OEWG 39
Side Event

Challenges and responses in refrigerant conversion

Tetsuji Okada
JRAIA
12. July. 2017

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

1. Who is JRAIA?

■ Overview

The Japan Refrigeration and Air conditioning Industry Association (JRAIA)

- Established in 1949.
- 168 member companies including the associate members.
  (as of 1st of June 2017)
- The business fields of the member companies are :
  - Air conditioning (residential, commercial, automotive)
  - Refrigeration (commercial, industrial, transport)
  - Ventilation
  - Heat pump system (HP water heaters)
  - Refrigerants
  - Parts

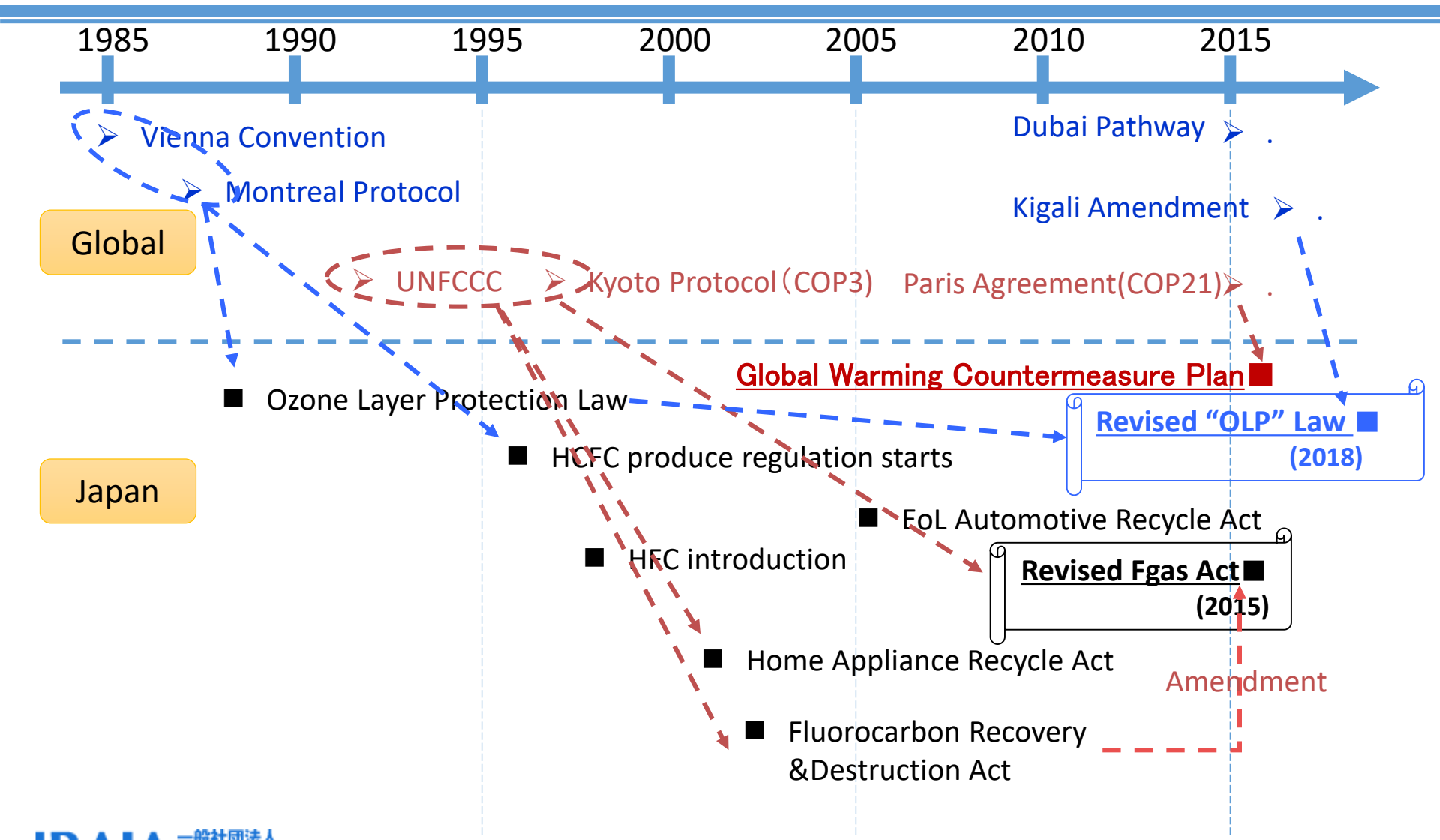
JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

