

Japanese market and issue of Heat Pump

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Kenji Matsuda

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About JRAIA

History

The Japan Refrigeration and Air Conditioning Industry Association (JRAIA) was originally established in February 1949.

Objective

JRAIA contributes to the steady development of Japanese industry and improvement in people's standard of living.

Membership

JRAIA members consist of regular and associate members. (123)

(1) Regular members: 76

(2) Associate members: 47



HITACHI
Inspire the Next

Panasonic
ideas for life



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 **TOYO ENGINEERING WORKS, LTD.**

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AISIN

Technology for Tomorrow

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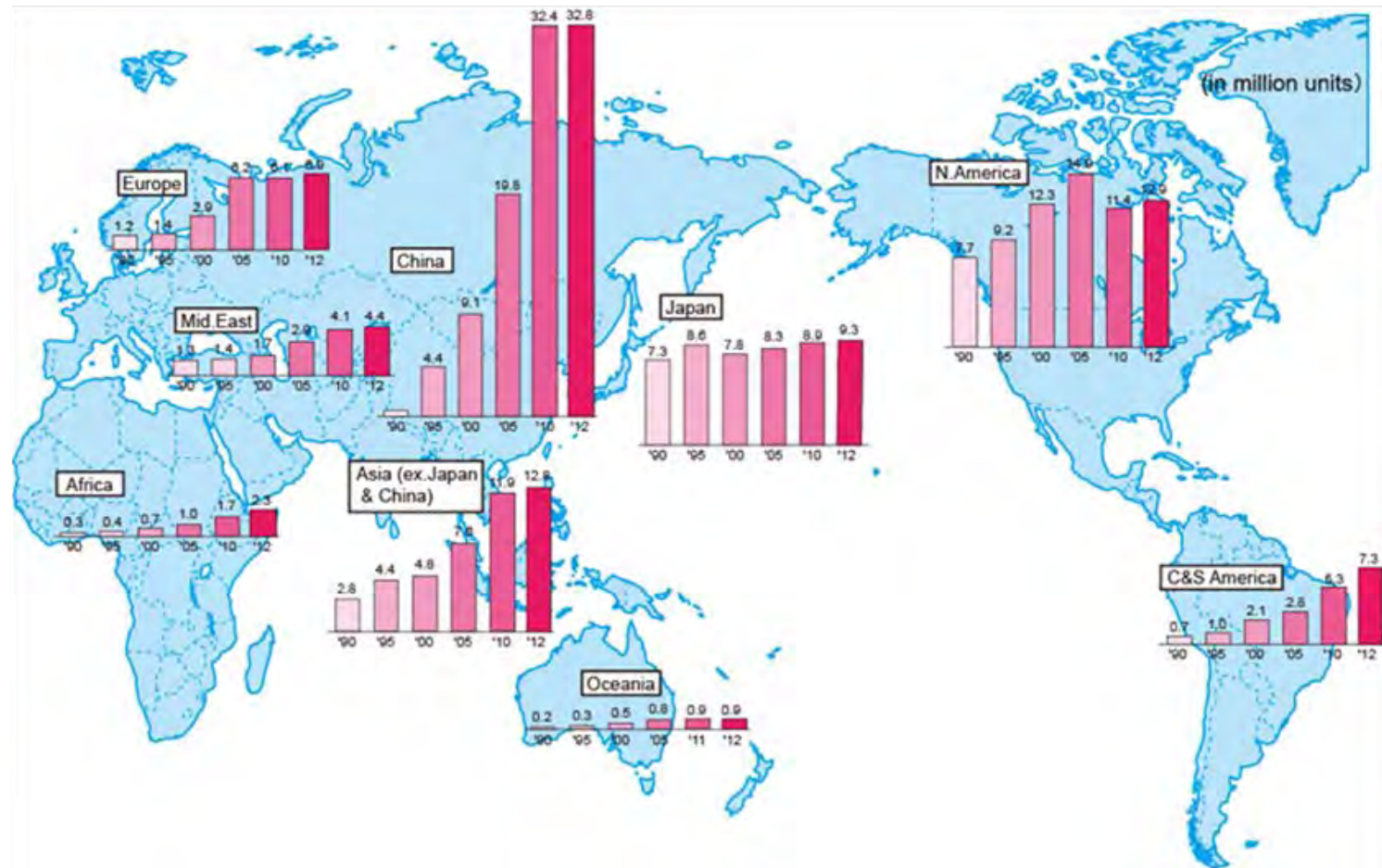
FUJIKOKI

