Let's protect the ozone layer

2021 edition

Ministry of the Environment,
Government of Japan

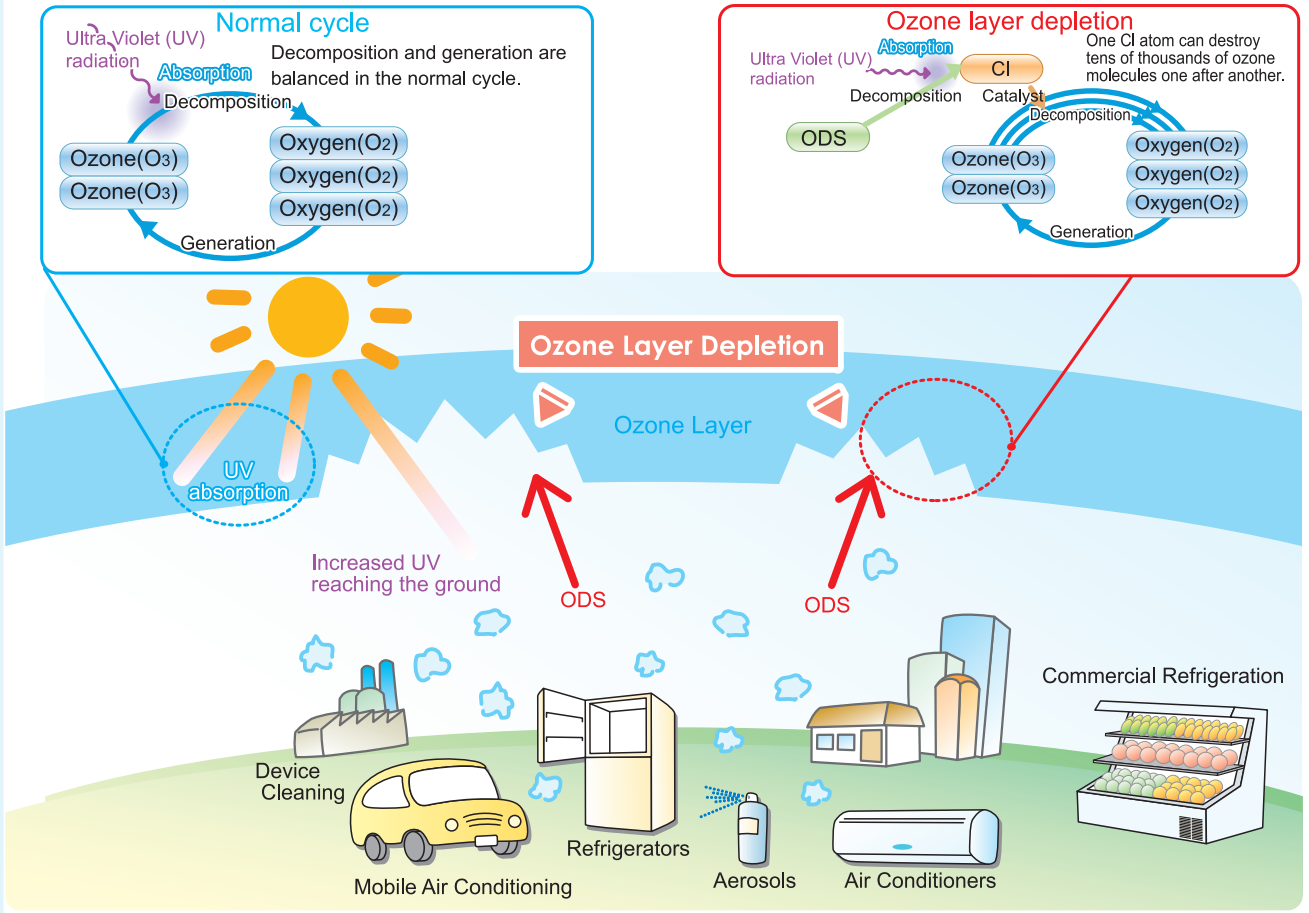
1-2-2 Kasumigaseki, Chiyoda-ku, Tokyo, 100-8975 JAPAN
URL: http://www.env.go.jp/en/

R100 Printed with soy ink on 100% recycled paper

Ministry of the Environment
JAPAN

The Ozone Layer & The Ozone Hole

The ozone layer is a protective shield up in the air that absorbs harmful ultraviolet(UV) rays, which can cause various negative impacts on human health and ecosystems. However, it has been destroyed by man-made chemicals called ozone depleting substances (ODS) so much. This phenomenon is referred to as the ozone hole.



Negative impacts of excessive UV-B on human health

Acute (symptoms immediately appear)

Sunburn
Red inflammation of the skin that appears a few hours after UV exposure

Suntan
Browning of the skin that appears a few days after UV exposure

Snow blindness
Inflammation of the iris of the eye that occurs when the eye is exposed to UV in places such as skiing grounds and marine beaches. The white of the eye congests, accompanied by pain. The symptom is remedied in 1-2 days.

Suppressions of the immune system

Chronic (symptoms gradually appear)

Skin
- Wrinkle, Freckle, Senile plaque
- Benign tumor
- Precancerous lesion
- Solar keratosis
- Skin cancer

