

# Training in Japan on Top Runner Program for Kazakhstan mission

**December 19 and 20, 2019,**

# Lecture List

## Lecture 1

Overview of the EE&C of the household - legal framework and actual methodology of Top Runner Program (hereinafter "Program")

ECCJ Ms. Kayo Hayai, International Cooperation Div.

## Lecture 2

Historical viewpoint of the Program and Comparison between the Program and other methods (Especially MEPS)

ECCJ Mr. Yasushi Tanaka, International Cooperation Div.

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ECCJ Dr. Kotaro Ohkuni, Energy Conservation Support Service Div.

## Lecture 4

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ECCJ Mr. Yasushi Tanaka, International Cooperation Div.

## Lecture 1

# Overview of the EE&C of the household - legal framework and actual methodology of Top Runner Program (hereinafter "Program")

**Kayo Hayai**

International Cooperation Division  
The Energy Conservation Center, Japan

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**1-1**    **Structure of Energy Conservation Act**

**1-2**    **Final Energy Consumption by Sector**

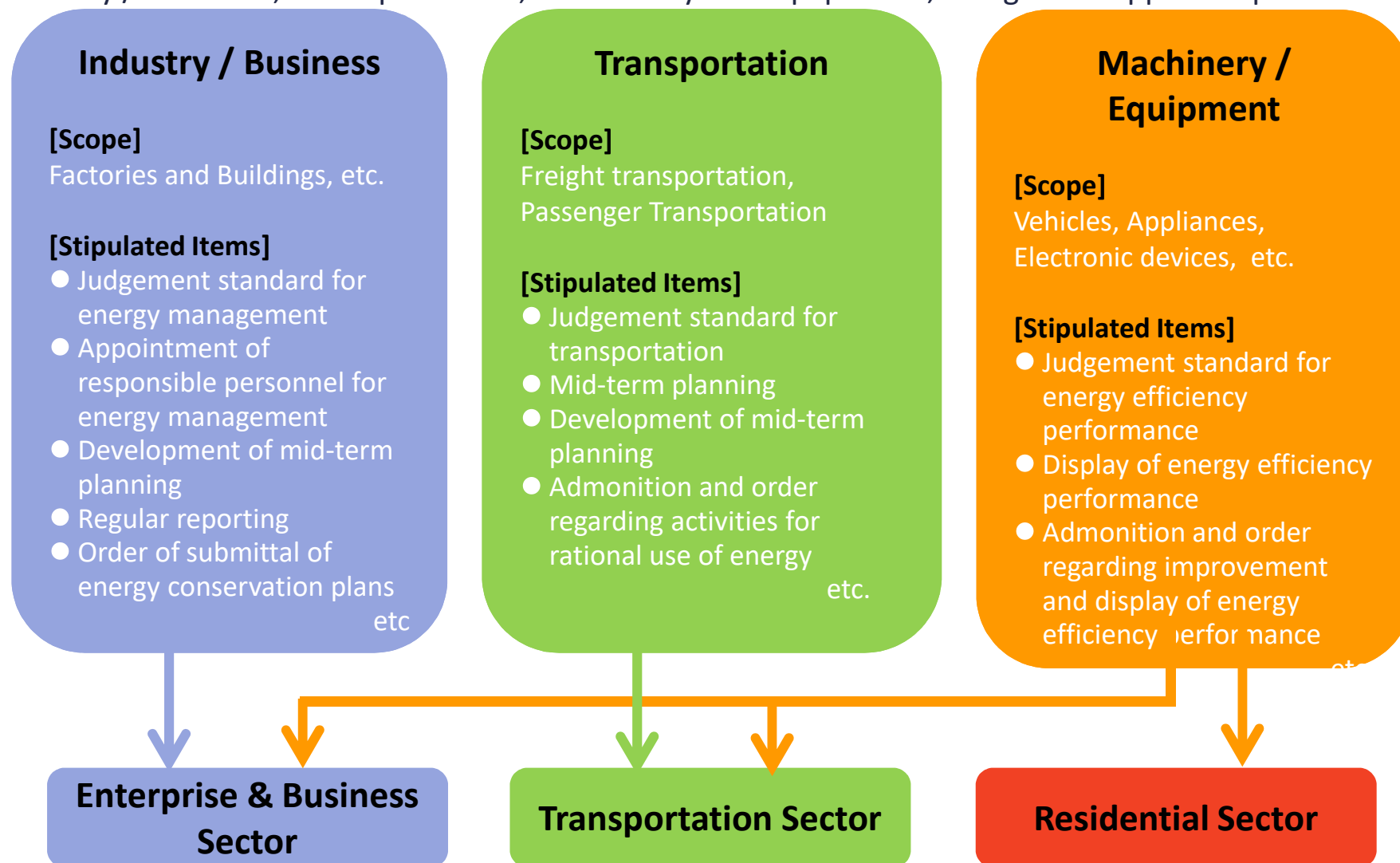
**1-3**    **Energy Consumption Status at Household**

**2**      **Energy Efficiency Standards for Machineries and Equipment and Labeling Schemes**

**2-1**    **Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)**

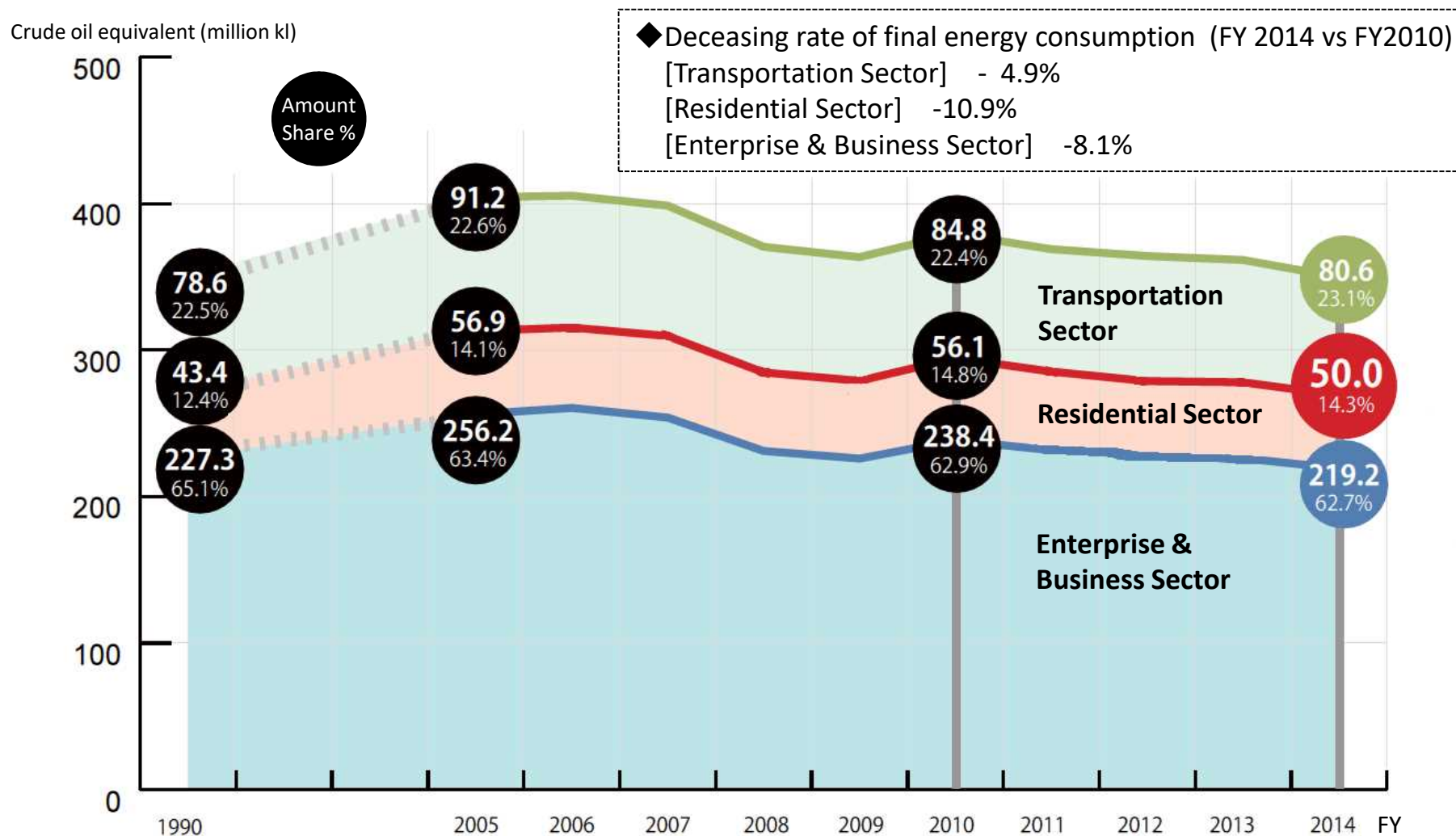
# 1-1 Structure of Energy Conservation Act

EC Act stipulates what business operators should do for the sake of rational use of energy in the field of “Industry / Business”, “Transportation”, “Machinery and Equipment”, along with supportive provisions.



# 1-2. Final Energy Consumption by Sector

The government requires targeted business operators to implement rational use of energy according to the Energy Conservation Act. In recent years, the final energy consumption is slightly decreasing.



Note: Developed from "Energy Saving Performance Catalogue 2016 Winter"

# 1-3. Energy Consumption Status at Household

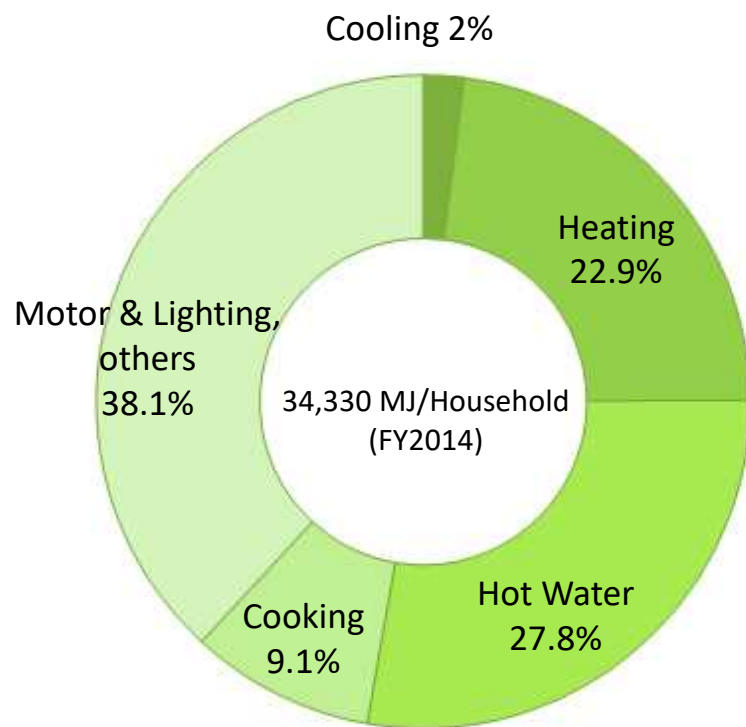
## [Energy Consumption Ratio by Use at Household]

(Reference: METI Energy Efficiency & Conservation Information Website)

- “Motor & Lighting, others” occupies the largest portion. This could be the result of recent trends, such as upsizing and diversifying, of home appliances

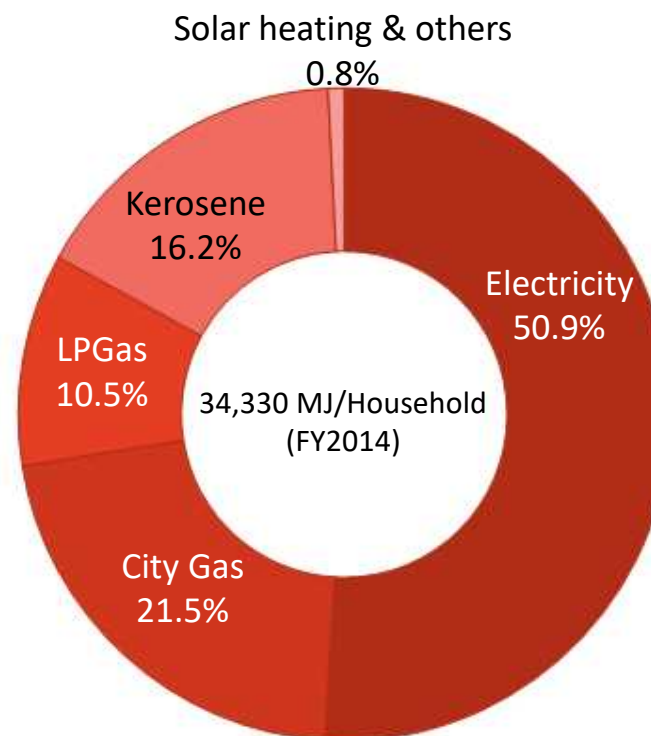
## [Energy Consumption Ratio by Source at Household]

- “Electricity” occupies the largest portion. This could be the result of increasing number of all-electric housing in addition to the spreading , upsizing, and diversifying of home appliances.