2. Trend of legislation and Protocols

1) Timeline in Japan



JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

2. Trend of legislation and Protocols

2) Regulation of refrigerant by "designated products" in Japan

Regulated by “Act on Rational Use and Proper Management of Fluorocarbons”

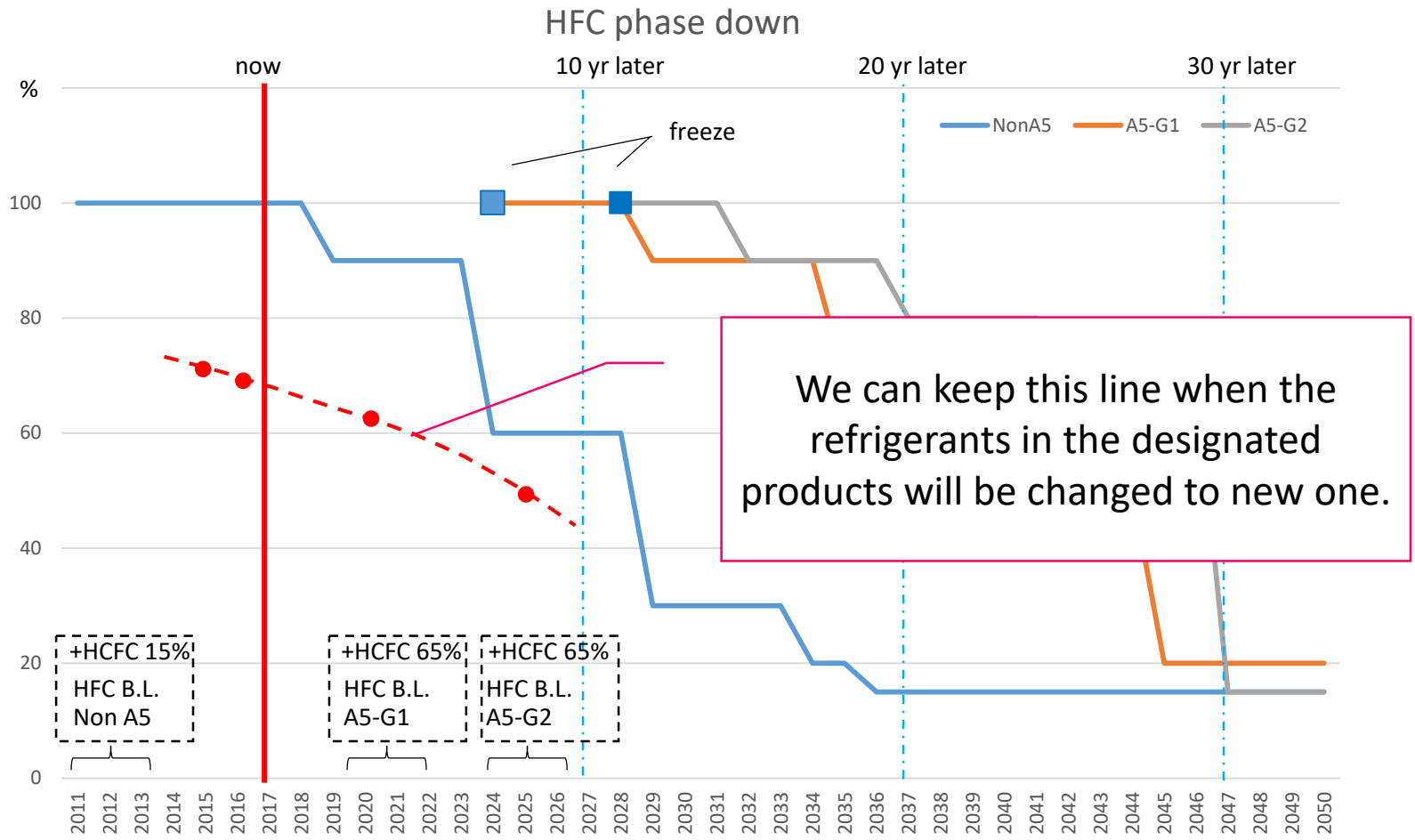
Designated Products	Target GWP (Weighted Average GWP)	Target year
Room air conditioning (Mini-Split)	750	2018
Commercial air conditioning (Split)	750	2020
Mobile air conditioning	150	2023
Condensing unit and refrigerating unit	1500	2025
Cold storage warehouses	100	2019
Urethane foam	100	2020
Dust blowers	10	2019

