

Japan's Fluorocarbons Control Policy and Industry's Actions toward Carbon Neutrality by 2050
Japan's Policy Measures for phasing down HFCs

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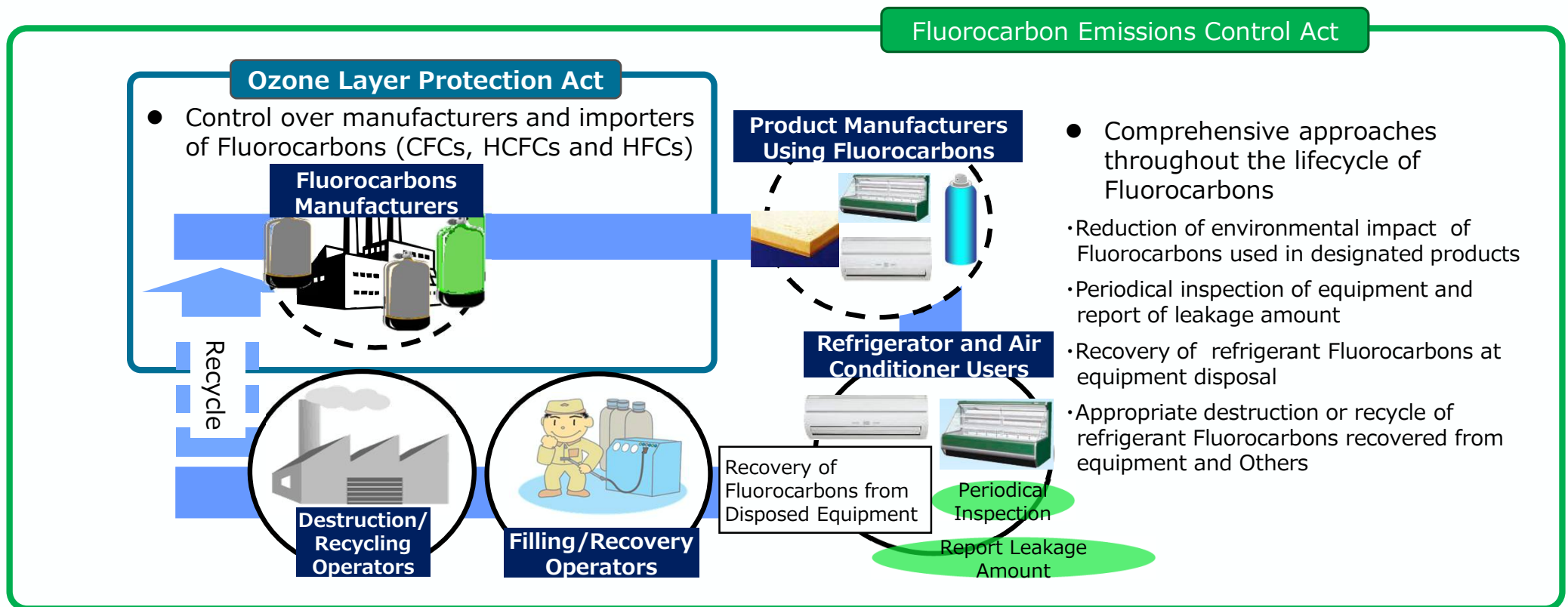
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Two Regulatory Measures for Reducing HFCs Emission

Ozone Layer Protection Act : To comply with the Montreal Protocol, this Act aims to control consumption and production of controlled substances by regulating their productions and imports.

Fluorocarbon Emissions Control Act : This Act aims to control emissions over the lifecycle of Fluorocarbons from up-stream to down-stream.



Kigali Amendment to Ozone Layer Protection Act

Kigali Amendment of the Montreal Protocol was adopted in October 2016.

- The amendment obliges Parties to reduce (phase-down) production and consumption of HFCs.

Japan amended the Ozone Layer Protection Act in June 2018

for reflecting the Kigali Amendment.

- Introduced regulatory measures such as controlling manufactures and imports of HFCs.
- **The amended Act was enacted in December 2018 and came into force on 1 January 2019.**

Japan accepted the Kigali Amendment in December 2018.

