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NEDO

Achieving successful transition to Natural Refrigerant

Negative impacts and countermeasures against **CFCs/HCFCs**

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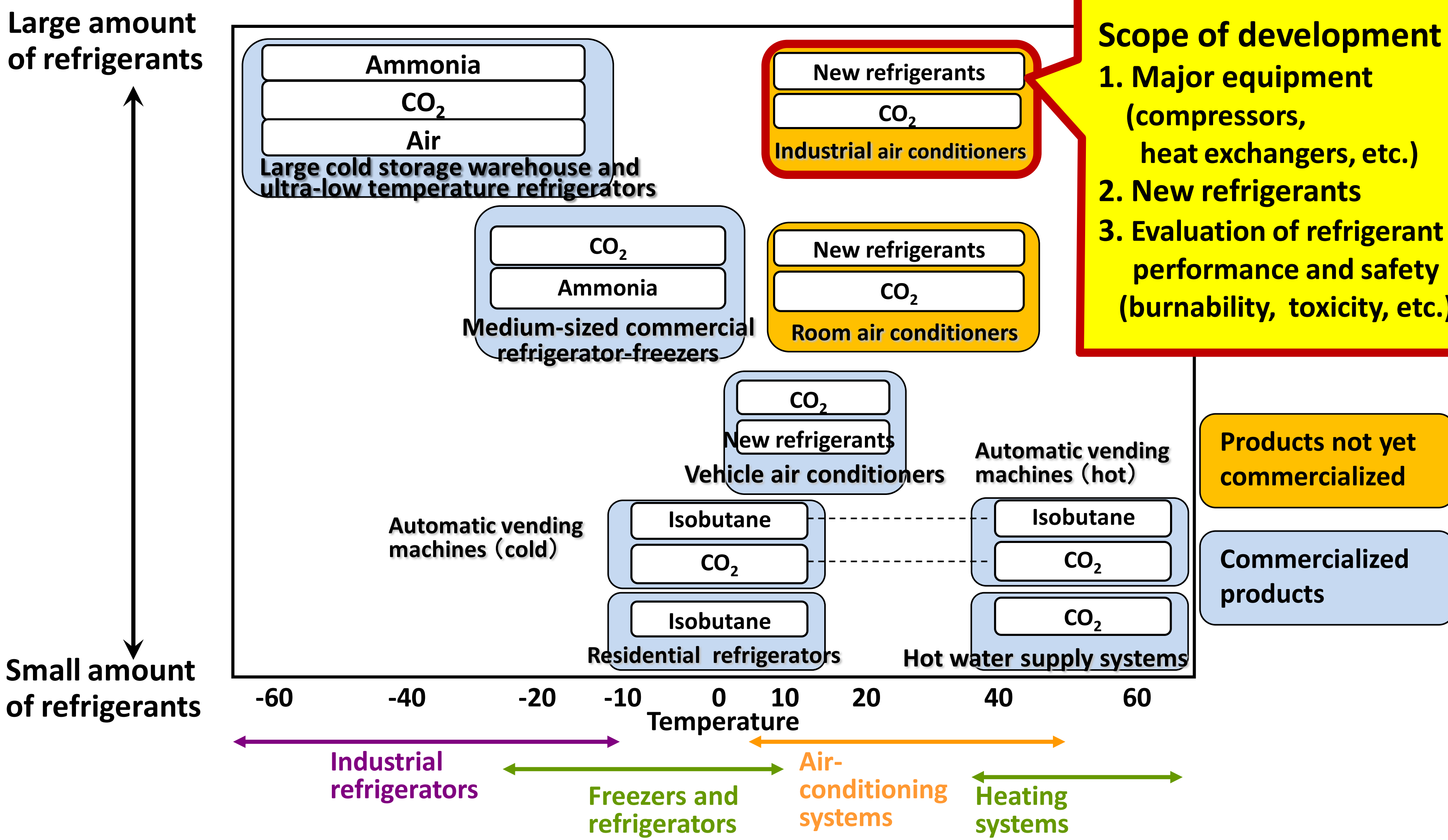
NEDO's Projects

