Resource Book for Life Cycle Management of Fluorocarbons

Good practice portfolio for policy makers

2022

INITIATIVE ON FLUOROCARBONS LIFE CYCLE MANAGEMENT

環境省
Ministry of the Environment

CLIMATE & CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

Climate and Clean Air Coalition
to Reduce Short-Lived Climate Pollutants (CCAC)

in collaboration with
The Initiative on Fluorocarbons Life Cycle Management (IFL)

supported by
The Ministry of the Environment, Japan

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Acronyms

AC	air conditioner or air conditioning
ADB	Asian Development Bank
ADF	Advanced Destruction Fee
AP	Approval Permit
BAFA	Bundesamt für Wirtschaft und Ausfuhrkontrolle (German Federal Office of Economics and Export Control)
BMU	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (German Ministry for the Environment, Nature Conservation and Nuclear Safety)
BNSP	Badan Nasional Sertifikasi Profesi (Indonesian National Agency for Professional Certification)
CAA	Clean Air Act
CCAC	Climate and Clean Air Coalition
CCO	Chemical Control Order
CFC	chlorofluorocarbon
CRP	Conference Room Paper
DENR	Department of Environment and Natural Resources
DME	dimethyl ether
DoE	Department of Environment
ECI	Efficient Cooling Initiative
EE	energy efficient
ELV	End-of-Life Vehicles
EoL	end of life
EPR	Expanded Products Responsibility
ExCom	Executive Committee
GEC	Global Environment Center Foundation
GHG	greenhouse gas
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
HPMP	HCFC Phase-out Management Plan
HVAC	heating, ventilating, air conditioning
ICS	Instituto Clima e Sociedade (Institute for Climate and Society)
IEA	International Energy Agency
IFL	Initiative on Fluorocarbons Life Cycle Management
IGSD	Institute for Governance & Sustainable Development

JCM	Joint Crediting Mechanism
KCEP	Kigali Cooling Efficiency Programme
LCCP	life cycle climate performance
MEPS	Mandatory Efficiency Performance Standards
METI	Ministry of Economy, Trade, and Industry, Japan
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MOEJ	Ministry of the Environment, Japan
NDC	nationally determined contribution
NEA	Norwegian Environment Agency
ODP	ozone-depleting potential
ODS	ozone-depleting substance
ODSHAR	Ozone-depleting Substances and Halocarbon Alternatives Regulation
OECC	Overseas Environment Cooperation Centre, Japan
OEWG	Open-Ended Working Group (of the Montreal Protocol)
PFC	perfluorocarbon
PHS	Projeto Hospitais Saudáveis (Healthy Hospitals Project)
POD	Philippine Ozone Desk
PPP	public private partnership
PRO	Producer Responsibility Organization
PSS	product stewardship scheme
PU	polyurethane
QPS	Quarantine and Pre-Shipment
RAC	refrigeration and air conditioning
RRA	Refrigerant Reclaim Australia
SADC	Southern African Development Community
SGG	synthetic greenhouse gases
SLCP	short-lived climate pollutants
SNAP	Significant New Alternative Policy
SZ CHKT	Slovenský zväz pre chladiacu a klimatizačnú techniku (Slovak Association for Refrigeration, Air Conditioning Technology and Heat Pumps)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USEPA	United States Environmental Protection Agency
VRF	Variable Refrigerant Flow air conditioning system
WEEE	Waste Electrical and Electronic Equipment
XPS	extruded polystyrene

1. Background

The 2016 Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer is a landmark event in the global effort to phase down hydrofluorocarbons (HFCs). As HFCs have no ozone-depleting potential (ODP), they have been widely used to replace ozone-depleting substances (ODSs) that are being rapidly phased out, such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) in air conditioning, refrigeration, thermal insulating foam, technical and medical aerosol products. HFCs have also been used to phase out halons used in fire extinguishers. HFC emissions have increased significantly in recent years in response to increased demand for cooling services and the phasing out of ODS under the Montreal Protocol. Many HFCs are potent greenhouse gases (GHGs) with a global warming potential (GWP) up to 12,400 times (IPCC/AR5, 2013) that of CO_2 per mass unit over a 100-year time horizon, therefore it is crucial to control the emission of HFCs as part of climate change mitigation, in the context of the Paris Agreement. Furthermore, environmentally superior replacements for HFCs are now available or will soon be available.

Under the Kigali Amendment, the Parties have set a cap on the production and consumption of HFCs to comply with the designated phase-down schedule. However, the Montreal Protocol, including the Kigali Amendment, focuses on upstream measures, namely controlling the production, import and export of refrigerants, while downstream actions such as avoidance of leakage, and appropriate treatment through collection and destruction, are left to the respective Parties. At the same time, the 'bank' of refrigerants contained in stationary and mobile cooling equipment remains, with the risk of massive release of HFCs and other gases into the atmosphere, and there are no appropriate responses. It is projected that, despite compliance with the Kigali Amendment, an additional 72 billion t-CO_2eq of fluorocarbons will be released into the air in the next four decades.[1] As the potential impact on climate change is substantial, addressing HFCs currently trapped in the banks is crucial to achieving levels of mitigation in the next few decades consistent with the 1.5°C target, and achieving the net zero emissions target in the latter half of this century. Also, for many developing countries, the bank issues relate not only to HFCs, but also CFCs and HCFCs, and they need to be addressed both for the protection of the ozone layer and climate change mitigation.

The demand for cooling is rapidly growing, especially in the developing world, and is in turn driven by an expected increase in per capita wealth combined with the effect of rising temperatures due to climate change. According to the International Energy Agency (IEA), the global stock of air conditioners (ACs) in buildings will grow to 5.6 billion by 2050, up from 1.6 billion today, which amounts to 10 new ACs sold every second for the next 30 years.[2] While this projection has been made with a relatively long time span,

[1] Scientific Assessment of Ozone Depletion (WMO/UNEP 2018)
[2] The Future of Cooling (IEA 2018)

the rapid growth in demand for cooling has already begun, before the Montreal Protocol Parties initiate their first actions of the phase-down. And in many countries, developed and developing countries alike, downstream measures to control emissions of refrigerants leave much room for improvement or simply do not exist, and used HFCs as well as CFCs and HCFCs are released into the atmosphere. In other words, the risk of emissions of HFCs as well as other types of fluorocarbons remains unresolved, unless appropriate downstream measures are taken to deal with the bank.

To address the issue of the fluorocarbons bank, Japan launched the Initiative on Fluorocarbons Life Cycle Management (IFL) at COP25 of the United Nations Framework Convention on Climate Change (UNFCCC) in Madrid, Spain, and as of December 2021, 13 member countries and international organizations[3] have engaged in domestic and international collaborative efforts. The IFL promotes controlling fluorocarbons throughout their life cycle, including refrigerant leakage during equipment use and discharges at the time of equipment retirement or replacement. The IFL focuses on institutionalizing the life cycle management of fluorocarbons in government policies, and catalyzing stakeholders such as the private sector and international development partners to build relevant infrastructure, spur innovation, and create sustainable economic growth and quality jobs. Also, Germany has contributed by developing a global roadmap on ODS bank management and supporting some countries in estimating their national ODS banks and future waste streams. Supported by the Kigali Cooling Efficiency Programme (KCEP) and the United Nations Development Programme (UNDP), developing countries like Brazil, Colombia, Ghana and others have introduced positive policy measures and demonstrated projects to control fluorocarbons with life cycle management perspectives.

These efforts have helped draw attention to the importance of the life cycle management of fluorocarbons. The Climate and Clean Air Coalition to reduce Short-Lived Climate Pollutants (CCAC), through the Efficient Cooling Initiative (ECI), has strengthened collaboration with the IFL. Under the Cooling Sector Engagement Strategy, the CCAC aims to raise high-level global awareness of the relevance of the cooling sector in combating climate change (including by reducing the need for cooling) and mobilize political support for ambitious actions and the provision of finance beyond what is provided by the Multilateral Fund of the Montreal Protocol to help developing countries transition towards climate-friendly cooling as a goal for 2025.

The Resource Book for Life Cycle Management of Fluorocarbons has been published for the purpose of raising global awareness and encouraging appropriate treatment of fluorocarbons not only by upstream but also downstream measures. It showcases examples of policy measures relevant to the life cycle management of fluorocarbons in their respective stages (refrigerant production and import, appliance

[3] Chile, France, Japan, Maldives, Mongolia, New Zealand, Philippines, Singapore, United Kingdom, Viet Nam, the World Bank, the Asian Development Bank (ADB), the Climate and Clean Air Coalition (CCAC), and the United Nations Industrial Development Organization (UNIDO).

manufacturing and import, installation of appliances, recovery of refrigerants, recycling and destruction, as well as cross-cutting measures).

Photos: COP25 the launch ceremony of the Initiative on Fluorocarbons Life Cycle Management

2. Concept of life cycle management of fluorocarbons

(1) Concept of life cycle management

Controlling fluorocarbon emissions contributes to both stratospheric, ozone and climate protection. Taking only upstream measures for phasing down/out the production and consumption of fluorocarbons is not sufficient to reduce the amount of refrigerants released into the atmosphere. The issues remain, as high-GWP refrigerants continue to leak during the use of equipment and to be discharged at end of life. For the global reduction of HFC emissions, the life cycle management approach highlights the importance not only of selecting energy efficient equipment with environmentally superior refrigerants, but also addressing problems of leakage and release into the atmosphere at all stages in the life cycle, including use, collection and destruction of refrigerants

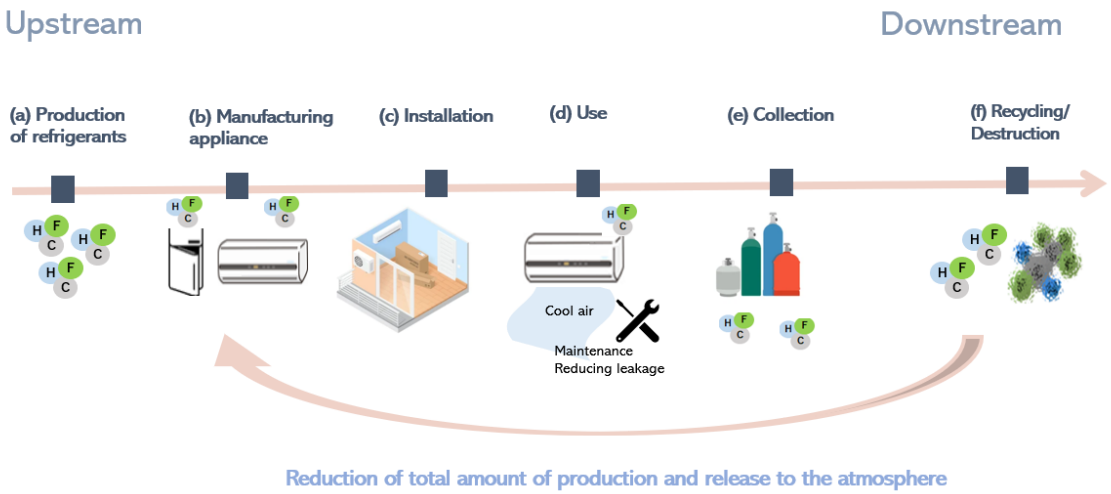


Figure 1: Stages in the life cycle of fluorocarbons

(2) Stages in the life cycle

Life cycle management emphasizes a comprehensive approach throughout the different life stages of fluorocarbons and cooling appliances. In some cases, a single policy measure is introduced, and in others, two or more measures function in combination. Refrigerant management requires specific technical considerations, bearing in mind the economic, social and environmental impacts of the respective life stages. There follows a general explanation of the life cycle stages to give an overall picture.

(a) Production and/or import of refrigerants

In general, regulations can be applied to restrict, encourage or discourage the choice of certain refrigerants, as well as enforcing quota and registration requirements on producers and importers, including tracking the appropriate downstream measures such as collection and destruction. For those importing refrigerants, these measures are applied as part of import control.

(b) Manufacturing and/or import of new and used appliances containing obsolete ODS or HFC refrigerants

As in (a) above, regulations and other types of measures are applied at the time of manufacturing appliances containing refrigerants, such as air conditioners and refrigerators (e.g. introducing natural or low GWP refrigerants, etc.). Also, if ODS or HFC refrigerants are imported as part of appliances, the control measures are applied to those products.

(c) Installation of appliances

Proper installation of an appliance is key to avoiding unnecessary life cycle leakage of refrigerants. In this regard, there are best practice and quality control standards for installing appliances, including proper placement of outside heat exchanges to minimize energy use and length of refrigerant lines. Also, as an upstream measure, the choice of low GWP refrigerants, natural refrigerants or next-generation refrigerants offering superior life cycle climate performance (LCCP) can be promoted, taking into account leakage and energy efficiency.

(d) Use of appliances

Preventive maintenance, including leak detection, is a proven way to avoid unnecessary leakage of refrigerant, and has the side benefit of maintaining the optimal charge for energy efficiency. Preventive actions include training, best practices and quality control. In some countries, a mandatory system to monitor leakage has been introduced.

(e) Collection of refrigerants

At the end of life of appliances, refrigerants should be collected for proper recycling or destruction, to avoid releases into the atmosphere. In some countries, collection is an obligation for appliance users, and designated technical regulations as well as payment of the costs are prescribed. Some countries have introduced a refrigerant deposit system to pay for ultimate refrigerant recycling and destruction costs. As a certain level of technique is required to practice collection, a licensing system is applied to verify the technicians' qualifications. The appliance itself should be disassembled and the materials collected should be recycled so that inefficient used cooling appliances are not redeployed.

(f) Recycling and destruction

After used refrigerants are collected, some of them can be recovered for recycling. Other refrigerants need to be destroyed in processes such as local cement kilns. Such processes should also be regulated by law and meet certain standards of safety and technical efficiency. Consideration of the cost allocation is important. In this regard, various business and institutional models for supporting recycling and destruction are implemented. For example, some countries have introduced an obligatory fee collection system, and others have developed schemes to incentivize refrigerant destruction with a carbon crediting mechanism.

(g) Cross-cutting actions

The life cycle management of fluorocarbons can also be introduced and implemented in combination with, or as part of, other policy measures, such as promotion of energy efficiency and efficient use of resources including material recycling. By integrating these efforts, policy measures are expected to deliver multiple benefits, with more efficient and effective interventions.

(3) Various formats of policy measures

To implement life cycle management of fluorocarbons, there are various formats of policy measures available.

Regulations are a commonly used format to introduce obligations of key stakeholders (e.g. refrigerant producers, manufacturers, importers, users, chemical waste managers, etc.). By setting legally binding rules and procedures, governments oblige those stakeholders to comply with bans on specific substances, import quotas and other requirements.

