

Contributions of equipment manufacturers supporting the LRM ecosystem

The Japan Refrigeration and Air Conditioning Industry Association

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Introduction

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- The initiatives of JRAIA that we are introducing today are **a model based on Japan's Fluorocarbon Emission Control Act (abbr. F-gas Act), and the Japanese market and infrastructure.**
- Market structures, climate conditions, and the stage of legal development **differ greatly from country to country, and these methods cannot be directly applied to other countries;** there is **no "one-size-fits-all" solution that applies to all countries.**
- To achieve Kigali Amendment sustainably, it is crucial that **each government accurately analyses its own situation and autonomously designs its own "unique LRM ecosystem"** that suits its circumstances.
- We, JRAIA hope that by widely sharing the ideas and approaches we have cultivated through our experience, they can **serve as hints for proactive initiatives in other countries.**

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1. Who is JRAIA?

JRAIA (Japan Refrigeration and Air Conditioning Industries Association)

- **Established in Feb. 1949**
- Minato city, Tokyo (located in front of Tokyo Tower)
- Chairman: Toru Kubo (from Carrier Japan Corporation)
- The number of the members: **170 companies** incl. associate members as of June. 2026
- **Business Fields:**
 - Air conditioning (residential, commercial, automotive)
 - Refrigeration (commercial, industrial, transport)
 - Ventilation
 - Heat pump system (HP water heaters)
 - Refrigerants
 - Parts



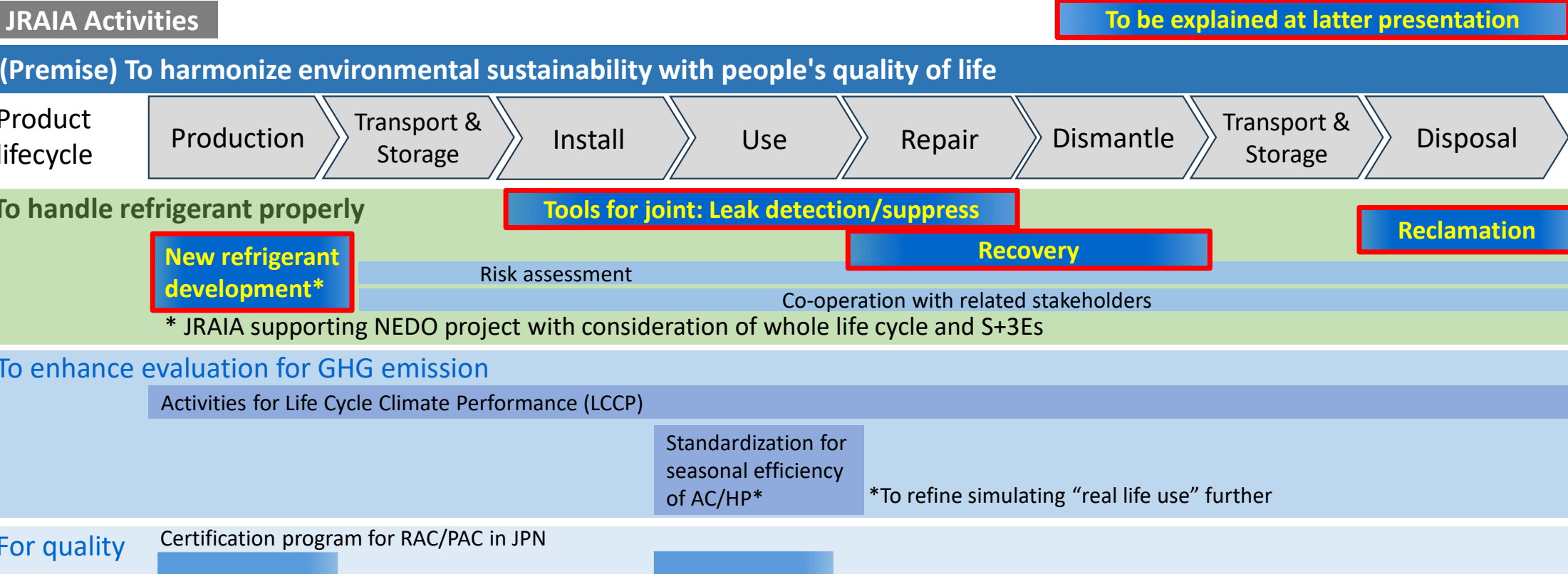
JRAIA HP

<https://www.jraia.or.jp/>

<https://www.jraia.or.jp/english/index.html>

1. Who is JRAIA? - Activities on Carbon Neutrality

- We have contributed through our activities in view of whole life cycle and will do further
- We'd like to inform you of **part of our activities**, specifically