RACHP sectors

JRAIA 一般社団法人 日本冷凍空調工業会 The Japan Refrigeration and Air Conditioning Industry Association

2. Trend of legislation and Protocols

3) HFC phase down latest status in Japan



JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

2. Trend of legislation and Protocols

4) Comparison of safety act

	U.S.	Europe	Japan
Legislation/ Act	Clean Air Act SNAP	F−Gas Regulation, Act	• Act on Rational Use and Proper Management of Fluorocarbons • **High pressure gas safety act**
National legislation	**Building Code** IMC, UMC, etc.	**Building Code**	• **High pressure gas safety act**
International standards	ISO817 （refrigerant classification）		ISO5149 （safety）
Standard / regulations (define ref types)	ASHRAE34	Relevant standards based on ISO	• **High pressure gas safety act**
Standard / regulations (safety)	ASHRAE15 UL60335-2-40 UL484, etc.	EN378 EN60335-2-40	• **High pressure gas safety act** • JIS C9335-2-40 • JRA standards, etc.

2. Trend of legislation and Protocols

4) Comparison of safety act

	U.S.	Europe	Japan
Legislation/ Act	Clean Air Act SNAP	F−Gas Regulation, Act	• Act on Rational Use and Proper Management of Fluorocarbons • **High pressure gas safety act**
Standard / regulations (define ref types)	ASHRAE34	Relevant standards based on ISO	• **High pressure gas safety act**
Standard / regulations (safety)	ASHRAE15 UL60335-2-40 UL484, etc.	EN378 EN60335-2-40	• **High pressure gas safety act** • JIS C9335-2-40 • JRA standards, etc.

What is "High Pressure Gas Safety Act"?

This act is the regulation for high pressure gas, but covers toxicity and flammability of the refrigerants, and applies to HVAC equipment of the size above certain refrigerant volume.

Contents :

3. Market trend

1) Refrigerant conversion status in each product sector

Product Category	Number of Units in 2016FY (in thousands)	Y/Y Ratio (%)	Refrigerant
Residential air conditioners	8,527.5	104.4	R410A>>R32 (almost 100%)
Commercial air conditioners	793.9	102.6	R410A>>R32 (only Small-size; 41%)
Residential heat pump water heaters	424.4	104.1	CO_2, (R32) (almost 100%)
Gas engine-driven air conditioners	30.5	98.1	R410A
Water chilling units	12.9	98.8	R410A,R134A
Air to air heat exchangers	109.2	93.2	NA
Commercial refrigerated cabinets	312.4	101.4	R404>>R410A, CO_2
Condensing units	91.3	98.3	R410A
Refrigeration units	29.7	102.2	R22>>NH_3,(+CO_2)