Technology Development of High-Efficiency Non-Fluorinated Air Conditioning Systems

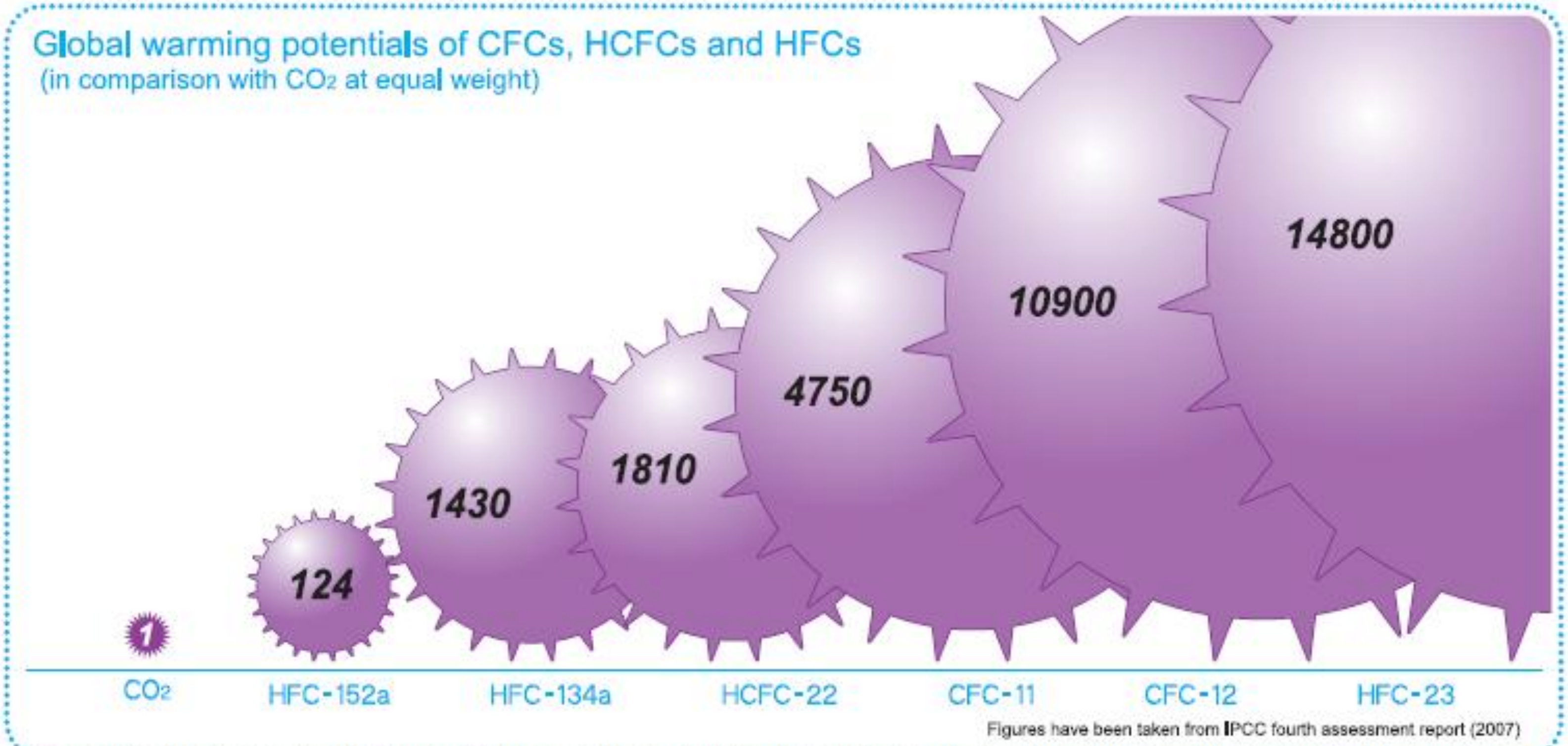
Scope of development

1. Major equipment (compressors, heat exchangers, etc.)
2. New refrigerants
3. Evaluation of refrigerant performance and safety (burnability, toxicity, etc.)



