Actions to Control Emission of HFCs in Japan

Implementation of “the Act on Rational Use and Proper Management of Fluorocarbons”

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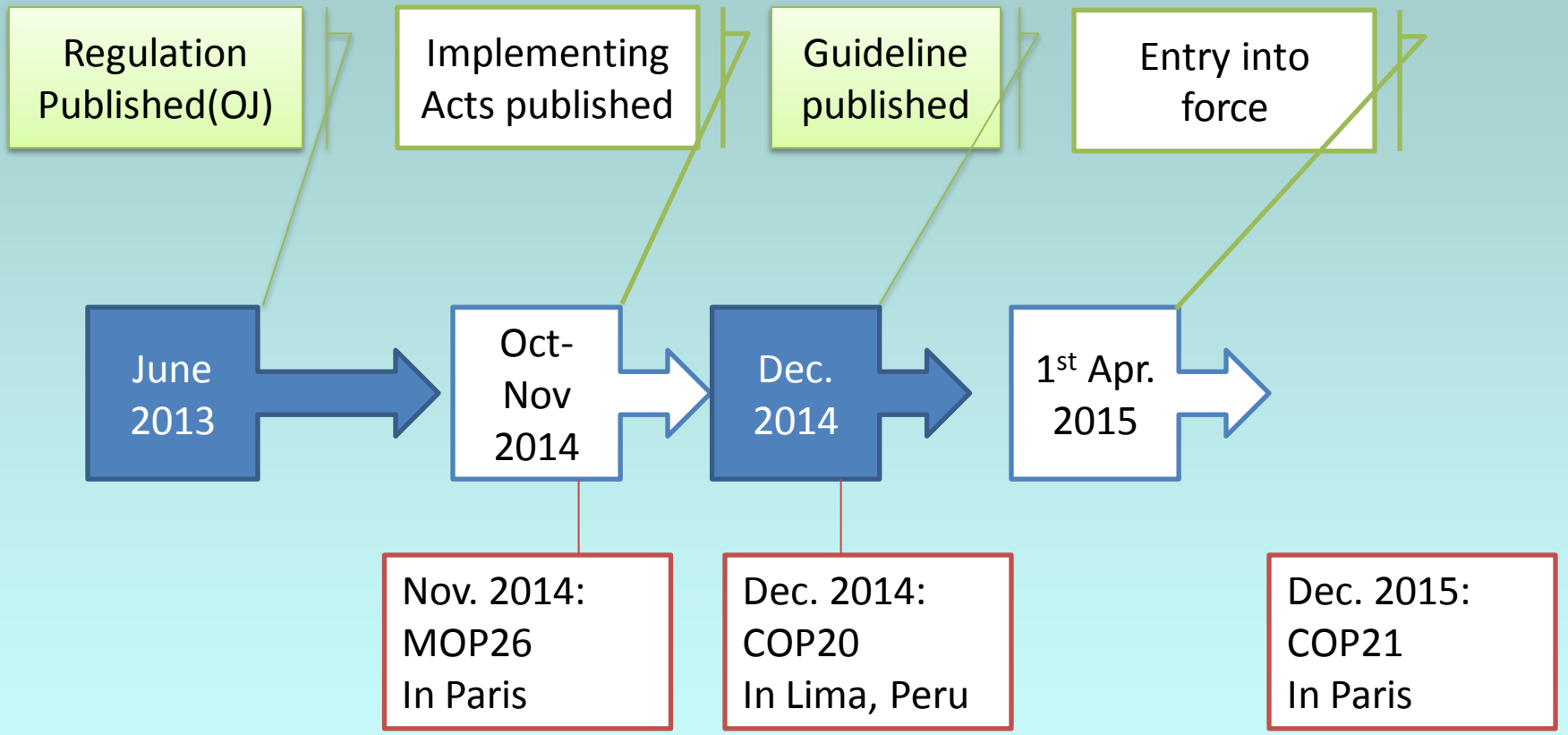
0. Timeline

"the Act on Rational Use and Proper Management of Fluorocarbons" in Japan



1. Direction of measures for HFCs in Japan

"the Act on Rational Use and Proper Management of Fluorocarbons" in Japan

Issues

1. Rapid increase of HFCs emission
2. Low recovery rate : Approximately 30%
3. Leakage in use of equipment : 13 to 17% per year in 2009
4. Development and commercialised equipment with low GWP or no HFC refrigerants
5. Global movements to enhance control of high GWP

Direction of measures

Comprehensive measures over whole life cycle from production to destruction of CFCs/HCFCs/HFCs Needed.