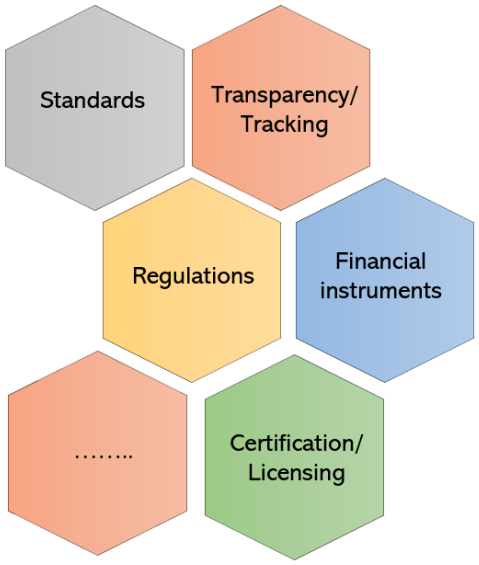


Figure 2: Various formats of policy measures

Standards are introduced for ensuring the quality or quantity of products and services. Standards and specifications clarify the technical requirements and procedures which the key stakeholders need to follow.

Transparency/tracking is an approach to visualize the stakeholders' activities and enable monitoring of their compliance with requirements, such as the appropriate treatment of fluorocarbons. This may sometimes involve a registration system with reporting requirements.

Certification/licensing is useful in ensuring the stakeholders' activities comply with the requirements of laws, regulations, and standards as above. One common example is the certification of the authorized technicians of providers of fluorocarbon treatment services.

Financial/fiscal instruments involve providing incentives (by subsidies) and disincentives (by taxation and fees) leading to reduction in, or choices of, certain refrigerants. These are also used to collect and cover the cost of final treatment of refrigerants, such as through a deposit system. In addition, there are efforts to mobilize private investment for reducing fluorocarbons by linking it to the carbon market. Extended producer responsibility, and financial obligations imposed on actors throughout the life cycle, particularly refrigerant producers and appliance manufacturers, can be also regarded as financial measures.

These are not necessarily implemented as standalone measures. In many cases, a number of policy measures are designed to function together. Actions leading to behavioural change ('nudging') are also useful. In introducing policy measures, policymakers choose the ones that are suitable for implementation

in their respective national circumstances, and that ensure equitable distribution of financial and operational responsibility.

3. How to use the Resource Book

(1) Case studies of policy measures at different stages

In this Resource Book, case studies are provided as Good Practices along with different stages of fluorocarbons management as shown in Figure 3. Cases are selected as representative of the respective stages.

Special attention is paid to the value of capacity development in developing countries. In this regard, cases have been selected with a view to achieving a balance between developing and developed countries.

Approximately 2-5 cases per life stage of fluorocarbons are available (in total 22 cases).

Life stages of management	Case study examples
Production/import of refrigerants	Reduced tax for recovered fluorocarbons (Spain) , Registration system of fluorocarbons users (Malaysia),
Manufacturing/import of appliances	Conversion of HCFC to non-ODS alternatives (Bangladesh etc.) Significant New Alternatives Policy listing up alternative refrigerants (USA), Ban on appliances with specific types of refrigerants (EU), Measures for designated products (Japan)
Installation of appliances	Introducing energy efficiency standards and incentives on refrigerating appliances(Ghana), Subsidy program for natural refrigerant equipment(Germany)
Use of appliances	Registration of appliances (Philippines), National qualification framework for maintenance service providers (Indonesia), Training and certification (EU) ,Tracking of appliances (Slovakia),
Collection of refrigerants	Obligatory collection of refrigerants (Japan), End-user deposit system (Denmark), Refrigerants take back program (Australia)
Recycling/ destruction	Regulation on destruction (Canada), EoL management (Nigeria), Expanded Producers Responsibility (Brazil etc.), Product stewardship (New Zealand), Incentives with carbon crediting mechanism (Thailand and Viet Nam)
Cross-cutting actions	Synergy effect of bulk procurement of EE products, stop dumping and collection and destruction of fluorocarbons (Brazil and Morocco)

Figure 3: Case studies of policy measures at the respective life stages of fluorocarbons management

(2) Good practices in policy measures at different stages

The Resource Book explains, in the format below, the policy measures for life cycle management of fluorocarbons.

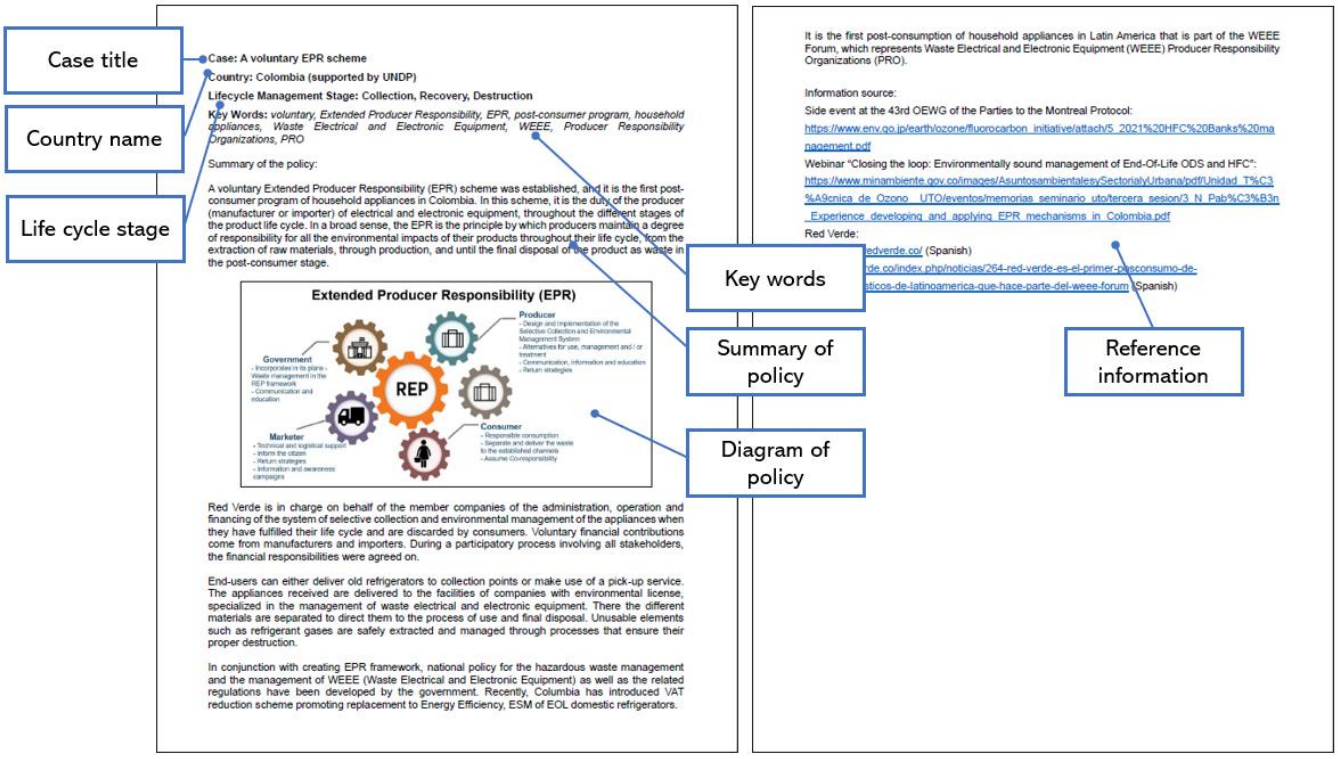


Figure 4: Contents of case studies

Each case study contains the case title, country name, and life cycle stage of fluorocarbons management. 'Key words' identify the major concepts for readers before they read the case. 'Summary of policy' explains the background, objectives, activities implemented and achievements in a qualitative and quantitative manner. 'Diagram of policy' provides a visual image of elements of the policy measures, and 'Reference information' lists the sources of information, which readers of the Resource Book may wish to further consult for more in-depth study.

4. Good Practices

(a)	Production and/or import of refrigerants	
Case 1	Tax on fluorinated gases	Spain
Case 2	Importer/exporter licence and national customs codes	Malaysia
(b) Manufacturing and/or import of appliances containing refrigerants		
Case 1	Conversion from HCFC to non-ODS alternative materials	Bangladesh, Swaziland, and Mexico (supported by UNDP)
Case 2	Significant New Alternatives Policy (SNAP) Programme	United States
Case 3	EU F-gas regulation bans for new products and appliances	EU
Case 4	Designated products scheme	Japan
(c) Installation of appliances		
Case 1	Introducing energy efficiency standards and incentives on refrigerating appliances and new actions to stop dumping of new and used cooling appliances containing obsolete ODS and HFC refrigerants	Ghana
Case 2	Subsidy programme for natural refrigerant appliances	Germany
(d) Use of appliances		
Case1	Registration of service providers of ODS-using appliances	Philippines
Case 2	National qualification framework and certification of work competence for RAC technicians	Indonesia

Case 3	Training and certification for personnel who service appliances or recover refrigerants	EU
Case 4	Electronic system links training and certification to reporting and data processing	Slovakia
Case 5	Rebate System on HFC/PFC tax	Norway
(e) Collection of refrigerants		
Case 1	Obligatory collection of refrigerants	Japan
Case 2	Danish Refrigerant Industry Environmental Scheme (KMO)	Denmark
Case 3	Refrigerant take back programme	Australia
(f) Recycling and destruction		
Case 1	Regulations regarding destruction of HCFCs and HFCs	Canada
Case 2	End-of-life management of Fluorinated Gases	Nigeria
Case 3	Voluntary Expanded Producers Responsibility (EPR) scheme	Colombia
Case 4	Product Stewardship Scheme (Voluntary Industry Agreement)	New Zealand
Case 5	Destruction of HFCs by the Joint Crediting Mechanism (JCM)	Thailand and Vietnam with Japan
(g) Cross-cutting measures		
Case 1	Synergy effect of bulk procurement of EE products and collection and destruction of fluorocarbons	Brazil and Morocco

(a) Production and/or import of refrigerants

Restricting the production and import of fluorocarbons is an effective strategy to achieve reduction of fluorocarbon use and emissions. Such restrictions have commonly been implemented in many countries. In addition to CFCs and HCFCs, which were phased out in developed countries and are in the course of phase-out in developing countries under the Montreal Protocol, many countries have begun to implement measures against HFCs. Control measures such as import/export licensing systems and quotas are adopted to respond to the obligations under the protocol, but the methods implemented can vary between countries, with some countries implementing import/export bans while others are using financial measures such as tax. In the EU, there is a quota allocation mechanism for companies producing or importing HFCs under the EU F-gas regulation.

In this chapter, the examples from Spain and Malaysia are presented. Spain has a tax on high GWP refrigerants with reduced tax rates for recycled and reclaimed refrigerants, and Malaysia restricts the import of HCFCs and HFCs by approving and registering every importer.

Case 1	Tax on fluorinated gases	Spain
Case 2	Importer/exporter licence and national customs codes	Malaysia

Case 1: Tax on fluorinated gases

Country: Spain

Lifecycle Management Stage: Production and/or import of refrigerants

Format of Policy Measure: Financial instruments

Key Words: *tax, GWP, lower tax rate, tax return*

Summary of the policy:

Spain's tax on fluorinated greenhouse gases entered into force in January 2014 through Article 5 of Law 16/2013. It aims to encourage the use of alternative low GWP refrigerants and improve the maintenance and recycling practices for existing appliances. The tax applies to: 1. Initial sale or delivery of F-gases after production, import (from third countries) or acquisition (from the EU), and 2. The consumption of F-gases by users, including producers, importers, and purchasers.

The tax covers F-gases with a GWP greater than 150 and it includes HFCs, PFCs and SF_6. The tax rates are set based on the GWP of each gas, with a maximum of EUR 100/kg. Some examples of tax rates are shown in the table below. For recycled and reclaimed F-gases, a lower tax rate is applied. Also, when the refrigerant is destroyed or recycled, the tax is returned to the final consumers who bore the tax.

After the introduction of the tax, the emissions of F-gases decreased from 16.9 kton CO_2-eq in 2014 to 5.9 kton CO_2-eq in 2018 (emissions in the category 'substitutes for substances that deplete the ozone layer'). The cause of this reduction is said to be changing behaviour in the refrigeration and air conditioning sectors. In these sectors, alternative refrigerants such as CO_2 and NH_3 were promoted for new installations, and for existing installations, measures such as use of automatic leakage control systems and retrofit of lower GWP refrigerants were implemented.

Examples: Tax rate for some selected gases

F-gases	GWP	Tax rate (EUR/kg)
HFC-23	14800	100
HFC-32	675	10.13
HFC-134a	1430	21.45
HFC - 143a	4470	67.05

Information source:

Institute of European Environmental Policy report
https://ieep.eu/uploads/articles/attachments/a3977c6e-7f07-4da9-bae2-ed3e060593da/ES%20Fluorinated%20Gases%20final.pdf?v=63680923242

UNFCCC document, 'A compilation of questions to – and answers by – Spain'
https://unfccc.int/sites/default/files/resource/SBI50_ESP_MA_QA.pdf

UNFCCC FCCC/TRR.3/ESP
https://undocs.org/FCCC/TRR.3/ESP

Iberley 'Impuesto sobre los Gases Fluorados de Efecto Invernadero' (Spanish)
https://www.iberley.es/temas/impuesto-sobre-gases-fluorados-efecto-invernadero-20551?__cf_chl_captcha_tk__=pmd_3I3aHETyQuGRwUaiphybZBu.IH3Vw709Htozv6Fx8CE-1631684732-0-gqNtZGzNAzujcnBszQbR

Case 2: Importer/exporter licence and national customs codes

Country: Malaysia

Lifecycle Management Stage: Production and/or import of refrigerants

Format of Policy Measure: Regulations

Key Words: *import and export*

Summary of the policy:
Malaysia ratified the Kigali Amendment to the Montreal Protocol in October 2020. All the HFCs used in Malaysia are imported since HFCs are not produced in the country. Parties to the Montreal Protocol must establish and implement a system for licensing the import and export of HFCs. A licensing system and customs codes assignment for multiple HFCs can be an effective method to accurately identify the volume of Malaysia's HFC baseline consumption. An accurate baseline is necessary to consider the future strategy for decreasing HFCs. In Malaysia, in addition, national customs codes were allocated for individual types of HFCs, though the original HS code under the Harmonized Commodity Description and Coding System is not allocated for individual types of HFCs.

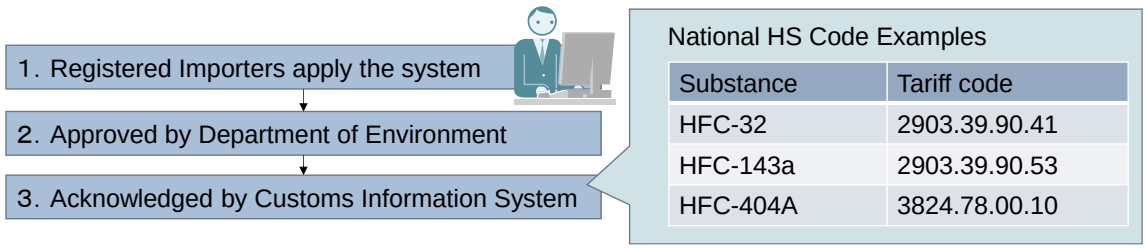
In 2020, a new amendment to the Customs (Prohibition of Imports) Order 2020 and Customs (Prohibition of Exports) Order 2020 was released. Starting from 1 March 2020, the import/export of HFCs must be approved through an Approval Permit (AP) system.