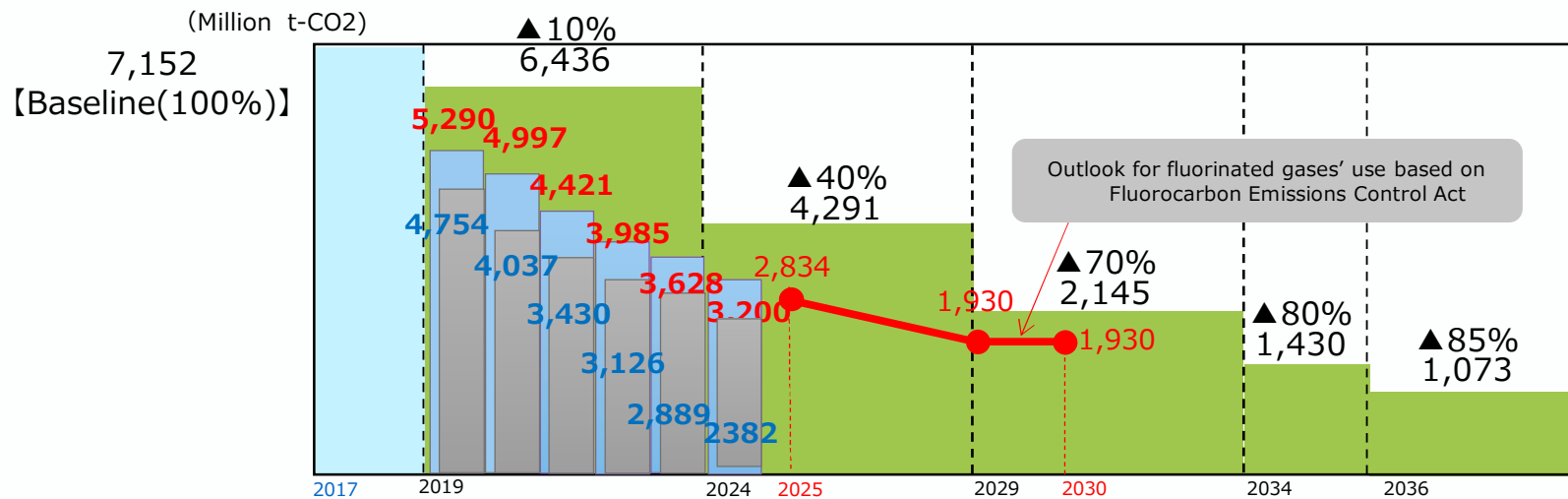
Details of Introduced Policy Measures

- The Ministry of Economy, Trade and Industry (METI) along with the Ministry of the Environment (MOE) **determines and publishes the limit of production as well as consumption of HFCs** which Japan should comply with in accordance with the Protocol.
- **Manufacturers and importers** of HFCs obliged to **request METI's permission as a quota** for manufacture/import of HFCs.
 - Import is subject to the provisions and procedure of the Foreign Exchange and Foreign Trade Act.
- Manufacture and import of **HFCs as feedstock** in the manufacture of other chemicals are **exempted from the quota** after the check and confirmation conducted by METI.

Results on consumption volume from 2019 to 2024

- 2024 quota on consumption was allocated to 32.00 million tons of CO2 equivalent for basic and special uses. This value is far below the target consumption by 25%. The actual consumption is also under the quota in 2024 . We have achieved the target affordably.
- Basic quota : 31.58 million tons of CO2 equivalent (producers eight businesses 23 importers)
- Special quota : 0.42 million tons of CO2 equivalent (producers three businesses nine businesses)

※Special quota are allocated for fire extinguishing agents, inhalers and use in test and research



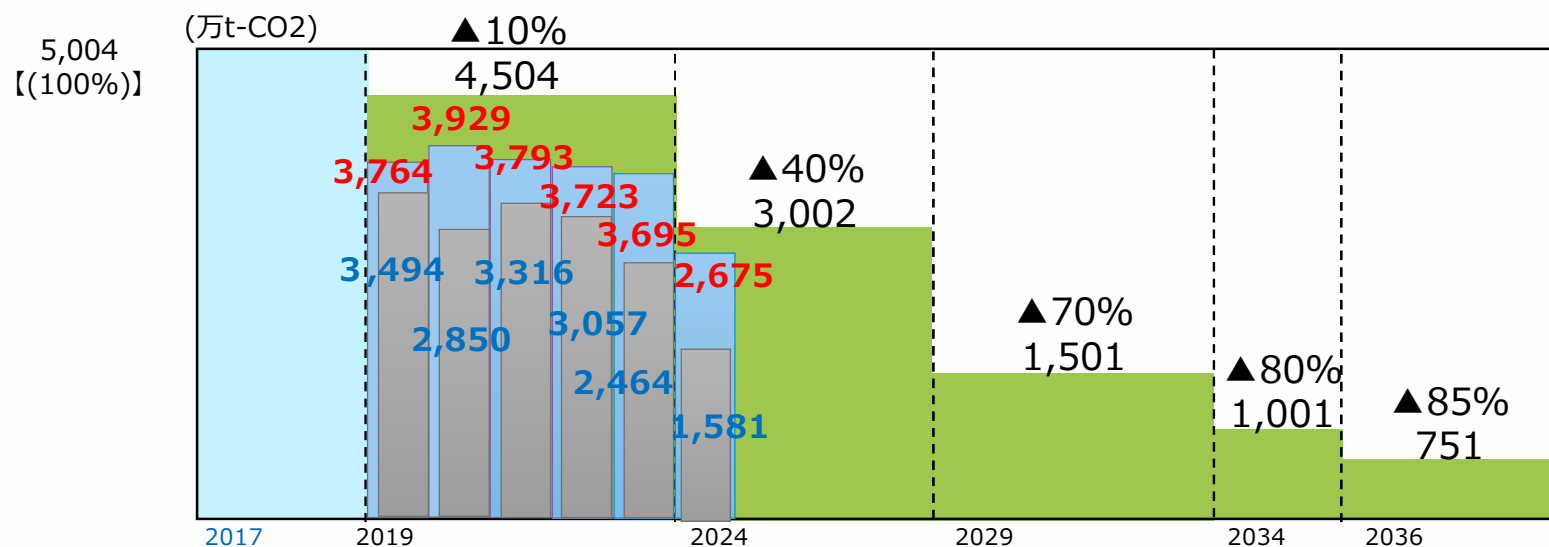
※ Baseline is calculated based on the average of actual value 2011-2013