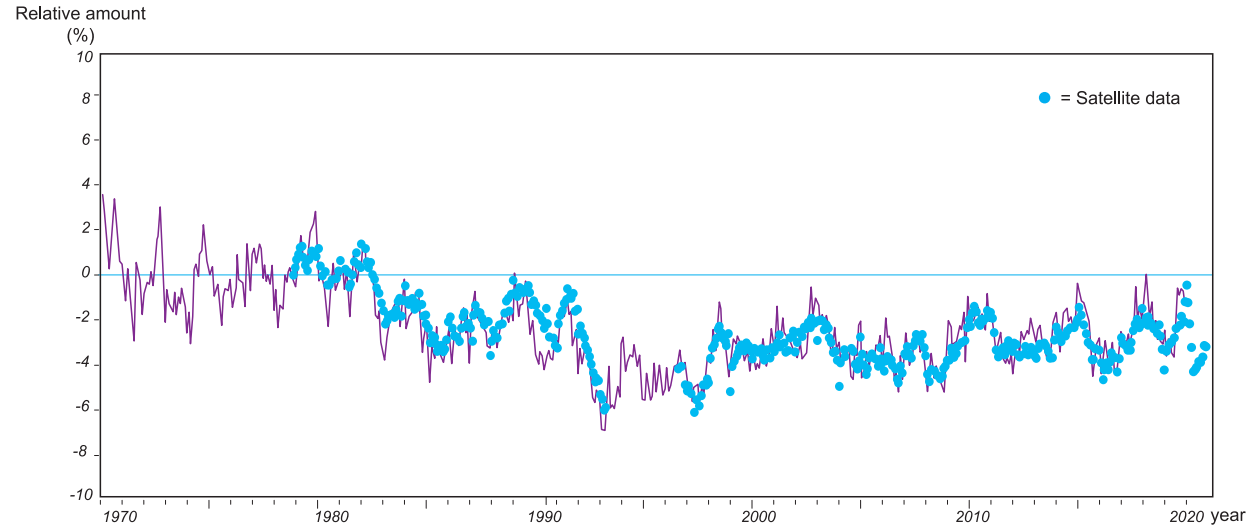
Eye

Cataract
A disease caused by UV exposure, etc. in which the crystalline lens of the eye gradually gets cloudy. The vision weakened by cataracts cannot be corrected with glasses and severe cases need surgical operation.

Pterygium
A disease in which the abnormal growth caused by UV in the tissue of the white (conjunctiva) of the eye gradually develops towards the iris (cornea). It can be removed by surgical operations but may recur.

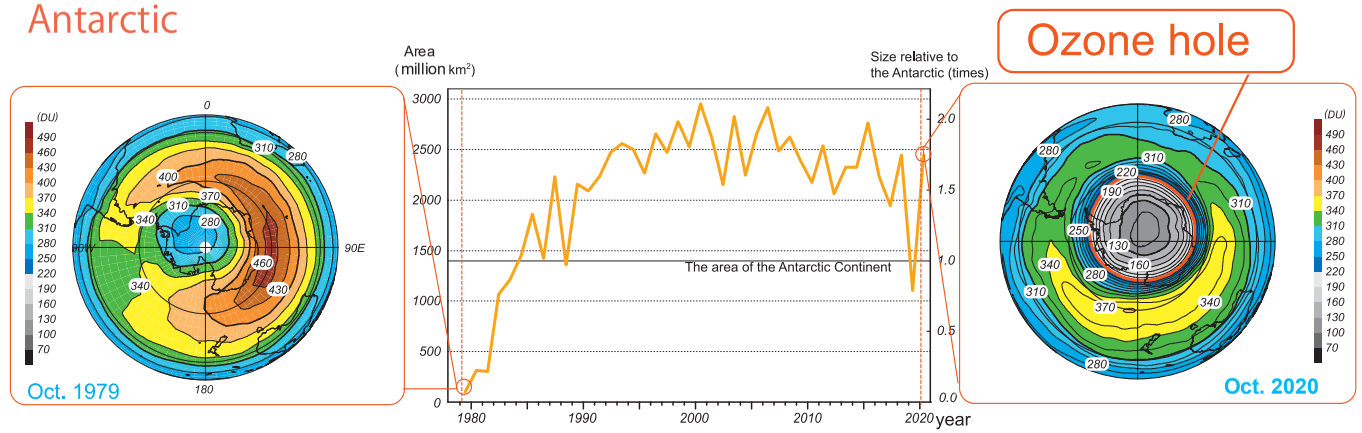
The amount of the ozone in the ozone layer decreased and the ozone hole rapidly grew in area from 1980 through the early 1990s. Although it picked up slightly from the late 1990s, the amount of the ozone in the ozone layer continues to be smaller than before.
In 2020, various meteorological conditions delayed the recovery of the Antarctic ozone hole, and the 2020 ozone hole was larger than the average size for the past 10 years.

Global



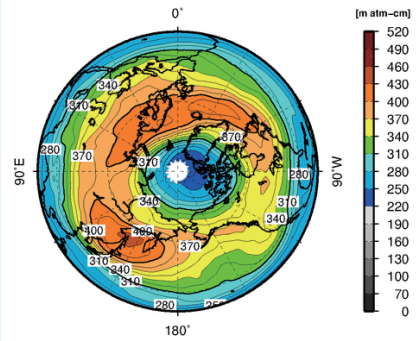
Time series in global mean total ozone
Source: Japan Meteorological Agency

Antarctic



Changes in annual maximum of the ozone hole area (center) and the total ozone maps over the Antarctic region in October (left and right)
Based on the data provided by Japan Meteorological Agency

