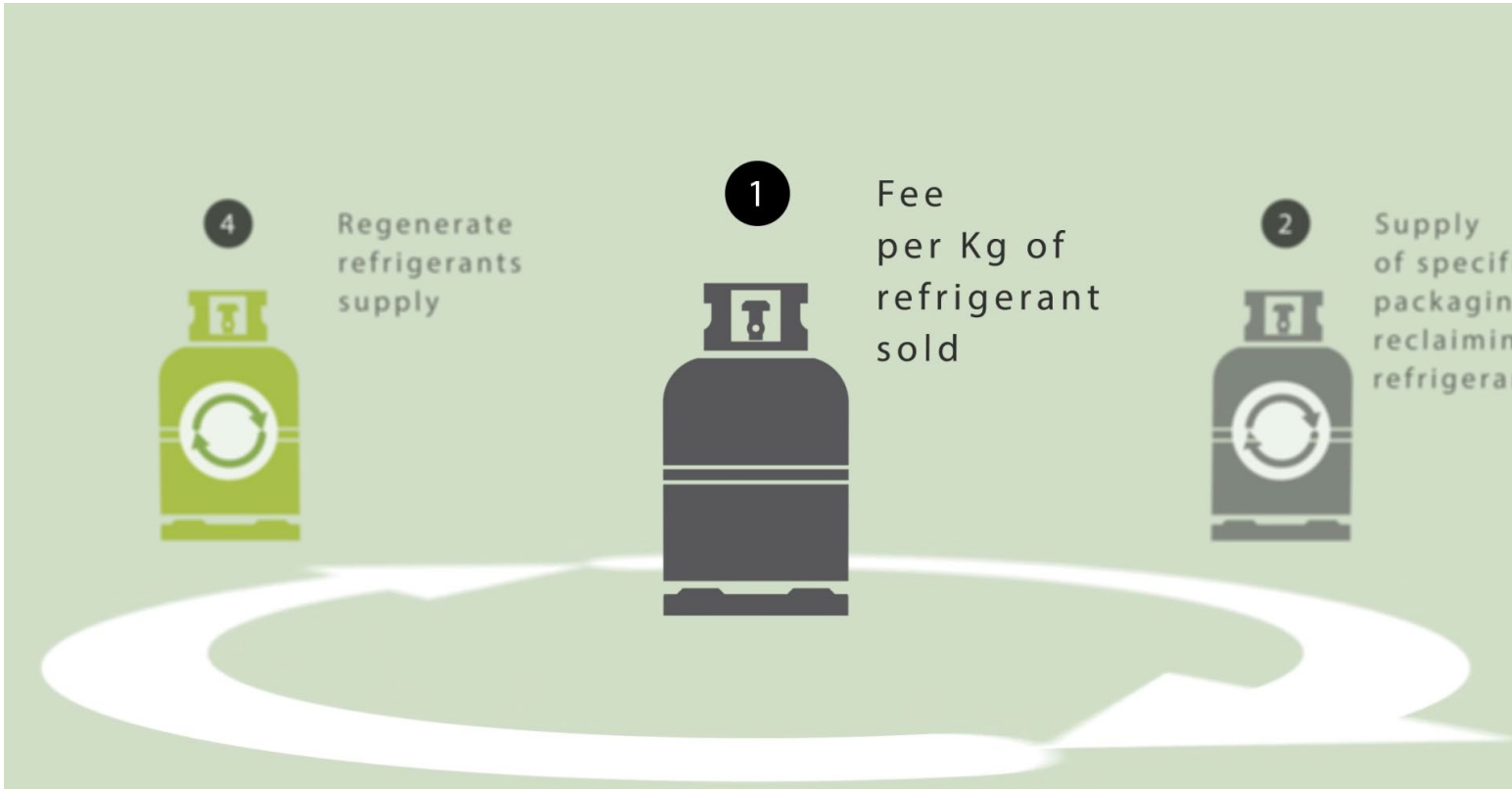
climalife.com

FIND US ON: @climalife

THE FRENCH CIRCULAR ECONOMY MECANISM

THE FRENCH CIRCULAR ECONOMY MECHANISM

- **A fee per kg for each virgin refrigerant sold**
  - including up front treatment cost
- **A free waste return**
  - The treatment cost is cover by the fee
- **An incentive to encourage the return of reclaimable waste.**
  - For a selective collection and avoid the waste mixture.



