

The Fluorocarbon-Free Option for the sake of the planet

# Fluorocarbon-Free Refrigerators



Ministry of the Environment



Ministry of the Environment  
JAPAN

# The Fluorocarbon-Free Option

## The Fluorocarbon-Free Option - for the sake of the environment

Climate change has become a serious problem. To help solve this problem, we have the option to purchase products that do not use fluorocarbons, "Fluorocarbon-free products"

## What are Fluorocarbons? . . . . .

Various types of fluorocarbons are used in various applications

Fluorocarbons are composed of Fluorine and Carbon. Fluorocarbons have many advantages such as being hard to burn, chemically stable, easy to liquefy and safe to humans. Because of this, they have become used widely as refrigerants, which carry heat in air-conditioners, mobile air-conditioners, refrigerators, vending machines, drinks coolers, freezer showcases and water coolers. They are also used as foam agents for insulation, cleaning agents for semiconductors and precision components and propellants for aerosols such as air dusters. There are many types of fluorocarbons; the first type was CFCs, followed by HCFCs and then HFCs.

### Types of Fluorocarbons

- CFCs (Chlorofluorocarbons)

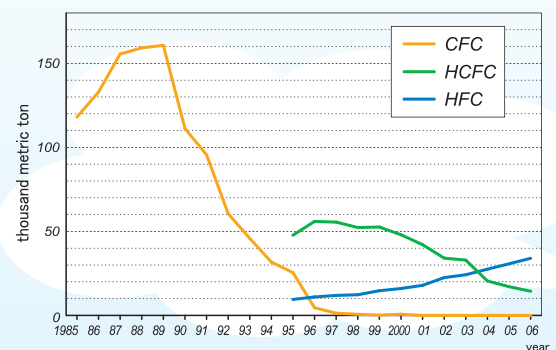
Compounds of Carbon, Fluorine and Chlorine

- HCFCs (Hydrochlorofluorocarbons)

Compounds of Carbon, Fluorine, Chlorine and Hydrogen

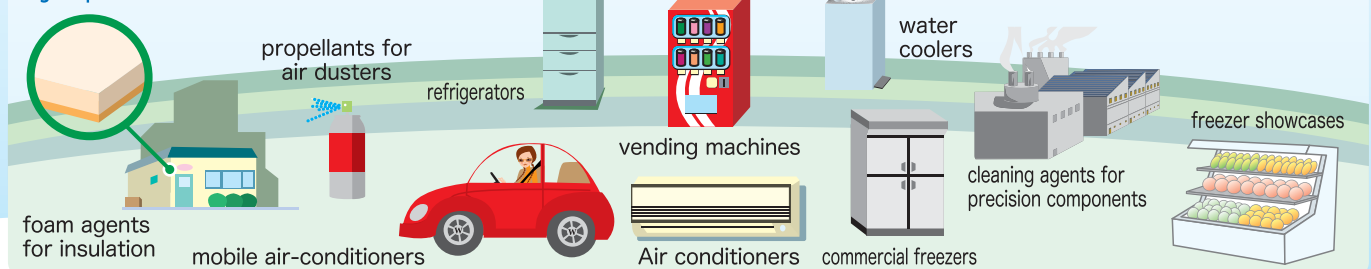
- HFCs (Hydrofluorocarbons)

Compounds of Carbon, Fluorine and Hydrogen



Fluorocarbons shipments in Japan  
Based on data of Japan Fluorocarbon Manufacturers Association