As a result, the import/export of HCFCs and HFCs in Malaysia is controlled by the Government of Malaysia through the AP system which is managed by the Department of Environment (DoE) of Malaysia. All importers and exporters must be registered with the DoE. Currently, 14 companies involved in import/export of HCFCs and 47 companies involved in import/export of HFCs are registered with the DoE.

Developing countries seeking further assistance from the Multilateral Fund for the HCFC phase-out beyond 2012 must provide confirmation that they have an enforceable national system of licensing and quotas in place for HCFC imports. Therefore, quota allocation for HCFC imports was introduced in 2012, so consumption of HCFCs is decreasing in Malaysia.

The Customs (Prohibition of Imports/ Export) Order 2017 (effective on 1 April 2017) states that the import into Malaysia of any goods containing CFCs (substances covered by the Montreal Protocol) is absolutely prohibited (Schedule 1, item No. 16).

The E-permit application process:



Information source:

Control of Import & Export of Hydrofluorocarbon (HFC)

https://www.doe.gov.my/portalv1/en/info-umum/info-protokol-montreal/kawalan-import-dan-eksport-hydrofluorocarbon-hfc/327903

List of importer/exporters

https://www.doe.gov.my/portalv1/wp-content/uploads/2017/06/Senarai-Pengimport-Pengeksport-HCFC-dan-HFC-2020.pdf

(b) Manufacturing and/or import of appliances containing refrigerants

Several countries and regions implement measures or programmes to limit the amount of fluorocarbons in the market by managing the manufacturing or import of air conditioning and refrigeration appliances. There are a variety of methods in this category, and the stringency of the measures varies widely, depending on the situation of the country or region.

For example, in the EU, bans on new appliances are in place for several types of appliance using HFCs. Other than bans and restrictions, there are other methods such as that of Japan, where a measure is in place to lower the average GWP of appliances per manufacturer. In the US, the SNAP programme lists acceptable substitutes for ODS. In addition to these measures implemented by governments, this chapter describes programmes supported by UNDP to convert HCFC into cleaner alternatives in Bangladesh, Swaziland and Mexico.

Case 1	Conversion from HCFC to non-ODS alternative materials	Bangladesh, Swaziland, and Mexico (supported by UNDP)
Case 2	Significant New Alternatives Policy (SNAP) Programme	United States of America
Case 3	EU F-gas regulation bans for new products and appliances	EU
Case 4	Designated products scheme	Japan

Case 1: Conversion from HCFC to non-ODS alternative materials

Country: Bangladesh, Swaziland, and Mexico (supported by UNDP)

Lifecycle Management Stage: Refrigerant Production, Export, Manufacturing

Format of Policy Measure: Pilot Programme

Key Words: *HCFC-141b, non-ODS, low-GWP, insulation foam, cyclopentane, methyl formate, methylal, MP-MLF, ExCOM, UNDP, UNEP, SADC, LVC*

Summary of the policy:
In Bangladesh, HCFC-141b was used in manufacturing insulation foam for domestic refrigeration appliances, amounting to 27% of total national ODP consumption. The manufacturing company and the government requested UNDP assistance to convert HCFC-141b technology to a non-ODS one under the Montreal Protocol.

The company selected cyclopentane as the non-ODS and low-GWP alternative foam blowing agent following a detailed evaluation of available technology options considering long-term sustainability. The project was approved by the Montreal Protocol Multilateral Fund Executive Committee (MP-MLF ExCom) at its 62nd Meeting in 2010, and the project was implemented during 2011-2013, covering the installation of new foaming machines, redesign of manufacturing lines including safety systems, training and safe manufacturing operational techniques.

The project phased out an annual consumption of 183.7 tons of HCFC-141b. The GWP impact of using cyclopentane instead of HCFC-141b is an annual reduction in GHG emissions of over 130,000 tons of CO_2 equivalent.

Similar projects were implemented in Swaziland, Mexico, India and other countries.

The project in Swaziland, the rigid PU foam conversion process from HCFC-141b to cyclopentane as a blowing agent which has zero ODP and low-GWP, was approved by the MP-MLF ExCom at its 63rd Meeting in 2011. The products have been exported to member countries of the Southern African Development Community (SADC), thus the project has positively impacted the neighbouring markets including non-LVC (low volume consuming) countries. 100 percent ODS-free production was announced in 2015 supported by UNDP, UNEP and Germany's GIZ, and it is an example of the best practice that multilateral cooperation can achieve.

The project in Mexico to replace HCFC-141b use in foams for shoe sole production to non-ODS was also approved by the MP-MLF ExCom. The pilot project demonstrated the viability of using methyl formate and methylal as a replacement for HCFC-141b in the production of shoe soles, and was completed in 2011.The new technology is also lower in cost and has easier applications, so that the project has helped to meet Mexico's ODS phase-out targets while simultaneously minimizing negative economic and social impacts of the industrial reconversion on local industries.

Information source:
Protecting the Ozone Layer and Reducing Global Warming - Results, Case Studies and Lessons Learned from UNDP's Montreal Protocol Programme -:
https://www.undp.org/publications/protecting-ozone-layer-and-reducing-global-warming
Proposal of the 62nd Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF):
http://www.multilateralfund.org/62/English%20Document/1/6220.pdf
Proposal of the 63rd Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF):
http://www.multilateralfund.org/63/English%20Documents%20Lib/1/6352.pdf

Case 2: Significant New Alternatives Policy (SNAP) programme

Country: United States

Lifecycle Management Stage: Manufacturing and/or import of appliances containing refrigerants

Format of Policy Measure: Standards

Key Words: *Acceptable substitutes for ozone-depleting substances*

Summary of the policy:
The SNAP programme was established under Section 612 of the Clean Air Act (CAA), which was enacted to limit the use of CFCs and HCFCs following the 1987 Montreal Protocol. The SNAP programme identifies and evaluates substitutes for ozone-depleting substances. It publishes lists of these substitutes, and by clearly listing acceptable substitutes, promotes the use of substitutes with less risk to human health and the environment. According to Section 612 of the CAA, the United States Environmental Protection Agency (USEPA) must prohibit the use of a substitute where USEPA has determined that there are other available substitutes that pose less overall risk to human health and the environment. The SNAP programme is designed for:

- Identifying and evaluating substitutes in end-uses that have historically used ozone-depleting substances (ODS)
- Looking at the overall risk to human health and the environment of both existing and new substitutes,
- Publishing lists of acceptable and unacceptable substitutes by end-use,
- Promoting the use of acceptable substitutes; and
- Providing the public with information about the potential environmental and human health impacts of substitutes.

To determine the acceptability of substitutes, USEPA performs an analysis of risks to human health and the environment from the use of various substitutes in different industrial and consumer uses that have historically used ODS. Acceptable or unacceptable substances are listed on the EPA website, and the list evolves according to the decisions by the USEPA. Below are some examples of refrigerants used in remote condensing units.

Examples of substitutes for remote condensing units

Substitute	Trade Names	Retrofit/ New	ODP	GWP	Listing status
HCFC-22		R/N	0.055	1,810	**Acceptable**
R-404A	SUVA HP-62	R/N	0	3,920	**Unacceptable** in retrofit appliances as of 20 July 2016. **Unacceptable** in new appliances as of 1 January 2018.
R-410A	AZ-20, Suva 9100, Puron	N	0	2,090	**Acceptable**

Information source:

USEPA, SNAP Programme webpage
https://www.epa.gov/snap
USEPA webpage, 'Overview of SNAP'
https://www.epa.gov/snap/overview-snap

Case 3: EU F-gas regulation bans on new products and appliances

Country and/or region: EU

Lifecycle Management Stage: Manufacturing and/or import of appliances containing refrigerants

Format of Policy Measure: Regulations

Key Words: *bans on new products and appliances*

Summary of the policy:

To control emissions from fluorinated gases, the EU adopted the F-Gas Regulation (842/2006) in 2006. Under the EU F-gas regulation, several measures were put in place, including bans on new products and appliances. Under this measure, the use of F-gas is banned in many new types of products and appliances where less harmful alternatives are widely available.

The bans affect the following products and appliances: a) Refrigeration, b) Air conditioning, c) Fire protection, d) Aerosols, e) Foam insulation, and f) Others (including windows, footwear and car tyres). The ban only applies to new products and appliances, and the table below shows the details of the ban. According to the European Commission, F-gas emissions in the EU have stabilized at 2010 levels since the adoption of the F-Gas regulation. The new F-gas regulation (517/2014), which replaced the 2006 Regulation, is expected to reduce F-gas emissions from the EU by two-thirds by 2030 compared with 2014 levels.

Bans for new products and appliances

Market Sector	Product Description	Scope of banned F-Gases	Start Date[1]
Refrigeration	Non-confined direct evaporation systems	All HFCs and PFCs	2007
	Domestic refrigerators and freezers[2]	HFCs with GWP > 150	2015
	Refrigerators and freezers for commercial use (hermetically sealed)[3]	HFCs with GWP > 2,500	2020
		HFCs with GWP > 150	2022
	All stationary refrigeration appliances[4]	HFCs with GWP > 2,500	2020
	Multipack central systems for commercial use with a cooling capacity above 40kW [5]	F-Gases with GWP > 150	2022
Air-conditioning	Moveable, hermetically sealed air conditioning	HFCs with GWP > 150	2020
	Single split systems containing 3 kg or less	HFCs with GWP > 150	2025
Insulating foam[6]	One component foam aerosols	F-Gases with GWP > 150	2008
	Extruded Polystyrene foam (XPS)	HFCs with GWP > 150	2020
	Other foams (including polyurethane)	HFCs with GWP > 150	2023
Fire protection	Systems using PFCs	All PFCs	2007
	Systems using HFC 23	HFC 23	2016
Aerosols	Novelty aerosols[7] and signal horns	HFCs with GWP > 150	2009
	Technical aerosols[8]	HFCs with GWP > 150	2018
Other applications	Non-refillable containers for bulk product	All F-Gases	2007
	Windows for domestic use	All F-Gases	2007
	All other windows	All F-Gases	2008
	Footwear	All F-Gases	2006
	Tyres	All F-Gases	2007

1 All start dates from 2015 onwards are 1 January of the year specified

2,3 This ban includes both refrigerant and foam blowing agents

4-8: Some exemptions and detailed conditions apply

Information source:

EC website

https://ec.europa.eu/clima/policies/f-gas/legislation_en

https://ec.europa.eu/clima/policies/f-gas_en

EU F-Gas Regulation Guidance Information Sheet

http://www.gluckmanconsulting.com/wp-content/uploads/2014/12/IS-26-Ban-Summary.pdf

Case 4: Designated products scheme

Country: Japan

Lifecycle Management Stage: Manufacturing and/or import of appliances containing refrigerants

Format of Policy Measure: Regulation

Key Words: *target GWP value, designated products*

Summary of the policy:
In order to manage the emissions from fluorinated gases throughout the lifecycle of refrigerants, the Act on Rational Use and Proper Management of Fluorocarbons was implemented in 2015. Under this Act, the 'Designated products scheme' aims to reduce the amount of refrigerant contained in appliances by targeting the manufacturers and importers. Manufacturers and importers of products designated by the government are required to replace high-GWP products with products using low-GWP or non-fluorocarbon alternatives. A target average GWP value and target year is set for each category of product, and the manufacturers and importers are required to make sure that the average GWP of each shipped product meets the target for each company by the target year. Designated products and their targets are shown in the table below. The target GWP value is set, considering the lowest GWP (weighted average by volume) among the designated products in the market in Japan. Factors such as safety, energy efficiency, affordability, etc. are also considered. Products are added to the designated products list depending on the availability of alternatives. Below are some examples of the designated products and GWP targets as of 2021.

Targets for designated products:

Designated products		Refrigerant in use (GWP)	Target value	Target year
Room air-conditioning		HFC- 410A (2090) HFC- 32 (675)	750	2018
Commercial air-conditioning (for offices and stores)	Category 1*	HFC- 410A (2090)	750	2020
	Category 2*	HFC- 410A (2090)	750	2023
	Category 3*	HFC- 134a (1430) HFC- 245fa (1030)	100	2025
Automotive air-conditioning (except those for 11 or more passengers.)		HFC- 134a (1430)	150	2023
Condensing unit and stationary refrigerating units (except equipment with rated capacity of the compressor of 1.5kw or lower.)		HFC- 404A (3920) HFC- 410A (2090) HFC- 407C (1774) CO2 (1)	1500	2025
Cold storage warehouses (for more than 50,000m3, new facilities)		HFC- 404A (3920) Ammonia (lower than 10)	100	2019
Rigid Polyurethane Foam in Refrigeration and Freezers		HFC- 245fa (1030) HFC- 365mfc(795)	100	2024
Rigid Polyurethane Foam in Cooling and freezing Vending Machines			100	2024
Rigid Polyurethane Foam Undiluted Liquid in Residential buildings			100	2020
Rigid Polyurethane Foam Undiluted Liquid in Non-Residential buildings			100	2024
Rigid Polyurethane Foam in Insulating (Applicable to those using rigid Polyurethane foam for insulation)			100	2024
Aerosol Spray Cans (except those requiring non-flammability)		HFC- 134fa (1430) HFC- 152a(124) CO2 (1), DME(1)	10	2019

Category 1: Under 3 refrigeration tons of cooling capacity, excluding floor type units
Category 2: Over 3 refrigeration tons of cooling capacity, excluding floor type units and category 3
Category 3: Central air-conditioning units using centrifugal chillers

Information source:
Act on Rational Use and Proper Management of Fluorocarbons pamphlet
https://www.env.go.jp/en/earth/ozone/laws/ozone4.pdf
Document by MoE Japan
https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/200928_MOEJ%20presentation%20for%20SPD.pdf

(c) Installation of appliances

Installation of appliances is often related to incentives for consumers. Replacement of old technologies that use ODP or high GWP refrigerants tends to be more expensive, and related products are sometimes less competitive in the market. To address these issues, governments and international programmes aimed at consumers and businesses have introduced products which are environmentally friendlier by setting targets or providing incentives. Apart from government policy measures, the private sector manufacturers and cooling industry associations sometimes provide manuals for service providers to meet standards of installation of appliances.