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MECHANISM FOR COUNTRY WITH LICENCE AND QUANTITY

MECHANISM FOR COUNTRY WITH LICENCE AND QUANTITY

The reclaiming equipment is refund by the resales on the second market

Necessary criteria

- No downward dumping on the refrigerant virgin price
- An incentive for reclaimable waste
- Some needs on the second market
- Existing laboratory to analyse
- Phase down for the transition

For Non reclaimable waste

- Use the carbon credit to finance the cost

Climalife develops local partnerships when we do not have our own site.

- Climalife contributes its technology and expertise

MECHANISM FOR COUNTRY WITHOUT RULES OR QUANTITY

MECHANISM FOR COUNTRY WITHOUT RULES AND QUANTITY

Challenges and barriers :

No rules to enforce recovery or not enough quantity

- Downward dumping on the refrigerant virgin price
  - OPEX of reclamation higher than the price
  - No second market possible

- Need a laboratory to analyse

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MECHANISM FOR COUNTRY WITHOUT RULES AND QUANTITY

Possibles options:

Rules to enforce recovery But not enough quantity

- At the political level: try to mutualise the investment in equipment
  - And : No downward dumping on the refrigerant virgin price
  - And An incentive for reclaimable waste
  - And Some needs on the second market
  - Phase down for the transition

Or

- Use the carbon credit to finance the cost

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No rules to enforce recovery or not enough quantity

- Use the carbon credit to finance the cost

CARBON CREDIT

STAGES OF A CARBON CREDIT PROJECT

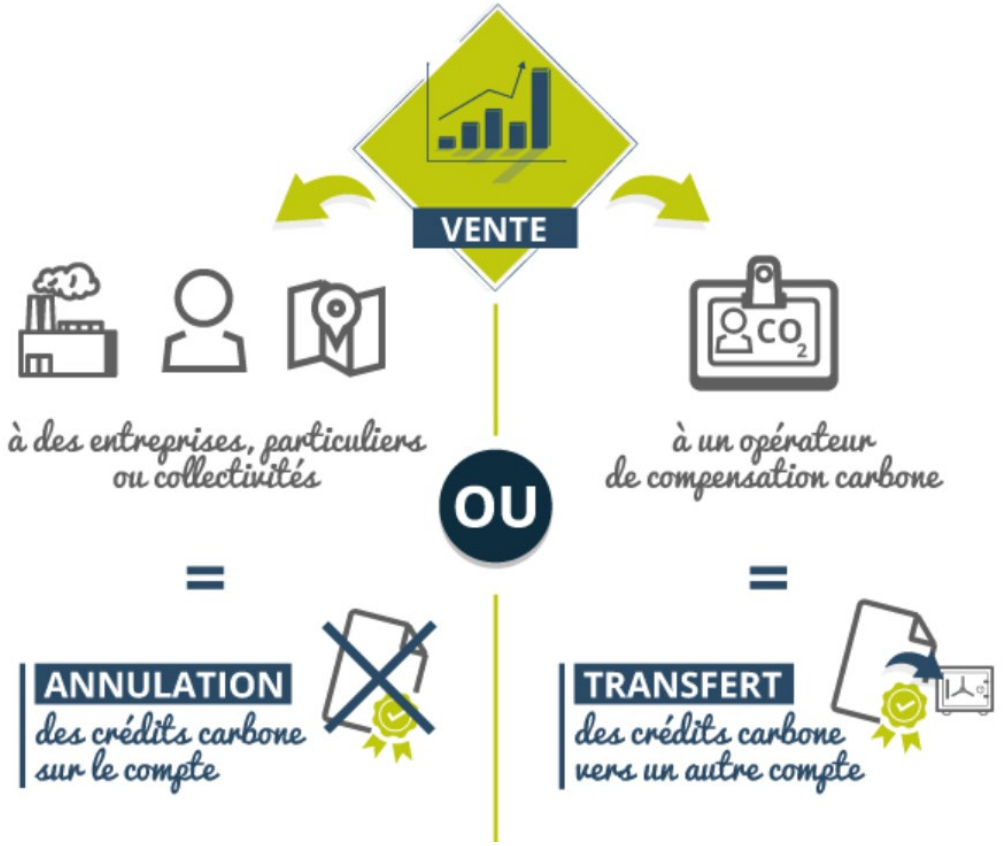
1. Study of the project's carbon potential
   2. Calculation of CO2 savings
   - Project financing
   - Choice of carbon assessment method
   - Drafting of the PIN (Idea Note Project)

2. Formalisation of the project
   - Acceptance by the host country
   - Stakeholder consultation
   - Drafting of PDD (Project Disgn Document)
   - Validation of PDD by an auditor