FUSO **FUSO Co., Ltd.**
Sense and Measure the Environment

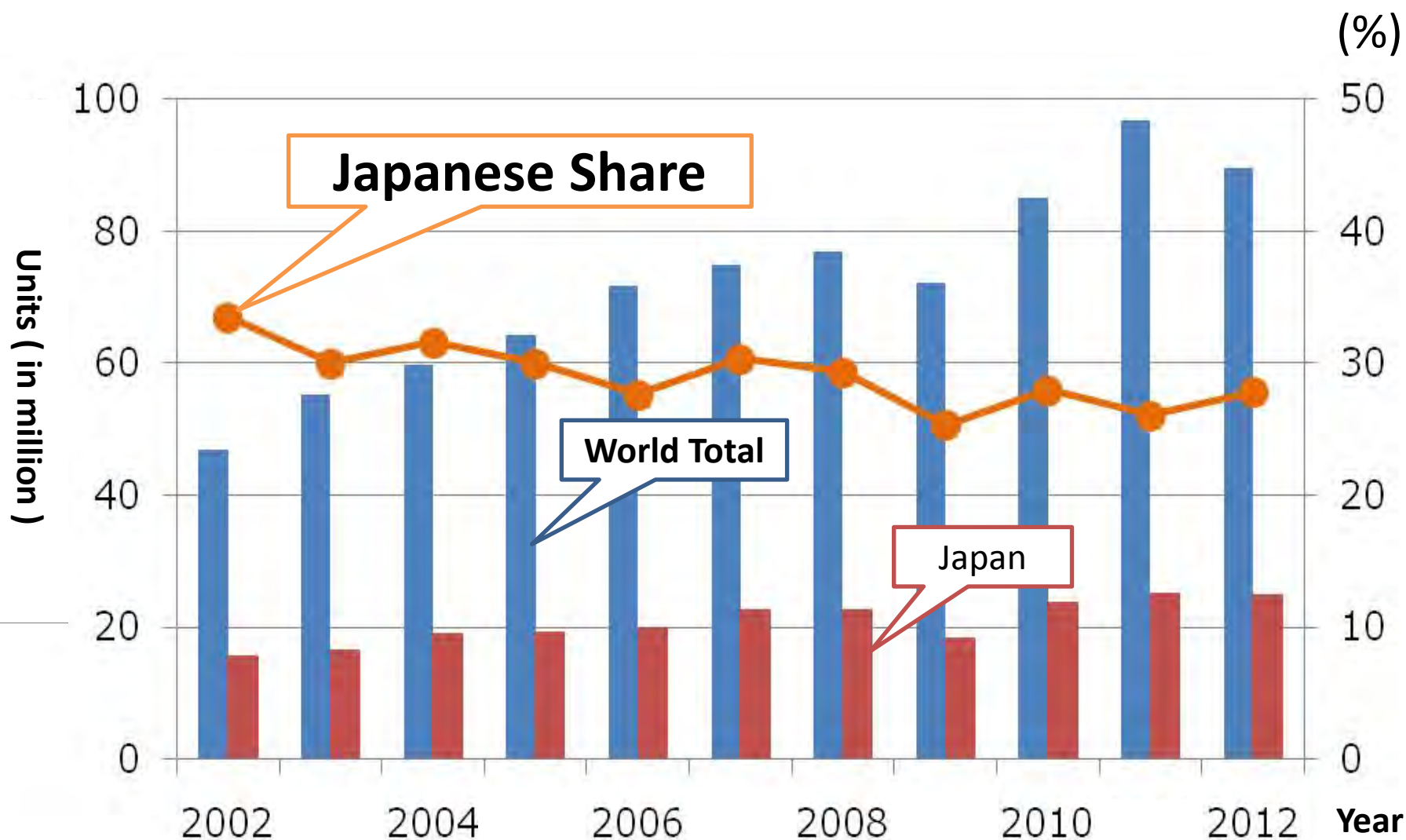
Valeo

Worldwide Heat Pump Market

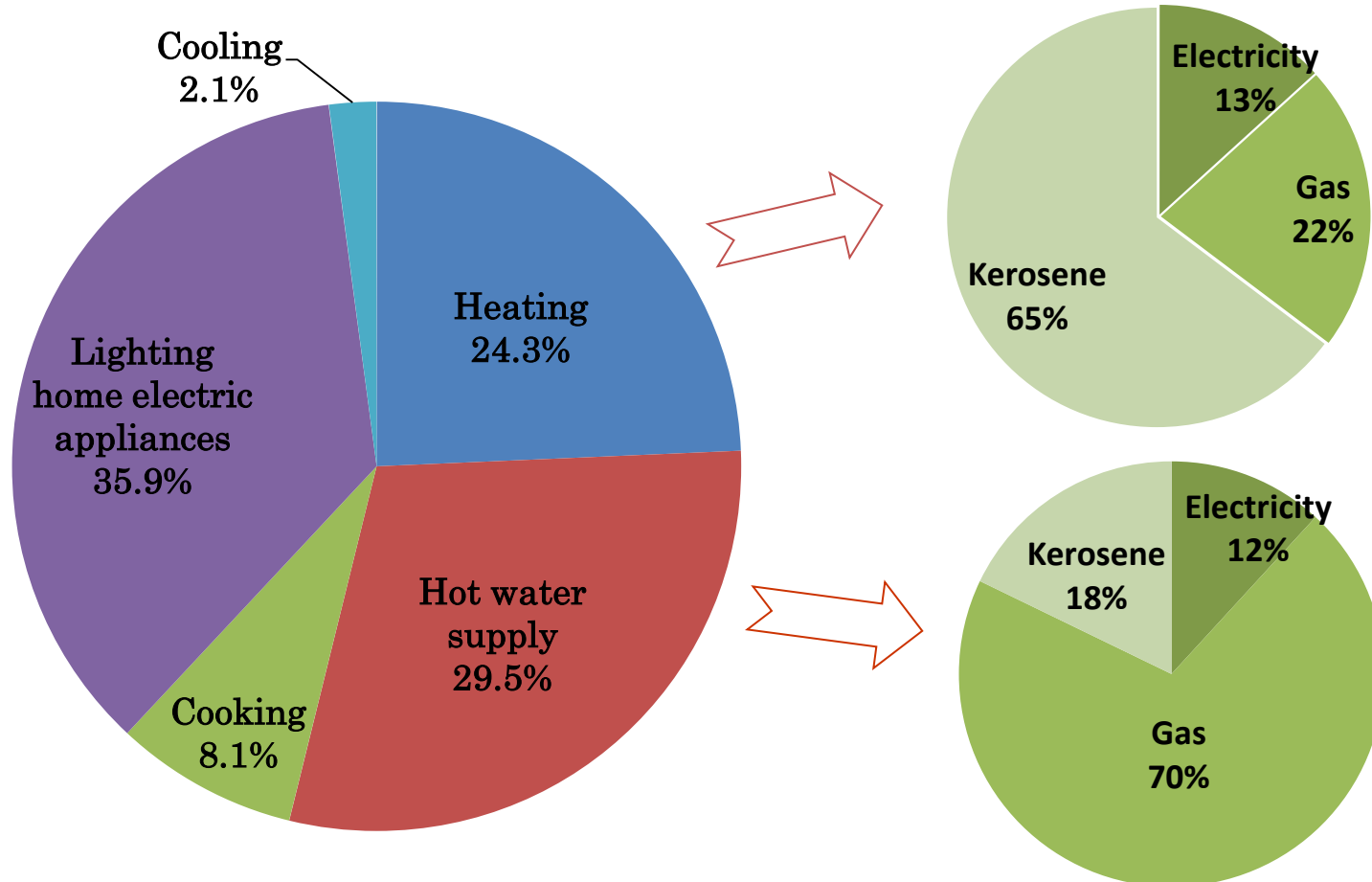
Estimates of World Demand for Air Conditioners
89.5 million units (2012 calendar year)