Results on production volume from 2019 to 2024

- 2024 quota on production was allocated way below the national cap of Kigali amendment. 26.75 million CO2 equivalent tones were allocated to basic use and special use in total. This value is 11% lower than that of the reduction target 30.02 million CO2 equivalent.

- Basic allocation : 26.61 million CO2 equivalent tons (eight producers)
- Special allocation : 0.14 million CO2 equivalent tons (three producers)

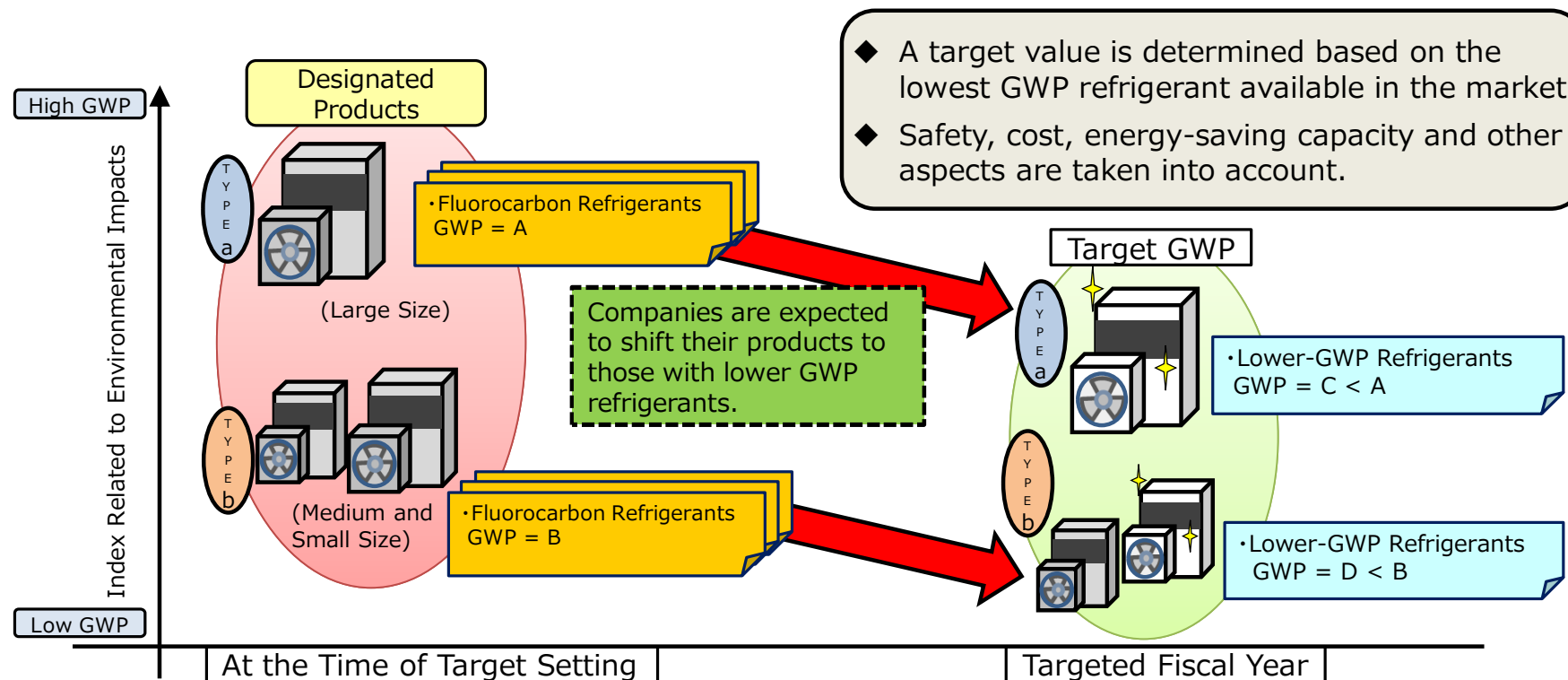
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Up stream: Promoting Low-GWP Top-runner Products