2. Current status and urgent challenges in the transition to next-generation refrigerants

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- To achieve carbon neutrality and the Kigali Amendment, JRAIA is promoting the transition to low-GWP refrigerants.
- Broad regulations that pursue only specific environmental indicators (such as GWP or PFAS) risk narrowing technological options and consequently slowing down HFC reductions.

	High GWP
Efficiency	High
Safety (flammability)	Low



Low GWP
Low
Med – High

- However, a “perfect green refrigerant with Low-GWP” that can be immediately adopted while meeting all requirements (Safety, Environment performance, Energy efficiency, and Economic feasibility) has yet to be established for air conditioning equipment.

JRAIA is supporting NEDO project which aims development of high-efficiency refrigeration and air conditioning technology **for the practical use of next-generation low-GWP refrigerants**

3. Transition to next-generation refrigerants with "S+3Es" policy

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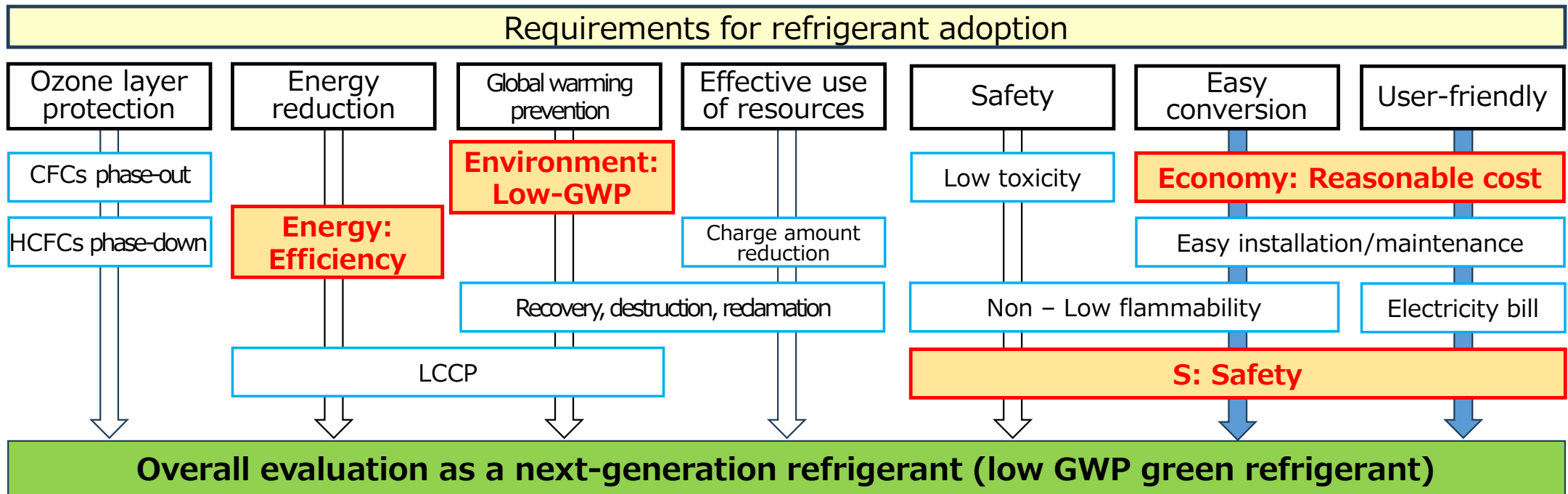