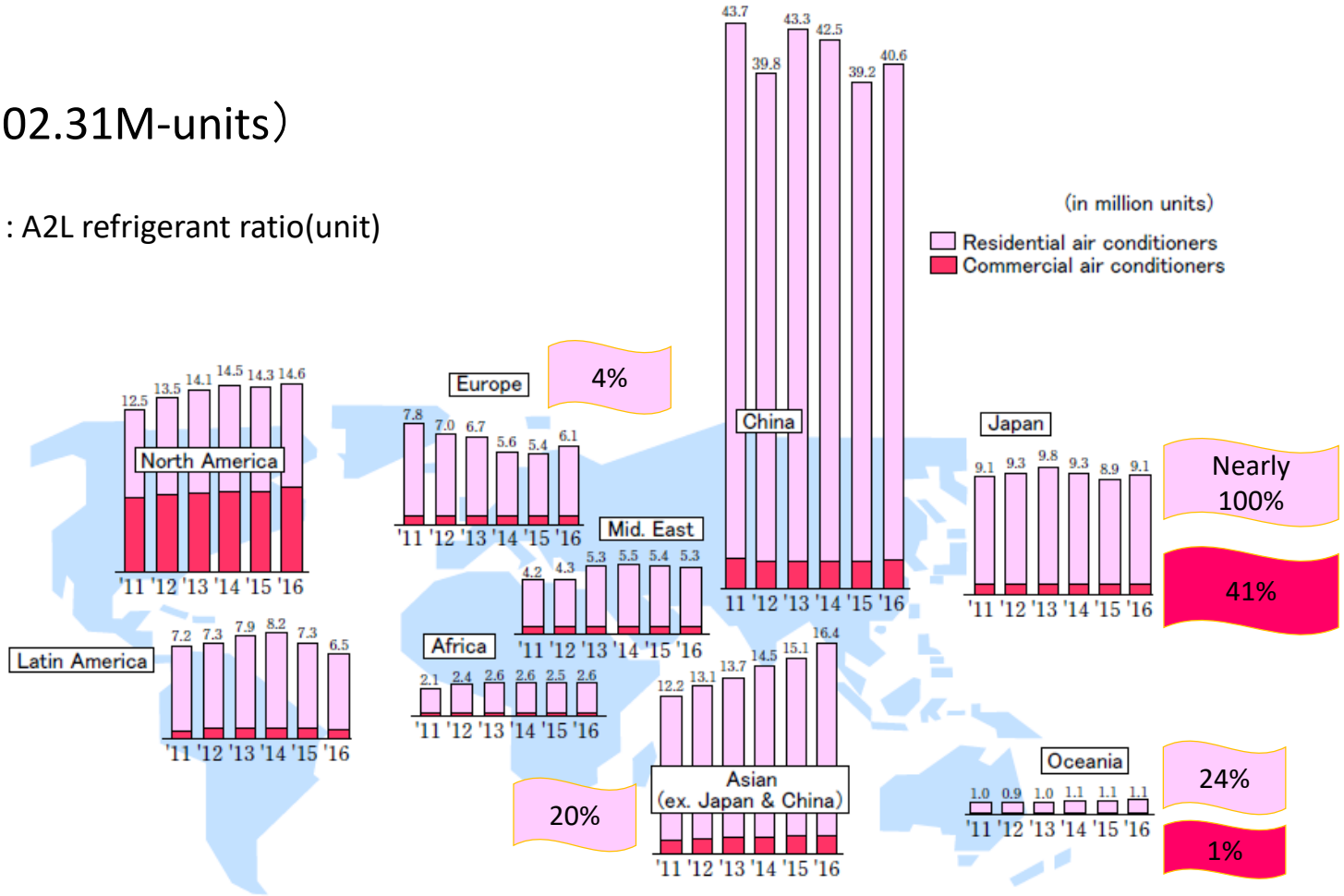
JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