Energy Consumption Ratio by Use at Household

(Reference: Energy White Paper 2016)



Energy Consumption Ratio by Source at Household

(Reference: Energy White Paper 2016)

# 1-3. Energy Consumption Status at Household

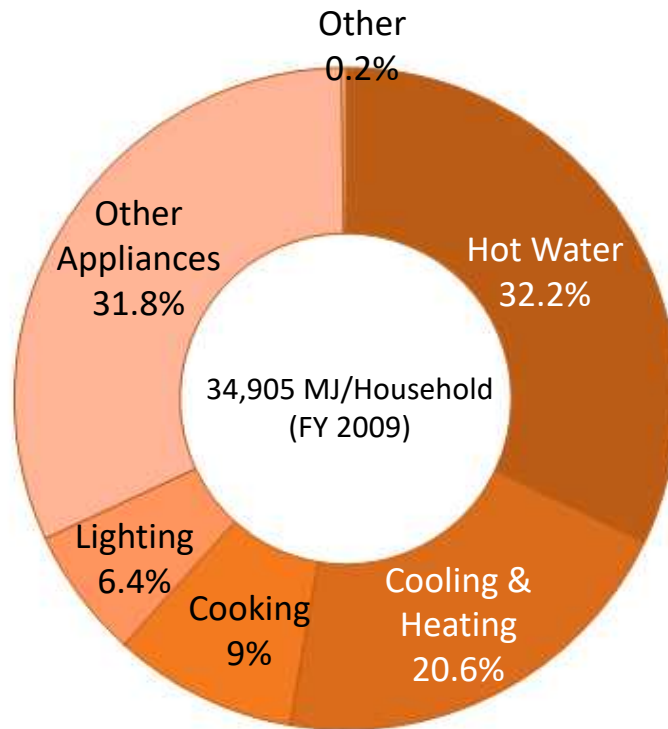
(Reference: METI Energy Efficiency & Conservation Information Website)

## [Energy Consumption Ratio by Type of Appliance at Household]

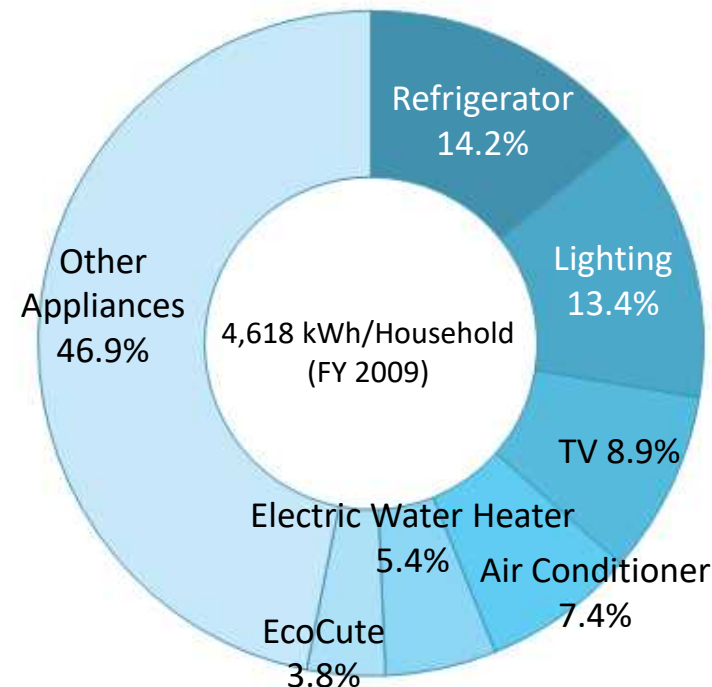
- Energy (including electricity, gas, oil) consumed by “hot water supply” and “space cooling and heating” occupies the largest portion.

## [Electricity Consumption Ratio by Appliances at Household]

- Major appliances such as “refrigerator”, “lighting”, “TV” and “air conditioner” occupy about 40%. Taking into account “water heaters (electric water heaters and EcoCute)”, the portion is increased to about 50%.



Energy Consumption Ratio by  
Type of Appliance at Household

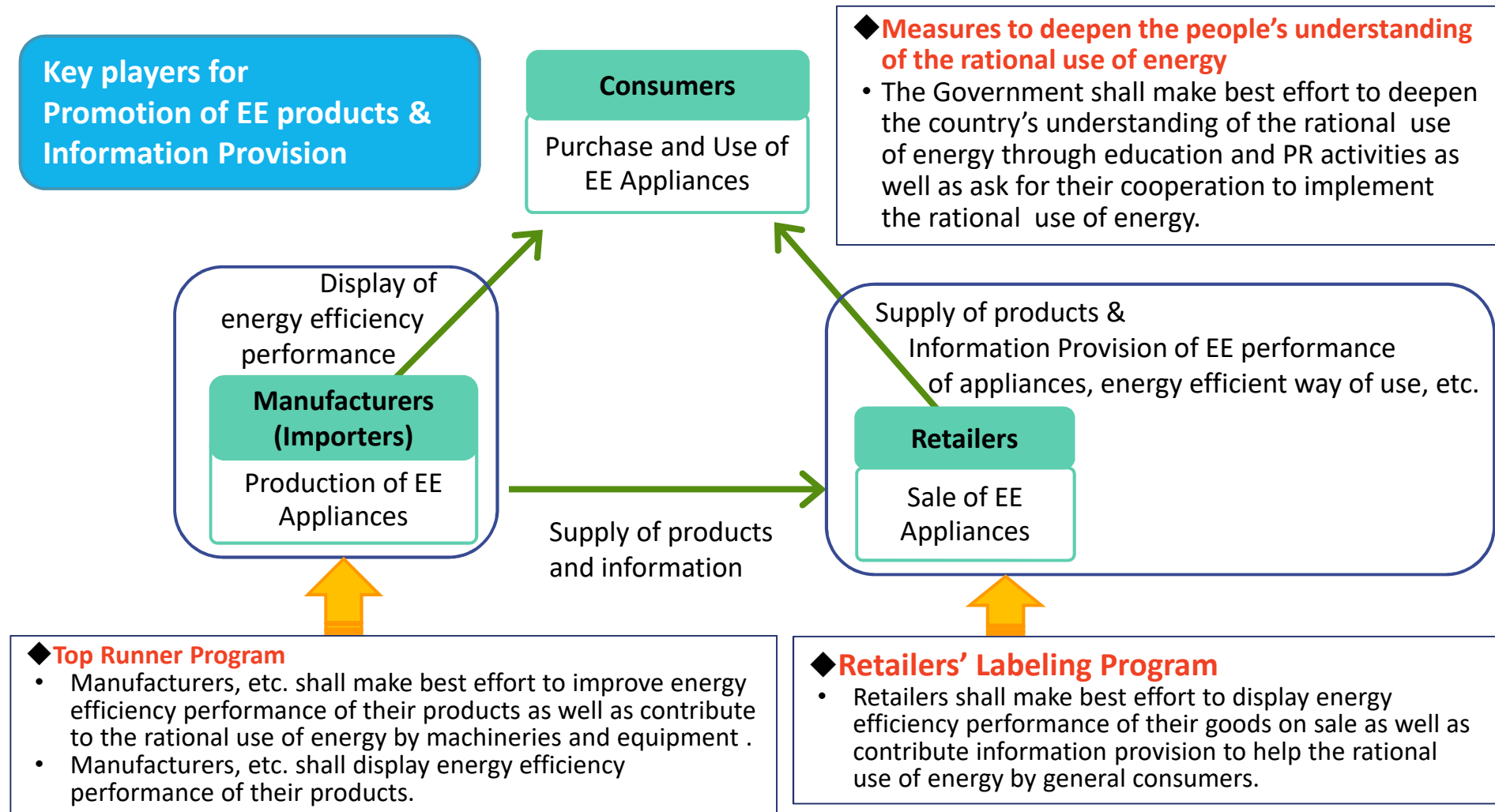


Electricity Consumption Ratio by  
Type of Appliance at Household



## 2. Energy Efficiency Standards for Machineries and Equipment and Labeling Schemes

Energy efficiency standards and labeling schemes are intended to contribute to the energy saving at home by improving energy efficiency performance of appliances and displaying it to the users.



## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

### What is Top Runner Program?

- General idea and basic concept
- Compare and contrast between Top Runner and MEPS
- Steps in reviewing new target products
- Target products
- Mandatory reporting and actual improvement of energy efficiency performance
- Penal provisions
- Steps of developing and revising energy efficiency standards
- Mandatory displaying (will be introduced in the next section “labeling schemes”)

## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Top Runner Program intends to improve energy efficiency performance of appliances, etc. The standard values are set based on the most efficient product with consideration for technological future development.

### Basic Concept and Characteristics of Top Runner Program

- Target standard values are set based on the most energy efficient models in the market at the time of developing standard values. Then, the energy efficiency improvement due to the technological development expected in a few years is also taken into consideration.
- Target standard values are either absolute values or expressions with using attributes which affect the energy efficiency performance of products, such as TV size, internal volume of refrigerator, printing speed of multifunction devices.
- Achievement of the standard is judged based on the results of “Target Fiscal Year”, which is 3 to 10 years after the effective date of the standard.
- Shipment-volume weighted average energy consumption efficiency, which is calculated category by category for each business operator, is used for judging the status of achieving the standard.