Japanese share of Heat Pump Market in the world



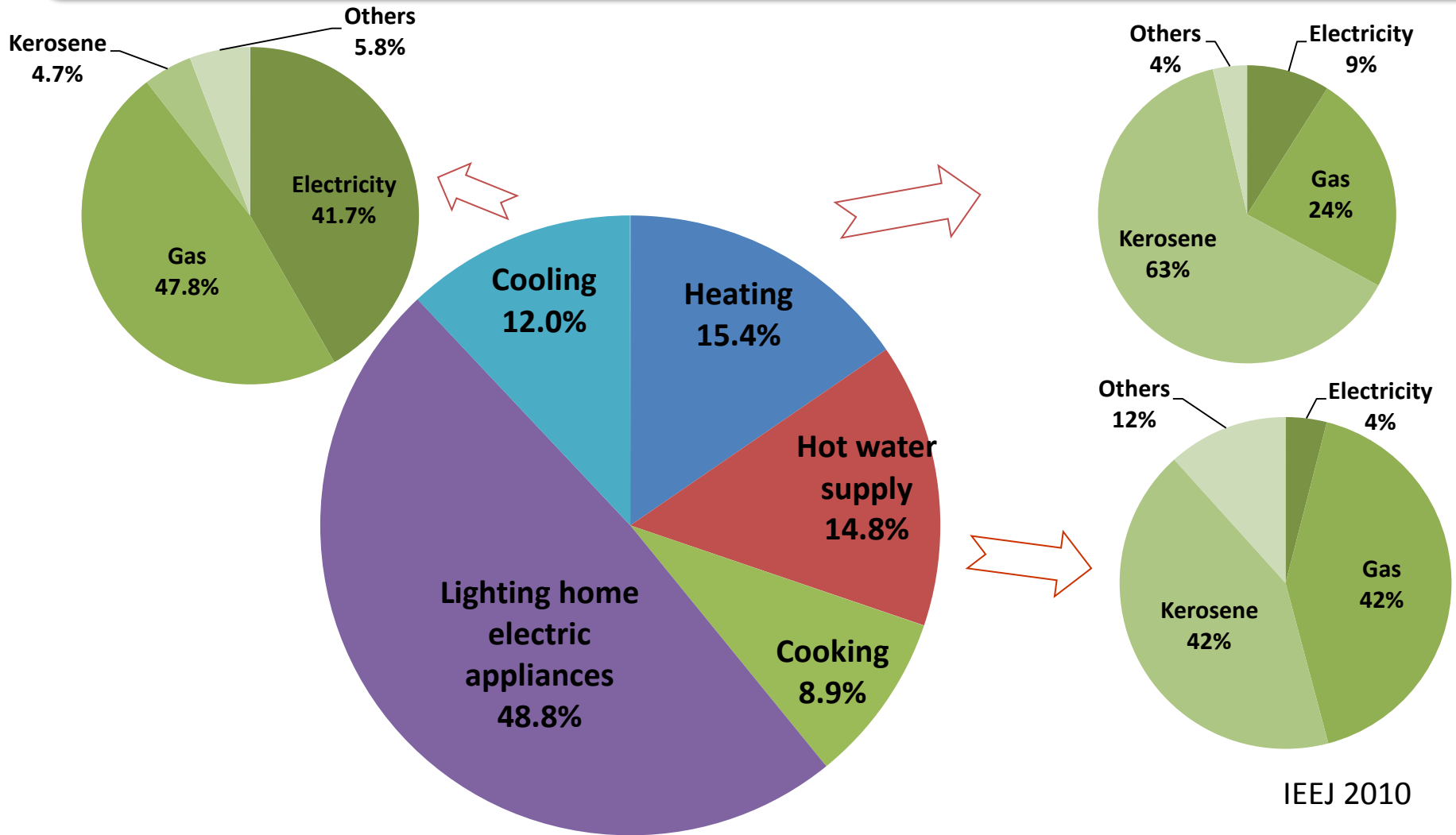
Energy consumption structure in the **residential sector**



IEEJ 2010

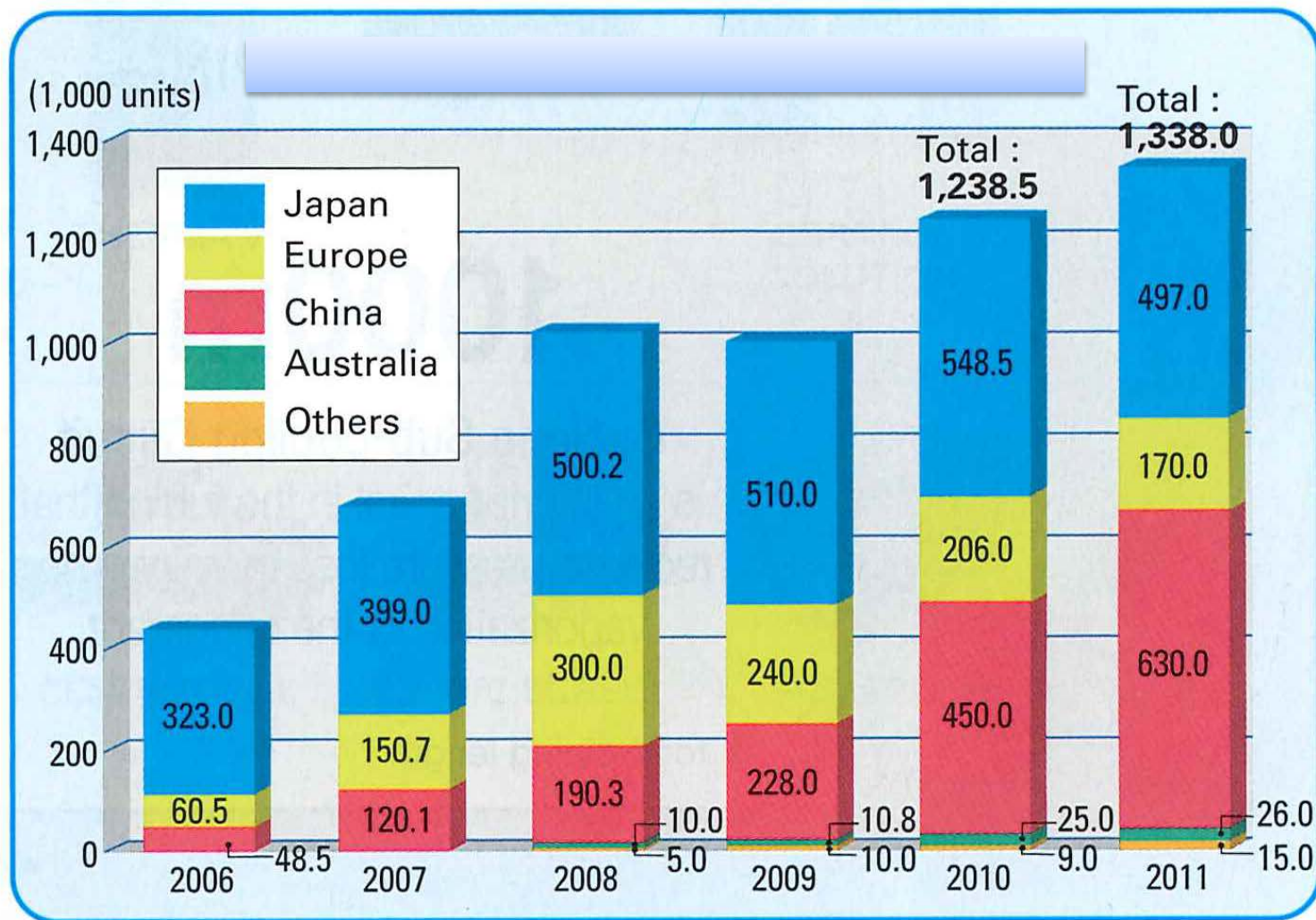
Combustion of fossil fuel accounts for a large portion of the breakdown of energy types for these two uses.