3. Market trend

2) World market trend of air conditioners

(2016；102.31M-units）

xx% : A2L refrigerant ratio(unit)



JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

4. Strategies to be taken as Japan

1) JRAIA's Vision and Activities on Environmental Conservation

EQUIPMENT

Energy Saving
Emission control on a CO_2 basis

REFRIGERANTS

Direct Emission Control
- Promotion of recovery
- Measures against leakage (proper management of refrigerants)
- Reduction of amount charged into equipment

ALTERNATE REFRIGERANTS

Acceleration to shift to new refrigerants
- Research of low GWP refrigerants
- Risk Assessment

Act on Rational Use & Proper Management of Fluorocarbons

Top Runner Program

Home Appliances Recycling Act

EoL Automotie Recycling Act

High Pressure Gas Safety Act

JRA
The Japan Refrigeration and Air Conditioning Industry Association

4. Strategies to be taken as Japan

2) Points for Refrigerants Conversion

Actions to phase down HFCs have been started sector by sector in Japan by considering not only environment performance but also safety, energy efficiency and economic feasibility.

S+3Es

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

LCCP* : Life Cycle Climate Performance

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

5. HFC step down

1) Steps to execute HFC reduction plan ：challenges and response

Step 1

Selection of candidate refrigerant

- Basic physical properties (energy efficiency), compatibility with lubricating oil, etc.
- Efficiency evaluation, confirmation of reliability etc.
- Low GWP refrigerant has flammability.

Step 2

Confirmation of equipment safety

- Risk assessment by product (Life cycle perspective, region by region)
- Development of new standards and guidelines by risk assessment
- Association for Evaluation of A2L Refrigerant by Industry-Government-Academia Collaboration

Step 3

Confirmation of safety standards

- Design complying with IEC, ISO and national standards
- Amendment of standard itself
- Especially concerning the mildly flammability, it is a new concept

5. HFC step down

2) Steps to execute HFC reduction plan ：challenges and response

Step 4

Confirmation of safety regulations

- Partial relaxation of Building Codes, High Pressure Gas Safety Act (in Japan)
- Security guarantee based on the above new standards and guidelines
- Addition of new category from the viewpoint of flammability

Step 5

Market acceptability

- Overcoming the additional issues related to the rising product price by installation of risks and installation work, understanding of the market is indispensable
- Example of risk countermeasure: installation of ventilator, gas sensor, installation of shutoff valve etc
- briefing sessions for the market, measures to promote penetration