1. Manufacturers and Importers of HFCs
Phase-down of HFCs

2. Manufacturers and Importers of Equipment
Acceleration of equipment using low GWP or no HFC refrigerants

3. Owners of Equipment
Prevention of HFCs' leakage from commercial refrigeration equipment in use

4. Refrigerant charge by registered operators, Reclamation by approved operators

Publication of the Revision of Fluorocarbons Recovery & Destruction Law in Jun 2013

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2. Scope

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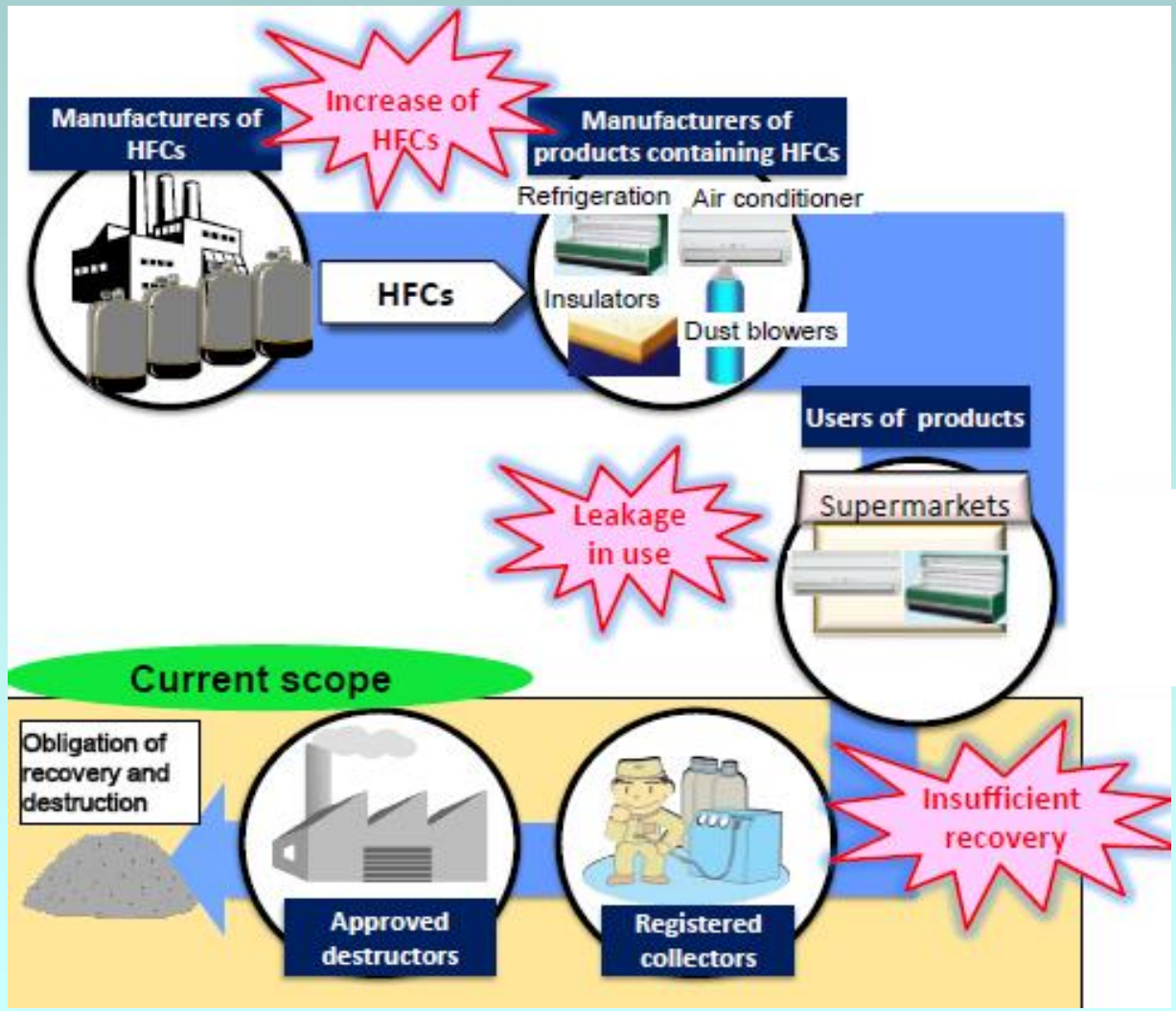