Alternative refrigerants for various types of equipment

CFC and HCFC are also high GWP gasses



The GWP of HCFC-22 is 1,810 times higher than that of CO_2.
(cf. 1 kg of HCFC-22 emissions = 1.8 tons of CO_2 emissions)
Average GHG emissions per capita in the Japanese residential sector (the year 2011): approx. 1.5 tons

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Fluorocarbon Emissions Offsetting CO_2 Reduction Efforts

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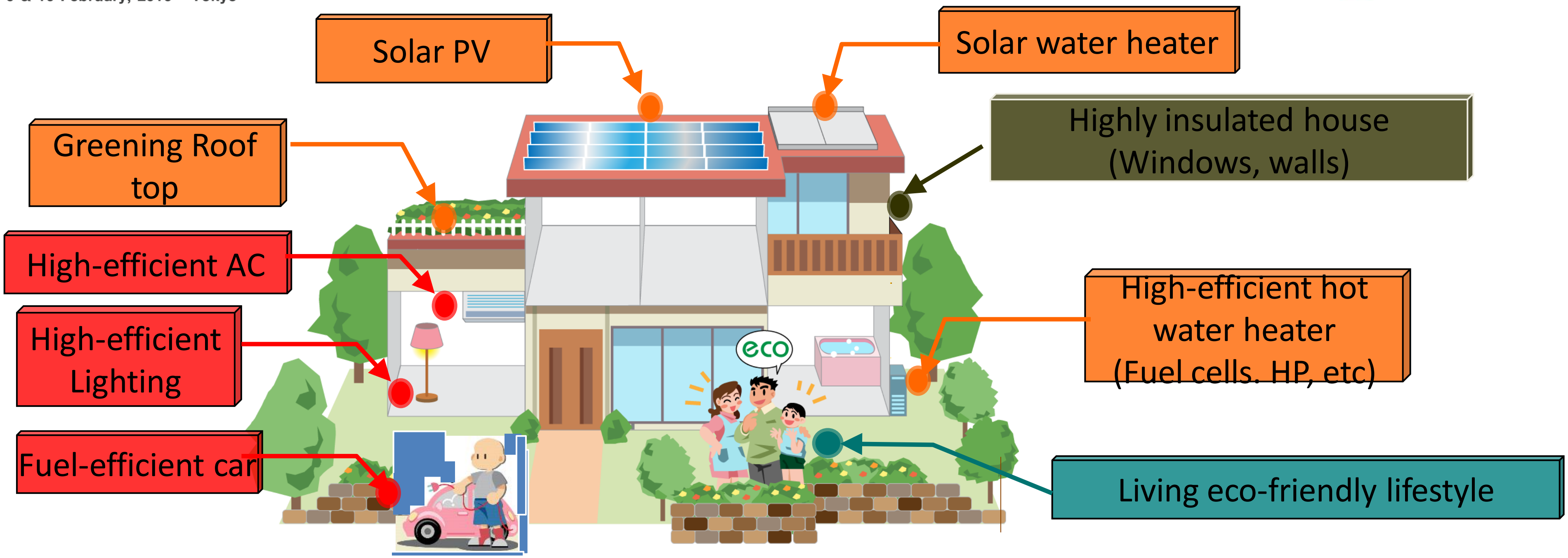


CO2 emission per household(FY2010): approx. 4,758 kg CO_2

Achieve significant cuts in CO_2 emissions

- Replacement to high-efficient technologies : 0.1 – 1.0 t CO_2
- New renewable(Non fossil) energies : Over 1.0 t CO_2
- Infrastructure Improvement : 0.1 – 1.0 t CO_2
- Eco-friendly life style : 0.1 – 1.0 t CO_2

Emitting fluorocarbons from an air conditioning system, refrigerator, and car air-conditioner is equivalent to emitting 2.0 tons of CO_2.