Energy consumption structure in **the commercial sector**



The combustion of fossil fuel also accounts for a large portion of energy consumption.

Worldwide ATW Heat Pump Market



Note: Japan: statistics from JRAIA Other areas besides Japan: JARN estimates

Policy and Activities for Environmental Issues

EQUIPMENT

Energy Saving

- Emission control on a CO₂ basis

REFRIGERANTS

Direct Emission control

- Recovery activities
- Emission control in production
- Leakage reduction in use

ALTERNATE REFRIGERANTS

Switch to new refrigerants

- Research and investigation
- Low GWP refrigerants
- Other refrigerants

Energy conservation law
Top Runner Program

Fluorocarbon Recovery and Destruction Law

New Law (2015)

Home Appliances Recycling Law

Automobile Recycling Law

Policy and Activities for Environmental Issues

EQUIPMENT

Energy Saving

- Emission control on a CO₂ basis

Energy conservation law

Top Runner Program

What is the Top Runner Program?

- Energy conservation law prescribes energy efficiency standards for appliances and vehicles according to the Top Runner method.
- The concept of the Top Runner Program is that standards are set higher than the best performance value of each product currently on sale in the market.
- Standard setting takes into account technological development.

Target products (23 products)

- | | |
|-----------------------------|---------------------------|
| 1. Passenger vehicles | 13. Gas cooking appliance |
| 2. Freight vehicles | 14. Gas water heaters |
| 3. Air-conditioners | 15. Oil water heaters |
| 4. TV sets | 16. Electric toilet seats |
| 5. Video-cassette recorders | 17. Vending machines |
| 6. Fluorescent lights | 18. Transformers |
| 7. Copiers | 19. Electric rice cookers |
| 8. Computers | 20. Microwaves |
| 9. Magnetic disc units | 21. DVD recorders |
| 10. Electric refrigerators | 22. Routers |
| 11. Electric freezers | 23. Switching Units |
| 12. Space heaters | |

New Face in 2013

- 24. Multifunction machine
- 25. Printer
- 26. **Heat Pump Hot Water supply machines**

Energy-Saving Labeling System for Retailers

Uniform Energy-saving Label



【Multi-stage rating system】

- Energy-saving performance is indicated in 5 stages, from 1 to 5 stars, from low to high performance of products offered on the market.
- In order to clarify the compliance level with the Top Runner standard, arrows are placed under the stars, showing achievement and non-achievement.

【Energy-saving labeling system】

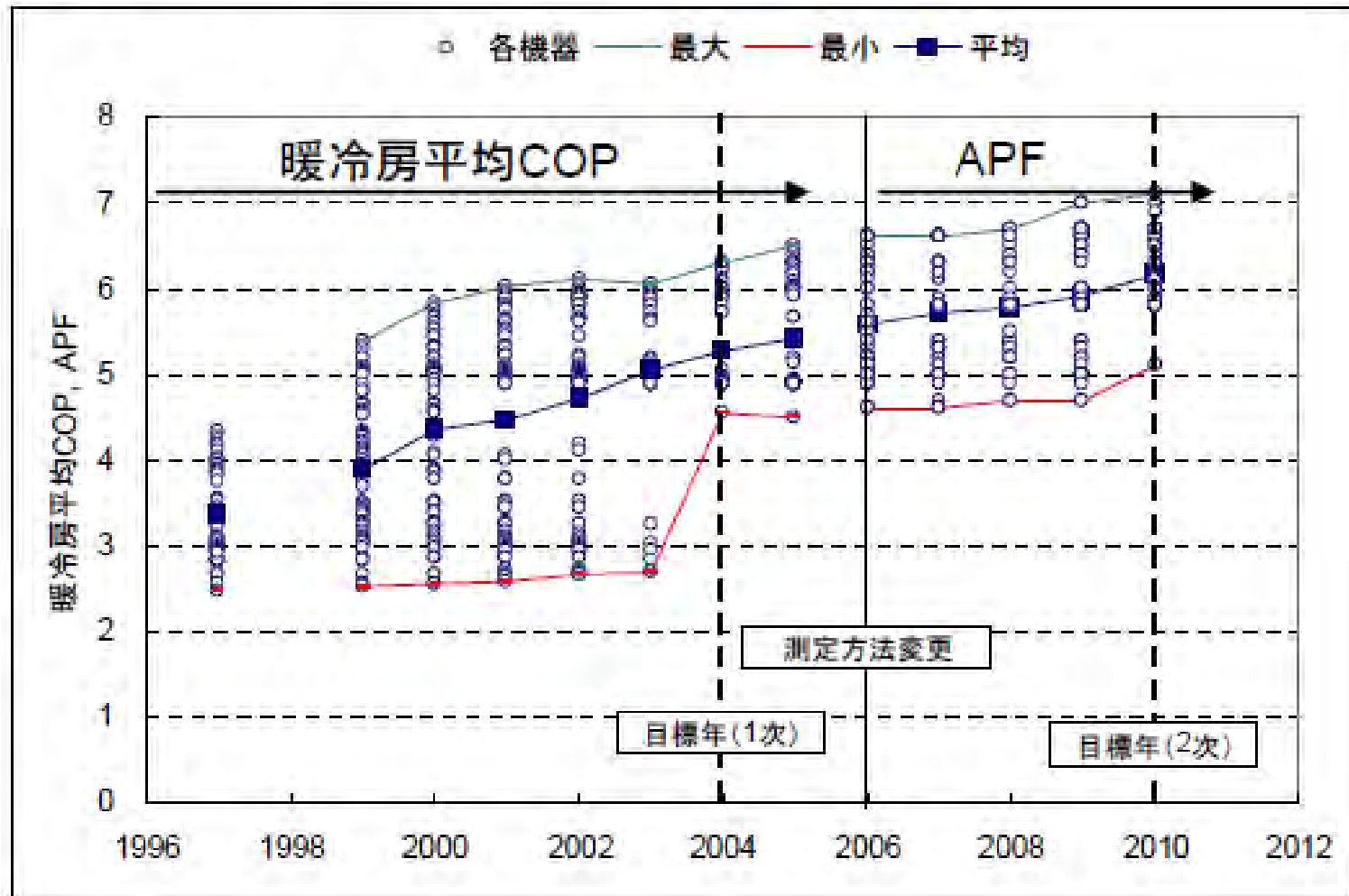
- Products which achieved the Top Runner standard carry a green “e” mark, while others carry an orange “e” mark.
- Achievement level and energy consumption efficiency (annual electricity consumption) are also indicated.