- **Fluorocarbon Emissions Control Act** designates product categories, for which lower-GWP refrigerants are available in the market.
- Based on the **best available product (called “top-runner”)**, the **target value (GWP)** is determined in that product category with the **target year** for achieving that target value.
- **Manufacturers and importers** are required to **meet the target GWP value** for their products **by the target year**.



Promoting Low-GWP Top-runner Products (as of this October)

- Target GWP values and target year have been determined for each product category.

Specified Product Categories			Refrigerant Currently Used (GWP)	Target GWP	Target Year	Enforcement date
Residential Air-Conditioners			R410A(2090), R32(675)	750	2018	
Commercial Air-Conditioners						
	Air-Conditioners for stores and offices		R410A(2090), R32(675)	750	2025	2025.4 Enforcement (revised)
	Central Air-Conditioners	Centrifugal Compression Refrigeration Unit	R134a(1430), R245fa(1030)	100	2025	
		Others	R410A(2090)	750	2029	2029.4 Enforcement (revised)
	Multiple-type Air-Conditioners for building use		R410A(2090)	750	2027	2027.4 Enforcement (revised)
	Air-Conditioners for facilities		R410A(2090)	750	2029	2029.4 Enforcement (revised)
	Gas engine heat pump Air-conditioner		R410A(2090)	750	2029	2029.4 Enforcement (revised)
Auto-motive Air Conditioners						
	for cars		R134a(1430)	150	2023	
	for buses and trucks		R134a(1430)	150	2029	
Condensing Units/Stationary Refrigeration Units						
	excluding those compressor with rated output of 1.5KW		R404A(3920), R410A(2090),	750	2029	2029.4 Enforcement (revised)
	others		R407C(1770), CO2(1)	150	2029	2029.4 Enforcement (added)
Refrigerate and freeze equipment combined unit for commercial use						
	Commercial refrigerator and freezer for commercial use		R404A(3920) , R410A(2090),	150	2029	
	Show cases		R407C(1770) , R134a(1430), CO2(1)	150	2029	
Centralized Refrigerators						
	Only for new refrigerated warehouses having effective volume of at least 50,000m³ ※		R404A(3920), Ammonia(1 digit value)	100	2019	
	Centrifugal Compression Refrigeration Unit (Others ※)		R134a(1430), R245fa(1030)	100	2029	2025.4 Enforcement (added)
	Screw type compressor (Others ※)		R407c(1770), R448A(1386)	150	2031	2025.4 Enforcement (added)
	Other than Centrifugal Compression Refrigeration Unit and Screw type compressor (Others ※)		R410A(2090)	750	2029	2025.4 Enforcement (added)
Refrigerate and freeze equipment using rigid polyurethane foam			HFC-245fa(1030), HFC-365mfc(795)	100	2024	
Vending machine with a Refrigerating or Freezing Function using rigid polyurethane foam				100	2024	
Rigid Polyurethane Form Stock Solution for residential use				100	2020	
Rigid Polyurethane Form Stock Solution for use other than residential use				100	2024	
Heat Insulating Materials (Using rigid polyurethane foam)				100	2024	
Aerosol Spray Cans (except those requiring non-flammability)			HFC-134a(1430), HFC-152a(124), CO2(1), DME(1)	10	2019	