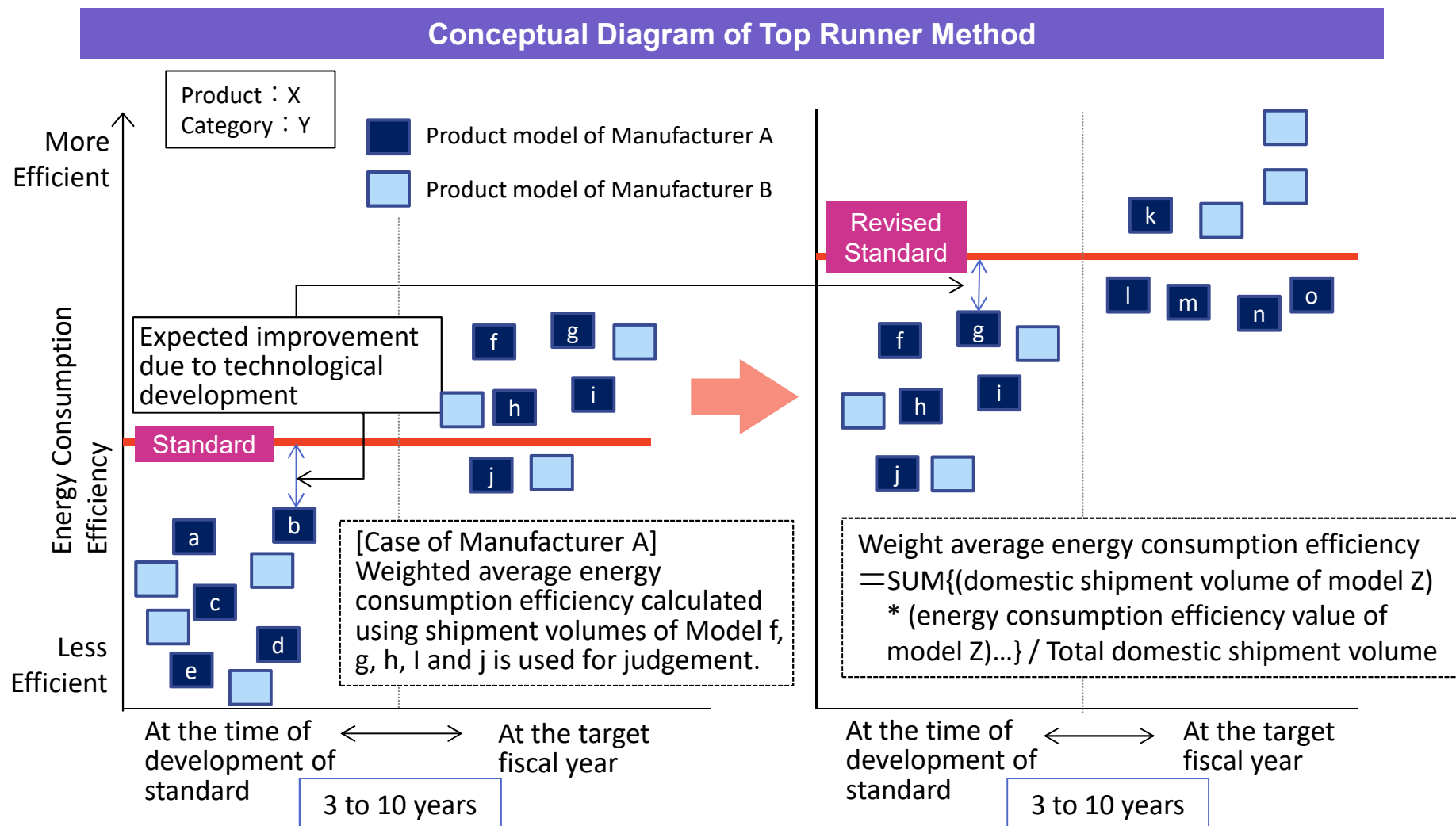
## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Target products have been gradually expanded since 1999. As of July 2017, 32 target products (29 for machineries & equipment and 3 for construction materials) are covered under Top Runner Program.

Target Product (Designated machineries & equipment) (Designated construction materials)		Construction materials are underlined.
<b>&lt;Addition in 1999&gt;</b> 1. Passenger Vehicles 2. Freight Vehicles 3. Air Conditioners 4. TV sets 5. Video Tape Recorders 6. Lighting Equipment (using Fluorescent Lamps) 7. Copying Machines 8. Computers & Servers 9. Magnetic Disk Units 10. Electric Refrigerators 11. Electric Freezers	<b>&lt;Addition in 2002&gt;</b> 12. Space Heaters (using Gas or Oil) 13. Gas Cooking Appliances 14. Gas Water Heaters 15. Oil Water Heaters 16. Electric Toilet Seats 17. Vending Machines 18. Transformers	<b>&lt;Addition in 2013&gt;</b> 24. Multifunction Devices 25. Printers 26. Electric Water Heaters (Heat Pump Type) 27. AC Motors 28. LED Lamps 29. <u>Insulation Materials</u>
	<b>&lt;Addition in 2006&gt;</b> 19. Electric Rice Cookers 20. Microwave Ovens 21. DVD Recorders	<b>&lt;Addition in 2004&gt;</b> 30. <u>Sashes</u> 31. <u>Double-glazed Glass</u>
	<b>&lt;Addition in 2009&gt;</b> 22. Routers 23. Switching Units	<b>&lt;Addition in 2017&gt;</b> 32. Showcase (for Cold or Frozen Food)

## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Top Runner Program intends to improve energy efficiency performance of appliances, etc. The standard values are set based on the most efficient product with consideration for technological future development.

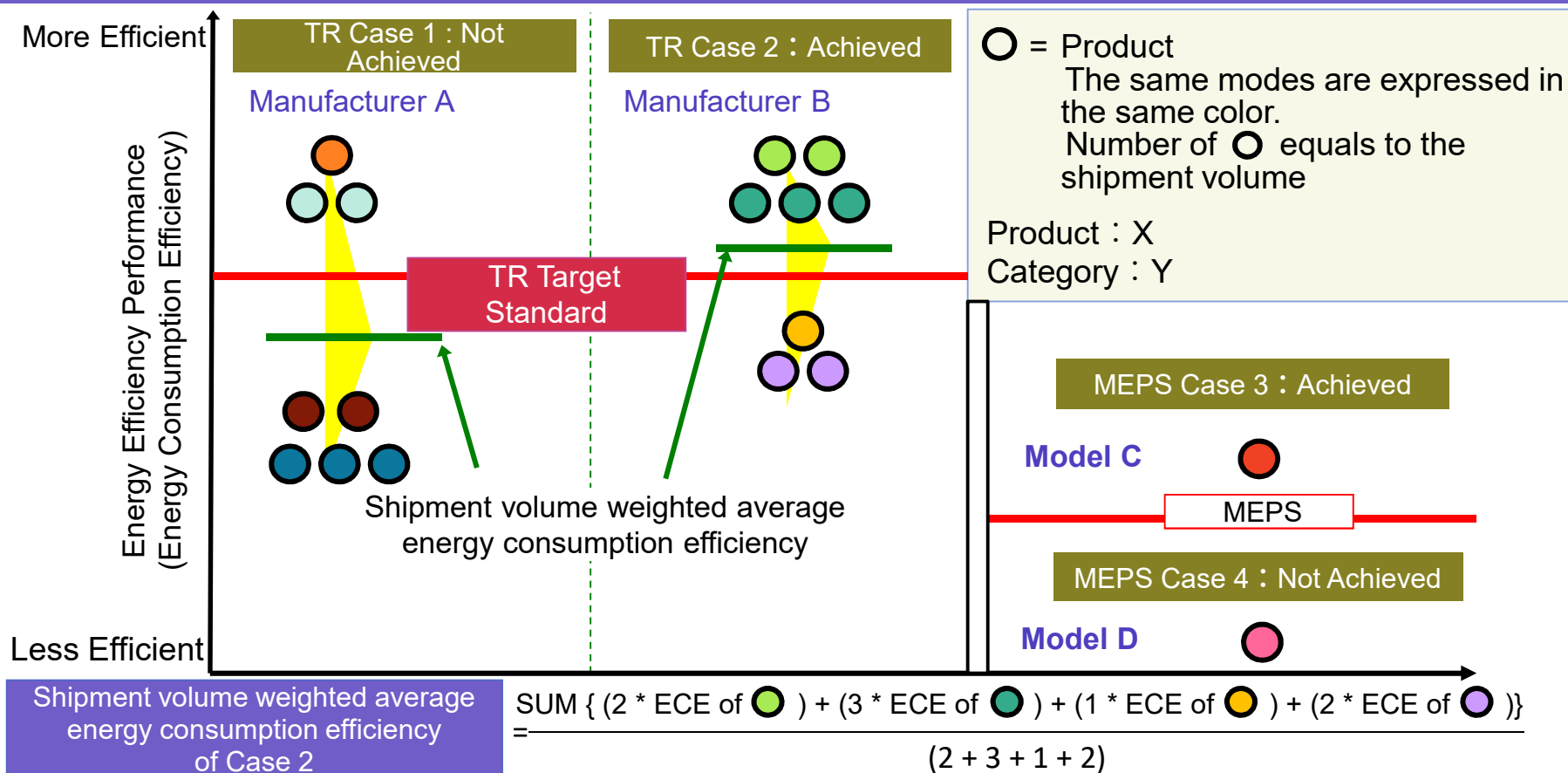


## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

- With using the shipment volume weighted average energy consumption efficiency to judge the standard achievement status, Top Runner Program can encourage energy efficient products to increase the number of shipment volume while keeping the diversity of product models in the market.

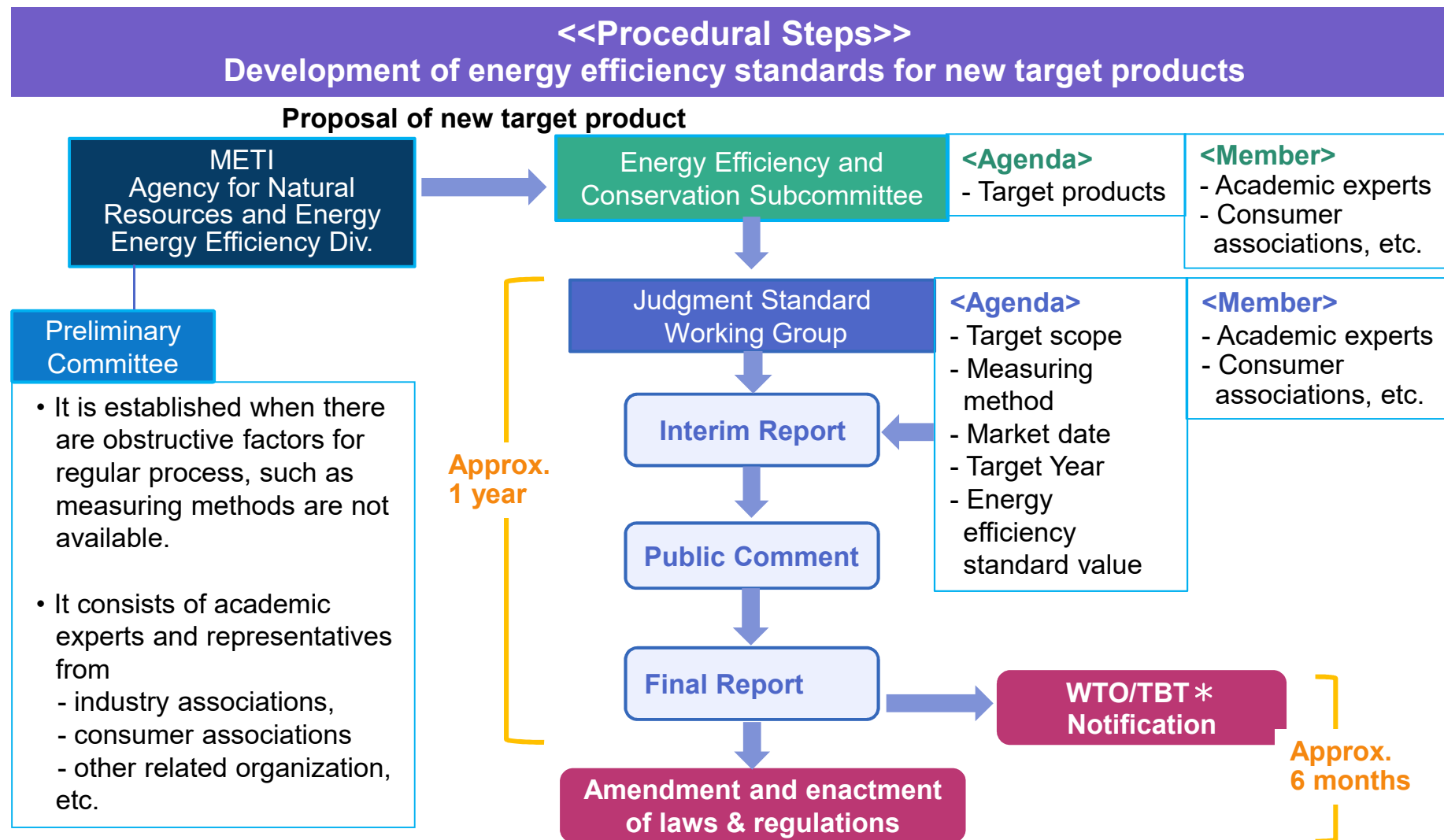
### << Compare & Contrast >>

#### Top Runner Method (TR) and Minimum Energy Performance Standard Method (MEPS)



## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Addition of target products are discussed at “Energy Efficiency and Conservation Subcommittee”, while the details of standards are discussed at “Judgment Standard Working Group”.