### Major products that use fluorocarbons

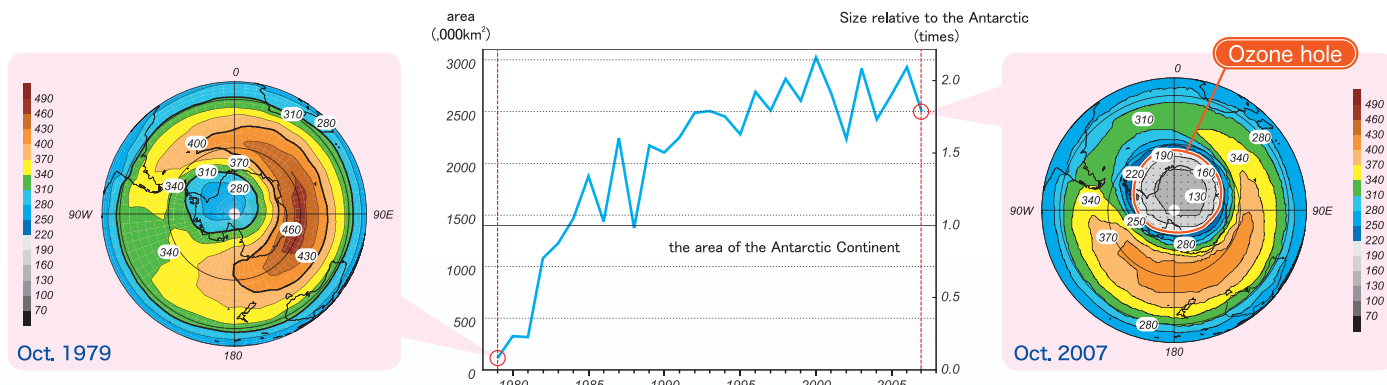


**However, Freons are a cause of climate change and ozone layer depletion!!**

# Ozone Layer Depletion

## Ozone layer depletion continues unabated

The Ozone Layer is 10-50km above the Earth's surface and absorbs harmful UV rays from the Sun. However, CFCs and HCFCs which are emitted into the air reach the ozone layer and decompose ozone by chemical reactions. The depletion of ozone above the Antarctic is so serious that in September - October each year the ozone density decreases drastically. This is called "Ozone Hole", because it looks like a hole in the sky. Still now, there is no clear sign of recovery of the Ozone Hole.



Chronological change of the size of the ozone hole and the distribution of the ozone above the Antarctic in October  
Source: Japan Meteorological Agency Ozone Layer Observation Report 2007

# Impact on Climate Change

## Fluorocarbons are about 100-10,000 times stronger greenhouse gases than CO<sub>2</sub>

Currently, climate change caused by man-made emissions of CO<sub>2</sub> is becoming more and more serious. Climate change is not only caused by CO<sub>2</sub>. Fluorocarbons such as CFCs, HCFCs and HFCs also have strong greenhouse effects. Their impact on climate change is known to be extremely strong -- ranging from a hundred times to over ten thousand times stronger than CO<sub>2</sub>. For example, fluorocarbons used in air-conditioners and mobile air-conditioners are more than 1,000 times stronger greenhouse gases than CO<sub>2</sub>. If 1 kg of fluorocarbons are emitted into the air accidentally, they will have the equivalent impact of more than 1 ton of CO<sub>2</sub>.

### Geographical pattern of surface warming

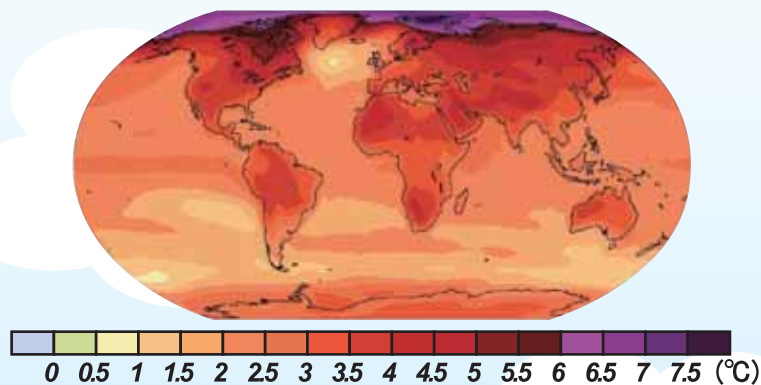


Figure : Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. Temperatures are relative to the period 1980-1999.