With efficiency measures and investments, CO2 emissions can be reduced by half (approx. 2.0 t of CO2/household)

Note: These effects were estimated based on the information available in the Energy Conservation Center, Japan, and Greenhouse Gas Inventory Office of Japan
Figures are subject to change depending on preconditions.

International Agreements in Comparison

Montreal Protocol [1987]

Refrigerant	ODP (Ozone Depletion Potential)	GWP (Global Warming Potential)
CFCs	**0.6 – 1**	**4750 – 14400**
HCFCs	**0.02 – 0.065**	**77 – 2310**
Halon	3 – 10	1640 – 7140
CCl_4	1.1	1400
Trichloro-ethane	0.1	146
CH_3Br	0.6	1 - 470

Replace

Kyoto Protocol [1997]

Refrigerant	ODP (Ozone Depletion Potential)	GWP (Global Warming Potential)
HFCs	**0**	**124 – 14800**
PFCs	**0**	**7390 – 12200**
SF_6	**0**	**22800**
CO_2	0	1
CH_4	0	25
N_2O	0	298

Regulation: **Production/Consumption**

Regulation: **Emissions**

Issue: Neither treaty regulates CFCs or HCFCs emissions.
->CFCs and HCFCs continue to be emitted into the atmosphere.

		CFCs (Ozone Depleting Substances with high GWPs)	HCFCs (Ozone Depleting Substances with high GWPs)	HFCs (Non-Ozone Depleting Substances with high GWPs)
Montreal Protocol (Regulating production/ consumption)	**Developed Country**	○ (Completely phasing-out by 1996)	○ (Completely phasing-out by 2020)	**Issue 1**
	Developing Country	○ (Completely phasing-out by 2010)	○ (Completely phasing-out by 2030)	
Kyoto Protocol (regulating emissions)	**Developed Country**	**Issue 3**		○ (Partially regulated)
	Developing Country			× **Issue 2**

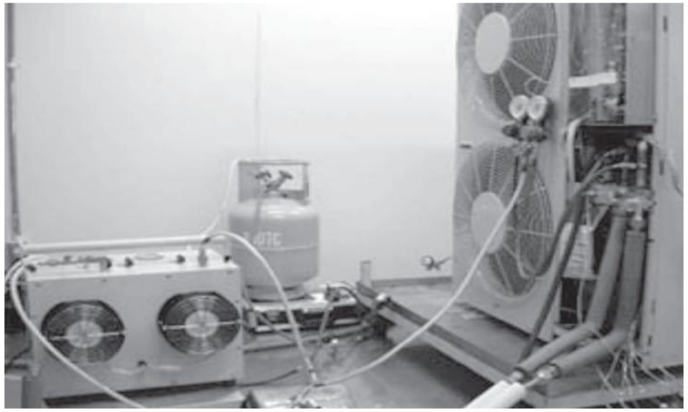
Issue 1 : Not regulate production/consumption of HFCs

Issue 2 : Kyoto Protocol partially regulates HFCs emissions. But it only binds developed countries to emission reduction targets.

Issue 3: Not regulate CFCs or HCFCs emissions from existing sources of equipment. These high GWP gases will eventually be emitted into the atmosphere.