Case 1	Introducing Energy Efficiency Standards and Incentives on Refrigerating Appliances and new actions to stop dumping of new and used cooling appliances containing obsolete ODS and HFC refrigerants	Ghana
Case 2	Subsidy programme for natural refrigerant appliances	Germany

Case 1: Introducing Energy Efficiency Standards and Incentives on Refrigerating Appliances

Country: Ghana

Lifecycle Management Stage: Installation of appliances

Format of Policy Measures: Standard setting

Key Words: *Mandatory Efficiency Performance Standards, incentives, Public Private Partnership (PPP)*

Summary of the policy:

In Ghana, the used cooling appliance market share in 2005 was 80%, mostly imported from Europe. 30% of the annual total of imported used cooling appliances went to waste because of inefficient appliance usage, and almost all of the used cooling appliances used CFCs and HCFCs, which cause ozone layer depletion and global warming. To reduce CFC and HCFC emissions from new and used cooling appliances and to enhance energy efficiency, Ghana introduced Mandatory Efficiency Performance Standards (MEPS) and a labelling regime, and incentives for new lower and non-ODP/GWP refrigerating appliances. Furthermore, on behalf of Africa, Ghana introduced a CRP at the 2021 Meeting of the Parties to the Montreal Protocol asking for a Decision to help stop dumping of new and used cooling appliances containing obsolete ODS and HFC refrigerants.

1) Mandatory Efficiency Performance Standards (MEPS)

Energy Efficiency (EE) regulations on cooling appliances were introduced as follows.

- EE Standards and Labelling (Non-Ducted Air-Conditioners and Self-Ballasted Fluorescent Lamps) Regulations, 2005 (LI 1815)
- EE Standards and Labelling (Household Refrigerating Appliances) Regulations, 2009 (LI 1958)
- EE (Prohibition of Manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigerator, Used Refrigerator-Freezer, Used Freezer and Used Air-Conditioner) Regulations, 2008 (LI 1932)

Along with these regulations, the dismantling process has been improved through public private partnership (PPP) and the separation of components and scrapyard operations.

2) Incentives on new refrigerating appliances

To promote the phase-down of CFCs/HFCs and the introduction of new energy-efficient appliances, an incentive system on refrigerating appliances was introduced (anyone purchasing a new energy efficient appliance is issued with a discount coupon).

The results of MEPS and Incentives on Refrigerating Appliances showed a significant drop in energy use on refrigerating appliances and enhancement of replacement of old fridges (See Fig.5 and 6).

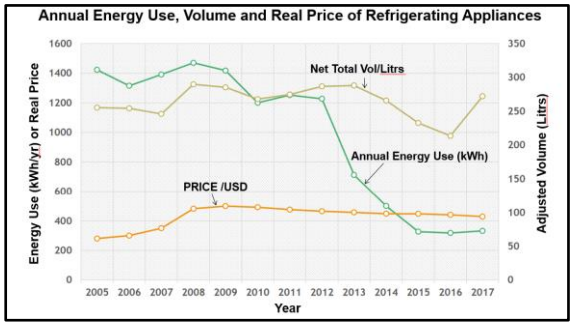


Fig. 5 Results of MEPS & Incentives on Refrigerating Appliances – Reduced consumption

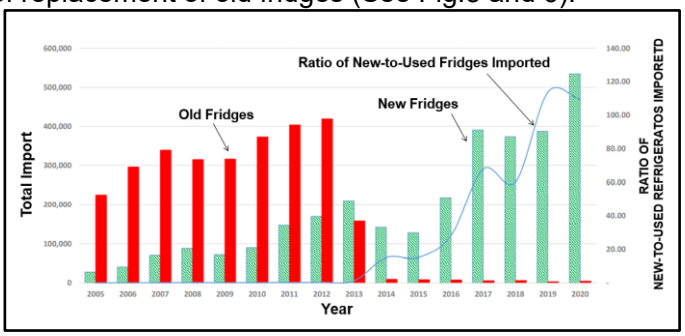


Fig. 6 Evidence of market transformation through MEPS

Over 10,000 used and inefficient refrigerating appliances have been replaced with the same number of new and efficient ones. Over 47,000 illegally imported refrigerators and 11,000 ACs have been confiscated and dismantled. 1,500kg of CFC have been recovered and 1.1 million tons of CO_2 have been saved.

Information sources:
Side events at the 43rd OEWG of the Parties to the Montreal Protocol:
https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/4_Mr.%20Kofi%20Agyarko_OEWG%2043%20Montreal%20Protocol%20Final%202.pdf
https://wedocs.unep.org/bitstream/handle/20.500.11822/30731/AMCEN_17Omnibus.pdf?sequence=7&isAllowed=y

African CRP asking for help to stop dumping of inefficient new and used cooling appliances containing obsolete ODS and HFC refrigerants:
https://ozone.unep.org/system/files/documents/COP-12-II-3-Add-1_MOP-33-3-Add-1E.pdf

Case 2: Subsidy programme for natural refrigerant appliance

Country: Germany

Lifecycle Management Stage: Installation of appliances

Format of Policy Measure: Financial instruments

Key Words: *natural refrigerants, subsidy*

Summary of the policy:
The Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) started a subsidy programme in 2008 to accelerate the adoption of natural refrigerants in refrigeration and air conditioning technologies. The programme aims to contribute to the government's climate protection goals by reducing emissions through increased energy efficiency and reduction of fluorinated gases.

The funding is provided to companies, not-for-profit organizations, local authorities, special purpose associations, self-employed businesses, schools, hospitals, and church organizations. In terms of the technologies covered by this programme, in addition to stationary refrigeration and air conditioning systems, vehicle air conditioning systems in buses and trains are also covered. Parties interested can apply for funding through the website of the German Federal Office of Economics and Export Control (BAFA).

The amount of funding is calculated using different formulas depending on the appliance category*. BAFA provides a funding calculation tool on its website so that applicants can calculate the expected funding. The maximum of funding is set at EUR 150,000 and 50% of eligible expenditure.

According to the BMU, 3,500 refrigeration and air conditioning systems in companies and residential buildings were funded by this programme in the period between 2008 and the end of 2020. The total funding provided was EUR 223 million. Of that EUR 223 million, 62% went to wholesale and retail warehouses.

*: Example of funding formula for stationary systems:

$$\mathbf{F = (A \times X^{B} + C) \times X}$$

F: Funding amount
X: Variable representing the cooling capacity, the length of refrigerated cabinets in the food trade, the storage capacity or volume.
A, B and C: Specific coefficients that depend on the type of chiller or component.

Information source:

BAFA webpage (German)

https://www.bafa.de/DE/Energie/Energieeffizienz/Klima_Kaeltetechnik/klima_kaeltetechnik_node.html

https://www.bafa.de/SharedDocs/Downloads/DE/Energie/kki_technisches_merkblatt.html;jsessionid=098488A189D4B8EE9ED7DFDAA8BABCC4.2_cid371?nn=8064164

BMU webpage (German)

https://www.klimaschutz.de/zahlen-und-fakten

(d) Use of appliances

Leakage of refrigerants occurs when appliances are in use, and monitoring and reducing such leakage are important. Maintenance is one way to minimize the leakage of refrigerants, and also serves to keep energy efficiency at a high level. Once refrigerants are in the market, they are sold many times and transferred from the original users to others in different locations. In this situation, some governments have introduced a tracking system to record changes in ownership of refrigerants, to clarify who is responsible for the appropriate treatment.

Case1	Registration of Service Providers of ODS-using Appliances	Philippines
Case 2	National qualification framework and certification of work competence for RAC technicians	Indonesia
Case 3	Training and Certification for service personnel handling fluorocarbons	EU
Case 4	Rebate System on HFC/PFC tax	Norway
Case 5	Electronic system links training and certification to reporting and data processing	Slovakia

Case 1: Registration of Service Providers of ODS-using Appliances

Country: Philippines

Lifecycle Management Stage: Maintenance, Collection, Reclamation, Reuse

Format of Policy Measure: Regulation/Registration

Key Words: *ODS*, *HCFCs, registration, service providers, DENR, POD, HPMP, MLF, CCO*

Summary of the policy:

The Philippines achieved phase-out of all ODS by 2010, except for HCFCs and MeBr for Quarantine and Pre-Shipment (QPS), with support from the MLF, since the first national programme for the phase-out of ODS was prepared in 1993, by the Philippine Ozone Desk (POD) in the Department of Environment and Natural Resources (DENR). Common uses of HCFCs in the Philippines were specified as cooling agent (HCFC-22, HCFC-123), foam blowing agent (HCFC-141b, HCFC-142b), cleaning agent/solvent (HCFC-141b, HCFC-225). DENR/POD decided to strengthen the legal infrastructure to support the implementation of the HCFC Phase-out Management Plan (HPMP).

The revised regulations under the Chemical Control Order (CCO) for Ozone Depleting Substances (ODS) (the DENR Administrative Order No. 2013-25) in 2013 mainly consist of a ban on the import of ODS, control of import of HCFCs, registration of service providers of ODS-using appliances as well as registration of importers, dealers, retailers and resellers of ODS, record keeping, a capacity-building programme, etc.

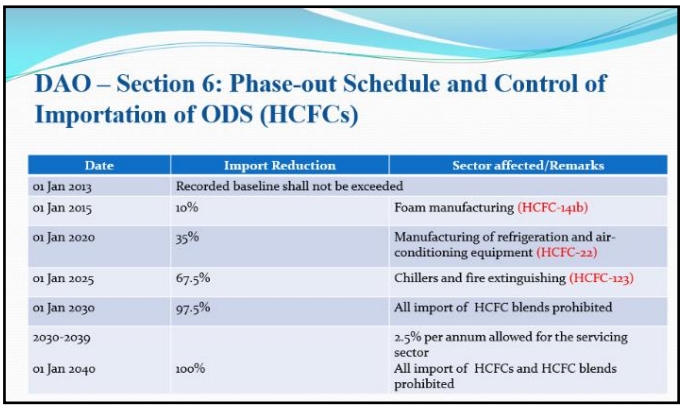
Registration and Renewal of Registration of Service Providers of ODS-using Appliances in the revised regulation under Section 10 of the DENR Administrative Order No. 2013-25 are described as follows.

- Service providers of ODS-using appliances must register with the Department through the Bureau to determine their capability in handling and working on these substances.
- Service providers should have the capability to take effective measures, including the necessary appliances, technology, training and infrastructure, for effectively handling ODS, including responsible re-use of refrigerants, minimizing their emissions, and ultimately phasing out their use by replacing ODS with substitutes or alternatives duly recognized and certified by the Department through the Bureau.
- Service providers must adhere to the good practices for handling and working with refrigerants set forth in the *Code of Practice for Refrigeration and Airconditioning* approved and adopted by the Department.
- Service providers must also participate in a system to recover, reclaim, and re-use refrigerants, which will be led by the Department.

In addition to the above requirement, a memorandum circular was issued in 2021 to implement Section 10 of the DENR Administrative Order No. 2013-25, which consists of Scope (Sec.1), Requirement for New or Renewal of Registration (Sec. 2), Duties and Responsibilities of Service Provider (Sec. 3), Monitoring, Inspection, and Good Practices (Sec. 4), Validity of Certificate of Registration (Sec. 5), etc.

By clarifying the registration system for service providers of ODS-using appliances, DENR/POD will be able to oversee the activities of the service providers and keep track of the stock and storage status of the recovered refrigerant.

With the introduction of the revised policy and regulatory framework, the Philippines achieved the phase-out target, to reduce HCFC consumption by 35% from the baseline by 2020, and the ongoing target is to achieve a 100% reduction by 2040. (See Fig. 7, Fig. 8)



DAO – Section 6: Phase-out Schedule and Control of Importation of ODS (HCFCs)

Date	Import Reduction	Sector affected/Remarks
01 Jan 2013	Recorded baseline shall not be exceeded	
01 Jan 2015	10%	Foam manufacturing (HCFC-141b)
01 Jan 2020	35%	Manufacturing of refrigeration and air-conditioning equipment (HCFC-22)
01 Jan 2025	67.5%	Chillers and fire extinguishing (HCFC-123)
01 Jan 2030	97.5%	All import of HCFC blends prohibited
2030-2039		2.5% per annum allowed for the servicing sector
01 Jan 2040	100%	All import of HCFCs and HCFC blends prohibited

Fig. 7 ODS Phase-out Schedule in the Philippines

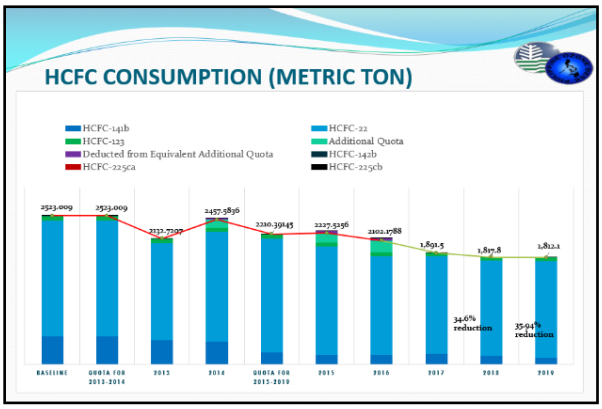


Fig. 8 HCFC Reduction Trend in the Philippines

Information source:
Revised Chemical Control Order for Ozone Depleting Substances (ODS)
(DENR Administrative Order No.2004-08):
https://chemical.emb.gov.ph/wp-content/uploads/2017/03/DAO-2004-08-CCO-ODS.pdf
Revised regulations on Chemical Control Order (CCO) for Ozone Depleting Substances (ODS) (DENR Administrative Order No.2013-25):
http://pod.emb.gov.ph/wp-content/uploads/2016/06/DAO-2013-25.pdf
Registration of Service Providers of Ozone Depleting Substances (ODS) using Appliance (Memorandum Circular No. 2021-11):
http://pod.emb.gov.ph/wp-content/uploads/2021/07/EMB-MC-2021-11.pdf
List of Registered Importers of Ozone Depleting Substances (ODS) and Its Alternative Chemicals 2020-2021:
http://pod.emb.gov.ph/wp-content/uploads/2021/08/REG_IMPORTERS_30JULY2021.pdf
List of Registered Dealers, Re-Sellers & Retailers of ODS
http://pod.emb.gov.ph/wp-content/uploads/2021/07/ODSDR2021.pdf

Case 2: National qualification framework and certification of work competence for RAC technicians

Country: Indonesia

Lifecycle Management Stage: Use of appliances

Format of Policy Measure: Certification/licensing

Key Words: *qualification, technicians*

Summary of the policy:
To prepare technicians with knowledge, skills, and the right attitude to maintaining RAC appliances and safely handling refrigerants, the government issued Ministry of Environment and Forestry decree No. 73 in 2019 on Indonesia's national qualification framework and certification of work competence for RAC technicians. There are five levels of competence for Refrigeration and Air Conditioning technicians based on the decree.