Arctic



Mar. 2020

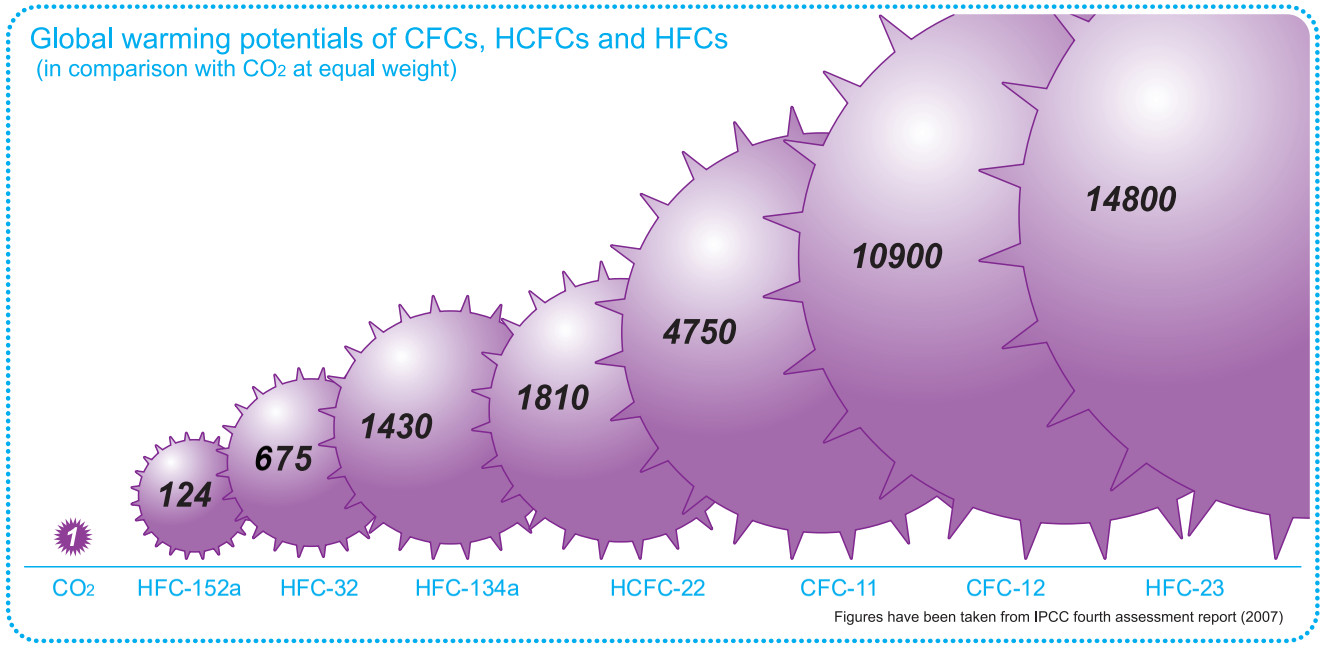
Above the Arctic, annual ozone depletion is more variable than the Antarctic depending on meteorological conditions.
In 2020, one of the largest ozone depletion was observed in recorded history.

Source: National Institute for Environmental Studies of Japan

Ozone Depleting Substances & Climate Change

Ozone depleting substances (ODS) such as CFCs and HCFCs are also greenhouse gases.
Therefore, the phase-out of ODS under the Montreal Protocol has contributed and will continue to contribute to the mitigation of climate change.
While the ozone-friendly HFCs are used as alternatives to CFCs and HCFCs, they are powerful greenhouse gasses.

HCFCs, and HFCs are still used in our daily life.
In fighting climate change, it is urgent and crucial to reduce the emissions into the atmosphere.



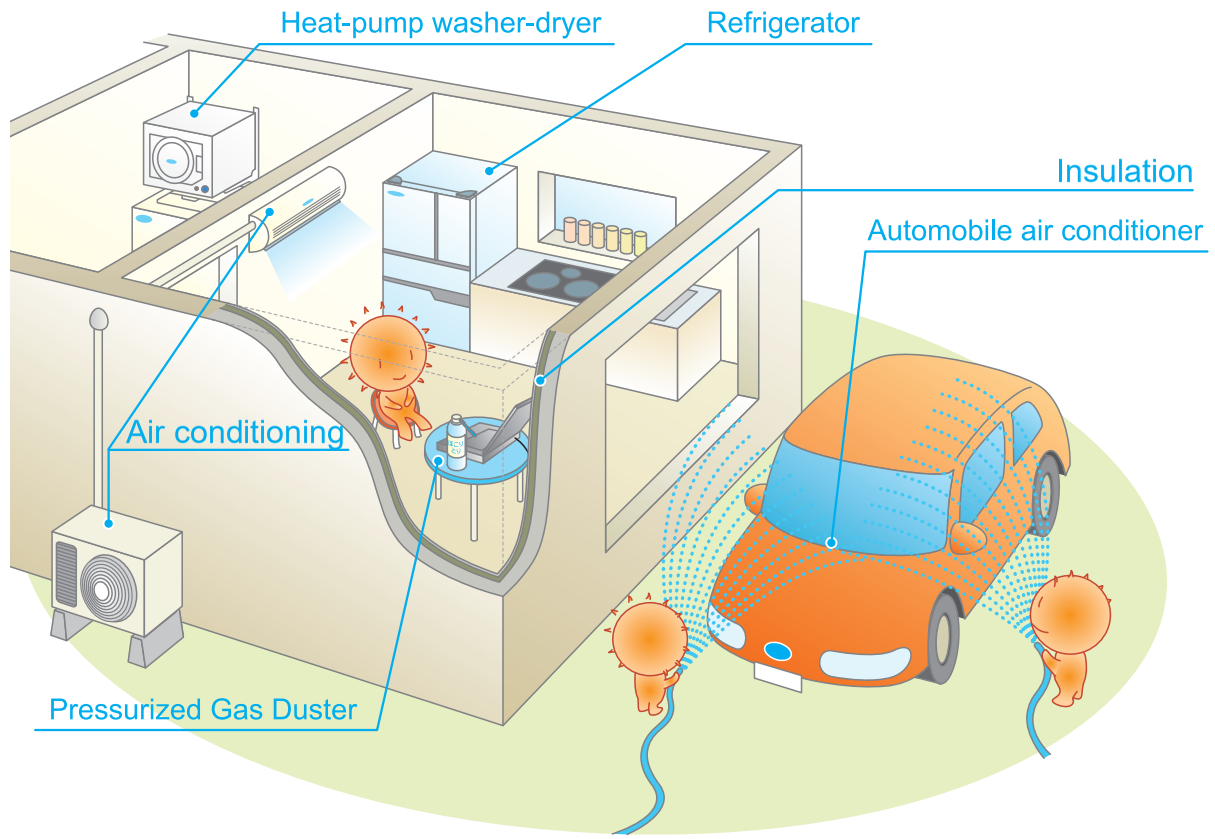
Figures have been taken from IPCC fourth assessment report (2007)