Step 6

Expanding penetration into the market

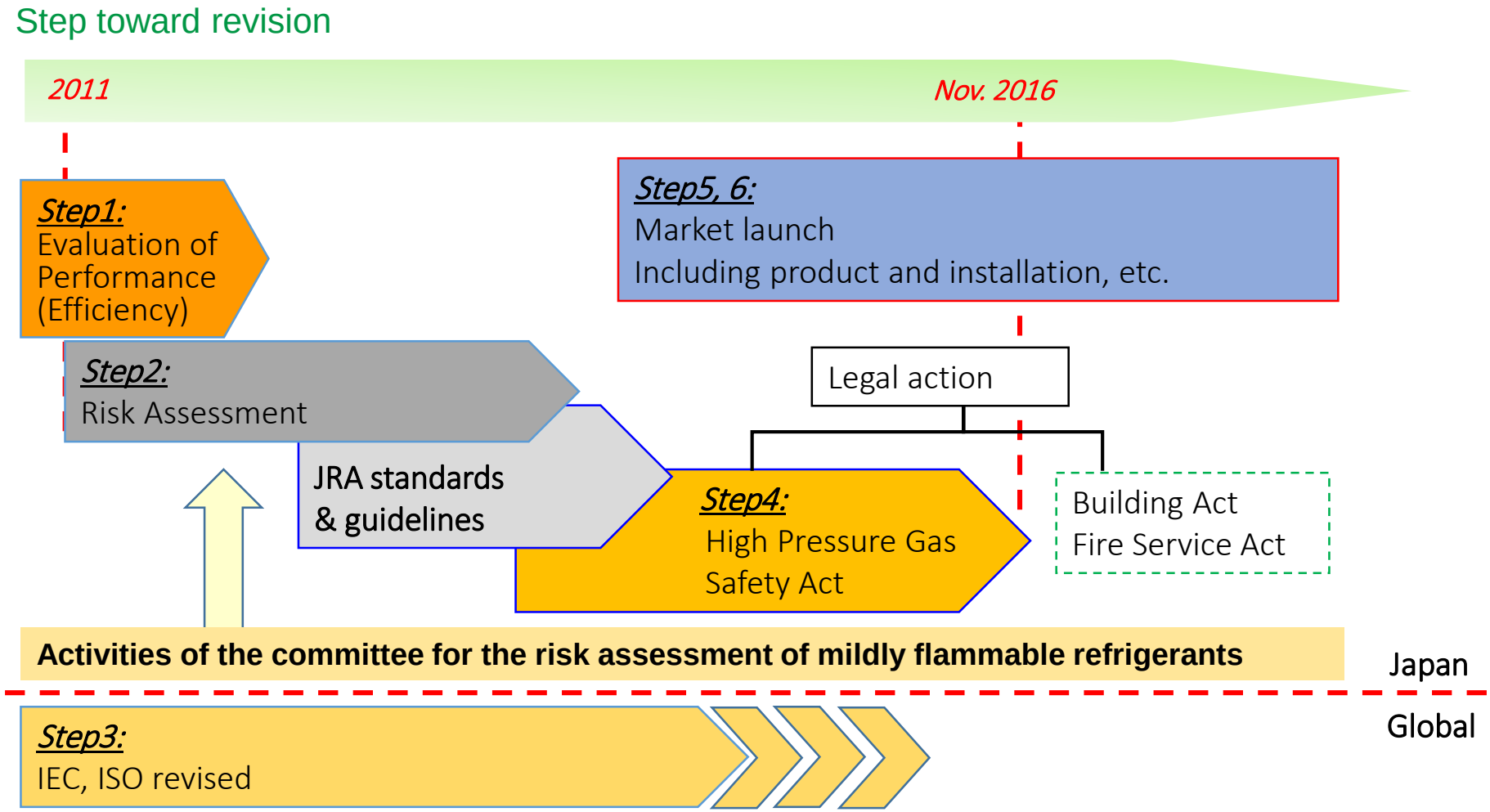
- Overcoming economic issues (cost increase etc.)
- Level of capital investment due to alternative refrigerant

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

5. HFC step down

3) Step toward revision of classification for A2L refrigerants

(legislations to assure safety)



JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

5. HFC step down

4) Main Point of the mitigation of High pressure gas safety Act

1. Revised classification A2L refrigerants.(R32, R1234yf, R1234zd)
2. Reference of JRA Standards and Guidelines.

Refrigerants (former)	
Fluorocarbon (inert gas)	No need of Notification or Approval for present refrigerant.
Fluorocarbon, NH3 (excluding inert gas)	Notification or Approval for A2L are needed same as other refrigerants.
Others(CO2, A3)	

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

5. HFC step down

4) Main Point of the mitigation of High pressure gas safety Act

1. Revised classification A2L refrigerants.(R32, R1234yf, R1234zd)
2. Reference of JRA Standards and Guidelines.

Refrigerants(revised)
Fluorocarbon (inert gas, CO2,)
Fluorocarbon (particular inert gas) R32, R1234yf, R1234zd
Fluorocarbon, NH3 (excl. inert gas)
Others(A3)

A2L:
Newly categorized

No need of Notification or Approval for A2L same as present refrigerants.