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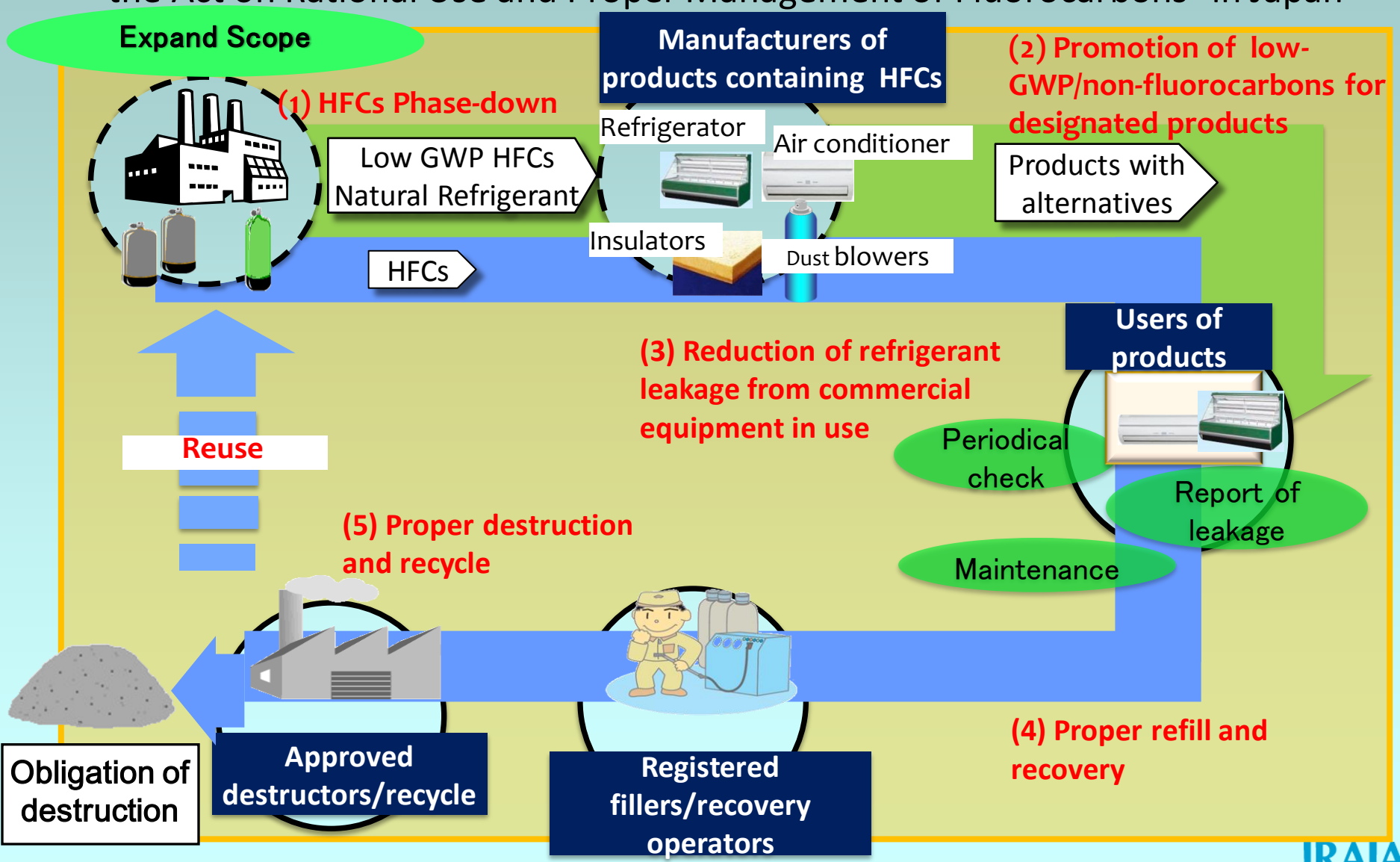