【Estimated annual electricity rates】

- The estimated annual electricity rates are indicated to show the energy consumption efficiency (annual electricity consumption) clearly.

Improvement of Energy Efficiency (Example of Air Conditioner)

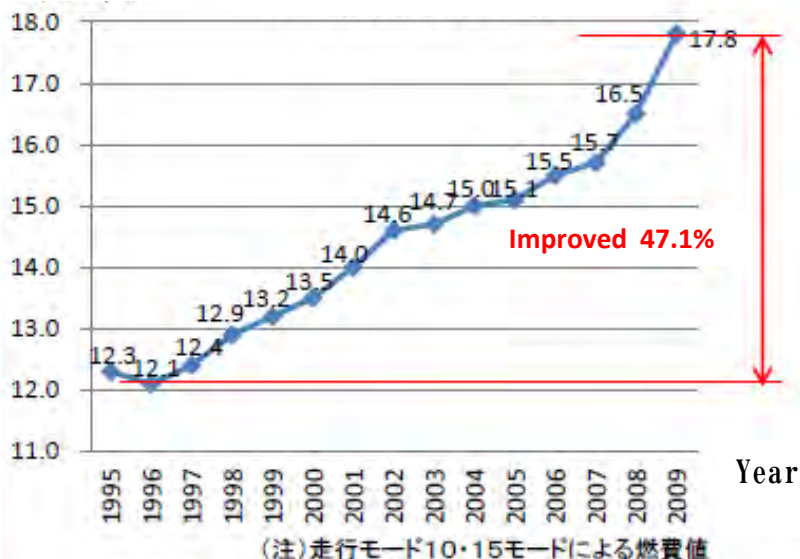
＜暖冷房平均COP, APFの推移＞



The effect of the Top Runner Program

Passenger vehicles

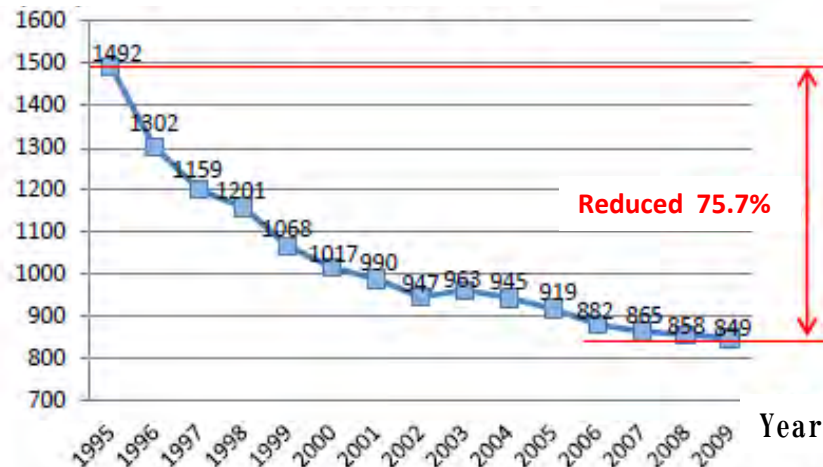
Fuel Consumption(km/L)



Year

Air-conditioners

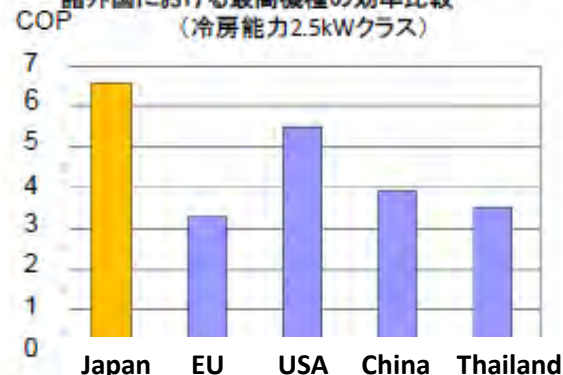
Seasonal Power Consumption(kW/h)



Year

(注) 壁掛け形冷暖房兼用・冷房能力2.8kWクラス・省エネ型代表機種の単純平均値

諸外国における最高機種の効率比較
(冷房能力2.5kWクラス)