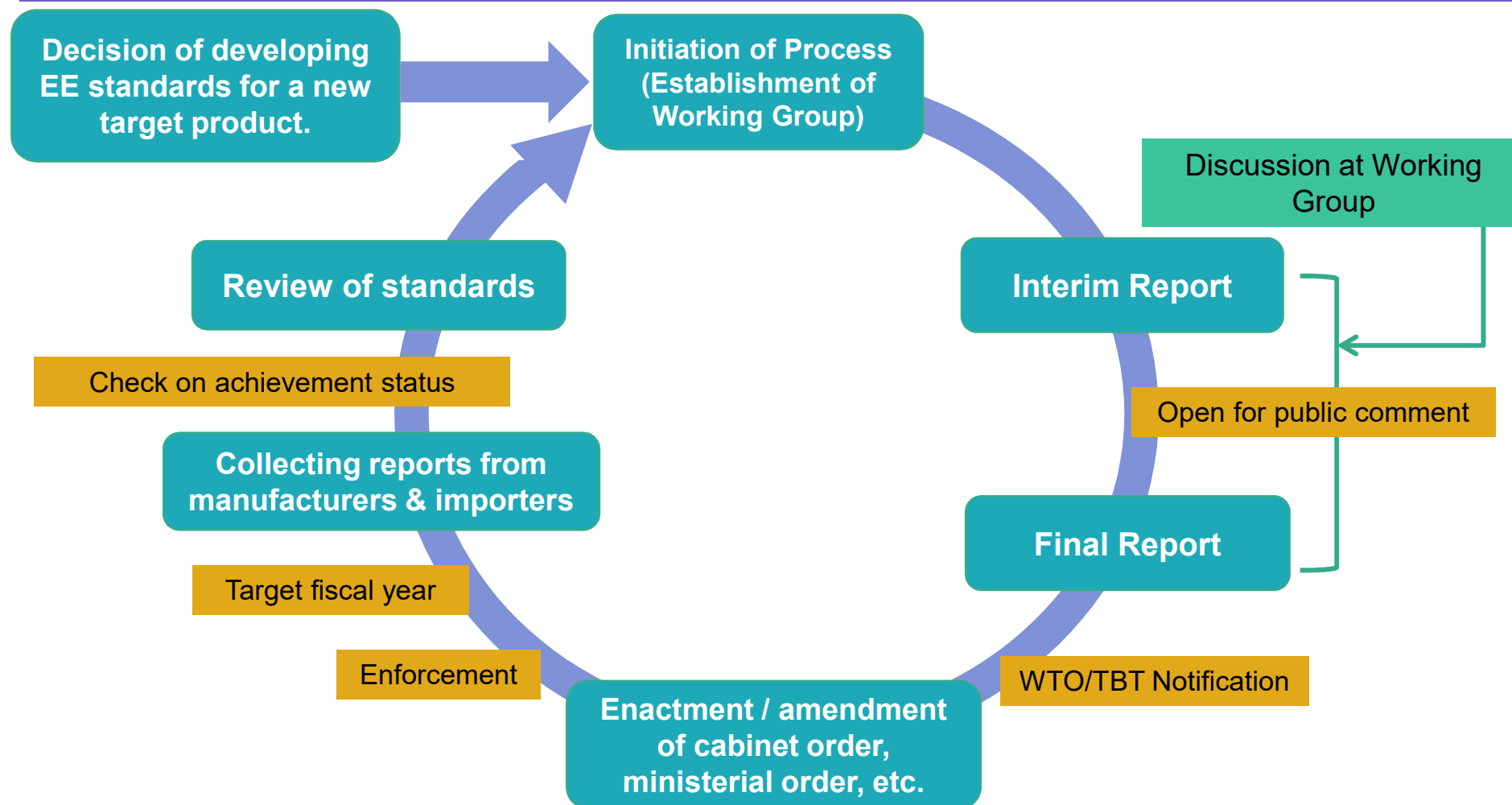


\*World Trade Organization / Technical Barrier to Trade Agreement

## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Continuous steps of [Development– Enforcement – Reviewing– Revision – Enforcement] are implemented to maintain the effectiveness of To Runner Program.

Flow diagram of development / revising energy efficiency standard in Top Runner Program





## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

### Electric Refrigerator

Reference: Reference material for the 17<sup>th</sup> EE&C Subcommittee (December 2011)

#### 1<sup>st</sup> Round

Category of models incl. refrigerator-freezer	Base FY 1998	Enforcement 1999	Target FY 2004	Improvement rate
Energy consumption efficiency	647.3 kWh/year	⇒	Expected 449.7 kWh/year	Expected 30.5%
		⇒	Actual 290.3 kWh/year	Actual 55.2%

#### 2<sup>nd</sup> Round

Category of models incl. refrigerator-freezer	Base FY 2005	Enforcement 2006	Target FY 2010	Improvement rate
Energy consumption efficiency	572 kWh/year	⇒	Expected 452 kWh/year	Expected 21.0%
		⇒	Actual 326 kWh/year	Actual 43.0%

As JIS standard (measuring method) was revised to reflect actual usage pattern, TR standard was also revised to adopt the latest JIS.

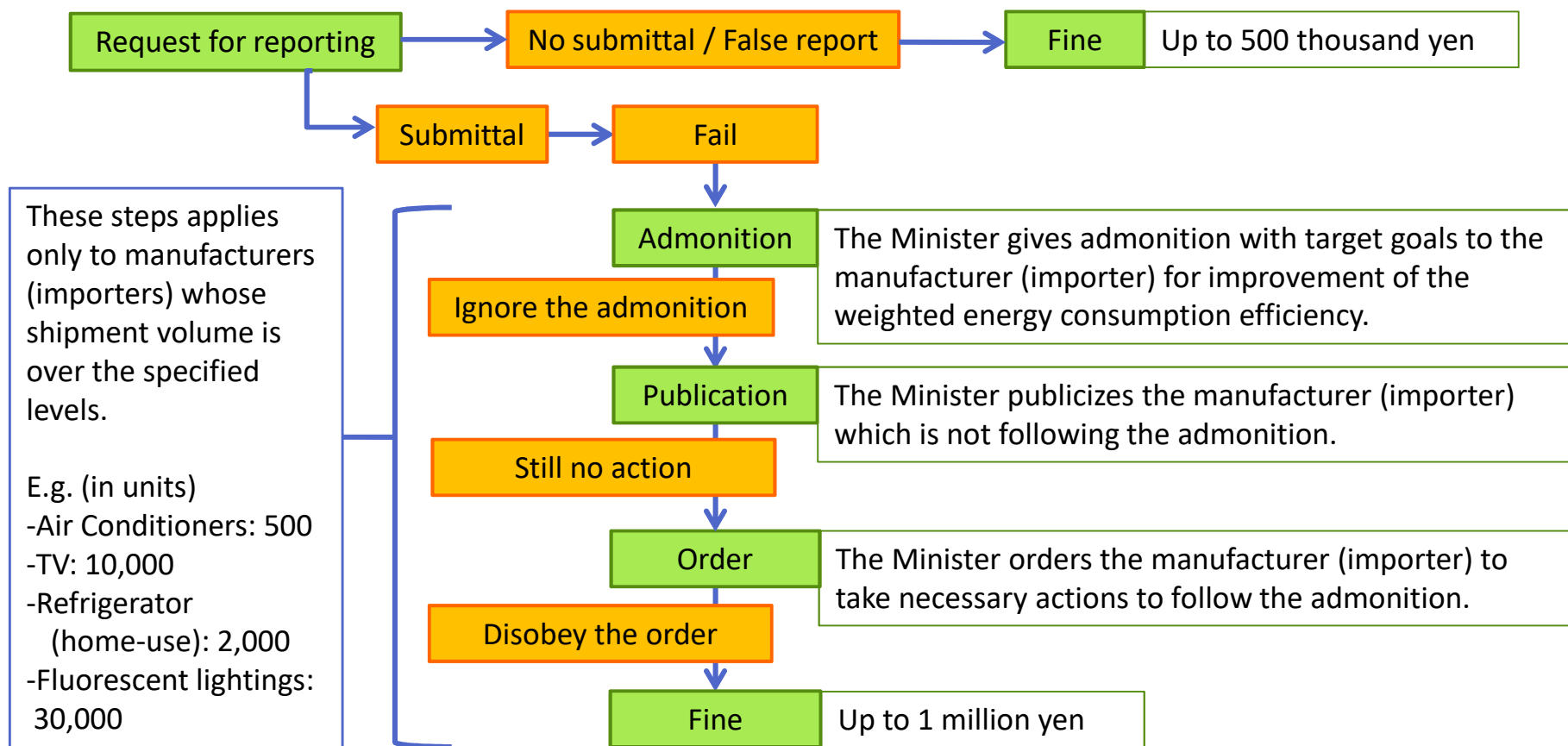
1 <sup>st</sup> Round	2 <sup>nd</sup> Round	3 <sup>rd</sup> Round (Enforced in FY 2016)
JISC 9801:1999	JISC 9801:2006	JISC 9801-3:2015

## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

If it is judged that substantial improvement of energy consumption efficiency is necessary based on the reporting, the manufacturer or importer is requested to correct their status to meet the standard.

### Admonition for energy efficiency improvement

If it is recognized that substantial improvement of energy consumption efficiency is necessary based on the reporting, the Minister may exercise his/her authority to admonish or publicize or order the manufacturer (importer) to improve the weighted energy consumption efficiency of the category in question. Violation of order may be charged up to 1 million yen. (Ref. Article 79 and Article 95)



## 2-1. Energy Efficiency Standards for Machineries and Equipment (Top Runner Program)

Manufacturers & importers have an obligation to report shipment volumes and energy consumption efficiency of their products. The reported numbers are used to judge the achievement status as well as to review the improvement of energy consumption efficiency of products as a whole.

### Mandatory Reporting

- Manufacturers (or importers) of specified machineries & equipment / building materials have an **obligation to report the following information when they are requested by the Minister**. (Ref. Article 87-10)
  - Production Volume (or import volume) and shipment volume for domestic market
  - Energy consumption efficiency and matters related to improvement of energy consumption efficiency
  - Display status of energy consumption efficiency
- In case of ignoring the request of the Minister or making a false report, penalty of 500 thousand yen or below will be imposed. (Ref. Article 96)
- The Minister has the authority to order to conduct on-site inspections, etc. In case of denial of the inspections, the same penalty rule will be applied.

### Examples of improvement rate of energy consumption efficiency

Target Product	Unit of Energy Consumption Efficiency	Improvement Rate based on Actual Status
Air Conditioners (Home Use, Direct blow, Wall -hung, Cooling capacity of 4kW or below)	APF (Annual Performance Factor)	16.3 % FY2005 ⇒ FY2010
TVs (LCD & Plasma)	kWh/year	60.6 % FY2008 ⇒ FY2012
Refrigerators (Home use)	kWh/year	43.0 % FY2005 ⇒ FY2010

## Lecture 2

# Historical viewpoint of the Program and Comparison between the Program and other methods (Especially MEPS)

**Tanaka Yasushi**

International Cooperation Division  
The Energy Conservation Center, Japan

# Historical viewpoint of the Program and Comparison between the Program and other methods (Especially MEPS)

## 1 Historical viewpoint of the Program

- (1) Pre-history of Top Runner Program
- (2) 1998~2016 what occurred during implementation period
- (3) 2016~ Current issues to be tackled

## 2 Comparison between the Program and other methods (esp. MEPS)

- (1) Conceptual difference
- (2) Features of both methods

# Pre-history of the Program

## 1. Prehistory of the Top Runner Program is as follows.

- 1979～ Beginning of the 1st regulations on energy efficiency of equipment efficiency standards,
  - target: air conditioners and electric refrigerators
- 1993～ 2nd regulation starts,
  - target: air conditioner, fluorescent lighting, TV, electronic computer, magnetic disk, VTR

(Refrigerators are excluded from the scope due to technical difficulties.)