Achievement Status of Designated Products that Have Reached the Target Year

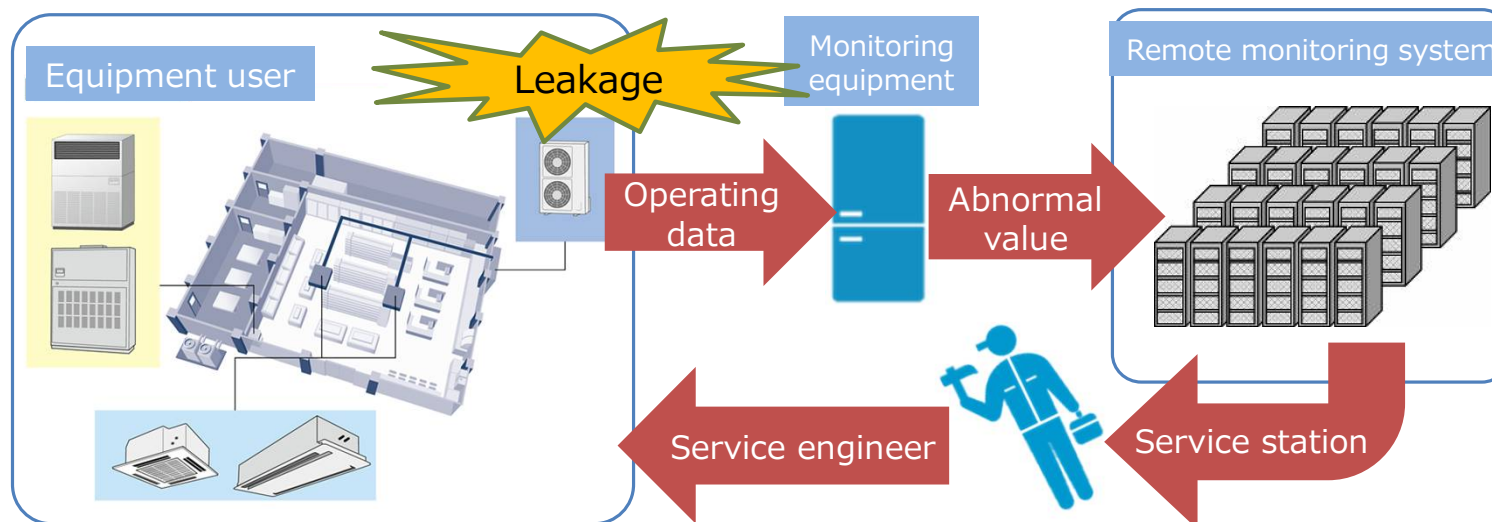
- For the products that have already reached their target year, the goals have generally been achieved.
- In the future, we will continue to monitor the achievement status of products that are approaching their target year and respond appropriately.
- For products that have already met their targets, we are also considering new top-runner products that are expected to be on the market, with a focus on setting even lower GWP target values and target years.

Product Categories	Target GWP VALUE	Target year	Achievement
Residential Air-Conditioners	750	2018	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 685. Refrigerant has been replaced by HFC-32 (GWP675). ○ All 11 manufacturers have achieved the target value.
Centralized Refrigerators	100	2019	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 1.62. Refrigerant has been replaced by CO2 (1) or combination of CO2/NH3 (2). ○ All four manufactures have achieved the target value.
Aerosol Spray Cans (Dust Blower)	10	2019	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 2.7. ○ Propellants have been Replaced by HFO (GWP1) or DME (GWP1) ○ Nineteen out of 20 manufactures have achieved the target. Remaining one has also achieved it after the target year.
Refrigeration Capacity less than 3 tons	750	2020	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 687.7. Refrigerant has been replaced by HFC-32 (GWP675). ○ All 11 manufacturers have achieved the target value.
Rigid Polyurethane Foam Undiluted Liquid in Residential building	100	2020	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 17.3. Stock solution has been replaced by HFO (GWP<2) or H2O/CO2 (GWP1) ○ Seven out of eight manufactures have achieved the target. Remaining one has also achieved it after the target year.
Air-Conditioners for stores and offices (Refrigeration Capacity more than 3 tons)	750	2023	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 683. Refrigerant has been replaced by HFC-32 (GWP675). ○ All 11 manufacturers have achieved the target value.
Auto-motive Air Conditioners for cars	150	2023	<ul style="list-style-type: none"> ○ Weighted average GWP value for total category is 33. Refrigerant has been replaced by HFO. ○ Eight out of 12 manufactures have achieved the target. Remaining four manufacturers have also achieved it after the target year