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3. Revised act for manufacturers and importers of equipment

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Specified Equipment

Specified equipment category	Currently used refrigerant and its GWP	Target index of environmental impact	Target year
Residential air conditioners (excluding floor-standing type)	R410A(2090) R32(675)	750	2018
Air conditioners for shops and offices (excluding floor-standing type)<<**small size only**>>	R410A(2090)	750	2020
Automotive air conditioners (only for passenger car)	R134a(1430)	150	2023
Condensing units and Stationary refrigeration units (rated output > 1.5kW)	R404A(3920) R410A(2090) R407C(1774), CO2(1)	1500	2025
Central refrigeration equipment (only for new refrigeration warehouses more than 50 thousands ㎥)	R404A(3920) Ammonia	100	2019
Hard urethane foam	HFC-245fa(1030), HFC-365mfc(795)	100	2020
Dust blower	HFC-134a(1430), HFC-152a(124) CO2(1), DME(1)	10	2019

※Manufacturers and importers shall ensure that the weighted average of GWP of domestic shipments does not exceed the target index to reduce environmental impact of the specified equipment.

4. Revised act for equipment owners (users of products)

"the Act on Rational Use and Proper Management of Fluorocarbons" in Japan

Details of equipment check required for equipment owners

<table>
<tr><th></th><th colspan="3">Check points</th><th>Frequency of check</th><th>Operator of check</th></tr>
<tr><td>Simplified periodical check

All Class-1 specified equipment</td><td colspan="3">（Air conditioners）
・Abnormal noise from air conditioner, apparent condition check and so on to judge leakage of HFCs
（Refrigeration equipment）
・Temperature inside the cabinet
・Abnormal noise from equipment, apparent condition check and so on to judge leakage of HFCs</td><td>More than once a 3 months (voluntary)</td><td>No limitation on the qualification</td></tr>
<tr><td rowspan="2">Periodical check</td><td rowspan="2">Visual check by an operator having professional knowledge</td><td>In the case that rough location of leakage can be found</td><td>The check shall be conducted with direct method.</td><td rowspan="2">More than once a period determined for each equipment</td><td rowspan="2">Authorised certification related to equipment management is needed.</td></tr>
<tr><td>Other cases</td><td>The check shall be conducted with indirect method or combination of direct and indirect method.</td></tr>
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Thank you for your kind attention.

Vielen Dank für Ihre Aufmerksamkeit.