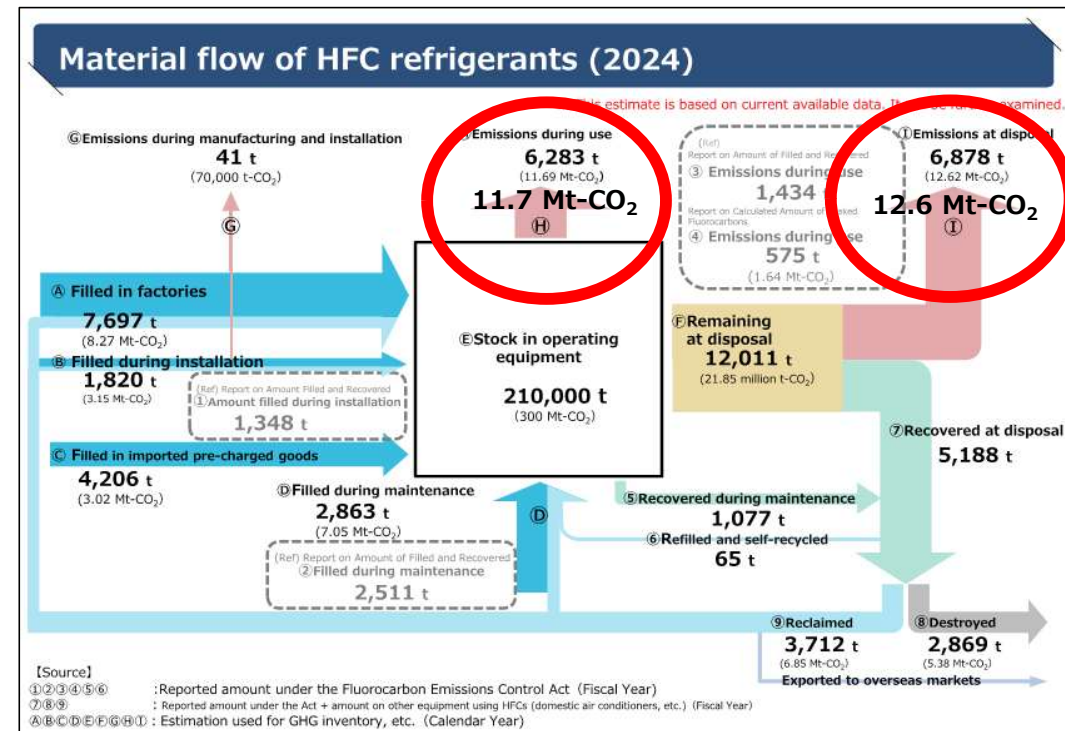
Fig. Schematic diagram of the next refrigerant selection process for air conditioning equipment.

The transition to next-generation refrigerants requires a **balance of "S+3Es** (Safety, Environment performance, Energy efficiency, and Economic feasibility)."

4. Why is "LRM" so important now?

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- Japan's HFC emissions (2024)
27.6 M tons-CO₂
 - During use: 11.7 Mt-CO₂ (42%)
 - At disposal: 12.6 Mt-CO₂ (46%)
 - Other than refrigerant: 3.3 Mt-CO₂ (12%)
 - If the Leakage rate: 3.9% ➔ 2.7%
 - During use: 11.7 ➔ 8.1 Mt-CO₂ (△ 3.6)
 - If the Recovery rate: 42% ➔ 70%
 - At disposal: 12.6 ➔ 6.5 Mt-CO₂ (△ 6.1)
- a total reduction: 9.7 Mt-CO₂
Vs Japan's reduction target at 2030
18.7 M tons-CO₂ (More than half!)



Instead of simply waiting for the dream refrigerant, implementing "LRM" that can be done right now is essential.

5. Contributions of equipment manufacturers supporting LRM

1) Leakage prevention during use - IoT continuous monitoring system

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JRAIA is promoting the introduction of "continuous monitoring system" that can detect leaks early and dramatically reduce the amount of leakage.

- "Guidelines for Fluorocarbon Leak Detection Systems by Continuous Monitoring (JRA GL-17)" has been established.
- Already certified as a form of "Simplified inspection" under the F-gas Act in Japan.
- JRAIA is promoting to have it recognised as a "Regular inspection" as the next step.
 - A "hybrid" approach combining direct method by specialist and continuous monitoring by a system.
 - Considering a legal system to completely replace Regular inspections with a continuous monitoring system alone.

