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

- Regulation Published (OJ) in June 2013
- Implementing Acts published between Oct-Nov 2014
- Entry into force on 1st Apr. 2015

Key Dates:
- Nov. 2014: MOP26 in Paris
- Dec. 2014: COP20 in Lima, Peru
- Dec. 2015: COP21 in Paris
1. Direction of measures for HFCs in Japan

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**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
2. Scope

“the Act on Rational Use and Proper Management of Fluorocarbons” in Japan
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- **(1) HFCs Phase-down**
  - Low GWP HFCs
  - Natural Refrigerant
- **(2) Promotion of low-GWP/non-fluorocarbons for designated products**
  - Refrigerator
  - Air conditioner
  - Insulators
  - Dust blowers
- **(3) Reduction of refrigerant leakage from commercial equipment in use**
- **(4) Proper refill and recovery**
- **(5) Proper destruction and recycle**

Users of products
- Periodical check
- Maintenance
- Report of leakage

Approved destructors/recycle
- Obligation of destruction

Registered fillers/recovery operators
- Reuse

Manufacturers of products containing HFCs
- Products with alternatives

Expand Scope

2.

Scope

5

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### Specified Equipment

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

※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)

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Details of equipment check required for equipment owners

<table>
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<tr>
<th>Simplified periodical check</th>
<th>Check points</th>
<th>Frequency of check</th>
<th>Operator of check</th>
</tr>
</thead>
</table>
| All Class-1 specified equipment | (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 | More than once a period determined for each equipment | Authorised certification related to equipment management is needed. |

| Periodical check | In the case that rough location of leakage can be found | The check shall be conducted with direct method. | More than once a 3 months (voluntary) | No limitation on the qualification |
| Visual check by an operator having professional knowledge | Other cases | The check shall be conducted with indirect method or combination of direct and indirect method. | | |

JRAIA
Thank you for your kind attention.

Vielen Dank für Ihre Aufmerksamkeit.
“the Act on Rational Use and Proper Management of Fluorocarbons” in Japan

[Estimation on BAU base]
- Actual shipment of HFC
- Reduction of new products
- Reduction of service usage
- Reduction of service usage
- Service usage
- New products

- Shipment of HFC
- Prospect of usage

Prospect of usage
- In 2020.
- In 2025.

40% down
52% down

(Mt-CO2)
Most of HFC refrigerants are introduced to phase out ODS. It also reduced GHG emission significantly, but this aspect is neglected in Kyoto protocol.
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
Various alternative candidates for HFCs by HFC manufacturers

- HFC143a: 4,470 \text{ (refrigerant)}
- HFC404a: 3,922 \text{ (refrigerant)}
  \text{※ Mixture of R125, R134a and R143a}
- HFC410a: 2,088 \text{ (refrigerant)}
  \text{※ Mixture of R32 and R125}
- HCFC22: 1,810 \text{ (refrigerant)}
- HFC134a: 1,430 \text{ (refrigerant, Injection agent)}
- HFC245fa: 1,030 \text{ (foaming agent)}
- HFC365mfc: 794 \text{ (foaming agent)}
- HFC152a: 124 \text{ (injection agent)}

Main HFCs currently used

- HFO1234yf: <1 \text{ (refrigerant)}
- HFO1234ze: <1 \text{ (refrigerant)}
- HFO1234yf: <1 \text{ (refrigerant)}

Mixed HFOs

- Butane: 15 \text{ (refrigerant)}
- Cyclopentane: 11 \text{ (insulator)}
- Isobutane: 4 \text{ (refrigerant)}
- Propane: 3 \text{ (refrigerant)}
- Ammonia: 1 \text{ digit} \text{ (refrigerant)}
- CO2: 1 \text{ (ref., insulator, injection, etc.)}

- Immediate conversion

- Nonflammable
- Flammable

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

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

- 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.
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)

- CO₂ Emission origin from energy in product usage
- Refrigerant Leaks in product usage
- CO₂ Emission at refrigerant destruction
- Refrigerant Leaks at product disposal

CO₂ Emission at refrigerant production
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.