3. Implementation of the project
   - Monitoring of project activities (1 year)
   - Verification by independent auditor

4. Delivery of carbon credits
   - Opening of an account on the carbon register
   - Obtaining carbon credits on the account

5. Sale of carbon credit



Payback around 3 years

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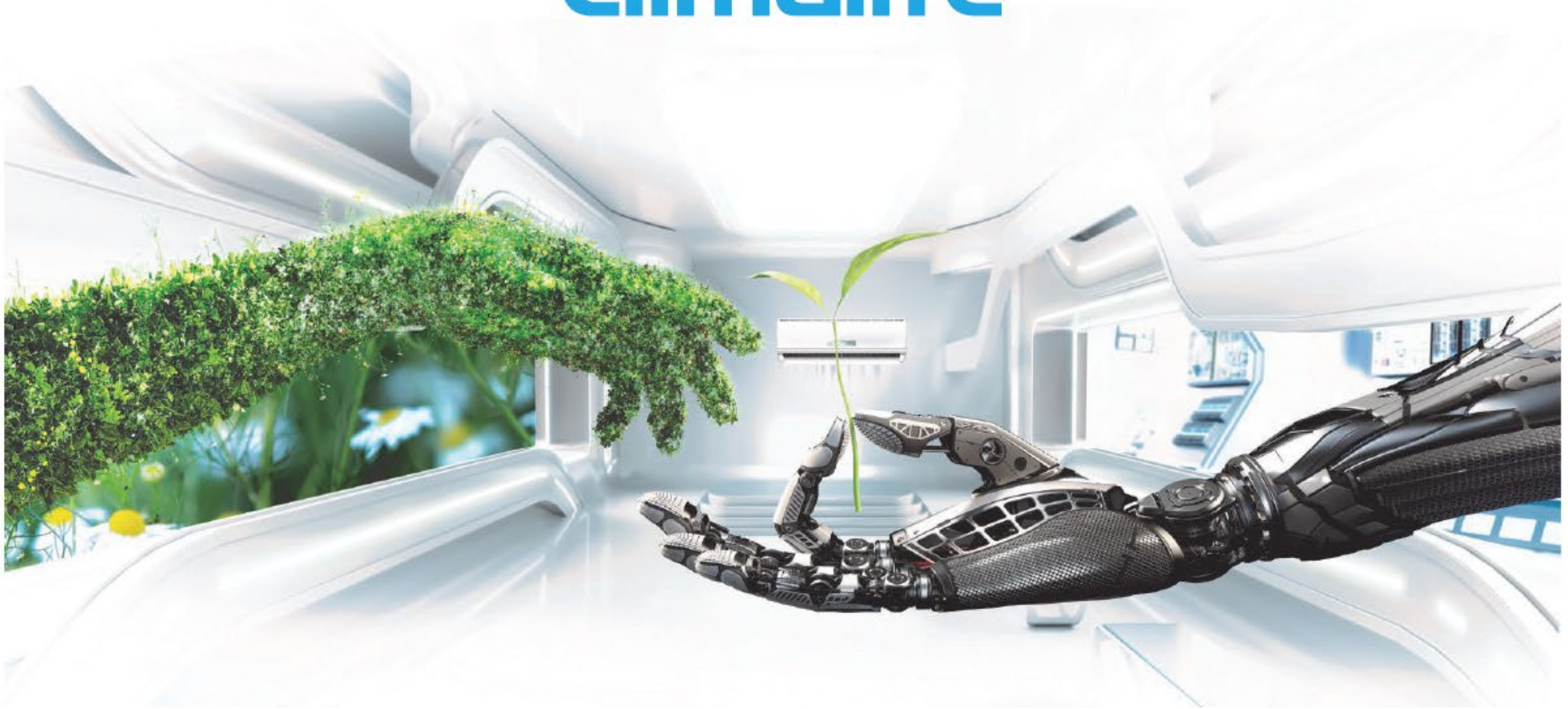

THANK YOU FOR YOUR ATTENTION

Panel discussion on challenges and lessons learned for the preparation of national inventories of waste-controlled substances and development of a national action plan

Mr. Ezzat Lewis, Egypt
Mr. Tapio Reinikainen, Finland
Mr. Youssef Hammami, Tunisia
Ms. Sezin Sönmez Erbas, Türkiye
Mr. Makoto Kato, Japan

Conclusion and Closing Remarks

Ellen Michel, GIZ

COPA
Cutting refrigerant emissions

Thank you!