## 2. The above-mentioned policies were not successfully implemented due to

- Almost no chance to revisit the standards
- Standards were set based on negotiations with industry

# History of the Program from 1999 to 2016

- In order to be target products of Top Runner Program, they have to meet the 3 requirements stipulated for either energy consuming machinery & equipment or thermal loss preventing construction material.
- (1) They are used in a large numbers in Japan.
- (2) They consume a significant amount of energy when they are used.
- (3) Improvement of their energy efficiency performance is considered as particularly essential.

FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016
●Mandatory display by manufacturers/importers	●Energy Saving Labeling Program • Voluntary • Manufacturer						●Retailers Labeling Program • Voluntary • Retailers										
Introduction of the Program [9 items]			➤ Add equipment [7 items]				➤ Add equipment [3 items]			➤ Add equipment [2 items]			➤ Add equipment [3 items]		➤ Add equipment [2 items]		➤ Add equipment [1 item]
1. Passenger vehicles			12. Gas heating stoves				19. Rice cookers			22. Routers			24. Multifunctional machines		30. Sashes		32. Showcases
2. Air conditioners			13. Gas cooking equipment				20. Microwave ovens			23. Switching units			25. Printers		31. insulated glazing		
3. Lighting equipment for fluorescent lamp			14. Gas water heaters				21. DVD recorders						26. Electric water heaters				
4. TV receivers			15. Oil water heaters										➤ Add equipment [2 items] [1 material]				
5. Copying machines			16. Electronic toilet seats										27. AC motors				
6. computers			17. Vending machines										28. LED lamps				
7. Magnetic disk units			18. Transformers										29. Insulations				
8. Freight vehicles																	
9. Video tape recorders																	
➤ Add equipment [2 items]																	
10. Electric refrigerators																	
11. Electric freezers																	

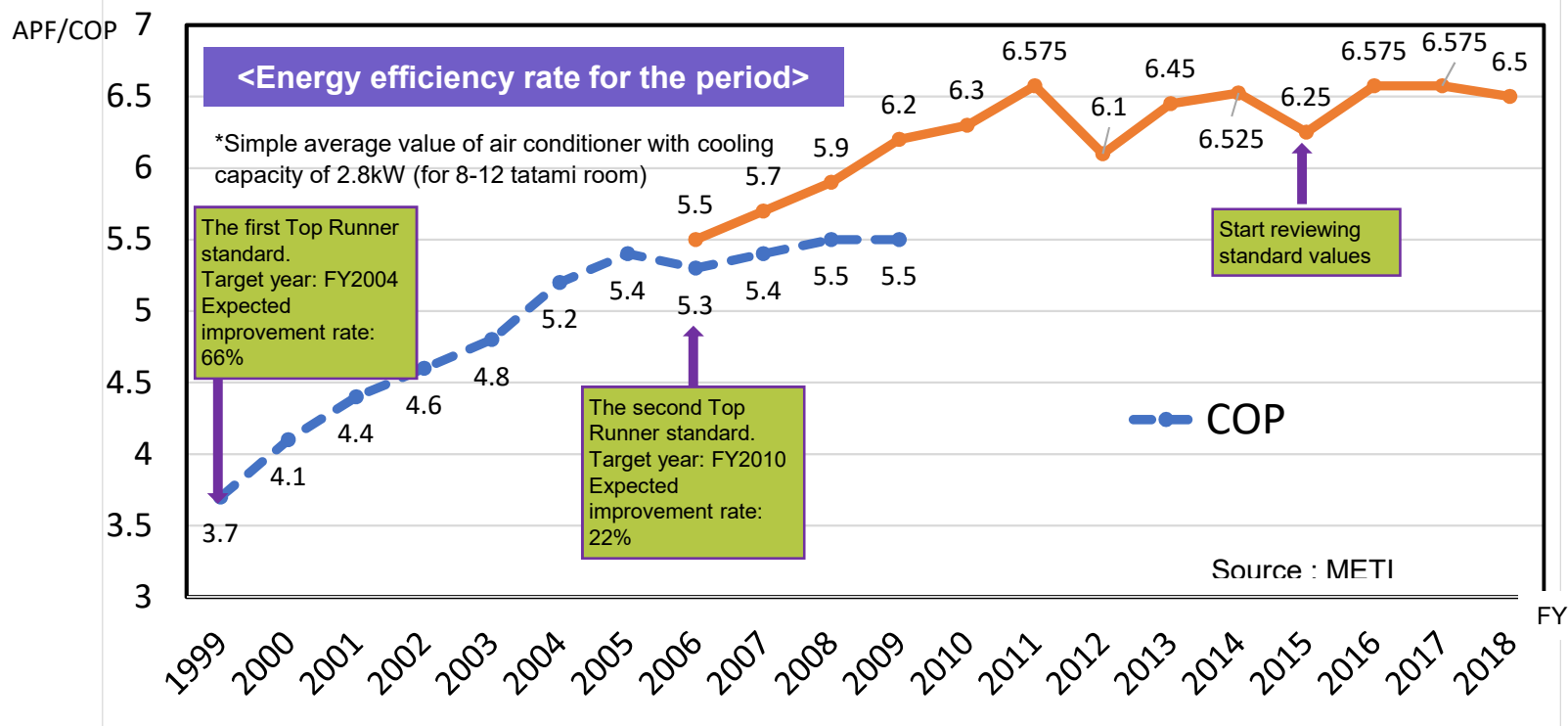
COP3

BEC

# Progress in RAC's energy efficiency

## -In terms of energy efficiency performance index-

- The energy efficiency of RAC (room air conditioners) has improved rapidly up to 2011 thanks to improvement of compressor motor and pressure loss and better design of the shape of the heat exchanger etc.
- Since 2011 efficiency improvement has slowed, while steady improvements were made to the various parts of the air conditioner.
- Recently we are aiming to promote further energy savings by optimizing equipment control using weather forecasts via HEMS, using human sensors, etc.



### ➤ COP: Coefficient of Performance

the rated cooling capacity (kW) divided by the rated power consumption (kW) in the case of operating the air conditioner under a certain temperature condition

### ➤ APF: Annual Performance Factor

A value obtained by dividing the cooling capacity (kWh) required for one year when using an air conditioner throughout the year under a certain modeled condition by the amount of power consumed (kWh) in that year.



# 2016~ Current issues to be tackled

## Existing Problems

### Issues and future development of the machinery and equipment Top Runner Program (1)

#### 1. Issues concerning methods for measuring energy conservation performance

Existing measuring methods are not capable of properly evaluating new techniques, using IoT, etc., that seek for energy conservation suitable for actual service environment. Existing targets and labeling system established based on such methods may not be able to sufficiently improve EE&C of the machinery and equipment. [See Fig. 1]

→ Measurement methods should be examined to identify the ones that are capable of properly evaluating new energy conservation techniques closer to actual service environment.

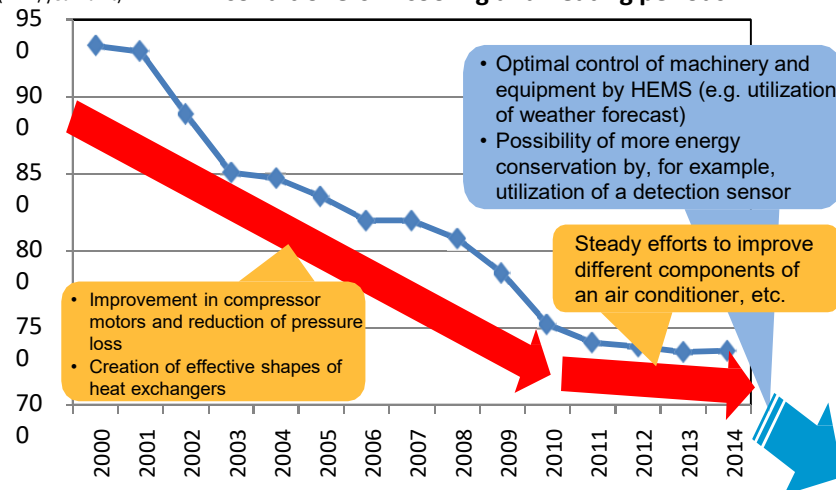
#### 2. Issues concerning incentives for promoting energy conservation in an earlier stage

Due to inadequacy of incentives to encourage manufacturers to achieve the target standard values ahead of schedule and/or exceed the target values, technological development may not be accelerated (or the acceleration may be prevented). [See Fig. 2]

→ Incentives for periodical reporting prior to the target standard fiscal year and/or early achievement of the target (e.g. announcement of companies that have achieved the targets ahead of schedule) should be considered.

Power consumption in cooling and heating periods (kWh/year·unit)

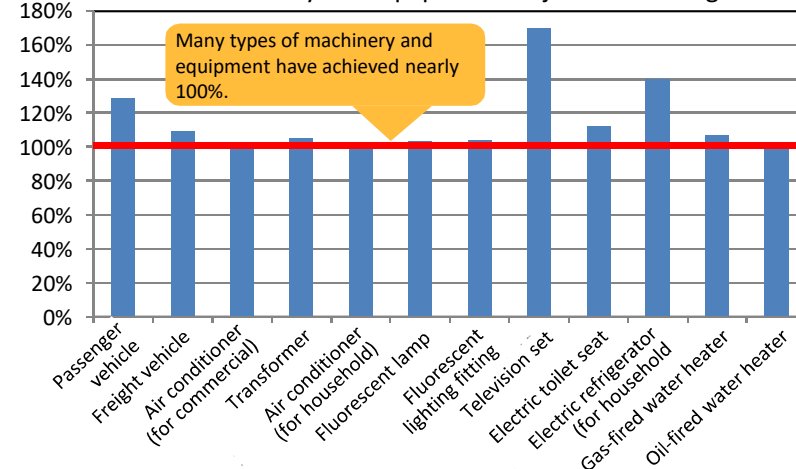
**Fig. 1 Changes in power consumption by household air conditioners in cooling and heating periods**



Source: Agency for Natural Resources and Energy

Percentage of achieved standard value (%)

**Fig. 2 Achievement of target standard values by major types of machinery and equipment subject to the Program**



Source: Agency for Natural Resources and Energy

# 2016~ Current issues to be tackled (2)

## Existing Problems (2)

### Issues and future development of the machinery and equipment Top Runner Program (2)

#### 3. Issues concerning labeling system

The existing labeling system may not be able to respond to the changes in the modes of distribution, including widely-used e-commerce, and may not appeal to consumers in terms of energy conservation performance. [See Fig. 3]

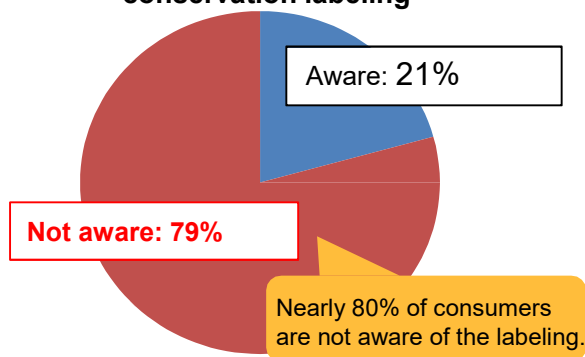
→ A more flexible labeling system appropriate for different modes of distribution should be considered. In addition, how a labeling system can have a higher appealing power to consumers (e.g. indication in yen amount, labeling method for different types of equipment designed for the similar purpose of use, etc.) should be discussed.