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

### Global warming potentials of CFC, HCFC and HFC (in comparison with CO<sub>2</sub> at equal weight)

1

CO<sub>2</sub>

124

HFC-152a

1430

HFC-134a

1810

HCFC-22

4750

CFC-11

10900

CFC-12

14800

HFC-23

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



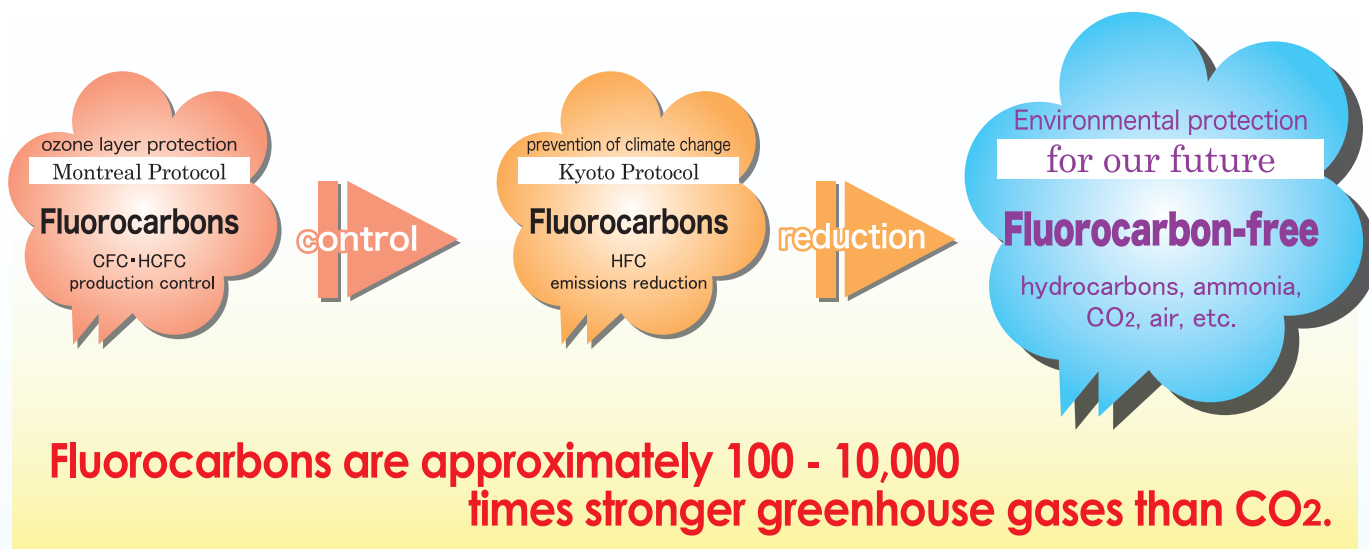
# Global Developments in Action on Fluorocarbons

The world is moving forward to prevent climate change and protect the ozone layer

When ozone layer depletion was recognized as a global environmental problem caused by fluorocarbons, the "Montreal Protocol on Substances that Deplete the Ozone Layer" was adopted, under which production of CFCs has been completely phased out in developed countries including Japan. Global actions are also being taken for the phase-out of production of HCFCs, which were introduced as the alternatives to CFCs.

In addition, HFCs, the alternative to CFCs and HCFCs, are controlled under the "Kyoto Protocol" because they have a significant impact on climate change though they don't have any impact on ozone depletion.

In order to protect the ozone layer and prevent climate change, various measures are taken in Japan, including recovery and destruction of a fluorocarbons in equipment such as refrigerators and air-conditioners, and promotion of the use of alternative products.



## Choose Fluorocarbon-Free Products

Our choices will change the future

Since fluorocarbons are a cause of climate change and ozone depletion, alternative technologies and products that do not use fluorocarbons are being developed. In Japan, to promote these products, government agencies are obliged to use fluorocarbon-free products in accordance with the "Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing)" and the government provides subsidies to encourage companies to adopt fluorocarbon-free products.

Fluorocarbon-free products are being developed and marketed in many areas. In this pamphlet, we will introduce **Fluorocarbon-Free Refrigerators**. Please carefully consider whether you can choose a fluorocarbon-free product for the sake of the environment.



Label for  
Fluorocarbon-Free  
Products



## Take a step towards combating climate change by choosing fluorocarbon-free products.

# About Fluorocarbon-Free Refrigerators • • •

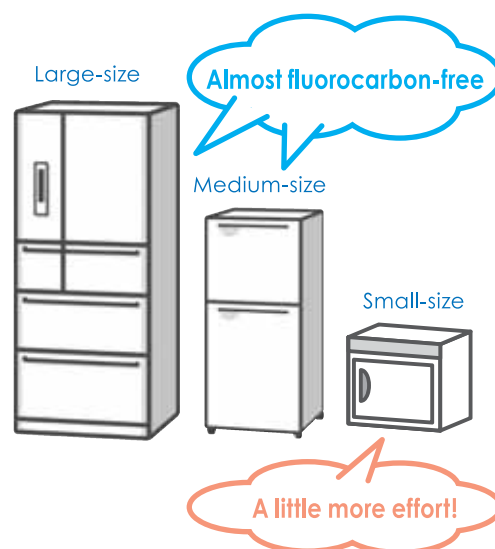
## What is a fluorocarbon-free refrigerator?