Level	**Example of competencies/requirements**
Level 1 • Assistant / Helper Technician	• Help/assist the technician in preparation of maintenance, installation and repair of RAC systems • Ability to clean indoor and outdoor AC units
Level 2 • Technician / Operator	• A minimum degree from vocational school majoring in refrigeration engineering, • At least 1 year's work experience in a related field • Ability to use maintenance appliances for servicing and changing electrical and mechanical components in the RAC system
Level 3 • AC Residential Technician • Domestic Refrigeration Technician	• At least 2 years' experience in installation, maintenance, and repair • Ability to check for refrigerant leakage and do refrigerant recycling • Ability to carry out a refrigerant filling process • Ability to install and repair a residential AC system
Level 4 • RAC Installation Technician • RAC Maintenance Technician • RAC Repair Technician	• At least 3 years' experience in commercial or industrial HVAC installation/ maintenance/repair • Recommendation letter from the employer • Ability to install RAC systems with various methods, such as flaring, swaging, brazing, etc. • Ability to conduct pressure and leakage tests, pipe vacuum, and refrigerant filling process • Ability to carry out installation, maintenance, and repair for VRF systems, commercial and industrial RAC systems • Ability to manage ammonia and flammable refrigerants
Level 5 • Senior Technician • Project Supervisor • Chief Engineer	• Competency certificate Level 4 for at least 3 years in commercial or industrial HVAC installation/maintenance/repair • Recommendation from the employer • Ability to manage technicians for the installation of RAC systems, analysis and troubleshooting, and coordinate with relevant people • Ability to do testing and commissioning for chillers, other commercial and industrial RAC systems, and reporting the progress of the project

In addition, a mobile application called the MontiR-AC was developed. By using this application, refrigerator/air conditioner technicians can receive offers of work while consumers can search for qualified technicians in their vicinity. Technicians who are eligible to get servicing work through the MontiR-AC application are technicians that have been certified by the Indonesian National Agency for Professional Certification (BNSP).

Information source:
Ministry of Environment and Forestry decree no. 73 year 2019
http://jdih.menlhk.co.id/uploads/files/P_73_2019_REFRIGERASI_DAN_TEKNISI_TATA_UDARA_menlhk_11132019084312.pdf
Montir AC Teknisi https://play.google.com/store/apps/details?id=com.dep.TeknisiAc&hl=en_US&gl=US
Montir AC Konsumen
https://play.google.com/store/apps/details?id=com.dep.MontirAcKonsumens&hl=en_US&gl=US

Case 3: Training and Certification for service personnel handling fluorocarbons

Country: EU

Lifecycle Management Stage: Maintenance, Collection, Reclamation, Reuse, Destruction

Format of Policy Measures: Regulation/Certification

Key Words: *training, certification, minimum requirement, controlled substances, CFCs, HCFCs, HFCs, ODS, fluorinated greenhouse gases, leak-check, installation, servicing, maintenance, repair, decommissioning, recycling*

Summary of the policy:
To reduce the release of controlled substances such as CFCs/HCFCs/HFCs into the atmosphere, provision should be made in the legislative system for the recycling of used controlled substances and the prevention of leakages of controlled substances. From this perspective, the EU has introduced training and certification systems for service personnel handling appliances that use controlled substances or recovering controlled substances.

According to Regulation (EC) No. 1005/2009 which controls life cycle management of ODS, EU member states shall define the minimum qualification requirements for the personnel carrying out activities such as leak-checking or recycling of the controlled substances operating refrigeration, air conditioning or heat pump appliances, or fire protection systems, etc. (Article 23: Leakages and emissions of controlled substances)

According to Regulation (EC) No. 517/2014 which controls life cycle management and reducing emissions of fluorinated greenhouse gases, EU member states shall establish or adapt certification programmes, including an evaluation system, on the basis of the minimum requirement. EU member states shall also ensure that training is available for technicians carrying out activities such as installation, servicing, maintenance, repair or decommissioning of the appliance, leak checks of the appliance, and recycling of fluorinated greenhouse gases. The certification programmes and training shall cover applicable regulations and technical standards, emission prevention, recycling of fluorinated greenhouse gases, safe handling of appliances of the type and size covered by the certificate, information on relevant technologies to replace or to reduce the use of fluorinated greenhouse gases and their safe handling. (Article 10: Training and certification)

Similar training or certification systems have been introduced in other countries such as the US, Japan, etc.

Information source:
Regulation (EC) No 1005/2009:
https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:286:0001:0030:EN:PDF
Regulation (EC) No 517/2014:
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0517

Case 4: Rebate System on HFC/PFC tax in Norway

Country: Norway

Lifecycle Management Stage: Import, Export, Manufacturing, Collection, Reclamation, Reuse, Destruction

Format of Policy Measures: Taxation

Key Words: *tax, HFCs, PFCs, rebate, refund, GWP, GWP-weighted tax, destruction*

Summary of the policy:

Since around 1990, imports of HFCs (hydrofluorocarbons) and PFCs (perfluorocarbons) have been increasing year by year in Norway, so taxation was introduced in 2003 with the aim of technological innovation that uses less HFCs/PFCs per appliance and increased use of alternative refrigerants.

The tax covers import and manufacture of pure gases in bulk, and import of all mixtures of HFCs and PFCs, both as compounds and mixed with other substances.

The tax is calculated on the basis of the net weight of the taxable gas multiplied by the GWP value of each taxable gas. If the type of HFCs or PFCs cannot be documented, the highest GWP value of the product types can be applied.

In 2004, the HFC/PFC tax rebate system was introduced. If the consumer uses an approved facility to destroy HFCs and PFCs, the tax will be refunded to the party that delivered the waste. The refund rate is the same as the tax rate. This scheme is administered by the Norwegian Environment Agency (NEA).

When the party that delivered the waste applies for the refund, an application form stating the type and amount of recovered and destroyed HFCs and PFCs will be sent from the collection company to the NEA through the destruction company. The refund will be paid by the NEA to the collection company, and the rest will be paid to the consumer after deducting expenses such as transportation.

As of 2005, it is estimated that CO_2 emissions were 280,000 tons (37%) less and total imports were 3.2 million tons (37%) less than without taxation. In addition, since the introduction of taxation, the rate of increase in imports has decreased due to technological innovations to reduce the amount of used HFCs/PFCs per appliance and increased use of alternative refrigerants.

Similar taxation systems for fluorocarbons have been introduced in Denmark, Slovenia and Spain, with the highest tax rates in Norway. In addition, only Norway has introduced the system of refunding all taxes by processing at a designated destruction facility.

Information source:
HFC and PFC tax (The Norwegian Tax Administration):
https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/hfc-and-pfc/
Regulations relating to the tax system in Norway:
https://lovdata.no/dokument/SF/forskrift/2001-12-11-1451/KAPITTEL_3-18#KAPITTEL_3-18

Case 5: Electronic system links training and certification to reporting and data processing

Country: Slovakia

Lifecycle Management Stage: Import, Export, Manufacturing, Maintenance, Collection, Reclamation, Reuse, Destruction

Format of Policy Measures: Certification, and reporting system

Key Words: *training, certification, reporting, data processing, leak tightness, leaklog, Slovak Association for Refrigeration, Air Conditioning and Heat Pumps*

Summary of the policy:
According to EU regulation 517/2014 (Article 6: Record keeping, Article 10: Training and certification, Article 20: Collection of emissions data), the Slovak Republic, one of the EU member countries, has introduced an electronic system that links training and certification to reporting and data processing. The system includes a section dedicated to electronic recording of appliance data and information on leak-tightness ('leaklog') and a section for electronic reporting and certification.

The following assumptions form the basis for the Slovak electronic tool.

- F-gas trade only takes place between certified companies.
- Customers can order services from certified companies only.
- Certificates are valid for a limited time period only and need to be renewed.
- Completion and submission of the reporting form on refrigerant imports and exports, including refrigerants contained in products and appliances, by certified companies, is a precondition for the renewal or update of company certificates.

National statistics on refrigerant movements and national data on emission reporting are compiled electronically. (See Fig.9)

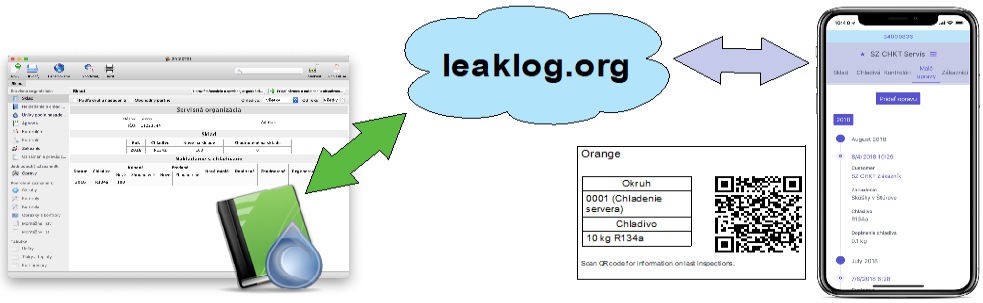


Fig.9 SZ CHKT introduced a new service named Leaklog.org that enables service companies and operators to share information about inspections and repairs of cooling appliances. Labels with QR codes placed on appliances link to logbooks with up-to-date information.

Information source:
Slovak Association for Refrigeration, Air Conditioning Technology and Heat Pumps:
https://szchkt.org/a/front_page?locale=en_GB, https://leaklog.org/
Electronic Logging and Reporting System based on Company Certification:
https://szchkt.org/a/docs/news/792

http://kgh-kongres.rs/images/2017/Prezentacije/69.pdf

https://www.green-cooling-initiative.org/fileadmin/Publications/2017_Guideline_on_policy_measures_for_the_managment_and_destruction_of_ozone_depleting_substances.pdf

(e) Collection of refrigerants

Collection is an important step for closing the loop of the refrigerant lifecycle. At the end of the lifetime of appliances, refrigerants need to be collected either for second use or destruction and final treatment in an appropriate way without leakage into the atmosphere. This requires a set of institutional arrangements, including a regulatory framework and detailed rules and standards, as well as experts having proper knowledge and expertise.

In Japan, the Act on Rational Use and Proper Management of Fluorocarbons laid the legal foundation for fluorocarbons management, including appropriate ways of treatment. In Denmark, there is a deposit scheme by the industry, which allows appliance users to receive some refund if used refrigerants are properly collected and brought to destruction or recycling. The scheme in Australia, also run by the industry, offers a rebate to contractors instead of appliance users.

Case 1	Obligatory collection of refrigerants	Japan
Case 2	Danish Refrigerant Industry Environmental Scheme (KMO)	Denmark
Case 3	Refrigerant take back programme	Australia

Case 1: Obligatory collection of refrigerants

Country: Japan

Lifecycle Management Stage: Collection of refrigerants, Recycling and destruction

Format of Policy Measure: Regulation, Transparency/tracking

Key Words: *specified products, registered fluorocarbons filling/recycling operator, process management sheets*

Summary of the policy:

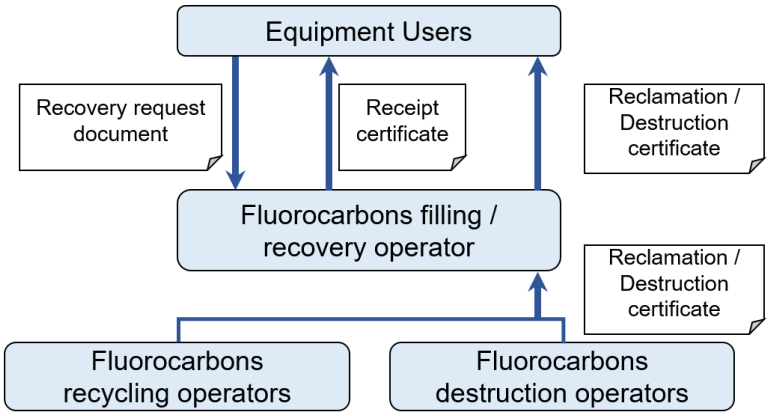
End-of-life appliances need to be treated properly so that the refrigerants contained in RACs and automobile ACs will not be discharged into the atmosphere, adding to the climate crisis. Japan has addressed this issue for 30 years by institutionalizing those refrigerant recovery mandates. Commercial RAC owners, residential AC owners, and automobile owners are responsible for proper end-of-life appliance treatment, including the recovery of refrigerants under the Act on Rational Use and Proper Management of Fluorocarbons, the Home Appliance Recycling Law, and the End-of-life Vehicle Recycling Law respectively.

Refrigerants contained in commercial RACs, in particular, must be recovered upon disposal by registered filling/recovering operators commissioned by their owners. An operator who wishes to practice fluorocarbon filling and recovering must be registered with the prefectoral governors of his/her practice locations. Registered operators must transfer recovered refrigerants to either recycling or destruction operators whose operations are permitted by the government. The treatment process is complete when the refrigerants are recycled or destroyed.

The whole treatment process can be tracked with documents as proof of recovery and recycling or destruction, which must be in the custody of each involved party.

During FY 2020, 1,465 tons of fluorocarbons were recycled, and 3,961 tons of fluorocarbons were destroyed.

Flow of documents during collection and destruction/reclamation:



Information source:

Act on Rational Use and Proper Management of Fluorocarbons pamphlet

https://www.env.go.jp/en/earth/ozone/laws/ozone4.pdf

Document by MoE Japan

https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/200928_MOEJ%20presentation%20for%20SPD.pdf

http://www.env.go.jp/press/files/jp/116598.pdf

METI Press Release

https://www.meti.go.jp/press/2021/08/20210805001/20210805001.html

Case 2: Danish Refrigerant Industry Environmental Scheme (KMO)
Country: Denmark

Lifecycle Management Stage: Collection of refrigerants

Format of Policy Measure: Financial instruments

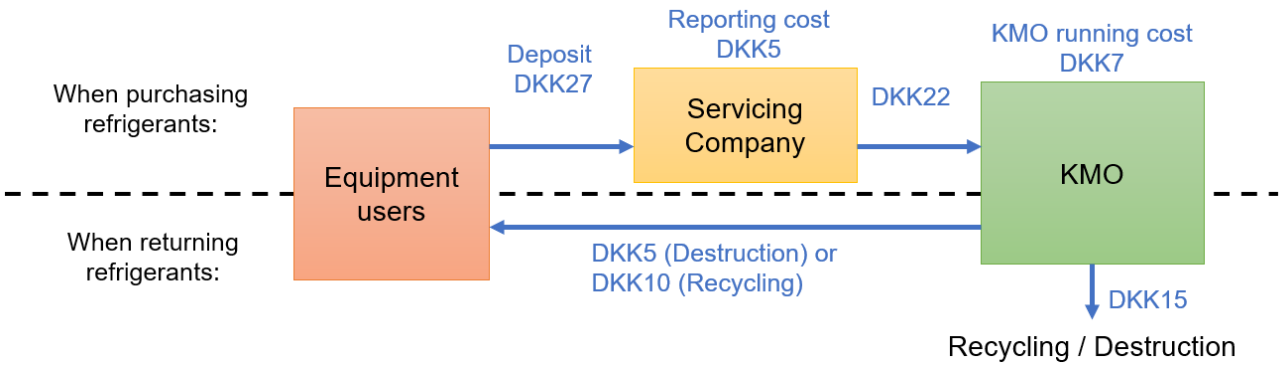
Key Words: *recycle, destruction, deposit-refund*

Summary of the policy:
The Danish Refrigerant Industry Environmental Scheme (KMO) is a voluntary deposit-refund scheme, set up by Danish refrigerant importers and the industry association of authorized refrigeration companies. It was set up in 1992 to promote the collection of CFCs, HCFCs, and HFC refrigerants and to control the use of these refrigerants, following Denmark's ratification of the Montreal Protocol.