#### 4. Issues concerning machinery and equipment subject to the Program

In some industries involving rapid innovation in technologies, such as IT sector, a wide variety of new equipment frequently appear on the market, which may cause difficulties in, for example, establishing definitions and setting target standard values for equipment. Some issues may arise in making the future regulation be more effective and fairer among different technologies. [See Fig. 4]

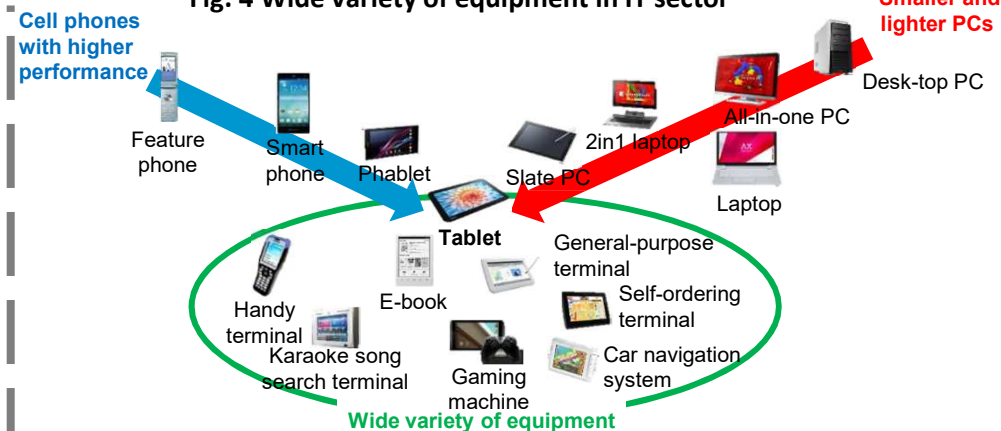
→ Taking account of not only energy consumptions and their growth but also trends in technological development, the effectiveness of the regulations applicable to different types of machinery and equipment should be reviewed, including looking at utilization of other regulatory approaches.

Fig. 3 Awareness of uniform energy conservation labeling



Source: Agency for Natural Resources and Energy

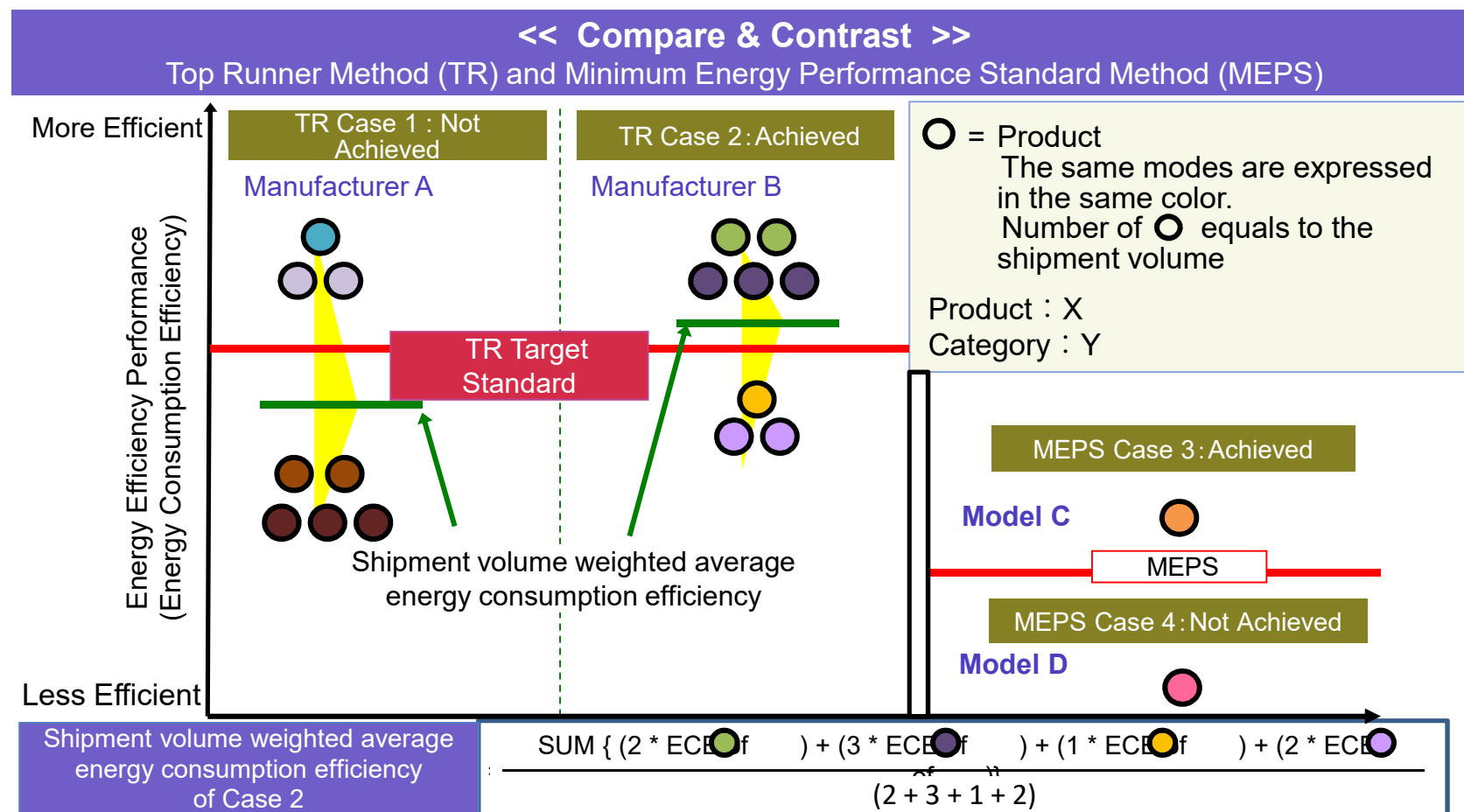
Fig. 4 Wide variety of equipment in IT sector



Source: Agency for Natural Resources and Energy

# Basic concept and methodology of Top Runner Program-(2) methodology

- With using the shipment volume weighted average energy consumption efficiency to judge the standard achievement status, Top Runner Program can encourage energy efficient products to increase the number of shipment volume while keeping the diversity of product models in the market.



# Comparison between Top Runner Program and MEPS

- Thanks to using the shipment volume weighted average of energy consumption efficiency to judge the standard achievement status, Top Runner Program can encourage the producer to increase the number of energy efficient products shipment volume while keeping the diversity of product models in the market.

## Top Runner Program

## MEPS Program

Feature	<input type="checkbox"/> Fostering an energy efficient market	<input type="checkbox"/> Protecting the market from inefficient products
Evaluation method	<input type="checkbox"/> Judging the achievement status <b>category by category</b> for each business operator using weighted average of energy consumption efficiency value.	<input type="checkbox"/> Judging the achievement status model by model using energy efficiency value of each model.
Effect / Mechanism	<input type="checkbox"/> Encouraging energy efficient models to increase the shipment in the market. <input type="checkbox"/> Accommodating the various market needs, which value features other than energy efficiency(e.g. Low price model etc.).	<input type="checkbox"/> Inefficient models are ruled out of the market whose energy efficiency values do not meet the MEPS. <input type="checkbox"/> Models sold in the market are all meeting the standard.
Concerns / Difficulties	<input type="checkbox"/> Difficult to develop / revise the standard <b>because</b> assessing the future technological development is difficult. <input type="checkbox"/> Since achievement status is judged only after the target fiscal year, <b>it may interfere active development of further energy efficient technologies in the period before the target date.</b>	<input type="checkbox"/> Difficult to revise the standard because of the necessity of, e.g. - protecting domestic manufacturers in stage of growth - keeping the availability of lower-price models in the market <input type="checkbox"/> Tendency to increase the models just slightly better than the standard.

## Lecture 3

# Labeling System in Japan, including measures for keeping reliability of the system

**Kotaro Ohkuni**

Energy Conservation Support Service Division  
The Energy Conservation Center, Japan

# Contents

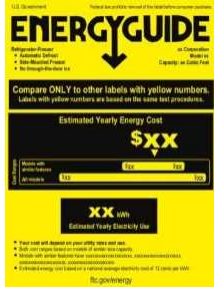



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## **1** Labeling Schemes

## **2** Acts and Laws on Labeling and Information Display

## **3** Summary

# Overview of consumer labeling programs in major countries

Country	United States	EU	Japan	United States
Program Name	ENERGYGUIDE Label	EU Energy Label	Retailers' Labeling Program	ENERGY STAR
Participation Category	Mandatory	Mandatory	Voluntary	Voluntary
Label type	Comparative	Comparative	Comparative	Endorsement
Implementing Agency	FTC(Federal Trade Commission) is responsible for the operation of labeling for household equipment. The US Department of Energy has developed test methods and minimum energy efficiency standards. Also responsible for the performance display for business equipment.	The European Commission	Ministry of Economy, Trade and Industry (METI)	United States Environmental Protection Agency and the US Department of Energy is responsible for developing test methods.
Law or orders	United States Code Title 42 – The Public Health and Welfare Chapter 77 – Energy Conservation Subchapter III – Improving Energy Efficiency Part A – Energy Conservation Program for Consumer Products Other Than Automobiles Section 6294: Labeling	Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products	The Act on the Rational use of Energy (Energy Conservation Law)	United States Code Title 42 – The Public Health and Welfare Chapter 77 – Energy Conservation Subchapter III – Improving Energy Efficiency Part A – Energy Conservation Program for Consumer Products Other Than Automobiles Section 6294a: Energy Star program
Features	 <ol style="list-style-type: none"> <li>started from 1980</li> <li>Label information(main items) <ul style="list-style-type: none"> <li>-producer's name</li> <li>-model number</li> <li>-specification</li> <li>-estimated annual electricity charges</li> <li>-estimated annual electricity charges for other models of the same item (maximum &amp; minimum)</li> <li>-estimated annual electricity consumption</li> </ul> </li> </ol>	 <ol style="list-style-type: none"> <li>Started from 1994</li> <li>Label information(main items) <ul style="list-style-type: none"> <li>-producer's name</li> <li>-model number</li> <li>-specification</li> <li>-energy efficiency grade(~10)</li> <li>-estimated annual electricity consumption</li> </ul> </li> </ol>	 <ol style="list-style-type: none"> <li>Started from 2006</li> <li>Label information(main items) <ul style="list-style-type: none"> <li>-manufacturer's name</li> <li>-model number</li> <li>-relative (multi-level) evaluation</li> <li>-Energy Saving label</li> <li>-estimated annual electricity charges</li> </ul> </li> </ol>	 <ul style="list-style-type: none"> <li>The base color is 100 cyan.</li> <li>Black or white inversion is also possible.</li> </ul>

Reference : Survey report on labeling program for energy consumption, ECCJ, 2017 年2 月  
Energy Standards and Labeling Programs Throughout the World in 2013, IEA, May 2014

# Section 1. Labeling Schemes

There are 3 kinds of labeling programs in Japan from mandatory display by manufacturers to voluntary display by retailers.

## Labeling Schemes on Energy Efficiency Performance of Appliances

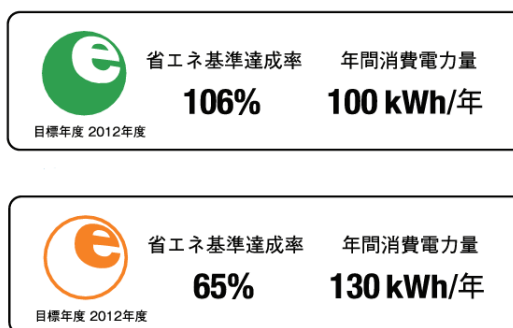
Enforced in 1999

**Mandatory display by  
manufacturers / importers**



Started in 2000

**Energy Saving Labeling  
Program**



Started in 2006

**Retailers' Labeling  
Program**



In order to support consumers to select and purchase energy efficient products, ways of providing information have been improved and revised to convey energy efficiency performance more comprehensively.