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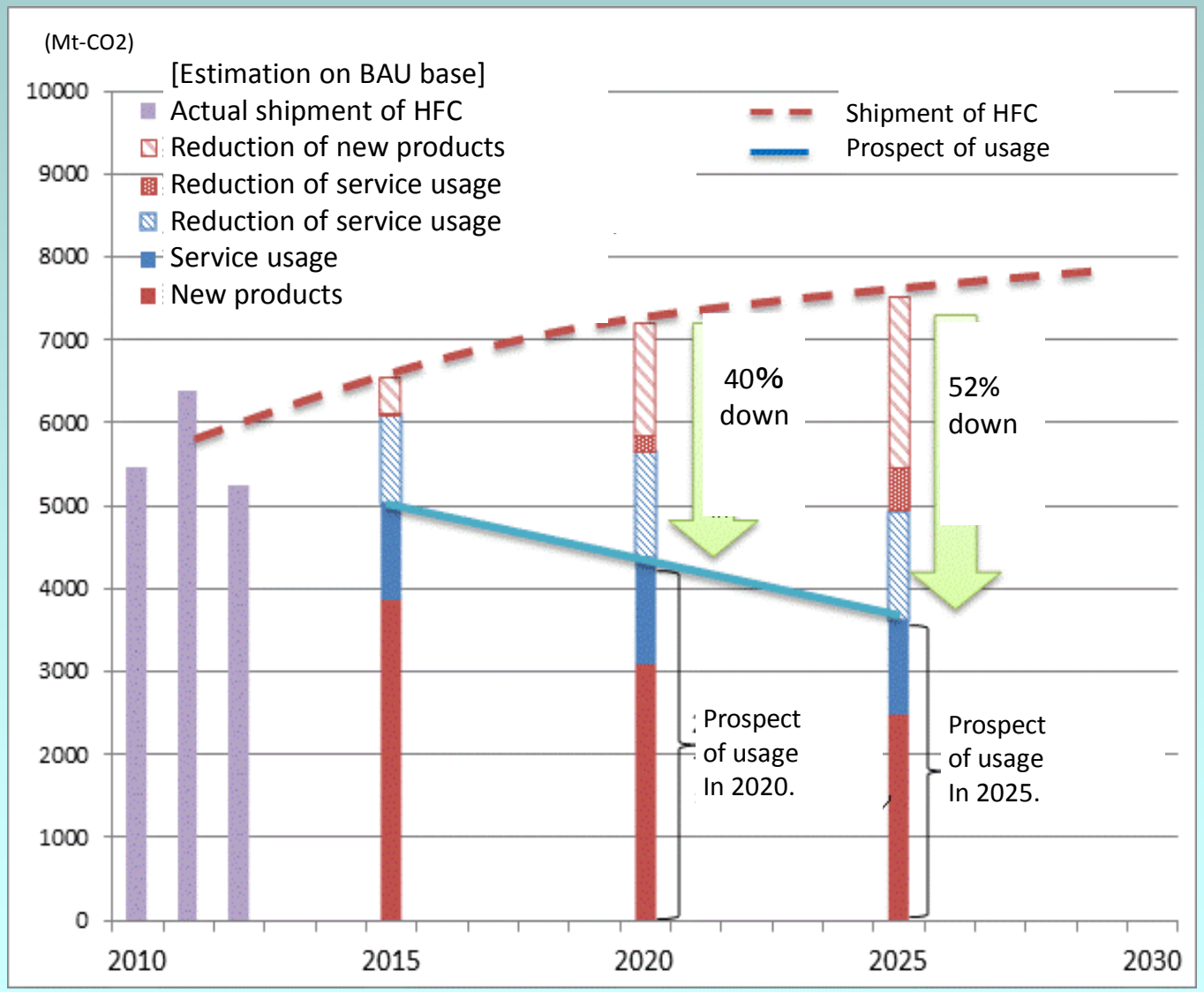
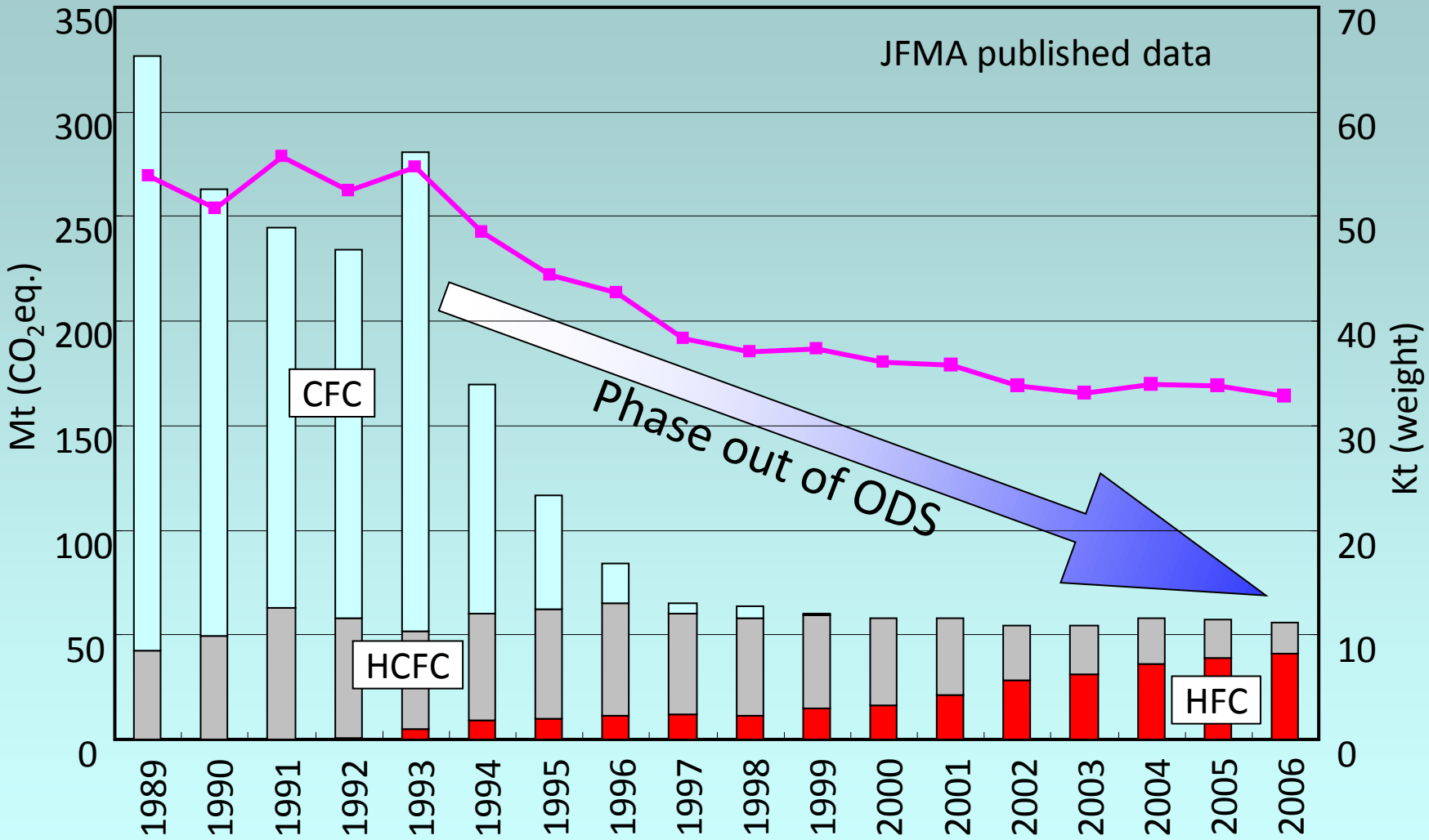