Appliance users are charged a deposit of DKK 27 per kg of refrigerant, then receive a refund of DKK 10 for recycling and DKK 5 for destruction, independent of the GWP value of the refrigerant. Out of the DKK 27 collected from end-users, DKK 22 is transferred to the KMO, while the rest is kept by servicing companies to cover the reporting costs to the KMO. Out of the DKK 22, DKK 7 covers the running costs of the KMO secretariat, and the rest covers the cost of recycling/destruction of refrigerants.

When refrigerant is collected from the appliance by servicing companies, the used refrigerant is sent by the servicing companies to KMO. Then the refrigerant recycling and destruction is done at KMO and the appliance users receive the refund. This scheme increases the cost by DKK 27/kg for F-gas refrigerants that are neither recycled nor destroyed, DKK 17/kg for refrigerants that are recycled, and DKK 22/kg for refrigerants that are destroyed.

Flow of deposit and refund:



Information source:
Website of Ministry of Environment of Denmark
https://eng.mst.dk/chemicals/chemicals-in-products/legislation-on-chemicals/danish-legislation-on-specific-substances/industrial-green-house-gases/
Document by KMO (Danish)
https://www.kmo.dk/Dokumenter/KMO%20Retningslinier%20pr.%2001-06-2020.pdf

Case 3: Refrigerant take back programme
Country: Australia

Lifecycle Management Stage: Collection of refrigerants

Format of Policy Measure: Financial Instruments

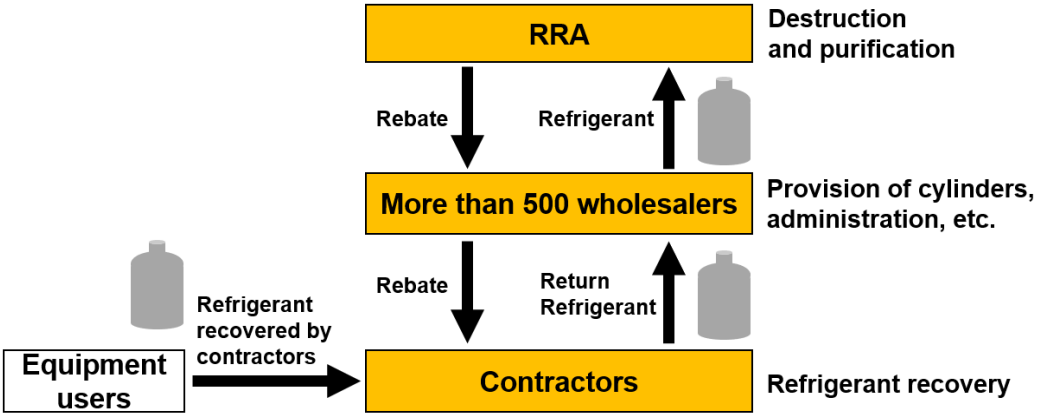
Key Words: *rebate, wholesalers, contractors*

Summary of the policy:
Refrigerant Reclaim Australia (RRA) provides a rebate to contractors and refrigerant gas wholesalers for returned refrigerants through their refrigerant take back programme, which started in 1993. For the wholesalers, the rebate part compensates for the costs of managing the take back of refrigerants. The wholesalers' branch networks act as a collection point for refrigerants, and they also provide cylinders, decanting services and administration. There are more than 500 wholesaler branches around Australia that can provide these functions.

For contractors, the rebate is an incentive to recover and return used F-gases. To return refrigerants, contractors can rent, buy, or take on deposit cylinders from the wholesalers and then return the full cylinders to the same wholesaler. The returned refrigerants are sent to RRA for destruction or purification for reuse. The value of the rebates is set by RRA, and is currently set at AUD 3/kg.

According to the website of RRA, starting in 2013, they recovered 6,500 tons of refrigerant by 2017, a reduction of more than 10 million tons of CO_2 equivalent emissions. The majority of the collected refrigerant has been destroyed. Between 1993 and 2017, 91% of refrigerant was destroyed, 6% was reclaimed, 1% was stored and 2% was returned to the manufacturer for use as feedstock.

Flow of refrigerant take back programme:



Information source:
Refrigerant Reclaim Australia website
https://refrigerantreclaim.com.au/educational-tools/
https://refrigerantreclaim.com.au/program-performance/
https://refrigerantreclaim.com.au/about-refrigerants/returning-refrigerants/

Australian Competition & Consumer Commission document
https://www.accc.gov.au/system/files/public-registers/documents/Final%20Determination%20-%2012.05.21%20-%20PR%20-%20AA1000537%20-%20RRA.pdf

(f) Recycling and destruction

Recycling and destruction are crucial parts of life cycle management. Usually, recycled refrigerants can be sold in the market and the revenues can be an incentive for recovery, whereas otherwise they are released into the atmosphere where no such regulations or practices are in place. Destruction is the end point in the life cycle of refrigerants. In countries where destruction obligations for users are in place, appliances are either incinerated at dedicated plants or in combination with other industrial processes (e.g., cement production and waste incineration etc.). The cost of destruction, as well as collection and transportation, becomes an issue unless there is a cost allocation mechanism. In this regard, the cost of recycling and destruction should be considered. Regarding destruction technologies, the Technical and Economic Assessment Panel under the Montreal Protocol produces a list of approved technologies for destruction of controlled substances.[4]

Case 1	Regulations regarding destruction of HCFCs and HFCs	Canada
Case 2	End-of-life management of Fluorinated Gases	Nigeria
Case 3	Voluntary Expanded Producers Responsibility (EPR) scheme	Colombia
Case 4	Product Stewardship Scheme (Voluntary Industry Agreement)	New Zealand
Case 5	Destruction of HFCs by the Joint Crediting Mechanism (JCM)	Thailand and Vietnam with Japan

[4] Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer Fourteenth edition (2020), UNEP Ozone Secretariat

Case 1: Regulations regarding destruction of HCFCs and HFCs

Country: Canada

Lifecycle Management Stage: Import, Export, Manufacture, Maintenance, Collection, Reclamation, Reuse, Destruction

Format of Policy Measure: Regulations

Key Words: ODSHAR, ODS, HCFCs, HFCs, destruction

Summary of the policy:
In Canada, the Ozone-depleting Substances and Halocarbon Alternatives Regulations (ODSHAR) are the means by which Canada meets its obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer. The ODSHAR are modernized regulations that repealed and replaced Canada's Ozone-depleting Substances Regulations (1998), in 2016.

The ODSHAR control the export, import, manufacture, sale and certain uses of ozone-depleting substances (ODS) and products containing or designed to contain them. These controls include the gradual elimination of ODS, a requirement to obtain written authorizations for certain activities and a requirement to report on the export, import and manufacture of ODS. Several ODS have already been phased out, while HCFCs are in the process of being phased out.

In addition to ODS, the regulations also require that permits be obtained for the import, export and manufacture of HFCs, and that reports on these activities be submitted.

Regarding the destruction of HCFCs and HFCs, the regulations stipulate as follows.
(ODSHAR: 54(1) Destruction of HCFCs, HCFC no longer needed; 65.05 Destruction of HFCs, HFC no longer needed)

A person in possession of HCFCs or HFCs imported or manufactured under a permit issued under the regulations and that are no longer needed for the use set out in that permit must, within six months after the day on which it is no longer needed,

(a) ensure that it is sent for destruction to a facility that is operated in accordance with the *Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer*, published by the Ozone Secretariat, United Nations Environment Programme.
(b) ensure that it is exported for destruction, for use as a feedstock, or laboratory or analytical use.
(c) in the case of recovered, recycled or reclaimed HCFCs or HFCs, ensure that it is sent to a recycling or reclamation facility.

This is one of the examples of the mandatory destruction of HFCs that are no longer needed, within a fixed period.

Information source:

Ozone-depleting Substances and Halocarbon Alternatives Regulations:

https://laws-lois.justice.gc.ca/PDF/SOR-2016-137.pdf

Ozone-depleting Substances and Halocarbon Alternatives Regulations: general information:

https://www.canada.ca/en/environment-climate-change/services/air-pollution/issues/ozone-layer/depleting-substances-halocarbon-alternatives-regulations.html

Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer:

https://ozone.unep.org/sites/default/files/Handbooks/MP_Handbook_2019.pdf

Case 2: End of life management of Fluorinated Gases

Country: Nigeria

Lifecycle Management Stage: Maintenance, Collection, Reclamation, Reuse, Destruction

Format of Policy Measures: Pilot Programme

Key Words: *indigenous technologies, capacity building, rotary kiln incineration, Kigali Cooling Efficiency Programme (KCEP)*

Summary of the policy:
Over the years, Nigeria has been managing the end of life of HCFCs, CFCs and halons through the establishment of the Ozone Village, a centre for promotion and development of indigenous ozone-friendly technologies and human resources.

The main end-of-life F-gases managed include CFC-12, Halon1211 and Halon1301. The pilot CFC-12 waste project for Nigeria was approved at the 67th Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF). UNIDO was the implementing agency. The project aimed at disposing of stocks of ODS (CFC-12) collected by oil and gas companies from their installations in Nigeria and from chiller operators. The project also aimed to provide capacity building activities for operators in the waste management sector and end-users, on the proper handling and management of waste ODS.

The waste CFC-12 was destroyed by a local company using the Rotary Kiln Incineration Technology.

The Rotary Kiln Incinerator

The amount of ODS handled by the project was 84 tons of CFC-12.

In addition to the project, Nigeria also intends to use the best available locally developed technologies and to manage the gases (HCFCs and HFCs) that will be replaced, through the Kigali Cooling Efficiency Programme (KCEP) funding window on transforming the market of inefficient RAC appliances, which will promote a large scale rebate/replacement programme for inefficient RAC appliances.

Information source:

MOP32 side event:

https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/20201127%20Presentation%20by%20Nigeria.pdf

Proposal of the 67th Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF):

http://www.multilateralfund.org/67/English/1/6727.pdf

KCEP (Kigali Cooling Efficiency Programme):

https://www.k-cep.org/

Case 3: Voluntary Expanded Producers Responsibility (EPR) scheme

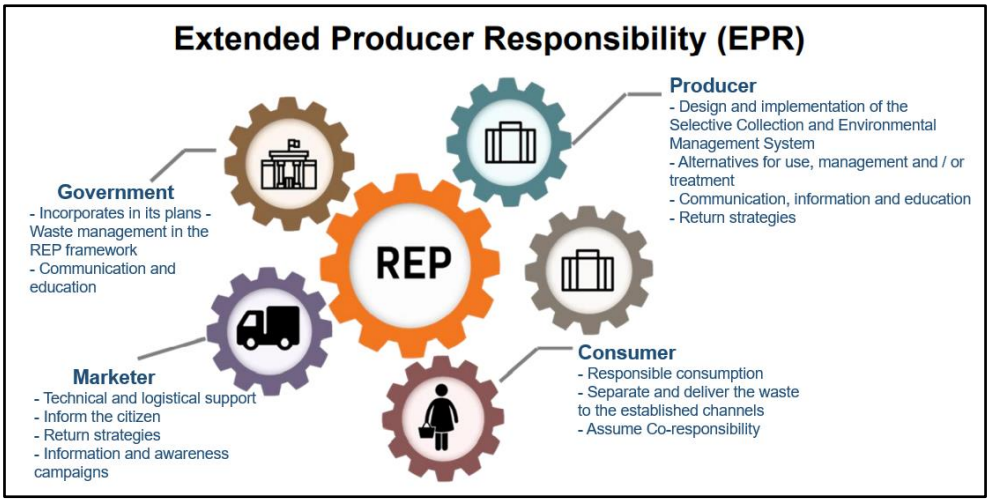
Country: Colombia (supported by UNDP)

Lifecycle Management Stage: Collection, Recycling, Destruction

Format of Policy Measures: Pilot Programme

Key Words: *voluntary, Extended Producer Responsibility, EPR, post-consumer programme, household appliances, Waste Electrical and Electronic Equipment, WEEE, Producer Responsibility Organizations, PRO*

Summary of the policy:
A voluntary Extended Producer Responsibility (EPR) scheme was established, the first post-consumer programme for household appliances in Colombia. In this scheme, it is the duty of the producer (manufacturer or importer) of electrical and electronic appliances to design and implement environmental management of the appliances, throughout the different stages of the product life cycle. In a broad sense, EPR is the principle by which producers maintain a degree of responsibility for all the environmental impacts of their products throughout their life cycle, from the extraction of raw materials, through production, and until the final disposal of the product as waste in the post-consumer stage.



Red Verde is in charge, on behalf of the member companies, of the administration, operation and financing of the system of selective collection and environmental management of the appliances when they have fulfilled their life cycle and are discarded by consumers. Voluntary financial contributions come from manufacturers and importers. The financial responsibilities were agreed on in a participatory process involving all stakeholders.

End-users can either deliver old refrigerators to collection points or make use of a pick-up service. The appliances received are delivered to the facilities of companies with environmental licences, specialized in the management of waste electrical and electronic appliances. There the different materials are separated to direct them to the process of use and final disposal. Unusable elements such as refrigerant gases are safely extracted and managed through processes that ensure their proper destruction.

In conjunction with creating an EPR framework, the government has developed a national policy for hazardous waste management and the management of WEEE (Waste Electrical and Electronic Equipment) as well as the related regulations. Recently, Colombia has introduced a VAT reduction scheme promoting replacement for Energy Efficiency and ESM of EOL domestic refrigerators.

It is the first post-consumption programme for household appliances in Latin America that is part of the WEEE Forum, which represents Waste Electrical and Electronic Equipment (WEEE) Producer Responsibility Organizations (PRO).

Information source:

Side event at the 43rd OEWG of the Parties to the Montreal Protocol:

https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/5_2021%20HFC%20Banks%20management.pdf

Webinar 'Closing the loop: Environmentally sound management of End-Of-Life ODS and HFC':

https://www.minambiente.gov.co/images/AsuntosambientalesySectorialyUrbana/pdf/Unidad_T%C3%A9cnica_de_Ozono_UTO/eventos/memorias_seminario_uto/tercera_sesion/3_N_Pab%C3%B3n_Experience_developing_and_applying_EPR_mechanisms_in_Colombia.pdf

Red Verde:

https://www.redverde.co/ (Spanish)

https://redverde.co/index.php/noticias/264-red-verde-es-el-primer-posconsumo-de-electrodomesticos-de-latinoamerica-que-hace-parte-del-weee-forum (Spanish)

Case 4: Product Stewardship Scheme (Voluntary Industry Agreement)

Country: New Zealand

Lifecycle Management Stage: Refrigerant Production, Import, Export, Manufacturing, Maintenance, Collection, Reclamation, Reuse, Destruction

Format of Policy Measures: Voluntary scheme

Key Words: *product stewardship, Product Stewardship Schemes (PSS), voluntary industry agreement, Recycling, Advanced Destruction Fee (ADF), Synthetic Greenhouse Gases (SGG),* manufacturers, brand owners, importers, retailers, consumers

Summary of the policy:
In New Zealand, a single product stewardship scheme, 'Recycling', for the safe disposal of refrigerants has been established since 1993. It is a voluntary scheme that is accredited by the Ministry for the Environment under the Waste Minimization Act 2008.