Refrigerators and freezers are indispensable in everyday life for conserving fresh food.

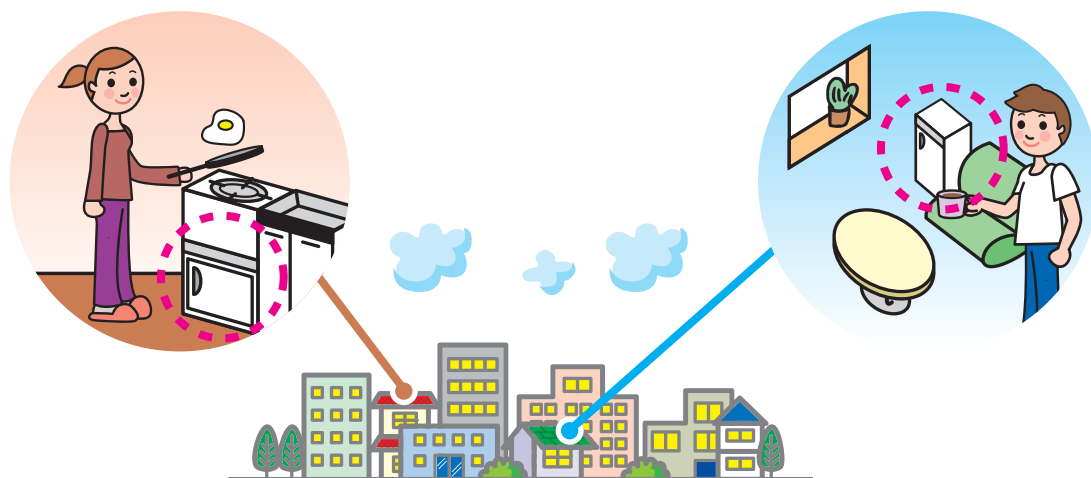
Chlorofluorocarbons (CFC), which are a variety of fluorocarbons, have traditionally been used as refrigerants to release heat from inside domestic refrigerators. When CFC production was restricted in order to protect the Earth's ozone layer, hydro-fluorocarbons (HFC) were replaced with CFC as refrigerants.

However, HFC is a substance that has an effect on climate change one thousand times as strong as carbon-dioxide. For example, a large-sized domestic refrigerator contains about 150g of HFC134a. When this is released into the atmosphere, the impact on climate change is the same as the emission of 0.2t of carbon-dioxide (the equivalent of 20,000 soccer balls in volume). Since HFC is included in the list of restricted greenhouse gases under the Kyoto Protocol, its use must be reduced as much as possible, and research and development into new refrigerants has been undertaken. Refrigerators using isobutane, a hydrocarbon-type refrigerant, have already been put to practical use. At present, fluorocarbon-free refrigerators using isobutane as refrigerant are most commonly used for large- and medium-sizes.



Practical use of fluorocarbon-free refrigerators

On the other hand, in terms of small-sized refrigerators used mostly by students or unmarried people living on their own, products using either isobutane or HFC are both marketed. It is hoped that these small-sized refrigerators will also become fluorocarbon-free.



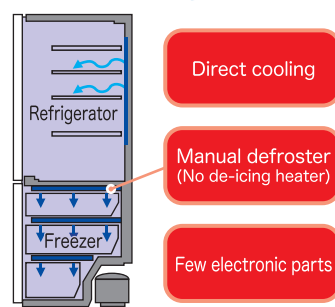
**Small-sized refrigerators for which fluorocarbon-free is desirable**  
(Models used mostly by students and unmarried people living on their own)

# Technological Development of Fluorocarbon-Free Products . . . . .

## Issues Concerning the Introduction of Fluorocarbon-Free Refrigerators in Japan

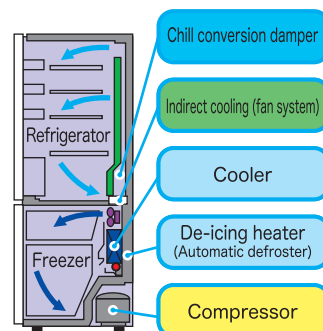
Since the hydrocarbon refrigerant isobutane is inflammable, the prevention of explosion in case of leaks was an issue regarding its use.