Middle-stream: Inspection Obligated to Equipment Users

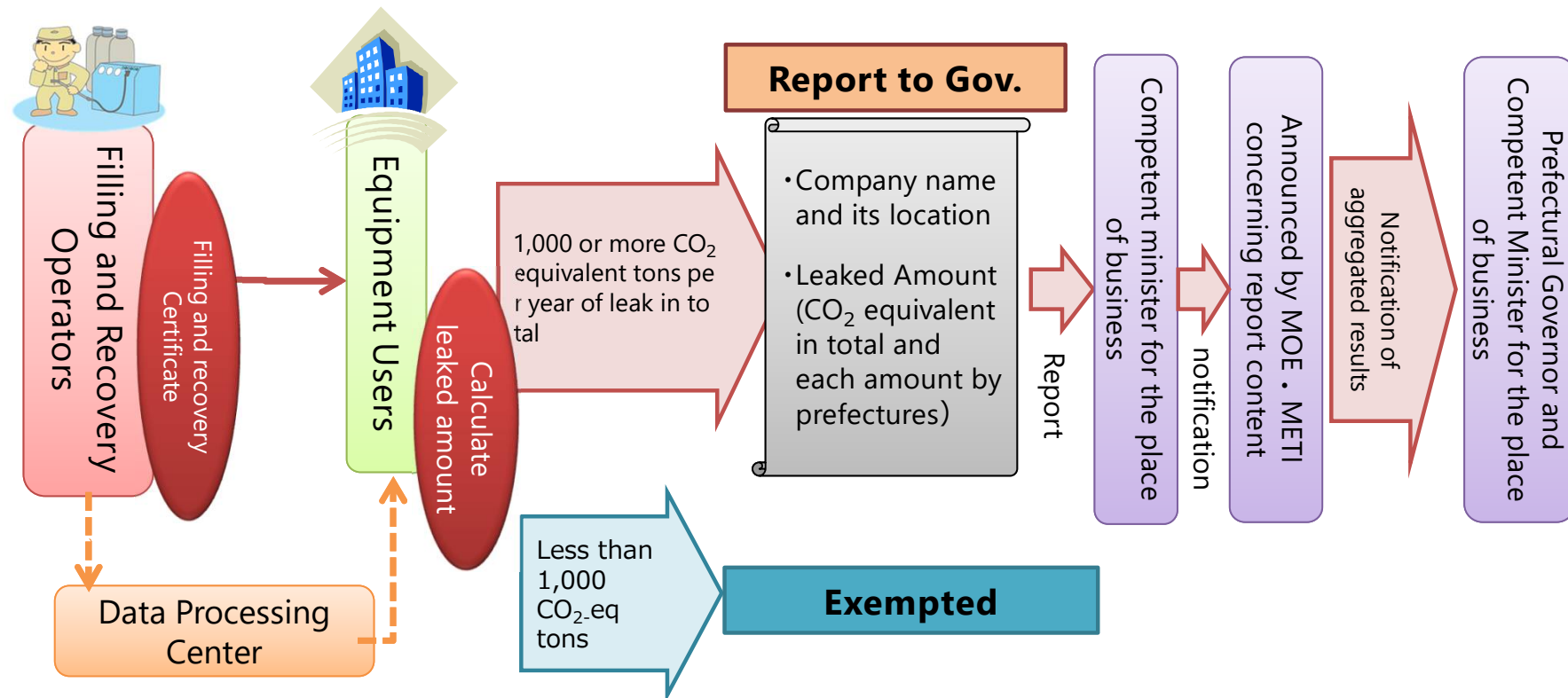
- Equipment users are required to perform simple inspections for equipment at least once every 3 months. Periodic inspections by experts should be performed for certain types of equipment as shown in the following table.
- Remote monitoring systems, which can find leakage of fluorocarbons or its possibility by detecting state value of temperature and pressure, etc. on a constant basis, have become common. In the light of this circumstances, the systems could be used as a replacement for simple inspections under the revised announcement of Fluorocarbon Emissions Control Act since August 2022.

Equipment category	Rated output of motor used by compressor, or output of engine driving compressor	Inspection frequency
Refrigeration equipment and freezer equipment	Equipment of 7.5 kW or more	At least once per year
Air conditioners	Equipment of 50 kW or more	At least once per year
	Equipment of at least 7.5 kW but less than 50 kW	At least once every three months