Product stewardship is a 'cradle to grave' methodology that helps reduce the environmental impact of manufactured products. Under product stewardship schemes (PSS), producers or manufacturers, brand owners, importers, retailers, consumers and other parties accept responsibility for the environmental effects of their products – from the time they are produced until the end of their useful life when they are recycled or disposed of.

Product stewardship scheme participants take responsibility for the environmental effects of their products and take these costs into account when making decisions about the production, purchase and disposal of their products. Recycling is funded by an Advanced Destruction Fee (ADF) that is paid by most of the bulk 'Synthetic Greenhouse Gases' (SGG) refrigerant importers. This fee funds the aggregation, transport and disposal of SGG refrigerant deposited at specific locations around the country. The service is free to all holders of SGG refrigerant, regardless of whether the producer or holder has paid the advanced disposal fee to Recycling.

Since the establishment of PSS, Recycling has worked closely with the New Zealand Government, providing data on their activities, as well as representing the refrigeration and air conditioning industry. Recycling works with various kinds of stakeholders such as the refrigeration and air conditioning industry, the motor trade automotive air conditioning sector, refrigerant wholesalers, chemical companies, the retail grocers' association, etc. This allows them to present a balanced view in representing the supply chain, from the import and supply of refrigerants, through to their application and use for end users.

From 1993 to 2020, Refrigerant Recycling NZ safely collected and destroyed about 430 tons of refrigerant gases. This has had the impact of saving up to 467,000 tons of ozone and reducing the build-up of greenhouse gases by up to 1,034,000 tons of CO_2 equivalent.

The evolution of refrigerants over time shows HCFCs have significantly reduced as a proportion of the refrigerants destroyed, in favour of HFCs. (See Fig.10) Analysis of refrigerants destroyed by year shows that Recycling typically destroys around 30 tons per year. The destroyed volume ratio of CFCs/HCFCs/HFCs shows technology changes impacting the volume of refrigerant. (See Fig.11)

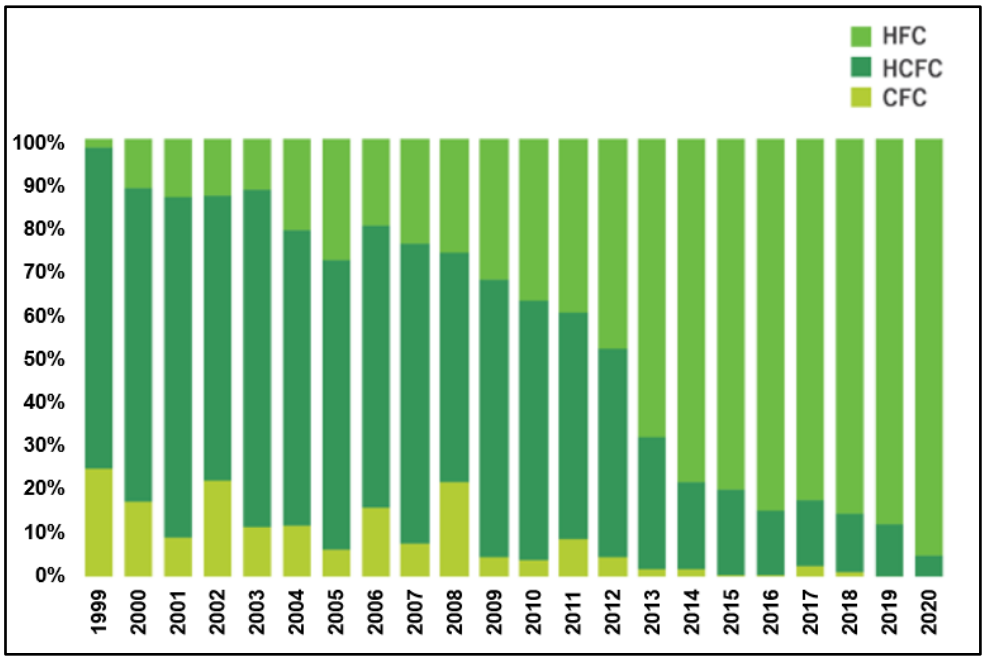


Fig.10 Evolution of destroyed refrigerants

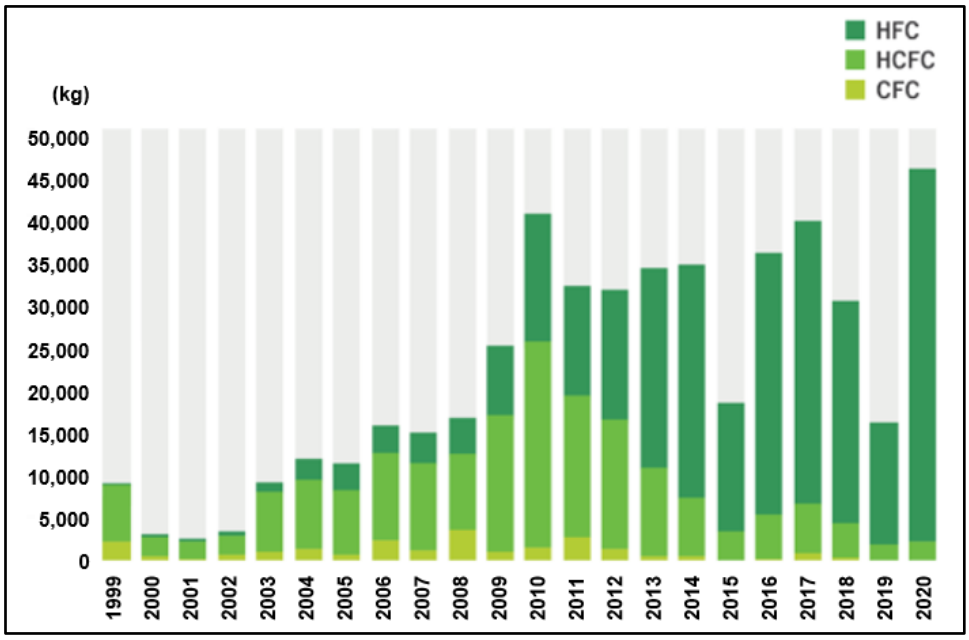


Fig.11 Amount of destroyed refrigerants

Information source:

Refrigerant Recycling NZ:

https://www.refrigerantrecycling.co.nz/

Case 5: Destruction of HFCs by the Joint Crediting Mechanism (JCM)

Country: Japan and JCM Partner Countries (Thailand and Viet Nam)

Lifecycle Management Stage: Collection and destruction (with additional recycling efforts)

Format of Policy Measure: Carbon crediting mechanism

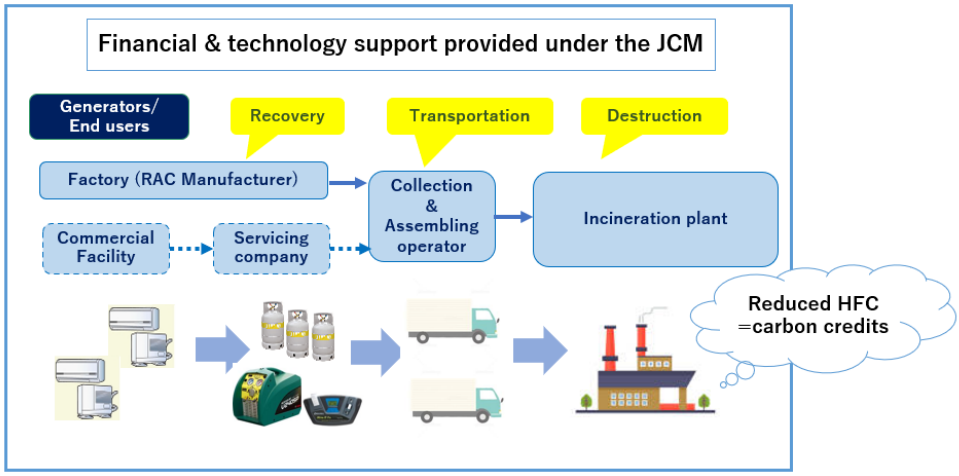
Key Words: *incentives, incineration plant, decarbonization technologies, carbon credits*

Summary of the policy:
The Joint Crediting Mechanism (JCM) is a system initiated by the Government of Japan to cooperate with developing countries for reducing greenhouse gas emissions by spreading decarbonization technologies, in which the result of reduction is assessed as contribution by both partner countries and Japan. It is implemented under Article 6.2 of the Paris Agreement. To facilitate the formation of a network of end-users, commercial facilities, service companies, transportation companies and destruction operators, the MOEJ has provided financial and technological support through the JCM to collect and destroy HFCs, and conduct measurement, reporting and verification (MRV) of emissions reductions.

Thailand and Viet Nam had no HFC users' obligations and incentives for collection and destruction and HFC emissions had not been addressed. There, the JCM scheme has provided extra incentives to local stakeholders to introduce appropriate technologies, as well as treatment systems.

In the case of Thailand, an existing waste incineration plant was remodelled for fluorocarbons incineration and 12,512 tCO_2e/y of HFCs was collected and destroyed, together with CFCs and HCFCs in 2018-2020. In Viet Nam, an independent incinerator was introduced aiming to reduce 6,294 tCO_2e/y of HFCs. Some HFCs and HCFCs have also been recovered where the quality of gases meets a quality standard. Both actions have been useful to mitigate climate change, since those substances would otherwise have been released into the atmosphere.

Carbon credits will be issued for the destroyed amounts of HFCs, which provides incentives for the private sector to recover the cost of collection, transportation and destruction. Part of the credits will be collected by the Government of Japan and other parts are shared by project participants from partner countries and Japan.



Information source:

Global Environment Centre Foundation (GEC) Website on the JCM

http://gec.jp/jcm/projects/18fgas_tha_01/

http://gec.jp/jcm/projects/18fgas_vie_01/

(g) Cross-cutting measures

Policies addressing HFC emissions and policies aiming to meet other objectives can often work well in harmony to generate synergies. For instance, the projects in Brazil and Morocco that replaced old appliances with more energy efficient ones via the treatment of used refrigerants show how well-planned projects can achieve multiple goals at once. Also, Japan's legal framework on end-of-life home appliances and vehicles includes obligations not only of proper treatment of the appliance itself but also refrigerants recovery and recycling/destruction. Combined measures like these can take various forms based on countries' needs and contexts and can set multiple goals.

Case 1	Synergy effect of bulk procurement of EE products and collection and destruction of fluorocarbons	Brazil and Morocco

Case 1: Synergy effect of bulk procurement of EE products, stopping dumping, and collection and destruction of fluorocarbons

Countries: Brazil, Morocco

Dr. Suely Carvalho and Dr. Kamyla Borges (Kigali Project, ICS), Mr. Vital Ribeiro (President of the Board, PHS), and Dr. Stephen O. Andersen, Director of Research, IGSD.

Lifecycle Management Stage: Introduction of appliances, Collection, Reclamation, Reuse, Destruction

Coordination of Policy Measures: Pilot Programme

Key Words: *bulk procurement, buyers' club, energy efficient, low-GWP, ODS, HFCs, air conditioners*

Summary of the policy:

This good practice focused on the synergy effect of bulk procurement for energy efficient and lower GWP appliances, stopping dumping of inefficient appliances with obsolete ODS and HFC refrigerants, and collecting significantly larger quantities of ODS and HFCs in a 'controlled' replacement programme including destruction. The pilot projects were implemented in Brazil and Morocco in economically feasible and profitable schemes with environmentally sound management.

The overall project is designed as follows using 'Buyers' Clubs'.

1st step: Identify purchasing power of large buyers of a specific energy efficient lower GWP product
2nd step: Aggregate the demand
3rd step: Negotiate a favourable price with manufacturers
4th step: Simplify installation and recovery of ODS and/or GHG refrigerant for final disposal/destruction

(1) The pilot project: Health Sector in Brazil

There are more than 2,900 public and 4,300 private health institutions, 445,000 patient rooms with split ACs and refrigerators installed along with central cooling systems in Brazil. Major refrigerants are R-22, R-410A and R-134a. Detailed assessment was implemented for 33 health institutions and confirmed that they refer to energy efficiency in their corporate sustainability policy. Energy and cost saving analysis showed there are significant benefits from replacing air conditioners with models of superior efficiency. The potential found for refrigerant collection and EoL actions was 1,469 kg recycling of R-410A and 2,116 kg recycling of R-22 for the 33 health facilities, 9,356 tons of recycling of R-410A and 13,473 tons of recycling of R-22 for all 6,368 hospitals in Brazil. Refrigerants can be locally destroyed, for instance, in cement kilns.

(2) The pilot project: Bank and Government Sector in Morocco

The bank and government sectors were selected as a case study. Goals were set to replace older ACs that were inefficient when purchased and improperly installed and maintained, with super-efficient inverter ACs with lower GWP refrigerants for energy efficiency, as well as to replace, collect and destroy obsolete ODS and HFC refrigerants in local cement kilns, combined with materials recycling to prevent deployment of appliances to other locations. Benefits of the project are that bulk procurement and buyers' clubs reduce the purchase price of superior AC and stop dumping of inefficient appliances; refrigerant destruction in local cement kilns avoids the extraordinary cost of permits, packaging, and shipping to foreign facilities and brings added value in local jobs and profits, etc.

In conclusion, energy savings and corporate environmental responsibility of Buyers' Club members can be entry points for successful AC replacement programmes, bringing the scale needed for an economically feasible EoL programme.