	Type	Ozone Depleting Potential	Global Warming Potential	Use
Ozone depleting substances	CFC	CFC-11 (1.0) CFC-12 (1.0) CFC-113 (0.8)	CFC-11 (4,750) CFC-12 (10,900) CFC-113 (6,130)	Refrigerants Foam blowing agents Device cleansings Aerosols
	Halon	Halon-1211 (3.0) Halon-1301 (10.0) Halon-2402 (6)	Halon-1211 (1,890) Halon-1301 (7,140) Halon-2402 (1,640)	Fire extinguishings
	Carbon Tetrachloride	1.1	1,400	Solvent used in laboratories and as materials
	1,1,1 - Trichloroethane	0.1	-	Cleaning Agents
	HCFC	HCFC-22 (0.055) HCFC-141b (0.11)	HCFC-22 (1,810) HCFC-141b (725)	Refrigerants Foaming agents Cleaning agents
	HBFC	0.74	-	(Fire extinguishings)*
	Bromochloromethane	0.12	-	(Solvents Agrichemicals Medicine Mothball)*
	Methyl Bromide	0.6	-	Soil fumigation agents (Sterilizations) Pesticide
Other fluorinated gases	HFC	0	HFC-23 (14,800) HFC-32 (675) HFC-134a (1,430) HFC-152a (124) R-410A (2,090)	Refrigerants Foaming agents Cleaning agents Aerosols
	PFC	0	7,390 -- 12,200	Solvents Device cleansing agents Semiconductor production Liquid crystal production
	SF_6	0	22,800	Electric insulator (insulating/internal) Semiconductor production Liquid crystal production Magnesium production
	NF_3	0	17,200	Solvents

* HBFC and Bromochloromethanes are not used in Japan.

Source (GWP) : IPCC fourth assessment report (2007)

CFCs, HCFCs, HFCs, and their alternatives are used in our daily life for...



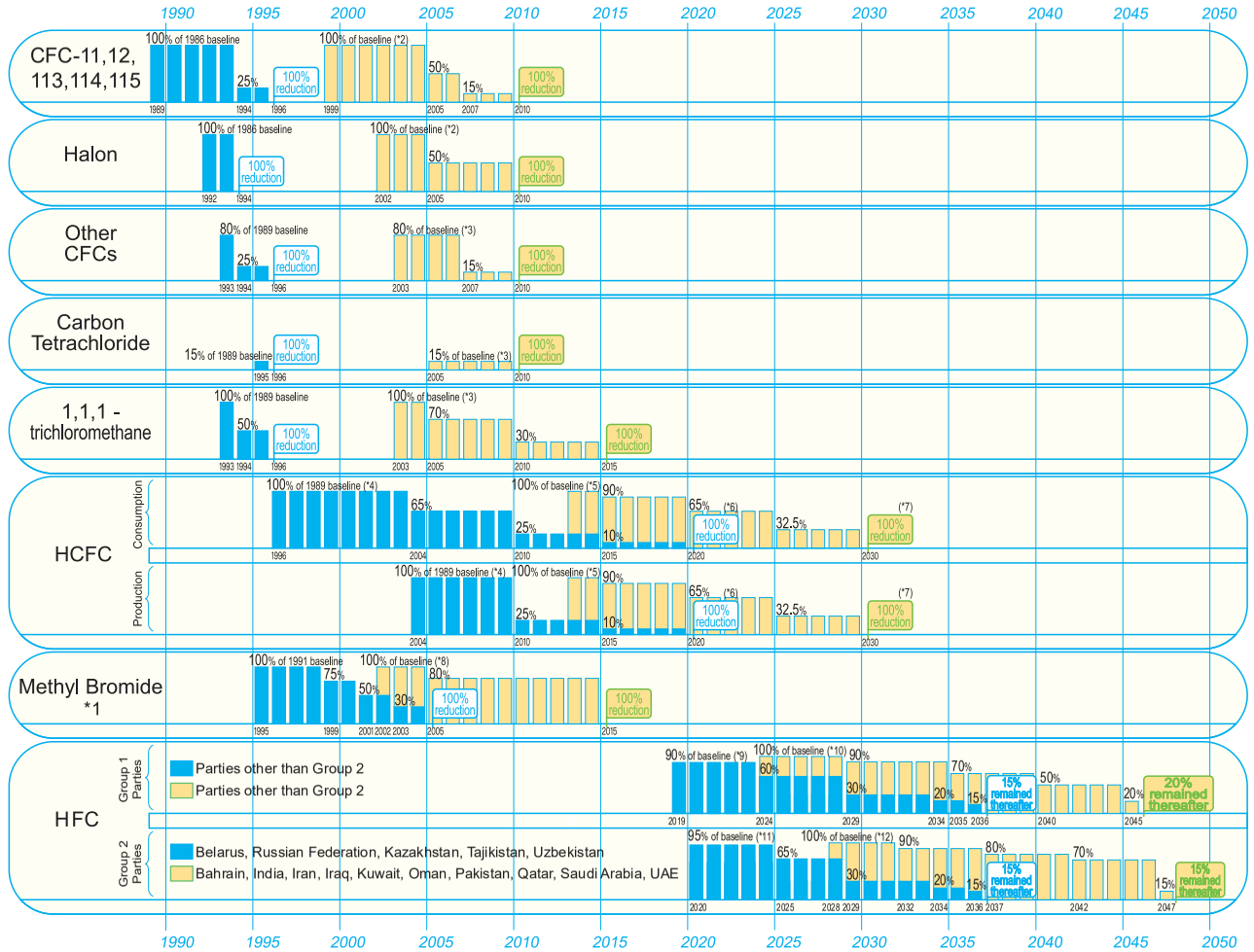
Global Efforts & Japan's Commitment

The global community has agreed to phase out ozone depleting substances such as CFCs and HCFCs under the Montreal Protocol on Substances that Deplete the Ozone Layer (1987).