Middle-stream: Report on calculated amount of leaked fluorocarbons

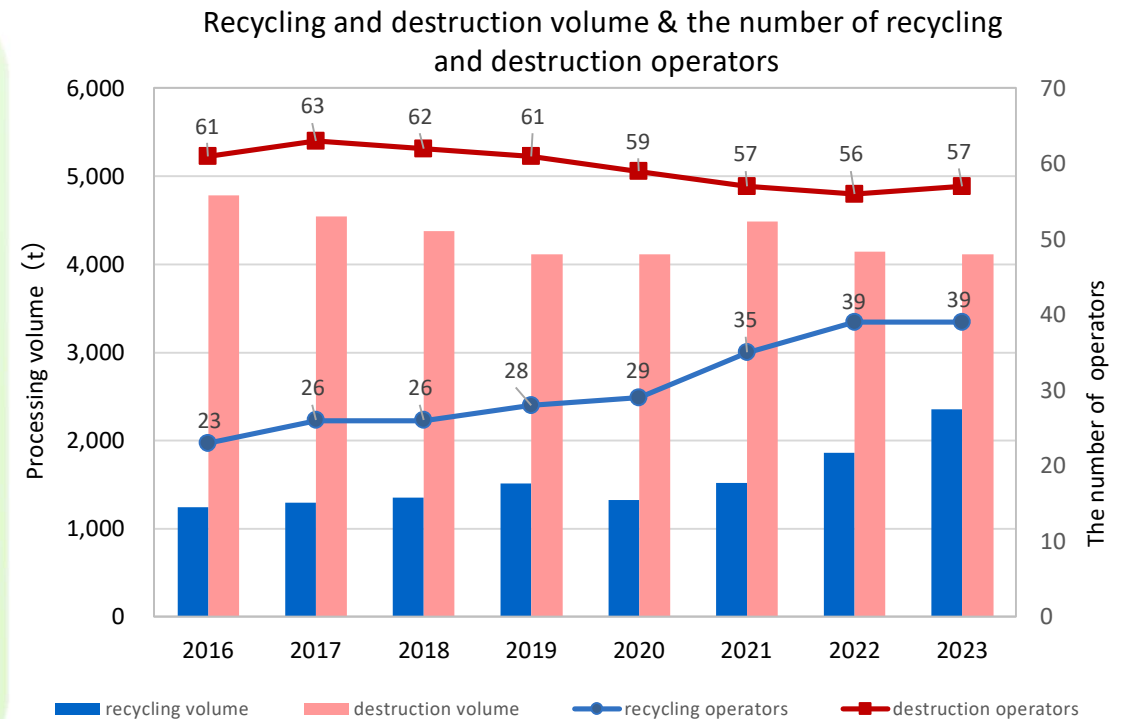
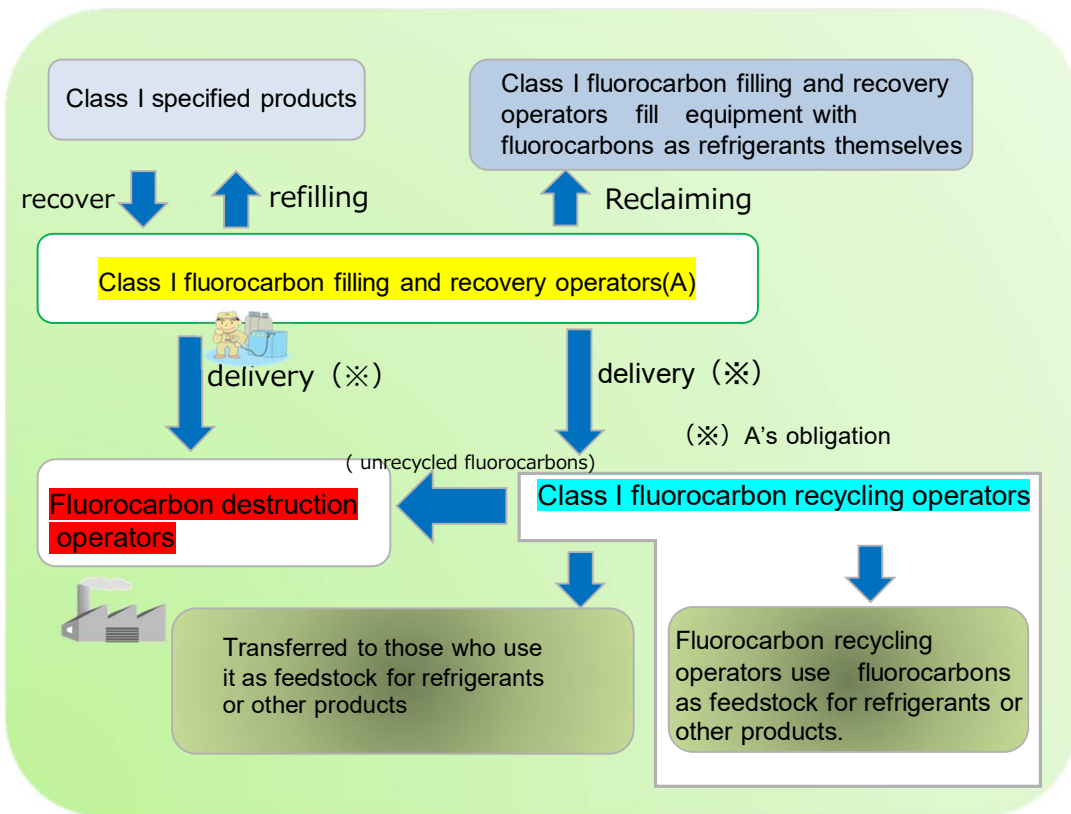
- Equipment users are required to report the leaked amounts of fluorocarbons to the government. Such requirement is subject to users who leaked 1,000 or more CO₂ equivalent tons per year.
- Editing the information that equipment users report, the government publicizes it so that such users can self-manage the fluorocarbon leakage properly while raising their awareness.