# Section 1. Labeling Schemes

Manufacturers (importers) are obligated to display energy consumption efficiency and related information on product bodies, etc. according to the announcement under the Energy Conservation Act

## Mandatory Display by Manufacturers

[ Labeling scheme within in Top Runner Program ]

- ❑ Manufacturers (importers) of specified machineries & equipment / building materials are **obligated to display energy consumption efficiency (thermal loss prevention performance)**. Specific display items are stipulated in announcements.
- ❑ Once it is recognized that the display is not following the announcement, the Minister may exercise his/her authority to admonish or publicize or order the manufacture (importer) to take corrective actions. Violation of order may be charged up to 1 million yen. No exemption based on shipment volume.

## Display Item

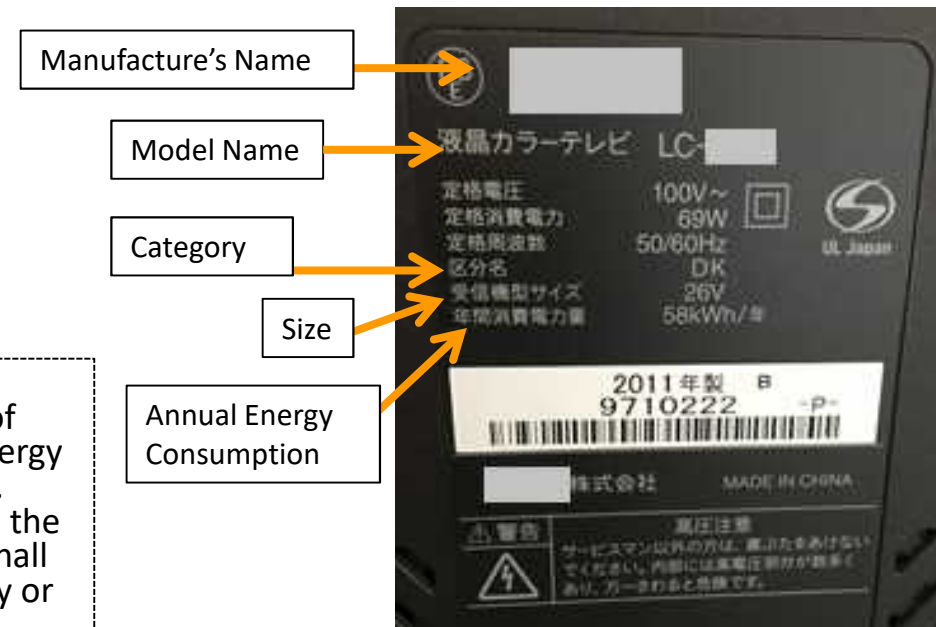
In general, display items are as follows.

- Name of manufacturer / importer
- Product name / model number
- Name of energy efficiency standard category
- Energy consumption efficiency
- Product information related to energy consumption efficiency

### <Example: Television sets>

Display Items: Name of manufacturer/ importer, Name of category, Annual energy consumption (energy consumption efficiency), Size, Usage note.

Place to display: Any places where consumers easily find the information. As for the usage note, it shall be either displayed on the product body or included in the instruction manual.



<Example: TV sets>

# Section 1. Labeling Schemes

For supporting consumers to identify, select, purchase energy efficient appliances, this labeling program was started with the aim of conveying energy efficiency performance in a comprehensive and uniform manner.

## Energy Saving Labeling Program

- ☐ Using the energy consumption efficiency and other related data which are disclosed by manufacturers (importers) according to the EC Act, this labeling program was started in 2000 to provide such information to consumers in a comprehensive and uniform manner.
- ☐ This is a voluntary program based on JIS standards, which stipulates how to create & use the label.
- ☐ This label is mostly used by manufacturers (importers) in their product catalogues.

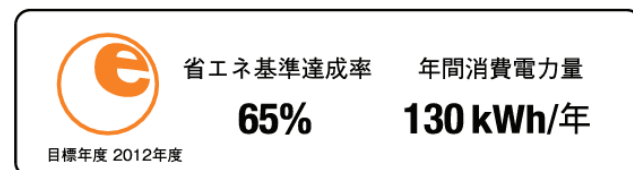
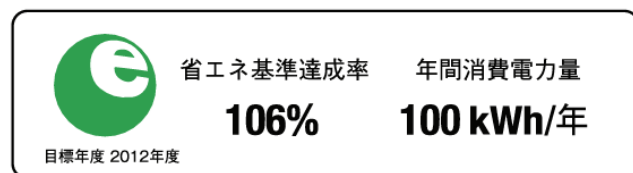
## Contents

**[EE standard achievement rate]** Expressed in % to show how much the product achieves the EE standard (TR target standard value)

**[Energy saving mark]** Green for products with achievement rate of 100 +%. Orange for products with achievement rate of below 100%.

**[Target Fiscal Year]** Target fiscal year of the applied EE standard.

**[Energy Consumption Efficiency]** Annual energy consumption in the case of example below.



## Feature

- ☐ It shows how much the product is better or worse in terms of energy consumption efficiency comparing to the national standard.
- ☐ It visually indicates the information of the level of energy consumption efficiency by means of using the green and orange marks.
- ☐ 3<sup>rd</sup> party certification is not required.

# Section 1. Labeling Schemes

Retailers play an important role in promoting energy efficient appliances since they are direct contact points with consumers. Retailers' Labeling Program was started to encourage their activities of providing useful information for energy efficiency & conservation to consumers.

## Retailers' Labeling Program

- Article, which requires retailers to make best effort to provide information about energy efficiency performance of appliances and others to consumers, was added in the EC Act (enforced in April 2006).
- Based on the Article, Retailers' Labeling Program was started in October 2006 as a program with no penalty.

## Contents

**[Relative Evaluation]** It shows the relative position of the product in the market in terms of energy consumption efficiency. **The more the stars, the better the energy consumption efficiency.**

**[Energy Saving Label]**

**[Manufacturer's name & Model Name]**

**[Estimated annual electricity bill]** Energy consumption efficiency is converted to electricity bill, which is more familiar for general consumers. (For gas / oil appliances, fuel amount is used for the sake of uncertainty nature of fuel charge.)



## Feature

- It is voluntary displayed by retailers.
- 3<sup>rd</sup> party certification is not required.
- It indicates **the relative position of the product in the market in terms of energy consumption efficiency.**

<Example: TV> Relative evaluation standard and distribution of models as of Oct 2013

Star Rating	EE standard achievement rate
★★★★★	246% and above
★★★★	198%~below 246%
★★★	149%~below 198%
★★	100%~below 149%
★	Below 100%



# Section 1. Labeling Schemes

## Closer Look of the Star Rating Label

- ❑ Retailers are required to make efforts to provide information of EE displayed with a star rating label in their shops.

<Example of a label for air conditioners>



Fiscal year to which the contents of this label belong.

Star rating in five stage

Energy saving label: if EE standard achievement ratio is 100+% then the color is Green, otherwise Orange.

EE standard achievement ratio

EE value

Manufacturer's name & Model number

Expected annual electricity bill  
(estimated kWh/y \* ¥27)

EE standard value (cooling capacity: under 3.2kW): APF 5.8

→ EE standard achievement ratio:  $7.1/5.8 \times 100 = 122\%$

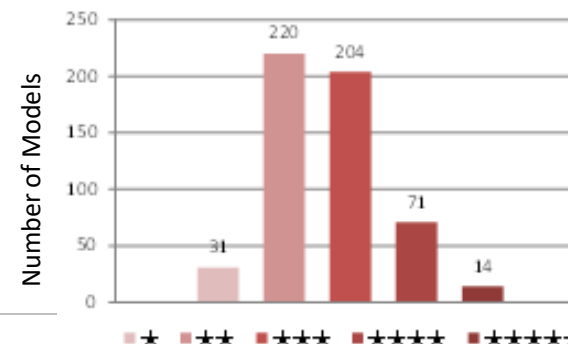
# Section 1. Labeling Schemes

As years go by, the model distribution according to the star rating often changes. Thus, evaluation standards for star rating are periodically reviewed and revised to maintain the 5-star always indicates the best performers in the market.

## < TV: Star Rating & Model Distribution as of Oct. 2010 >

Evaluation standard was newly set (revised) at that time.

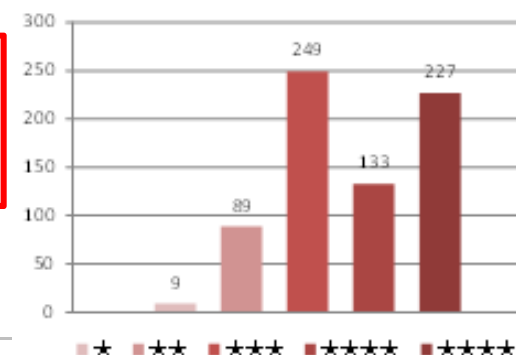
Star Rating	EE Standard Achievement Rate	# of models	Ratio
★★★★★	155% & above	14	2.6%
★★★★	128% ~ below 155%	71	13.1%
★★★	100% ~ below 128%	204	37.8%
★★	70% ~ below 100%	220	40.7%
★	below 70%	31	5.7%
Models with achievement rate of 100% & above			53.5%



## < TV: Star Rating & Model Distribution as of Oct. 2013 >

Star Rating	EE Standard Achievement Rate	# of models	Ratio
★★★★★	155% & above	227	32.1%
★★★★	128% ~ below 155%	133	18.8%
★★★	100% ~ below 128%	249	35.2%
★★	70% ~ below 100%	89	12.6%
★	below 70%	9	1.3%
Models with achievement rate of 100% & above			86.1%

Increased by 30 points & over

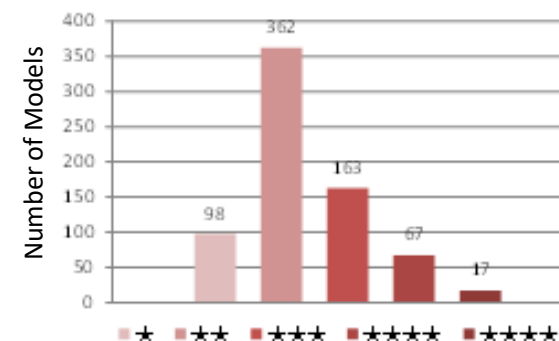


### Revision of Evaluation Standard

## < TV: Star Rating & Model Distribution as of Oct. 2013 >

Evaluation standard was newly set (revised) at that time.

Star Rating	EE Standard Achievement Rate	# of models	Ratio
★★★★★	246% & above	17	2.4%
★★★★	198% ~ below 246%	67	9.5%
★★★	149% ~ below 198%	163	23.1%
★★	100% ~ below 149%	362	51.2%
★	below 100%	98	13.9%
Models with achievement rate of 100% & above			86.1%







# Section 1. Labeling Schemes

## Reference : Similar Actions in EU - Maintenance of Rating Scale & Establishment of Open Product Database -

EU is now reviewing the proposal of amendment to the labeling regulation:

- 1) to revise the energy labeling scale, and
- 2) to establish an online database for product information.



### Proposal 1) to revise the energy labeling scale

- ☐ Currently there are various scales, such as from A to G, from A+++ to D, etc.
- ☐ All scales will be returned to the original single scale of “from A to G”.

[Reason for change] Current scaling makes consumers difficult to distinguish the best performing products. Most of the products are in the top classes today, so that, in some cases, even an A+ class product may be one of the least efficient one in the market.

### Proposal 2) to establish an online database for product information

- ☐ A product registration database where manufacturers & importers will register their products by uploading information obligatory under the EU Law.
- ☐ The database makes
  - the key product information for compliance available for the authorities in the Member States.
  - the label and key product information available to consumers and dealers.