In 2016 the Parties adopted the Kigali Amendment to phase down HFCs in order to reduce the use of high global warming potential HFCs, and the Kigali Amendment entered into force in January 2019.

Japan accepted the Kigali Amendment on 18 December 2018.

ODS phase-out and HFC phase-down schedule under the Montreal Protocol



Production and consumption (= production + import - export) are to be phased out by substance group according to specific schedules.

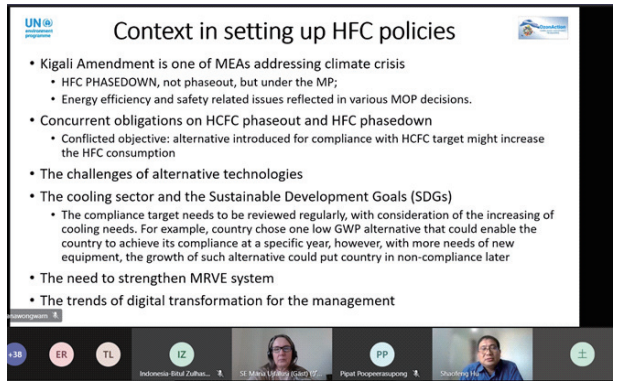
*1) Methyl bromide used for guarantine and pre-shipment is exempted from control.
*2) Baseline = the average of production and consumption from 1995 to 1997 or 0.3 kg per capita, whichever is lower.
*3) Baseline = the average of production and consumption from 1998 to 2000 or 0.2 kg per capita, whichever is lower.
*4) Consumption baseline = HCFC consumption in 1989 + CFC consumption in 1989 x 2.8 %
Production baseline = the average of HCFC production and consumption in 1989 + the average of CFC production and consumption of 1989 x 2.8%
*5) Baseline = the average of production or consumption of 2009 and 2010.
*6) Production and consumption only for servicing of existing refrigeration and air-conditioning equipment are allowed until 2030, provided that such
production and consumption do not exceed 0.5 % of the baseline.
*7) Production and consumption only for servicing of existing refrigeration and air-conditioning equipment are allowed until 2040, provided that such
production and consumption do not exceed 2.5 % of the baseline.
*8) Baseline for methyl bromide = the average of production and consumption from 1995 to 1998.
*9) Baseline = the average of HFC production and consumption from 2011 to 2013 + the baseline of HCFC production and consumption x 15% (CO2 eq.)
*10) Baseline = the average of HFC production and consumption from 2020 to 2022 + the baseline of HCFC production and consumption x 65%(CO2 eq.)
*11) Baseline = the average of HFC production and consumption from 2011 to 2013 + the baseline of HCFC production and consumption x 25% (CO2 eq.)
*12) Baseline = the average of HFC production and consumption from 2024 to 2026 + the baseline of HCFC production and consumption x 65% (CO2 eq.)

**Each Party may produce the controlled substances for basic domestic needs in developing countries beyond the controlled level and essential or critical uses such as laboratory and analytical uses are exempted from control. For the HFC phase down, a high ambient temperature exemption shall be available to Parties with high ambient temperature conditions.

Japan's Commitment

Japan has been committed not only to achieving its own obligations under the Montreal Protocol but also to assisting other countries, mainly those in Asia and the Pacific region, based on its experience in policy enforcement and technical development.
The Ministry of the Environment of Japan has been working through the Regional Network Meetings of Asia and the Pacific, and through the Multilateral Fund for the Implementation of the Montreal Protocol, including the HPMP refrigeration servicing sector of China and Mongolia.

Thematic Workshop for National Ozone Officers of South Asia Network.
Ulaanbaatar, Mongolia. August 2019.



Virtual Thematic Meeting of South Asia / Southeast Asia Network on Policy Options for an HFC Phase-down.
April 2021.

Initiative on Fluorocarbons Life Cycle Management

Since the 2019's launch of the Initiative on Fluorocarbons Life Cycle Management at the UNFCCC COP 25 in Madrid, Spain, Japan has worked actively to promote the global awareness on the importance of the life cycle management of fluorocarbons.
In collaboration with partner countries and international organizations, Japan calls for concrete actions, innovations, and collaborations among the partners to foster the initiative.
Japan has held and will hold several meetings/side events annually to showcase good practices and learn from each other.