CFC, HCFC and HFC Consumption in Japan



Most of HFC refrigerants are introduced to phase out ODS. It also reduced GHG emission significantly, but this aspect is neglected in Kyoto protocol.

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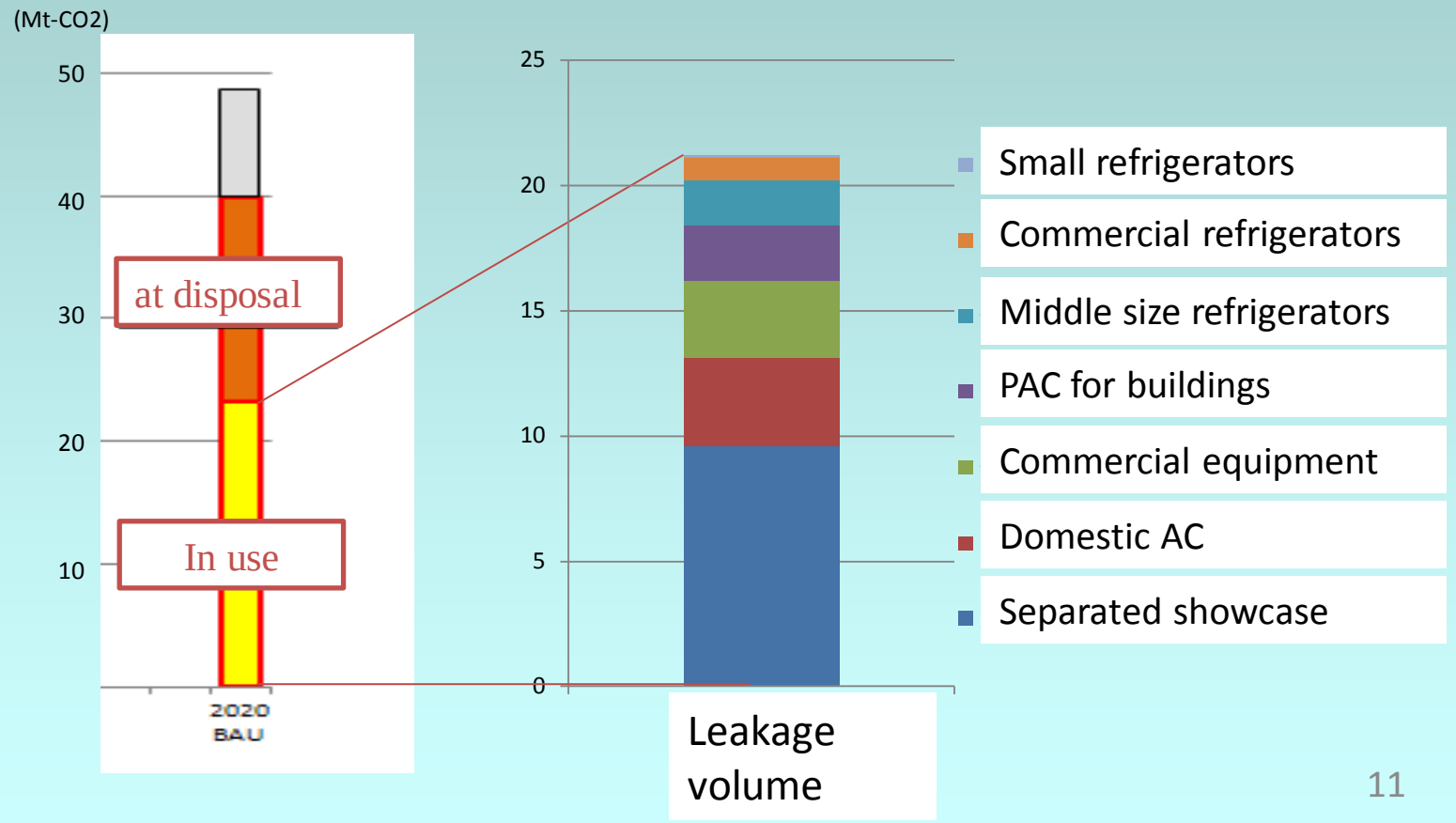
Future Possibility of HFCs Emissions (Leakage in Use of Equipment)