Appropriate handling by recycling and destruction operators

- Fluorocarbons recovered by Class I fluorocarbon filling and recovery operators are either recycled by Class I fluorocarbon recycling operators or destroyed by fluorocarbon destruction operators. During these operations, recycling or destruction certificates are issued to the filling and recovery operators to verify that the fluorocarbons have been recycled or destroyed.

- As of April 2025, there are 42 licensed Class I fluorocarbon recycling businesses and 55 fluorocarbon destruction operators. Over the five years, the volume of recycled fluorocarbons has been gradually increasing while the amount being destroyed has been leveling off.



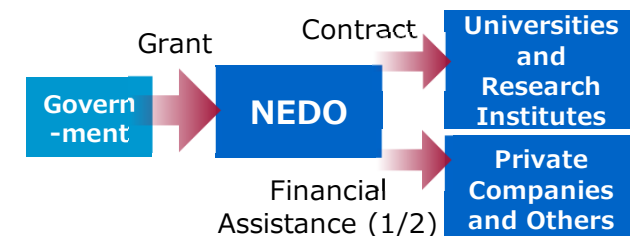
Government Supports for Low GWP Refrigerants

- METI and MOE respectively support development and introduction of low-GWP refrigerants as follows:
 - METI: Research and development on the next-generation low-GWP refrigerants.
 - MOE: Financial support to low-GWP equipment for its introduction into the market.

Development Project on the Next Generation Refrigeration and Air-Conditioning Technologies, and Assessment Methods (METI)

Budget: 500 Million Yen in FY2025 Time Period: Five Years (2023-2027)

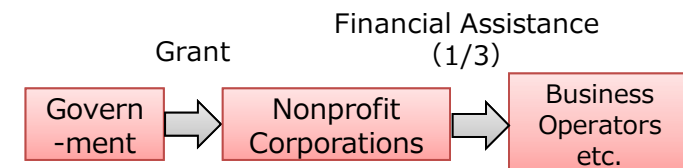
- The goal is to **establish risk assessment methods on candidate alternative refrigerants** under industrial-academic cooperation. The results of the assessment are expected to be utilized for development of air-conditioners.
- Financial assistance is provided to private companies for **developing low-GWP refrigerants and equipment technologies**, which satisfy the balance among low greenhouse effects, energy conservation and safety of products.



Project to Accelerate Introduction of Energy Saving-Type Natural Refrigerant Equipment for Realising Fluorocarbon-Free and Low Carbon Society (MOE)

Budget: 7.0 Billion Yen in FY2025 Time Period: Five Years (2023-2027)

- Although technologies of an energy saving-type natural refrigerant to replace fluorocarbons are available in some uses, **introduction of those technologies is limited due to high initial costs**.
- The government supports **introduction of natural refrigerant equipment with high energy-saving capacity** to realise fluorocarbon-free and low carbon society.



Alternative Refrigerants - High GWP to Low GWP

Stage	Sector	Present Alternative Refrigerants (GWPs)	Low-GWP Alternatives Available or will be Available
Low-GWP alternatives are available or will be available soon	Home Freezers & Refrigerators	[HFC-134a (1,430)]	Isobutane
	Vending Machines	[HFC-134a (1,430)] [HFC-407C (1,770)]	CO ₂ , Isobutane, HFO-1234yf
	Automotive Air Conditioners	HFC-134a (1,430)	HFO-1234yf
Low-GWP alternatives with some challenges on its further dissemination (e.g. cost reduction)	Ultra-Cold Freezers	HFC-23 (14,800)	Air
	Large-scale Commercial Freezers & Refrigerators	HFC-404A (3,920) HFC-410A (2,090)	NH ₃ , CO ₂
	Medium-scale Commercial Freezers & Refrigerators (e.g. Stand-alone Showcases)		CO ₂
Low-GWP alternatives are still under development	Small-scale Commercial Freezers & Refrigerators	HFC-404A (3,920) HFC-410A (2,090)	<i><u>Candidate alternatives are under development</u></i>
	Commercial Air Conditioners	HFC-410A (2,090) HFC-32 (675)	
	Home Air Conditioners	HFC-32 (675)	

※GWP: Global Warming Potential (A value indicating intensity of global warming impact, with reference to CO₂ as 1)

※HFC-407C: Mixed refrigerant of HFC-32, 125, and 134a (23:25:52)

HFC-404A: Mixed refrigerant of HFC-125, 143a, and 134a (44:52:4)

HFC-410A: Mixed refrigerant of HFC-32 and 125 (1:1)



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Thank you for your attention!