Most European domestic refrigerators operate upon the "direct cooling method", in which the inside is directly cooled by the chill from the cooler, and no defroster is installed inside. Therefore, there is no threat of ignition due to the heat from the defroster, even in the case of a gas leak. For this reason, the use of isobutane was accelerated in domestic refrigerators made in Europe.



Structure of European domestic refrigerators

However, in Japan, frost can build up inside the refrigerator due to high humidity. Therefore the "indirect cooling method", which forcibly circulates the chill from the cooler by using a fan was introduced, and de-icing heaters (automatic defrosters) were installed inside refrigerators. Refrigerators in Japan are mostly large- or medium-sized, the quantity of refrigerant filling tending to be large, and there are many wooden houses. For these reasons, extra care was required in the adoption of isobutane, in order to avoid fires.

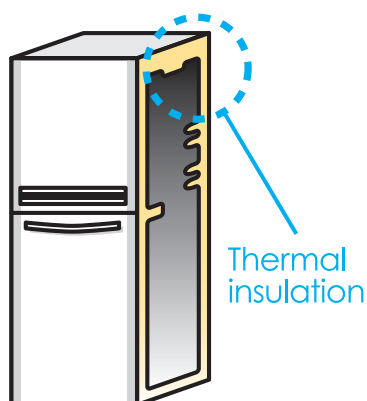


Structure of Japanese domestic refrigerators

## Fluorocarbon-Free Technology

Domestic refrigerator manufacturers developed various technologies and made structural improvements in order to enable the use of fluorocarbon-free refrigerants.

In order to minimize the use of the inflammable isobutane and avoid refrigerant leaks, various measures were taken such as developing technologies for reducing the quantity of refrigerant filling, the use of ultrasonic welding for the outside of the refrigerator, structures with the minimum number of welds, technologies using electric parts which do not ignite the refrigerant in case of leaks, and explosion prevention structures. As a result, the use of isobutane refrigerants was achieved.



## Thermal Insulation of Refrigerators

In the past, CFC and HCFC were used as foaming agents of thermal insulation for refrigerators. Fluorocarbons were excellent substances as foaming agents, but as they were recognized as environmentally unfriendly, foaming agents for refrigerators are becoming fluorocarbon-free. Today, hydrocarbons (cyclopentane) are used as foaming agents in most of the refrigerators made in Japan.

# Major National Policies . . . . .

**Many schemes are being put into place in order to encourage the use of fluorocarbon-free refrigerators.**

## 1) Labeling Fluorocarbon-Free Appliances

Based on the "Rationalization in Energy Use Law", a "Standardized Energy Saving Label" is affixed to domestic appliances meeting energy-saving standards, providing easily to understand information on the energy-efficiency of the product to the consumer. A fluorocarbon-free mark is printed on this label along with energy-saving information (energy saving labeling system, multiple grade evaluation system, rough estimate of annual electricity charges, etc.,) enabling the consumer to distinguish fluorocarbon-free products from products that use fluorocarbons.



## 2) Purchasing Initiative Taken by Governmental Entities

Based on the "Law Concerning the Promotion of Procurement of Eco-Friendly Goods by the States and Other Entities (Law on Promoting Green Purchasing)" requiring Government Entities to purchase environmentally friendly products, government entities have to follow the "Evaluation Criteria" listed below, when purchasing domestic refrigerators. "Factors for Consideration" are matters that are recommended for consideration but are not compulsory.

Evaluation Criteria and Factors for Consideration for Electric Refrigerators, etc., from the Law on Promoting Green Purchasing (extract)

Evaluation Criteria	① Omitted
	② No substance that depletes the ozone layer shall be used as a refrigerant or as an insulation foaming agent .
	③ No hydro-fluorocarbon (alternative fluorocarbon) shall be used as a refrigerant or as an insulation foaming agent.
	④ Omitted
Factors for Consideration	① Substances with the smallest possible impact on climate change should be used as refrigerants or insulation foaming agents .
	②~⑤ Omitted

Source: Basic Policy on the Promotion of Procurement of Eco-friendly Goods (Partly revised by the Cabinet on 5th February 2008)

**When purchasing a domestic refrigerator or freezer, it is important to make sure that it is fluorocarbon free and energy-efficiency in order to gain further climate benefit.**





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