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

5. HFC step down

5) JRA Standards and Guidelines(1)

products	No. of Std. or GL.	Title	References
the refrigerant charge equipment	JRA GL20	"Appropriate measures to prevent combustion against refrigerant gas leakage from the refrigerant charge equipment using semi-inert gas"	ISO 817 ISO 5149-1, -3:2014 IEC 6033-2-40 61D/338/INF:2016
refrigerant leak detector and alarm	JRA 4068	"Requirements of refrigerant leak detector and alarm for air conditioning and refrigeration equipment"	ISO 5149-1, -3:2014
refrigerant leakage from refrigerating and air conditioning equipment	JRA GL14	"Guideline for prevention of refrigerant leakage from refrigerating and air conditioning equipment and systems using fluolocarbon"	ISO 14903
chiller	JRA GL15	"Guideline of design construction for ensuring safety against refrigerant leakage from chiller using lower flammability(A2L) refrigerants"	ISO 5149-2, -3, -4 IEC 60335-2-40 IEC 60079-10-1
commercial air conditioners	JRA 4070	" Requirements for ensuring safety against refrigerant leakage from commercial air conditioners using lower flammability(A2L) refrigerants"	ISO 5149-1, -2, -3, -4 ISO 5149-1/Amd1
	JRA GL16	"Guideline of design construction for ensuring safety against refrigerant leakage from commercial air conditioners using lower flammability(A2L) refrigerants"	ISO 5149-1, -2, -3, -4 ISO 5149-1/Amd1

5. HFC step down

6) JRA Standards and Guidelines(2)

products	No. of Std. or GL.	Title	References
commercial refrigeration equipment	JRA 4072	" Requirements for ensuring safety against refrigerant leakage from commercial refrigeration equipment using lower flammability(A2L) refrigerants"	ISO 14903 IEC 60079-10-1:2015 IEC 60335-2-40:2013
	JRA GL18	"Guideline of design construction for ensuring safety against refrigerant leakage from commercial refrigeration equipment using lower flammability(A2L) refrigerants"	ISO 5149-1 IEC 60079-10-1:2015 IEC 60335-2-40:2013 IEC 60335-2-40 61D/338/INF:2016
commercial packaged air conditioner	JRA 4073	" Requirements for ensuring safety against refrigerant leakage from commercial packaged air conditioner for facilities using lower flammability(A2L) refrigerants"	IEC 60335-2-40 61D/338/INF:2016
	JRA GL19	"Guideline of design construction for ensuring safety against refrigerant leakage from commercial packaged air conditioner for facilities using lower flammability(A2L) refrigerants"	IEC 60335-2-40 61D/338/INF:2016

Contents :

1. Who is JRAIA ?
2. Trend of legislation and Protocols
3. Market trend
4. Strategies to be taken as Japan
5. HFC step down
6. Refrigerant management in Japan

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

6. Refrigerant management in Japan

1) Market response (refrigerant management) < Based on the revised F-gas act > (Not limited to flammable refrigerants)

1. Inspection system (user) → legal regulation

   Require periodic inspection for equipment with a certain capacity or more

2. Improve the level of contractors → Operate with private qualification

   Lecture implementation, qualification acquisition

3. Qualifications of collection / destruction traders, certification

   → registration system for local governments

4. (Efforts as Industrial Association)

   Formulation of leakage prevention guidelines

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association

Summary

1. Example of the measures for HFC step down in Japan is shown. (Effect of industry-academia-government collaboration)
2. Risk assessment is the key issue for each product sector and each country. (especially refrigerant life cycle and regionality)
3. It is needed to share the results of risk assessment in each region.
4. It is very important to assure safety and to mitigate the safety codes of each nation by using the results of risk assessment.

Thank you for your kind attention!!

JRAIA 一般社団法人 日本冷凍空調工業会
The Japan Refrigeration and Air Conditioning Industry Association