INITIATIVE ON FLUOROCARBONS LIFE CYCLE MANAGEMENT

Initiative on Fluorocarbons Life Cycle Management

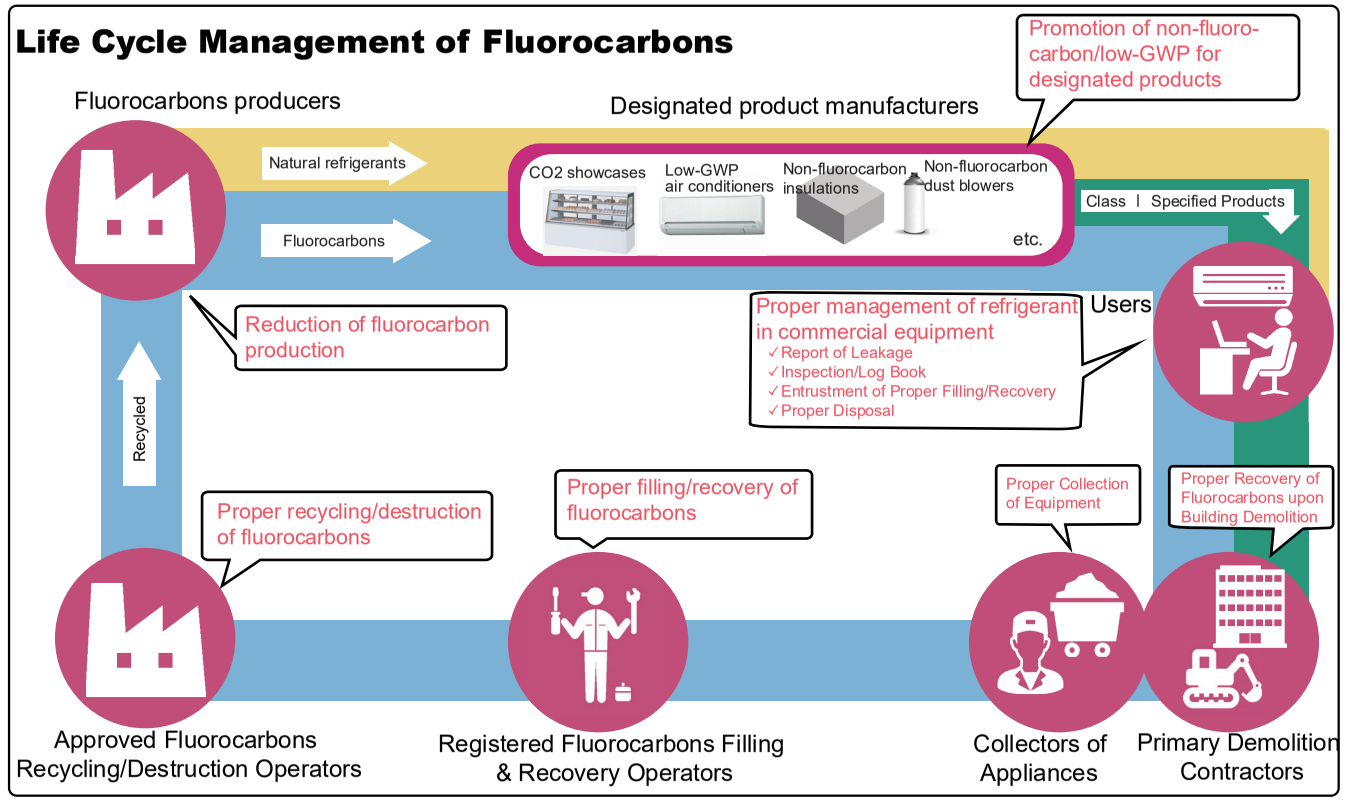
Ministry of the Environment, Japan

14 State/Int'l Organization Partners
Chile, France, Japan, Maldives, Mongolia, New Zealand, The Philippines, Singapore, The United Kingdom, Vietnam, The World Bank, CCAC, ADB, and UNIDO (as of Jan '21)

Japan's legal framework on fluorocarbon management

In Japan, CFCs, HCFCs, and HFCs have been recovered from commercial refrigerators and air conditioners at the time of maintenance and disposal of equipment since 2001 in line with a law. And they have been recycled or destroyed in order to prevent fluorocarbons from being released into the air.

In 2015 and 2019, the "Act on Rational Use and Proper Management of Fluorocarbons" was amended and strengthened to implement comprehensive measures throughout the life cycle of fluorocarbons.



■ Major responsibilities of stakeholders

Fluorocarbons Producers

Manufacturers and importers of CFCs, HCFCs, and HFCs must be received permission and assigned quota systems. Moreover, they must rationally use fluorocarbons, including the production of alternatives following the criteria established by the government.

Designated Product Manufacturers

Manufacturers and importers of designated product must strive to reduce environmental impact due to fluorocarbons in accordance with the evaluation criteria established by the national government.

The target GWP value of the designated products is set by category and periodically reviewed taking into consideration the lowest GWP refrigerant (the top runner) among the designated products in the market in Japan, taking into account safety, energy efficiency, affordability, etc.

Manufactures and importers of the designated products are required to meet the target GWP value by the target year of the corresponding category. The compliance with the target value is measured for each category based on the volume weighted average GWP of all the refrigerants, blowing agents, or propellant gases contained in all the products that are shipped by each company in each year, not on the basis of individual products.

Sections (Types) of designated Products	Currently Used Main Refrigerants and GWPs	Target GWPs	Target Years
Residential Air Conditioners (Excluding Through-the-Wall Types)	R410A(2090), R32(675)	750	2018
Stores/Shop/Office Air Conditioners			
(i)Those with Legal Freezing Capacity of Less Than 3 tons, Excluding Floor Type	R410A(2090), R32(675)	750	2020
(ii)Those with Legal Freezing Capacity of 3 tons or more, Excluding (iii) and Floor Type	R410A(2090)	750	2023
(iii)Those Central Air Conditioners Using Centrifugal Chillers	R134a(1430), R245fa(1030)	100	2025
Automotive Air Conditioners (Limited only to Those Listed as Passenger Vehicles (Excluding Automobiles with 11 or More Passengers))	R134a(1430)	150	2023
Condensing Units and Stationary Type Freezer Refrigerator Units (Excluding Condensing Units with Rated Output of 1.5kW or Less)	R404A(3920), R410A(2090), R407C(1770), CO2(1)	1500	2025
Central System Freezer Refrigerator Equipment (Limited to Those Shipped for Newly Installed Freezer Refrigerators with Freezing Capacity of 50,000m³ or More)	R404A(3920), NH3(1)	100	2019
Refrigerator or Freezer using Rigid Polyurethane Foams	HFC-245fa(1030), HFC-365mfc(795)	100	2024
Vending machines with refrigerating or freezing function (only products with rigid polyurethane foam for heat insulation)		100	2024
Rigid polyurethane foam stock solution		100	2020
Rigid polyurethane foam stock solution (except for products used for housing)		100	2024
Insulating Material Using Rigid Polyurethane Foams (Limited to Those Used for House Building Material and Formed at Building Sites)		100	2024
Sprayer Exclusively Filled with Propellants (Excluding Uses That Require Non-flammability)	HFC-134a(1430), HFC-152a(124), DME(1)	10	2019

Users/ Maintenance Operators/ Disposal Operators

Users of specified products must report the calculated leakage amount to the government if there is leakage of 1,000t-CO2 eq or more.