Who guarantees the performance of the product? 1/2

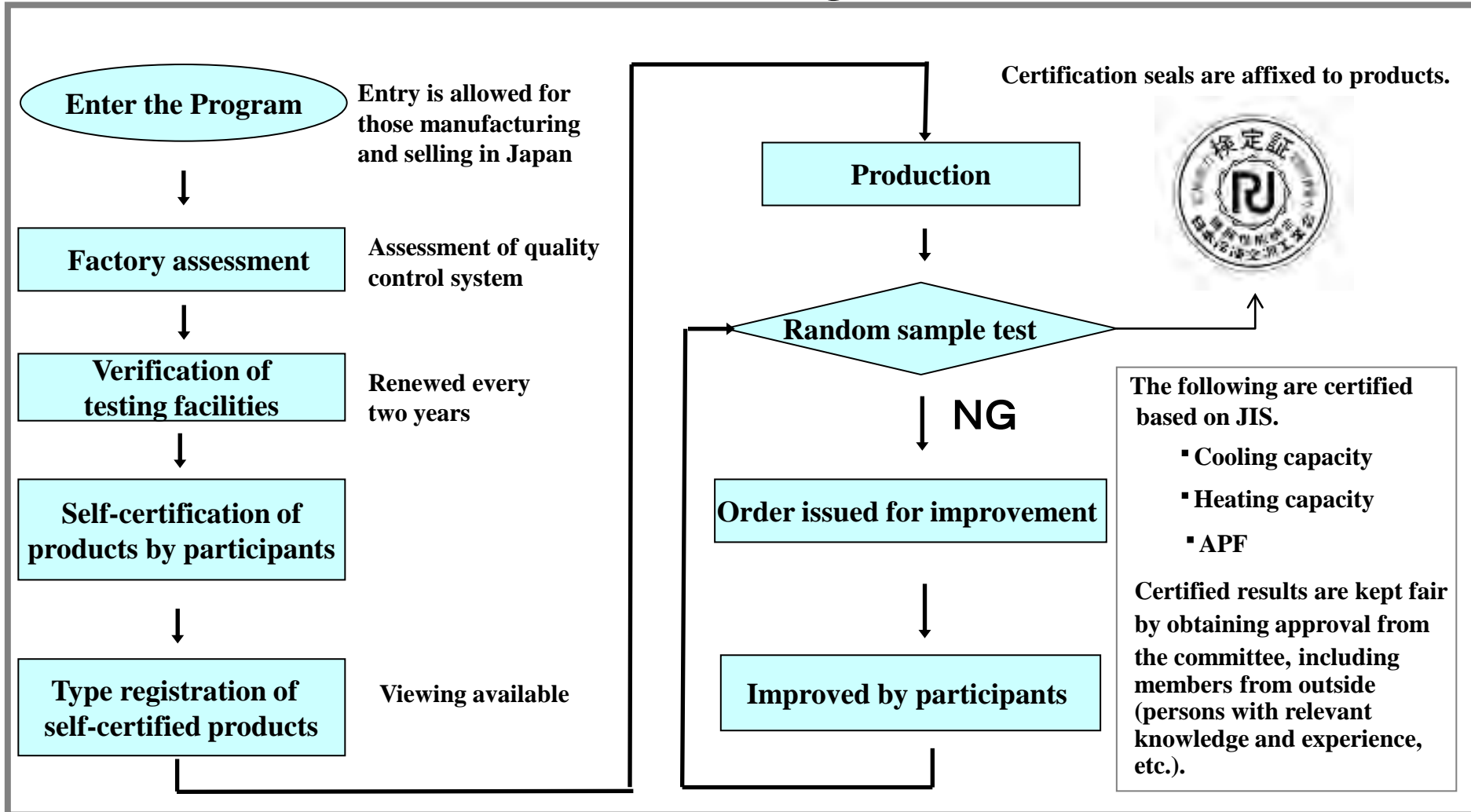


History

- | | | |
|----------|------|--|
| August | 1978 | ● JRAIA Testing Laboratory established |
| December | 1978 | ● Room air conditioner testing facilities completed |
| October | 1980 | ● Room air conditioner certification program started |
| | | ● Packaged air conditioner/heat pump testing facilities completed |
| October | 1983 | ● Packaged air conditioner/heat pump certification program started |
| October | 1985 | ● Room air conditioner/heat pump testing facilities completed |
| December | 1991 | ● Room air conditioner/heat pump low temperature heating capacity testing facilities completed |
| November | 1993 | ● Packaged air conditioner/heat pump low temperature heating capacity testing facilities completed |
| January | 2004 | ● Reorganized and split into Testing Laboratory and Certification Dept. |
| October | 2004 | ● Certified to ISO/IEC 17025 |
| April | 2010 | ● Packaged air conditioner/heat pump new testing facilities completed |
| February | 2011 | ● Japan Air Conditioning and Refrigeration Testing Laboratory (JATL) established |

Who guarantees the performance of the product? 2/2

Outline of Certification Program





Policy and Activities for Environmental Issues

REFRIGERANTS

Direct Emission control

- Recovery activities
- Emission control in production
- Leakage reduction in use

Fluorocarbon Recovery and Destruction Law

Home Appliances Recycling Law

Automobile Recycling Law

Japan's activities; Refrigerant Recovery

There are three major legislations
for the end of life of (EOL) products.
These laws require refrigerant recovery
from the EOL products and ban the release.

- 1) Home appliances
Recycling Plants : 49

Fluorocarbon Recovery and Destruction Law

- 2) Commercial A/Cs and
Refrigeration equipment

Home Appliances Recycling Law

- 3) Automobiles

Automobile Recycling Law

Promotion of Refrigerant Recovery

2 million units / year

Typical Recycling Plant

Hyper Cycle Systems Corporation
in Ichikawa city, near Tokyo



Refrigerant Recovery Process



Disassembling Process



Policy and Activities for Environmental Issues

New Law (2015)