Estimates of emissions (CFC's substitutes covered by the Kyoto Protocol) in 2020 (BAU) and breakdown by equipment in use



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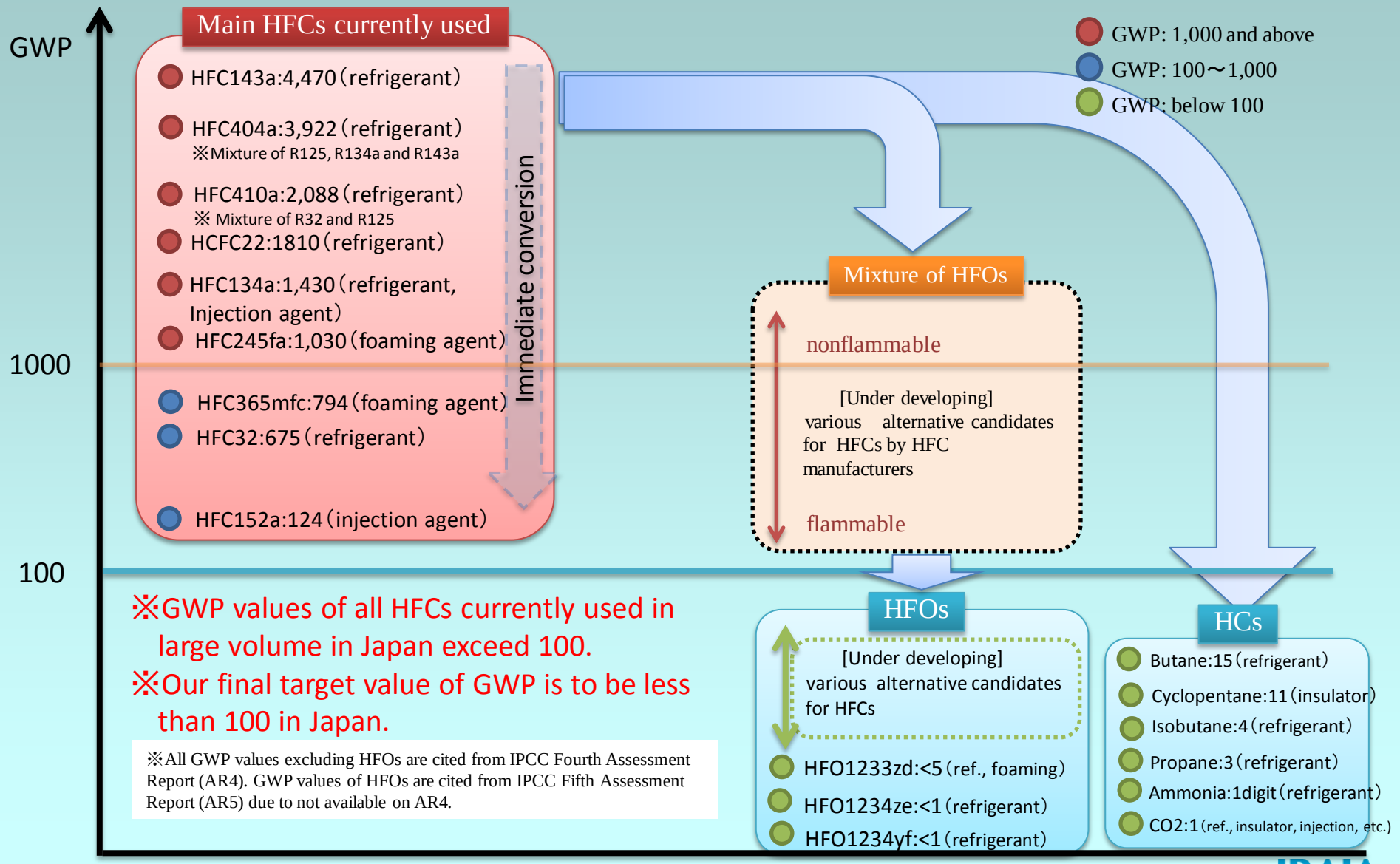
Target GWP