When filling or recovering them, users must entrust registered operators to fill/rocover. When disposing them, users must submit a certificate of recovery to recycling/destruction operators. (See p.9 for details)

Primary Demolition Contractors and Collectors of Appliances

Demolition contractors must confirm presence/absence of the specified products upon the building demolition.

Collectors of the appliances must not collect the appliances without the certificate of fluorocarbons recovery. (See p.9 for details)

Registered Fluorocarbons Filling/ Recovery Operators

Fluorocarbons filling/recovery operators must be registered to local governments and they must comply with the criteria in filling or recovering fluorocarbons. If they do not recycle recovered fluorocarbons by themselves, they must deliver fluorocarbons to an approved fluorocarbon recycling operator or an approved fluorocarbon destruction operator.

Approved Fluorocarbons Recycling/ Destruction Operators

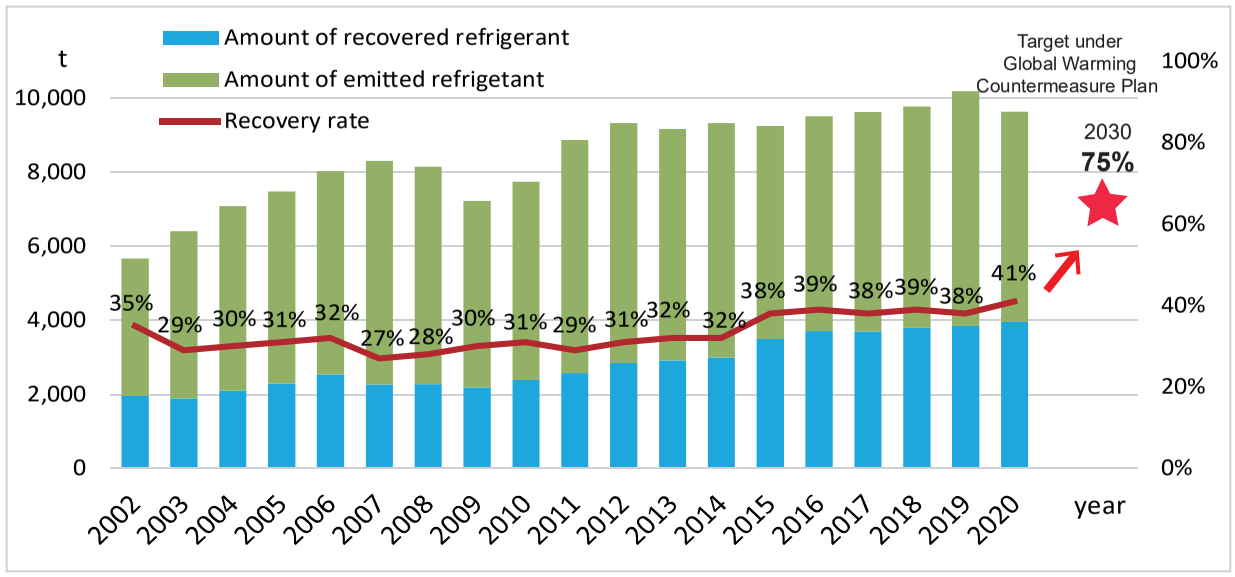
Fluorocarbons recycling/destruction operators must be approved by the government upon their operation. They must recycle or destroy delivered fluorocarbons in accordance with the standards for the recycling/destruction of fluorocarbons.

Specified products are commercial refrigerators and air conditioners containing fluorocarbon refrigerants. (Automobiles' mobile air conditioners are sepately regulated under a different law, i.e. the "End-of–life Vehicle Recycling Law".)

Strengthening of Recovery, Recycling & Destruction of Fluorocarbons

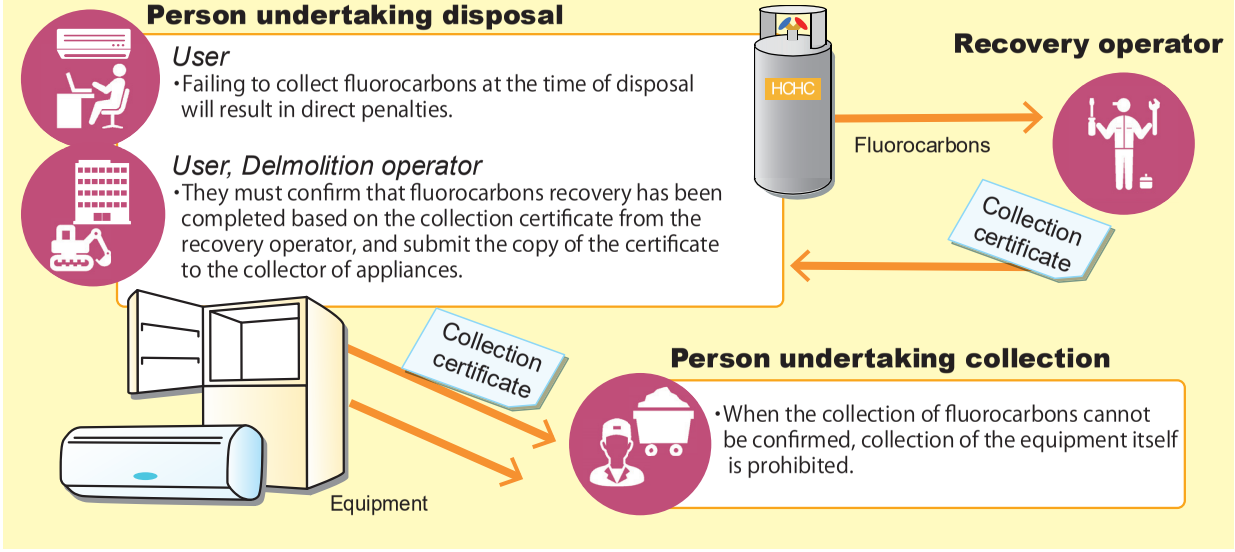
In Japan, the regulations on fluorocarbons prohibit intentional emissions of fluorocarbons contained in equipment at the time of disposal. The gases must be recovered from equipment such as home appliances, cars and commercial equipment, and the recovered gases are required to be recycled or destroyed.