ALTERNATE REFRIGERANTS

Switch to new refrigerants

- Research and investigation
- Low GWP refrigerants
- Other refrigerants

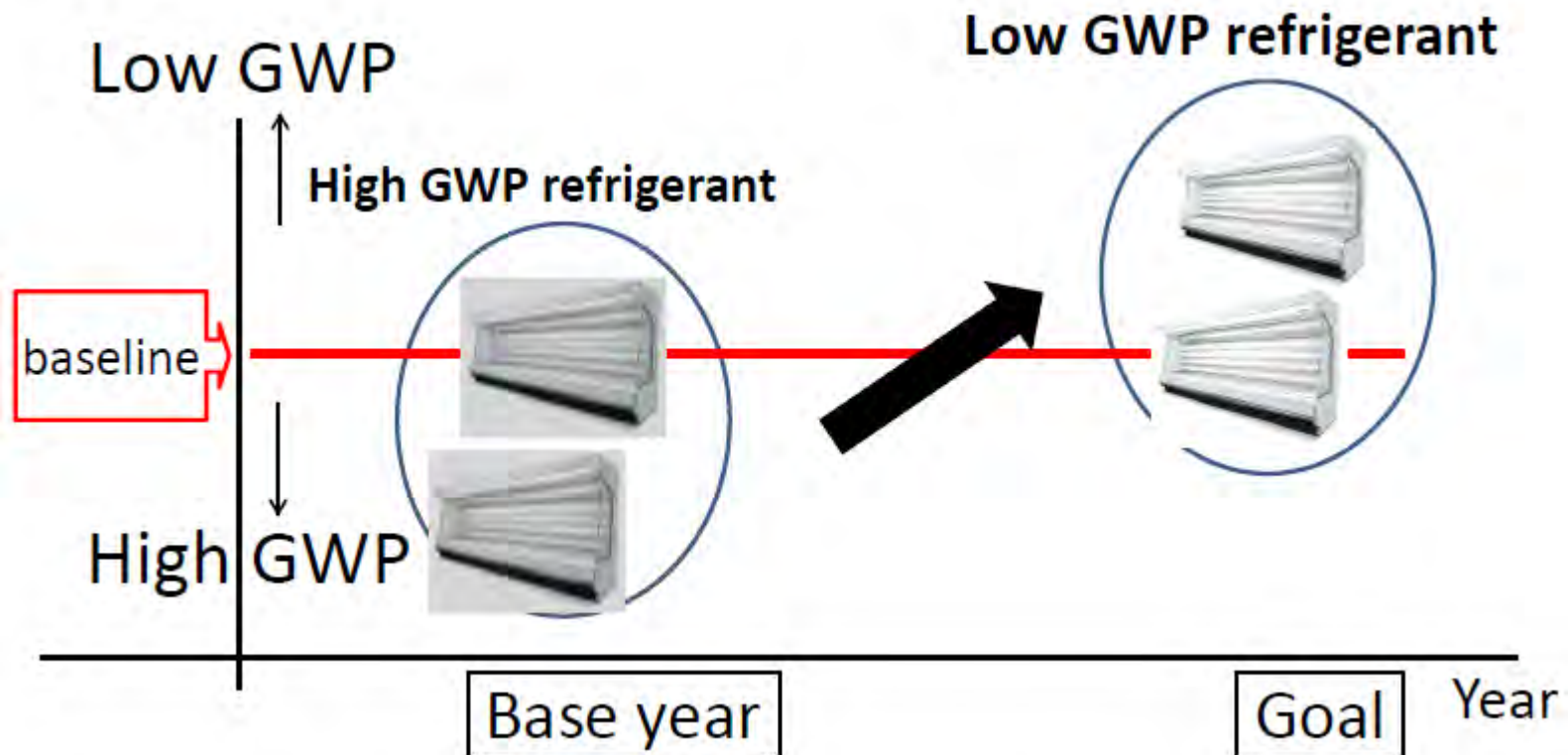
The name of the Act is revised to the Act for Rationalized Use and Proper Management of Fluorocarbons.

- 1) Entities that manufacture and import fluorocarbons
- 2) Entities that manufacture and import products using fluorocarbons, e.g., air conditioning and refrigeration units
- 3) Users that manage commercial air conditioning and refrigeration units
- 4) Proper filling of air conditioning and refrigeration units with fluorocarbons and proper recycling of used Fluorocarbons

Promotion of low GWP equipment and products

After a certain period, manufacturers and importers of equipment and products (ex: air conditioners) are required to introduce to the market new equipment and products whose gas are low GWP or natural refrigerants.

Achievement of baseline in weighted average sector by sector (image)



Domestic and Overseas Situation of Refrigerants and Future View

- EU passed a resolution to ban refrigerants with GWP150 and above for automobile air-conditioners from 2011 onward.
- Phase-out of HFC is put on a discussion table due to global warming impact caused by HFC.
- Japanese Government will frame a new system of the GWP reduction.
- ASHRAE has created a new grade A2L for moderate flammable refrigerants in its classification. There is a movement worldwide toward moderate flammable refrigerants with a low GWP.

Montreal Protocol (1987)
Protection of the ozone layer

Specified Chlorofluorocarbon

CFC: R11, R12
Phase-out by 1996
HCFC: R22, R123
Phase-out by 2020

Depleting the ozone layer
(due to chlorine)

Kyoto Protocol (1997)
Prevention of global warming

Alternative to Chlorofluorocarbon

HFC: R32, R125, R134a, R404A
R407C=R32+R125+R134a
R410A=R32+R125

Global warming impact
Increment of stock due to
replacement to the alternatives in the
future

Proper control of HFC
Responsible use

Low GWP refrigerants
Appearance of R1234yf
R1234ze
Mix

Other refrigerants
NH₃, CO₂, HC and so on
No ozone layer depleting and less
global warming impact
Problem of performance and safety
Limited use to a few equipment