※GWP values of all HFCs currently used in large volume in Japan exceed 100.

※Our final target value of GWP is to be less than 100 in Japan.

※All GWP values excluding HFOs are cited from IPCC Fourth Assessment Report (AR4). GWP values of HFOs are cited from IPCC Fifth Assessment Report (AR5) due to not available on AR4.

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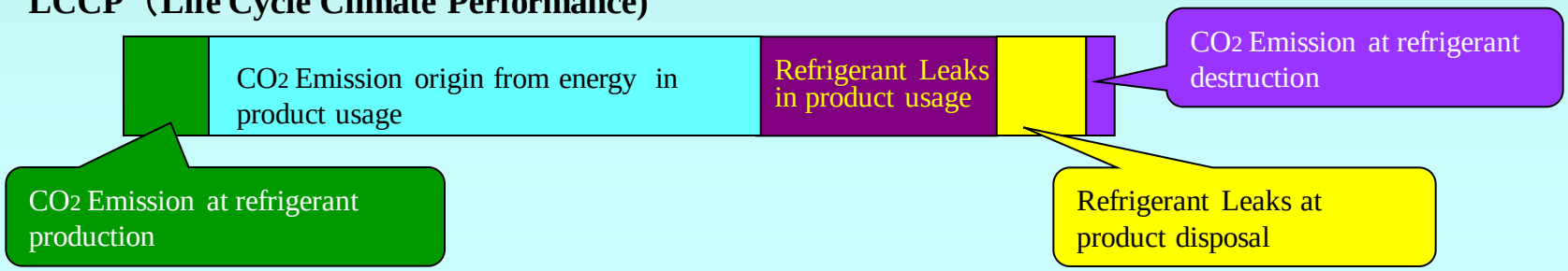
Requirements for the alternative refrigerants

3E+S

Safety(precondition)	・Low Toxicity ・Low Risk of Flammability
Environment Performance	・Ozone Depletion Potential =0 ・Low Global Warming Potential
Energy Efficient	・Superior for LCCP value ・Similar performance at high load cooling
Economic Feasibility	・Reasonable Cost ・Acceptable level in Developing Countries

LCCP（Life Cycle Climate Performance)



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New refrigerants for the next generation

HVAC&R industry has been proceeding with the development of next generation low GWP refrigerants to mitigate the impact of HFCs on global warming.

However ;

- **Ideal refrigerants have not been found yet.**
- **Every candidate of next generation refrigerants bears some sort of faults.**
- **Usable candidates, in particular, are mildly flammable.**
- **We are forced to make full use of those candidates for prevention of global warming caused by refrigerants.**