The recovery rate of fluorocarbons remained around 40% currently. To achieve 75% recovery rate by 2030, mechanisms to ensure the recovery of fluorocarbons during disposal of equipment are being strengthened.



Recovery rate of fluorocarbons from commercial refrigerations during disposal in Japan
Source: Ministry of the Environment, Japan

Amended "Act on Rational Use and Proper Management of Fluorocarbons" enforced in 2020, aiming to ensure the recovery of fluorocarbons during disposal of equipment.



The Amounts of Recovered, Recycled, and Destroyed Refrigerants in Japan

In Japan, there are :

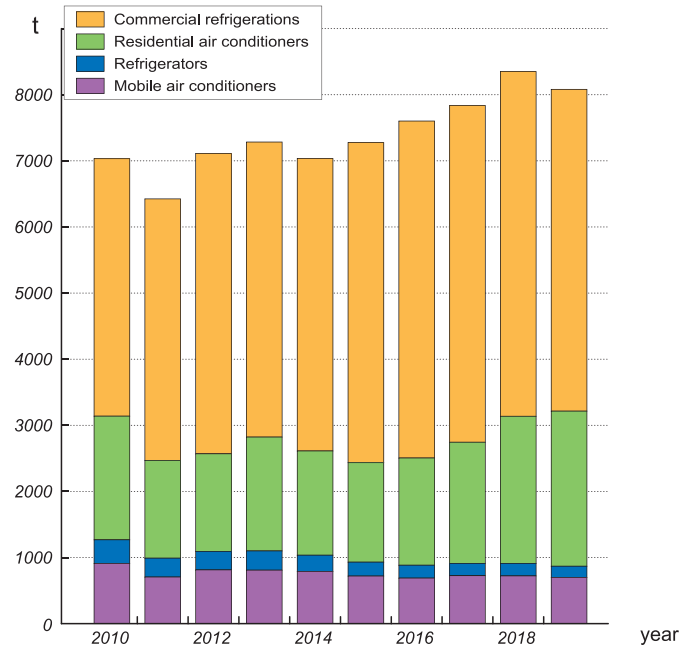
- 45 home-appliance recycling plants (Jul. 2021)
- 35 F-gas recycling facilities (Jan. 2022)
- 58 F-gas destruction facilities (Jan. 2022)

The destruction facilities use various technologies such as superheated steam, municipal waste incinerators, cement kiln, etc.

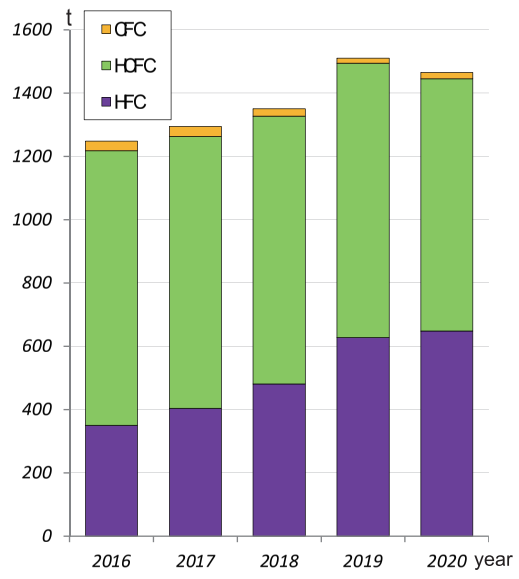
In these facilities :

- More than 8,000 tons of refrigerant was recovered (2019)
- More than 1,400 tons of refrigerant was recycled (2020)
- About 4,000 tons of refrigerant was destroyed (2020)

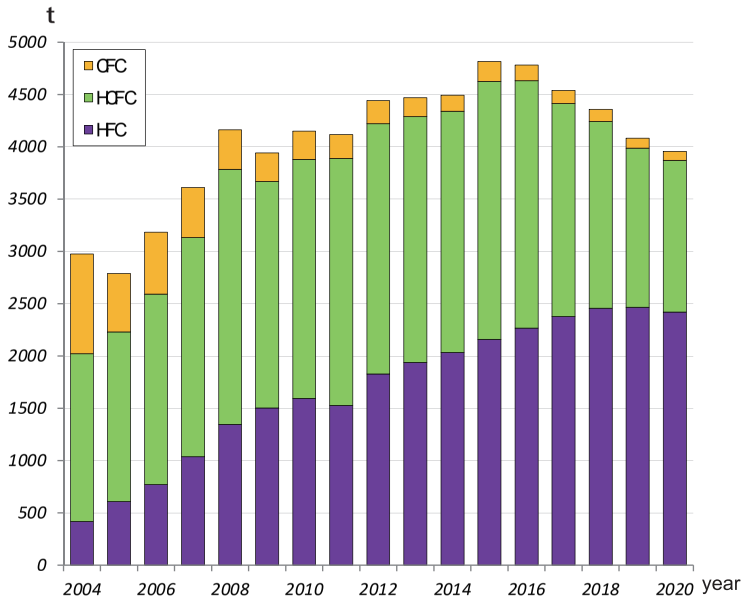
Recovery of refrigerant from super-market cold showcase
Source: Refrigerants Recycling Promotion and Technology Center, Japan



Amount of recovered refrigerant in Japan
Source: Ministry of the Environment, Japan



Amount of recycled refrigerant in Japan
Source: Ministry of the Environment, Japan



Amount of destroyed refrigerant in Japan
Source: Ministry of the Environment, Japan