Table. Revision plan of Regular inspection

Method	Current		Revision plan – Step1		Revision plan – Step2 (Final)	
	Conducted by	Frequency	Conducted by	Frequency	Conducted by	Frequency
Direct*	Specialist	Every 1(or 3) year(s) or more	Hybrid	Specialist	Relaxed (Every X years)	-
Indirect*	Specialist	Every 1(or 3) year(s) or more		Monitoring System	Daily	Monitoring System Daily

* Direct method : Directly finding the leak location using detection fluids, gas detectors, etc., in order to identify the leak location.

* Indirect method : Determining whether or not there is a leak from the state values (temperature, pressure, etc.) of various parts of the equipment during operation.

5. Contributions of equipment manufacturers supporting LRM

2) Reliable refrigerant recovery during disposal – refrigerant recovery mode

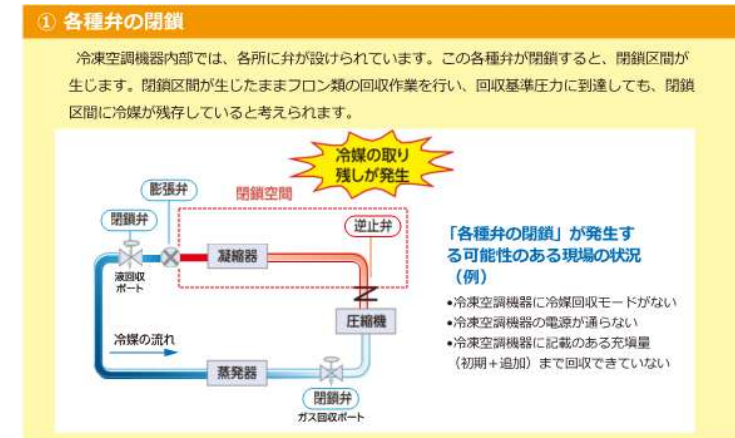
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【Issues】

- If various valves inside refrigeration and air conditioning equipment are closed, a "closed space" is created, resulting in residual refrigerant even after recovery work, which can lead to its emission into the atmosphere.

【Action from equipment manufacturers】

- To facilitate refrigerant recovery for on-site workers by equipment design, supporting an increase in refrigerant recovery rates.



Source; MOEJ -Guidebook for Reliable Recovery of Fluorocarbons from Multi-Air Conditioners for Buildings-

https://www.env.go.jp/earth/furon/files/r05_guidebook.pdf

- ◎ RACs, Commercial Acs, Refrigeration equipment: (Equipment NOT create a "closed space")
⇒ By pump-down (a function that recover refrigerant in the ODU).
- ◎ VRF: (Equipment that may create a "closed space")
⇒ Refrigerant recovery mode (forcibly open various valves) + pump-down

Note: Refrigerant recovery mode requires a power source (power for the equipment)

6. The key to LRM: "the use of reclaimed refrigerants" and its environmental significance

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- Reusing recovered refrigerants by "reclaiming" them, rather than simply destroying them, is an excellent circular economy solution that significantly reduces GHG emissions and energy consumption associated with the new production of HFCs.
- In fact, the amount of reclaimed HFCs produced in Japan is increasing year by year, and equipment manufacturers are eager to actively utilize reclaimed refrigerants.

7. Conclusion: Achieving a Sustainable Kigali Amendment from a LCCP Perspective

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- We, JRAIA representing equipment manufacturers will continue to support the LRM ecosystem from a technical standpoint while promoting refrigerant conversion.
- In the transition to next-generation refrigerants, pursuing only low GWP while sacrificing energy efficiency may increase indirect CO₂ emissions and LCCP (Life Cycle Climate Performance).
- Furthermore, a rapid shift to highly flammable natural refrigerants without adequate safety standards and infrastructure poses significant risks to the actual handling / usage.
- Promoting refrigerant conversion without resorting to the exclusion of specific substances or solely focusing on GWP, while thoroughly implementing immediately effective "LRM" and aiming for overall optimization of "S+3Es" is the most reliable climate change countermeasure for all countries.