Requirements for next generation refrigerants

Conditions required for Alternatives

Safety

- Low Toxicity
- Low Risk of Flammability

Environment Performance

- Ozone Depletion Potential =0
- Low Global Warming Potential

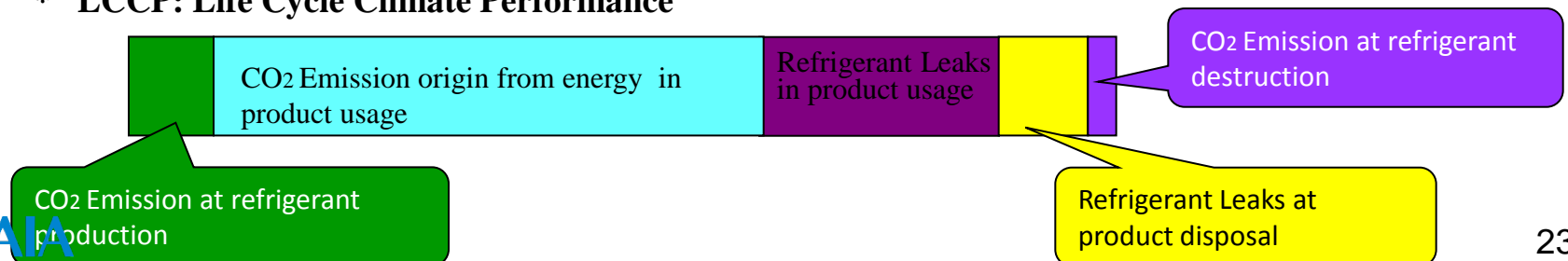
Energy Efficient

- Superior for LCCP \dot{v} value
- Similar performance at high load cooling

Economic Feasibility

- Reasonable Cost
- Acceptable in Developing Countries

* LCCP: Life Cycle Climate Performance

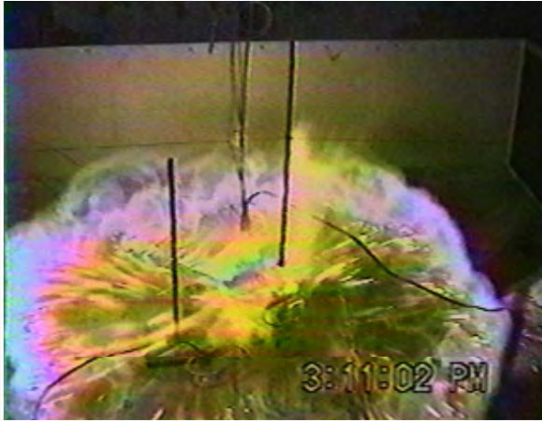


Next generation refrigerant candidates for air-conditioners

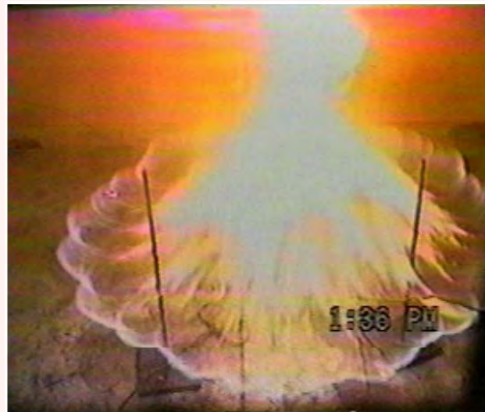
	ODP	GWP (IPCC 4AR)	ASHRAE safety classification	Ignition Point (°C)	Burning Quantity (kJ/kg)	Burning Velocity (cm/sec)	Pressure (MPa)
HCFC R22	0.055	1810	A1	-	-	-	1.72
R410A	0	2090	A1	-	-	-	2.72
R32	0	675	A2L	648	9.3	6.7	2.8
R1234yf	0	4	A2L	405	10.3	1.5	1.16
Mix	0	300~500 ?	?	?	?	?	?
New	0	?	?	?	?	?	?
R717 (NH ₃)	0	0	B2L	651	18.6	7.2	1.78
R290 (Propane)	0	<3	A3	410	46.3	39	1.53
R744 (CO ₂)	0	1	-	-	-	-	10.00

Several proposals from refrigerant maker

Combustion Test Results



R290(A3) Propane



R152a (A2)



R32 (A2L)

Compressed Gas Flammability Classifications

	Flammable Gas Classification		
Gas	EU	Japan	US
Propane	Flammable	Flammable	Flammable
HFC-152a	Flammable	Flammable	Flammable
Ammonia	Flammable	Flammable, but grandfathered	Nonflammable
HFC-32	Flammable	Nonflammable?	Flammable
1234ze(E)	Nonflammable	Flammable?	Nonflammable

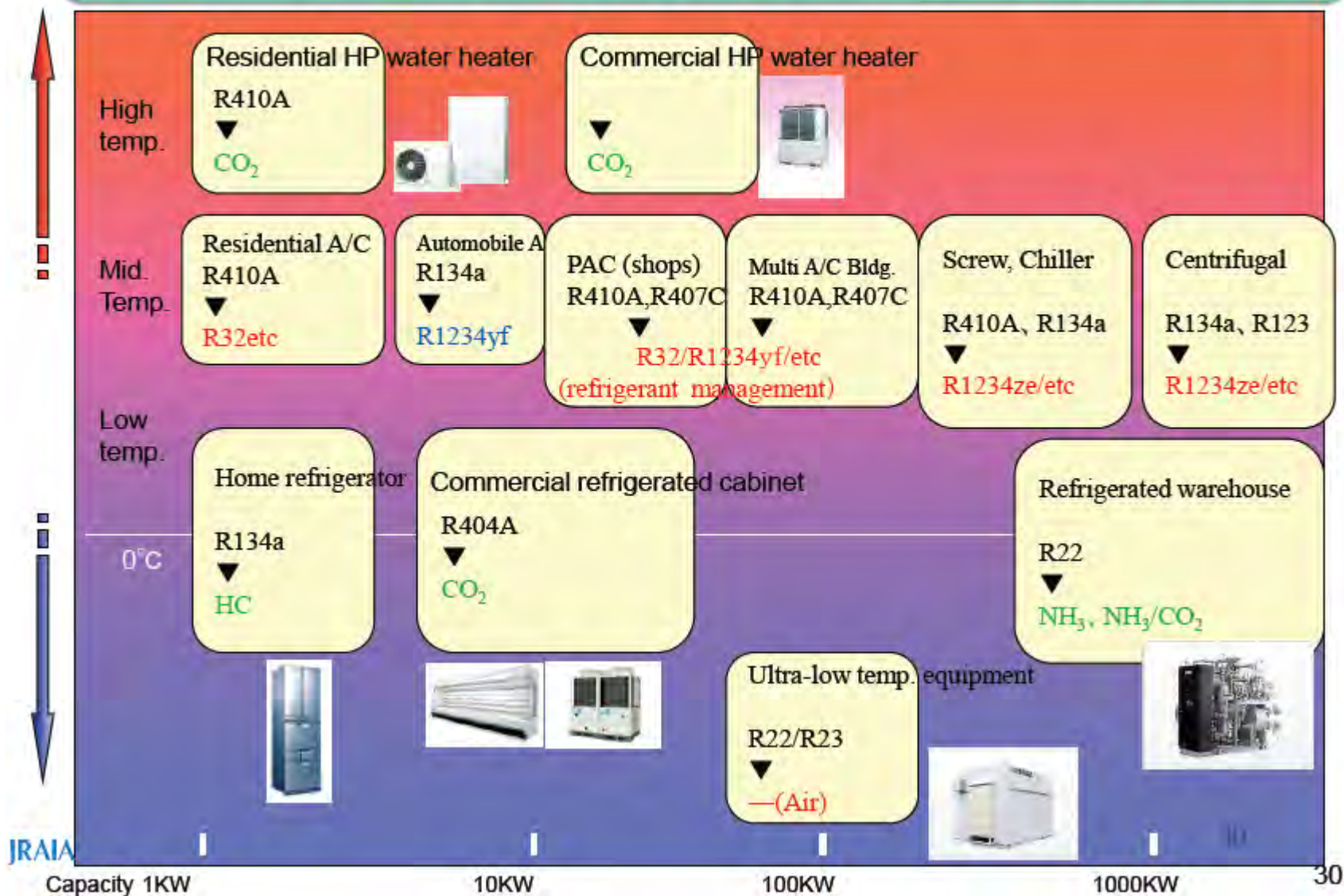
EU A11

Japanese High Pressure Gas Law

US DOT & ASHRAE

出典: Honeywell社より

Candidates for the next generation refrigerants by applications



Thank you for your kind attention!