Information source:
Presentation materials at the OEWG43 side event:
https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/1_Carvalho_%20Ribeiro_Andersen_Presentation%20Side%20%20Event%20OEWG%20July%2015%202021_final%201.pdf

5. References

Asako Toyozumi, Office of Fluorocarbon Control Policy, Ministry of the Environment, Japan. 2020. *Japan's Policy and Legislation on Life Cycle Management of Refrigerant*. CCAC Science Policy Dialogue. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/200928_MOEJ%20presentation%20for%20SPD.pdf

Australian Competition & Consumer Commission. 2021. Application for revocation of A91515 and the substitution of authorization AA1000537 lodged by Refrigerant Reclaim Australia Limited in respect of its operation of a product stewardship programme to recover ozone depleting and synthetic greenhouse gas refrigerants. https://www.accc.gov.au/system/files/public-registers/documents/Final%20Determination%20-%2012.05.21%20-%20PR%20-%20AA1000537%20-%20RRA.pdf

Bundesamt für Wirtschaft und Ausfuhrkontrolle. 2021. Kälte- und Klimaanlagen Ein Förderprogramm für gewerbliche Nutzer (German). https://www.bafa.de/DE/Energie/Energieeffizienz/Klima_Kaeltetechnik/klima_kaeltetechnik_node.html

Bundesamt für Wirtschaft und Ausfuhrkontrolle. 2021. 'Technisches Merkblatt (gültig für Anträge ab dem 01.12.2020)' (German). https://www.bafa.de/SharedDocs/Downloads/DE/Energie/kki_technisches_merkblatt.html;jsessionid=098488A189D4B8EE9ED7DFDAA8BABCC4.2_cid371?nn=8064164

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit. 'Zahlen und Fakten (German). https://www.klimaschutz.de/zahlen-und-fakten

CLASP and IGSD (2020). *Environmentally Harmful Dumping of Inefficient and Obsolete Air Conditioners in Africa Annexes: Room AC Market Profiles for Ten African Countries*: https://storage.googleapis.com/clasp-siteattachments/Annexes-Room-AC-Market-Profilesfor-Ten-African-Countries.pdf

Clean Cooling Collaborative. KCEP (Kigali Cooling Efficiency Programme). https://www.k-cep.org/

Department of Environment and Natural Resources, Environmental Management Bureau, Republic of the Philippines. 2021. EMB Memorandum Circular No. 2021-11. *Registration of Service Providers of Ozone-Depleting Substance (ODS) using Equipment*. http://pod.emb.gov.ph/wp-content/uploads/2021/07/EMB-MC-2021-11.pdf

Department of Environment and Natural Resources, Republic of the Philippines. 2004. DENR Administrative Order No. 2004 - 08. Revised Chemical Control Order for Ozone Depleting Substances (ODS). https://chemical.emb.gov.ph/wp-content/uploads/2017/03/DAO-2004-08-CCO-ODS.pdf

Department of Environment and Natural Resources, Republic of the Philippines. 2013. DENR ADMINISTRATIVE ORDER No. 2013 - 25. Revised regulations on Chemical Control Order (CCO) for Ozone Depleting Substances (ODS). http://pod.emb.gov.ph/wp-content/uploads/2016/06/DAO-

2013-25.pdf

European Commission. *EU legislation to control F-gases*. https://ec.europa.eu/clima/policies/f-gas/legislation_en

European Commission. *Fluorinated greenhouse gases*. https://ec.europa.eu/clima/policies/f-gas_en

Fleming, Peyton (9 September 2020). *A Flood of Polluting Air Conditioners Hampers Africa's Climate Efforts*: https://e360.yale.edu/features/a-flood-of-polluting-air-conditioners-hampers-africas-climate-efforts

giz. 2017. *Guideline on policy measures for the management and destruction of ozone depleting substances*. https://www.green-cooling-initiative.org/fileadmin/Publications/2017_Guideline_on_policy_measures_for_the_managment_and_destruction_of_ozone_depleting_substances.pdf

Global Environment Centre Foundation (GEC). *Development of Collection Scheme and Introduction of Dedicated System for Destruction of Used Fluorocarbons*. http://gec.jp/jcm/projects/18fgas_vie_01/

Global Environment Centre Foundation (GEC). *Project on Introduction of Scheme for Fluorocarbons Recycling and Destruction with Utilization of Existing Waste Incineration Plant*. http://gec.jp/jcm/projects/18fgas_tha_01/

Gluckman Consulting. 2014. *EU F-Gas Regulation Guidance, Information Sheet 26: Bans for New Products and Equipment*. http://www.gluckmanconsulting.com/wp-content/uploads/2014/12/IS-26-Ban-Summary.pdf

Government of Canada. *Ozone-depleting Substances and Halocarbon Alternatives Regulations: general information*. https://www.canada.ca/en/environment-climate-change/services/air-pollution/issues/ozone-layer/depleting-substances-halocarbon-alternatives-regulations.html

Iberley *Impuesto sobre los Gases Fluorados de Efecto Invernadero* (Spanish). https://www.iberley.es/temas/impuesto-sobre-gases-fluorados-efecto-invernadero-20551?__cf_chl_captcha_tk__=pmd_3I3aHETyQuGRwUaiphybZBu.IH3Vw709Htozv6Fx8CE-1631684732-0-gqNtZGzNAzujcnBszQbR

International Energy Agency. 2018. *The Future of Cooling, Opportunities for energy efficient air conditioning*. https://iea.blob.core.windows.net/assets/0bb45525-277f-4c9c-8d0c-9c0cb5e7d525/The_Future_of_Cooling.pdf

Kasper Koefoed-Hansen, UNDP Montreal Protocol Unit. 2021. *ADDRESSING HFC BANKs -A Need to Accelerate HFC Emissions Reduction*. Side event at the 43rd OEWG of the Parties to the Montreal Protocol. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/5_2021%20HFC%20Banks%20management.pdf

KMO. 2016. Retningslinier for Foreningen Kølebranchens Miljøordning, KMO Vedtaget på KMO's generalforsamling i Roskilde, 28-05-2020. https://www.kmo.dk/Dokumenter/KMO%20Retningslinier%20pr.%2001-06-2020.pdf

Kofi Agyarko, Ghana Energy Commission. 2021. *Energy Efficiency Opportunities While Phasing Down*

HFCs. An Importing Country Perspective. Side event at the 43rd OEWG of the Parties to the Montreal Protocol. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/4_Mr.%20Kofi%20Agyarko_OEWG%2043%20Montreal%20Protocol%20Final%202.pdf

LOVDATA. *Regulations relating to excise duties. Ch. 3-18. Tax on hydrofluorocarbon (HFCs) and perfluorocarbons (HFCs)*. https://lovdata.no/dokument/SF/forskrift/2001-12-11-1451/KAPITTEL_3-18#KAPITTEL_3-18

Ministry of Economy, Trade and Industry, Japan. 2019. *Booklet of Home Appliance Recycling Law* (Japanese). https://www.meti.go.jp/policy/it_policy/kaden_recycle/shiryousyu/guidebook2019_mihiraki.pdf

Ministry of Economy, Trade and Industry, Japan. 2021. *The result of the amount of chlorofluorocarbons regenerated and destroyed in 2020 based on the Fluorocarbons Emission Control Law* (Japanese). https://www.meti.go.jp/press/2021/08/20210805001/20210805001.html

Ministry of Environment and Forestry, Indonesia. 2019. Decree No. 73. http://jdih.menlhk.co.id/uploads/files/P_73_2019_REFRIGERASI_DAN_TEKNISI_TATA_UDARA_menlhk_11132019084312.pdf

Ministry of Environment and Water, Malaysia. *Control Of Import & Export Of Hydrofluorocarbon (HFC)*. Official Portal of Department of Environment. https://www.doe.gov.my/portalv1/en/info-umum/info-protokol-montreal/kawalan-import-dan-eksport-hydrofluorocarbon-hfc/327903

Ministry of Environment and Water, Malaysia. List of importer/exporters. https://www.doe.gov.my/portalv1/wp-content/uploads/2017/06/Senarai-Pengimport-Pengeksport-HCFC-dan-HFC-2020.pdf

Ministry of Justice, Japan. Japanese Law Translation System. 2006. Act on Recycling of End-of-Life Automobiles. http://www.japaneselawtranslation.go.jp/law/detail/?re=01&dn=1&x=47&y=17&co=1&ia=03&ja=04&yo=&gn=&sy=&ht=&no=&bu=&ta=&ky=%E8%87%AA%E5%8B%95%E8%BB%8A&page=6

Ministry of Justice, Japan. Japanese Law Translation System. 2013. Act on Rational Use and Appropriate Management of Fluorocarbons'. http://www.japaneselawtranslation.go.jp/law/detail/?vm=04&re=01&id=3236

Ministry of the Environment, Government of Japan. 2016. Act on Rational Use and Proper Management of Fluorocarbons. https://www.env.go.jp/en/earth/ozone/laws/ozone4.pdf

Ministry of the Environment, Government of Japan. *The result of the amount of chlorofluorocarbons regenerated and destroyed in 2020 based on the Fluorocarbons Emission Control Law* (Japanese). http://www.env.go.jp/press/files/jp/116598.pdf

Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Health, Labour and Welfare, Japan. 2021. *Booklet of the Act on Rational Use and Appropriate Management of Fluorocarbons* (Japanese). http://www.env.go.jp/earth/furon/files/int_01-16_201911_rev.pdf

Ministry of the Environment, Ministry of Economy, Trade and Industry, Japan. *Flyer of End-of Life*

Vehicles Recycling Law. https://www.env.go.jp/recycle/car/pdfs/businesses_flier_eng01.pdf

Ministry of the Environment, Ministry of Economy, Trade and Industry, Japan. *Flyer of End-of Life Vehicles Recycling Law*. https://www.env.go.jp/recycle/car/pdfs/businesses_flier_eng02.pdf

Montir AC Konsumen. https://play.google.com/store/apps/details?id=com.dep.MontirAcKonsumens&hl=en_US&gl=US

Montir AC Teknisi. https://play.google.com/store/apps/details?id=com.dep.TeknisiAc&hl=en_US&gl=US

Nurudeen Yaru Mahmud, National Ozone Office, Nigeria. 2020. *End of Life Management. Management of Fluorinated Gases*. MOP32 Side event. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/20201127%20Presentation%20by%20Nigeria.pdf

Office of Fluorocarbon Control Policy, Ministry of the Environment, Japan. 2021. *Life cycle Management of Fluorocarbons*. Presentation materials at the OEWG43 side event. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/2_210714%20JAPAN_OEWG%20side%20event%20presentation.pdf

Peter Tomlein, SZ CHKT Rovinka, Slovakia. 2017. *Electronic Logging and Reporting System based on Company Certification*. http://kgh-kongres.rs/images/2017/Prezentacije/69.pdf

Philippine Ozone Desk EMB-DENR. 2021. List of Registered Dealers, Re-Sellers & Retailers of ODS. http://pod.emb.gov.ph/wp-content/uploads/2021/07/ODSDR2021.pdf

Philippine Ozone Desk EMB-DENR. 2021. List of Registered Importers of Ozone Depleting Substances (ODS) and Its Alternative Chemicals 2020-2021. http://pod.emb.gov.ph/wp-content/uploads/2021/08/REG_IMPORTERS_30JULY2021.pdf

Rebecca Schloemann and Dr. Gabrielle Dreyfus. 2020. *Environmentally Harmful Dumping of Inefficient and Obsolete Air Conditioners in Africa* CLASP and IGSD: https://storage.googleapis.com/clasp-siteattachments/2020-Environmentally-Harmful-Dumping-of-Inefficient-and-Obsolete-Air-Conditioners-in-Africa.pdf.

Red Verde. Colombia. https://www.redverde.co/

Refrigerant Reclaim Australia. *Educational tools*. https://refrigerantreclaim.com.au/educational-tools/

Refrigerant Reclaim Australia. *Programme performance*. https://refrigerantreclaim.com.au/program-performance/

Refrigerant Reclaim Australia. *Returning refrigerants*. https://refrigerantreclaim.com.au/about-refrigerants/returning-refrigerants/

Refrigerant Recycling. New Zealand. https://www.refrigerantrecycling.co.nz/

Sergio Sastre (ENT). *Tax on fluorinated greenhouse gases in Spain*. Institute of European Environmental Policy report. https://ieep.eu/uploads/articles/attachments/a3977c6e-7f07-4da9-bae2-ed3e060593da/ES%20Fluorinated%20Gases%20final.pdf?v=63680923242

Slovak Association for Cooling and Air Conditioning Technology. Notified Body for Cooling and Air Conditioning Technology. https://szchkt.org/a/front_page?locale=en_GB

Suely Carvalho, Kamyla Borges, Kigali Project, ICS. Vital Ribeiro, PHS. Stephen O. Andersen, IGSD.

2021. *Towards Economically Sustainable EOL Schemes Case Studies in Brazil and Morocco*. OEWG43 side event. https://www.env.go.jp/earth/ozone/fluorocarbon_initiative/attach/1_Carvalho_%20Ribeiro_Andersen_Presentation%20Side%20%20Event%20OEWG%20July%2015%202021_final%201.pdf

The Danish Environmental Protection Agency. *Industrial green house gases*. https://eng.mst.dk/chemicals/chemicals-in-products/legislation-on-chemicals/danish-legislation-on-specific-substances/industrial-green-house-gases/

The European Parliament and the Council of the European Union. 2009. Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:286:0001:0030:EN:PDF

The European Parliament and the Council of the European Union. 2014. Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0517

The Minister of Justice, Canada. 2021. Ozone-depleting Substances and Halocarbon Alternatives Regulations. https://laws-lois.justice.gc.ca/PDF/SOR-2016-137.pdf

The Norwegian Tax Administration. *HFC and PFC tax*. https://www.skatteetaten.no/en/business-and-organisation/vat-and-duties/excise-duties/about-the-excise-duties/hfc-and-pfc/

UNDP. 2017. *Protecting the Ozone Layer and Reducing Global Warming - Results, Case Studies and Lessons Learned from UNDP's Montreal Protocol Programme*. https://www.undp.org/publications/protecting-ozone-layer-and-reducing-global-warming

UNFCCC document, Session SBI50 (2019). *A compilation of questions to – and answers by – Spain* exported 11 June 2019 by the UNFCCC secretariat. https://unfccc.int/sites/default/files/resource/SBI50_ESP_MA_QA.pdf

UNFCCC FCCC/TRR.3/ESP. 2018. *Report on the technical review of the third biennial report of Spain*. https://undocs.org/Home/Mobile?FinalSymbol=FCCC%2FTRR.3%2FESP&Language=E&DeviceType=Tablet

United Nations Environment Programme. 2010. Proposal of the 62nd Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF). http://www.multilateralfund.org/62/English%20Document/1/6220.pdf

United Nations Environment Programme. 2011. Proposal of the 63rd Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF). http://www.multilateralfund.org/63/English%20Documents%20Lib/1/6352.pdf

United Nations Environment Programme. 2012. Proposal of the 67th Meeting of the Executive Committee (ExCom) of the Multilateral Fund (MLF). http://www.multilateralfund.org/67/English/1/6727.pdf

United Nations Environment Programme, Ozone Secretariat. 2020. *Handbook for the Montreal Protocol*

on Substances that Deplete the Ozone Layer, Fourteenth Edition. https://ozone.unep.org/sites/default/files/Handbooks/MP-Handbook-2020-English.pdf

United States Environmental Protection Agency. *Overview of SNAP*. https://www.epa.gov/snap/overview-snap

United States Environmental Protection Agency. *Significant New Alternatives Policy (SNAP) Program*. https://www.epa.gov/snap

6. Acknowledgements

This Resource Book for the Life Cycle Management of Fluorocarbons was published by the CCAC, with the support of the MOEJ, to strengthen the efforts under the Efficient Cooling Initiative (ECI). The publication is intended to contribute to awareness of policymakers worldwide on the issue of fluorocarbon banks, and to accelerate ozone layer protection and climate change mitigation.

The draft was developed by the Team of the Overseas Environmental Cooperation Centre, Japan (OECC), supported by the Mitsubishi Research Institute (MRI). For the case studies, CCAC member countries and organizations made a tremendous contribution, as well as other partners, together with those engaged in the IFL.