(Reference: Dr. Kubota, NIES)

Recovery



Fluorocarbons recovery machine

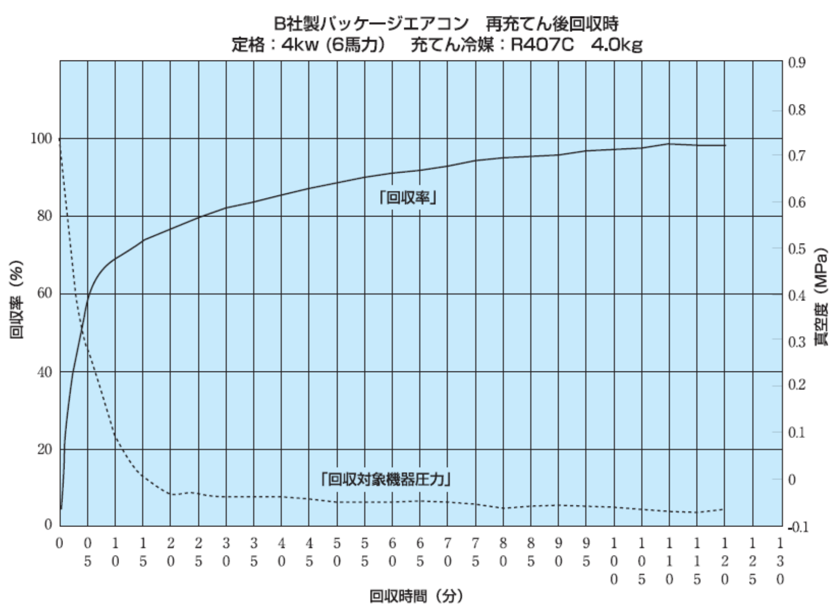


図５－７　回収時の圧力変化と回収量（率）の関係

<Curve of recovery rates>
Only 60% of fluorocarbon refrigerants is recovered in the first 5 minutes. It takes 2 hours to recover all fluorocarbons remaining in the unit.

Destruction

Compact ODS Destruction Machine using Plasma technology (Plasma X)

•Fluorocarbons can be destroyed by using heat or plasma technologies
•"Plasma X", a mobile type of ODS destruction machine, was showcased as a Japanese green technology.
•Installation cost is only 10 million yen, including materials (e.g., water, slaked limes)
•Up to 2 to 4 tons of fluorocarbons can be destroyed per year.

Reclamation

Small and lightweight Refrigerant Recovery & Reclaim Machine (Eco-cycle Aurora)

•Equipped with an electrostatic separation technology to remove oil from used fluorocarbons. Such purified fluorocarbons can be reused in the system, preventing atmospheric release.
•Portable (directly attachable to an outdoor unit)
•670,000 yen/unit

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Promotion of "Green Hospitals" by improving efficiency/environment in national hospitals in Vietnam（2013～2017）

NEDO

In this demonstration project, **high efficiency performance inverter ACs**, compliant to the energy efficiency rating standard in Vietnam, will be introduced in two state-owned hospitals. Not only will the inverter ACs be installed, but energy management system (EMS) will be developed and installed to enhance the energy efficiency of the entire hospital.

Newly Registered as JCM project 30 Nov 2015!!

In replacing ACs, a prevention plan is required to be prepared and implemented in order to ensure that fluorocarbons used as refrigerants are not released into the atmosphere when they are removed from conventional ACs. In consideration of environment integrity, such Eligibility Criteria have been established through the efforts of Japan and Vietnam, both of which are highly conscious of climate change issues.

1 With a momentum towards lower GWPs, the development of **natural refrigerants** is accelerating worldwide. NEDO has also contributed to development of **technologies** and **market penetration** through its various activities.

2 The global society should pay more attention to **CFCs/HCFCs** remaining in existing equipment, not only as ODSs but also as **high GWP gases** which are **not regulated under FCCC**. Inappropriate treatment of such high GWPs can **cancel out** positive effects of **natural refrigerants** during replacement.

3 While promoting **natural refrigerants**, it is important that all stakeholders, including policy makers, manufactures, and users, **play their respective roles** to realize appropriate treatment of **high GWP refrigerants**.

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THANK YOU FOR YOUR KIND ATTENTION!!

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