[Reason for establishment] It aims to enhance the proper labeling (greater transparency) and to strengthen the market surveillance by the authority.

Reference: European Commission – Fact Sheet (July 15, 2015)

# Section 1. Labeling Schemes

## Target Products of Top Runner Program & Labeling Programs

	Top Runner Program	Energy Saving Label	Estimated Annual Energy Consumption	Star Rating (Relative Evaluation)
<b>Retailers' Labeling Program</b>	Air Conditioner, TV, Electric Toilet Seat	●	●	●
	Ceiling Light (Fluorescent Light), Refrigerator, Freezer	●	●	● (Home-Use)
	CFL, Electric Rice Cooker, Microwave Oven, DVD Recorder, LED Lamp	●	●	
	Gas Cooking Appliance, Water Heaters (Gas/Oil)	●	● (Fuel Consumption)	
	Computer, Magnetic Disk Unit, Space Heater (Gas/Oil), Router, Switching Device, Water Heater (Heat-pump)	●		
	VTR		●	
	Transformer, AC Motor	●		
	Passenger Vehicle, Freight Vehicle, Vending Machines, Copier, Printer, Multifunction Device, Insulation Material, Sash, Double-glazed Glass, Showcase for cold food			

### Note on Retailers' Labeling program

- ☐ For products with ● in Star Rating, the ★ label are displayed.
- ☐ For products without ● in Star Rating, the simplified label are displayed, otherwise required items are displayed separately.





## Section 2. Acts and Laws on Labeling and Information Display

### 1. Energy Conservation Law (Ministry of Economy, Trade and Industry)

Manufacturers/Importers

Obligation to conform to energy efficiency standards

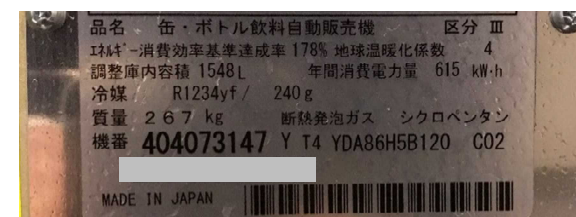
To ensure that the weighted average of EE of products in the category shipped in a year shall achieve the EE standard values by the target fiscal year.

Display obligations

To display EE, model number, manufacturer's name, etc. which are specified for each target product.

Labelling place

Product's body, catalogue, instruction manuals, etc., which are specified for each target product.



Penalty

Recommendation

Public disclosure

Order

Fine

Retailers

Display of star rating label, etc.



Labelling place

A place being easy to find for consumers

Penalty

None (Voluntary)

# Section 2. Acts and Laws on Labeling and Information Display

## 2. Household Goods Quality Labeling Law

- Electric Machinery and Appliance Quality Labeling Regulations - (Consumer Affairs Agency)

Display items and rules (example of room air conditioners)

\*Language of indication must be Japanese.

Items	Rules
Cooling capacity	kW (acceptable error range: -3%)
Category	Category name (A-M) classified by types, cooling capacity and dimension of indoor unit
Cooling power consumption	kW or W (acceptable error: +3%)
Heating capacity	kW (acceptable error range: -3%)
Heating power consumption	kW or W (acceptable error: +3%)
APF	To indicate to one place of decimals

Labelling place

A place being easy to find for consumers



Penalty

Indication



Public disclosure



Order



Prohibition of sales

## Section 2. Acts and Laws on Labeling and Information Display

### 3. Law against Unjustifiable Premium and Misleading Representations (Consumer Affairs Agency)

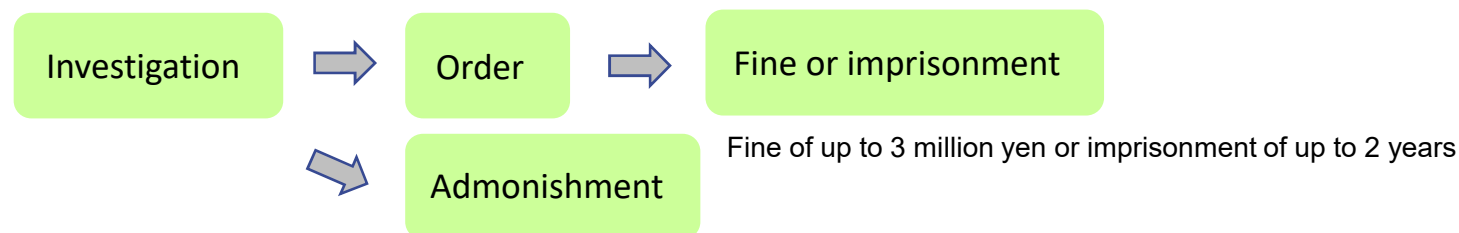
#### Target

Display on products, packages, flyers, pamphlets, manuals, posters, newspapers, magazines, TV commercials, websites, etc.

#### Summary

1. Bans on inaccurate display (actions that make items appear “better” than they really are)
  2. Bans on inaccurate display of advantages (actions creating the impression that items are better “bargains” than they really are)
- etc.

#### Responses for illegal actions



#### Reporting contact offices

Consumer Affairs Agency and Fair Trade Commission have reporting contact offices for gathering information on inaccurate labels from the public.

[Past cases penalized]

1. A case that the display of the material of refrigerators was different from the fact material  
(For a manufacture of refrigerators, April 2009)
2. A case that “brightness equivalent to ○○W of an incandescent light bulb” was displayed on the package of the LED bulb and the actual brightness was darker than it.  
(For 12 retailers and importers of LED bulbs, June 2012)

## Section 2. Acts and Laws on Labeling and Information Display

### 4. Fair Commission Codes on Indication in Home Electrical Appliances (Home Electric Appliances Fair Trade Conference)

Members of the Home Electric Appliances Fair Trade Conference are obligated to follow the codes.  
Currently 37 manufacturers, 8 manufacturers' associations, 8 retailers, 46 retailers' associations have joined the membership.

#### Target

Display on products, packages, flyers, pamphlets, manuals, posters, newspapers, magazines, TV commercials, websites, etc.

#### Summary

1. Bans on inaccurate display (actions that make items appear “better” than they really are)
2. Bans on exaggeration display

#### Rules on display of electricity consumption and cost

1. To show the conditions such as using hours, surrounding environments, etc. when electricity consumption is displayed.
2. To show the electricity cost per 1 kWh when electricity cost is displayed.

#### Responses for violations

Investigation





Admonishment



Penalty charges or exclusion from the conference

## Section 3. Summary

### Points of the today's presentation

- Under Energy Conservation Law, there are three way to display energy efficiency of products.
  1. **Mandatory information display by manufacturers and importers**
  2. **Voluntary labeling by manufacturers and importers**
  3. **Voluntary labeling by retailers**
- As for the star rating labels, **evaluation standards for star rating are reviewed and revised periodically** so that 5-star labels always indicate the most energy efficient models in the market.
- **Energy Conservation Law and Household Goods Quality Labeling Law specify display items and display location** for each target product of Top Runner Program. Penal provision is provided.
- Although voluntary labels (  &  ) are not certified by 3<sup>rd</sup> parties, **the contents of the labels are subject to Law against Unjustifiable Premium and Misleading Representations**. Penal provision is provided.
- **Members (manufacturers and retailers) of Home Electric Appliances Fair Trade Conference are obligated to follow Codes on Indication** in Home Electrical Appliances. Penal provision is provided.

## Lecture 4

### Technical aspects of the Program by looking at a Best Practice - Refrigerator case

**Yukihiro Okamoto**

International Collaboration Center,  
The Energy Conservation Center, Japan

# Content

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- 1-2. Electric Refrigerators and Freezers subject to Top Runner Program
- 1-3. Changes in Energy Consumption Efficiency of Electric Refrigerators

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- 2-2. Approaches to Target Standard Value Setting
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- 4-4. Energy Conservation Technologies for Refrigerators and Freezers - Vacuum Insulation Material

1

## Scope and Previous Standard



# 1-1. Energy Consumption Status at Household

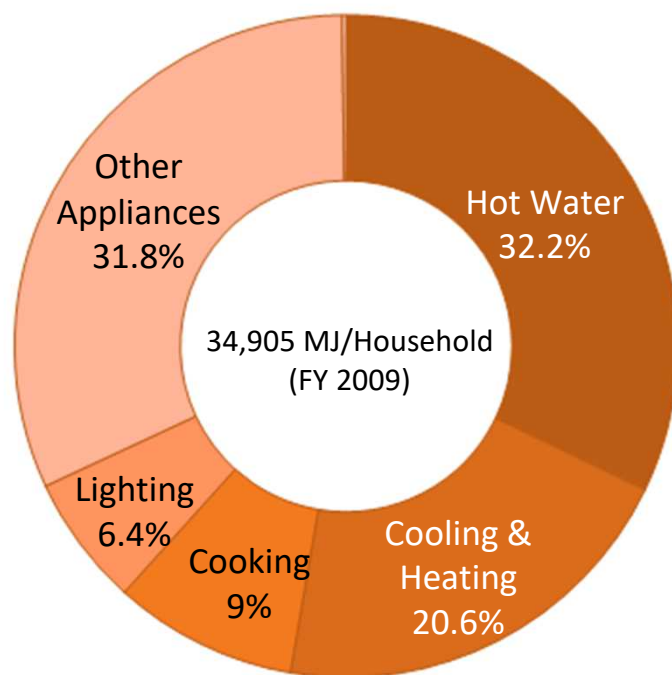
## [Energy Consumption Ratio by Type of Appliance at Household]

(Reference: METI Energy Efficiency & Conservation Information Website)

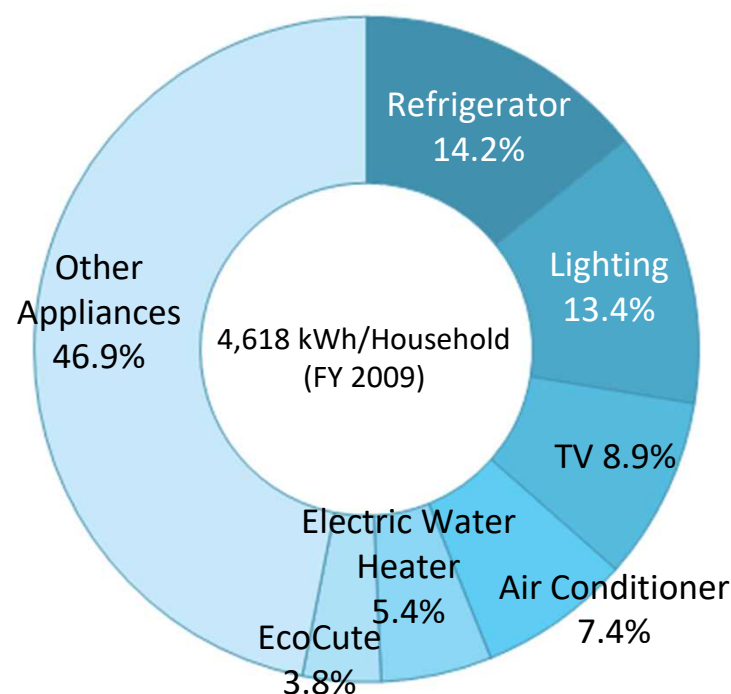
- Energy (including electricity, gas, oil) consumed by “hot water supply” and “space cooling and heating” occupies the largest portion.

## [Electricity Consumption Ratio by Appliances at Household]

- Major appliances such as “refrigerator”, “lighting”, “TV” and “air conditioner” occupy about 40%. Taking into account “water heaters (electric water heaters and EcoCute)”, the portion is increased to about 50%.



Energy Consumption Ratio by  
Type of Appliance at Household



Electricity Consumption Ratio by  
Type of Appliance at Household

## 1-2. Electric Refrigerators and Freezers subject to Top Runner Program

### Electric Refrigerators

Refrigerator-freezer



Refrigerator



### Electric Freezers

Freezer



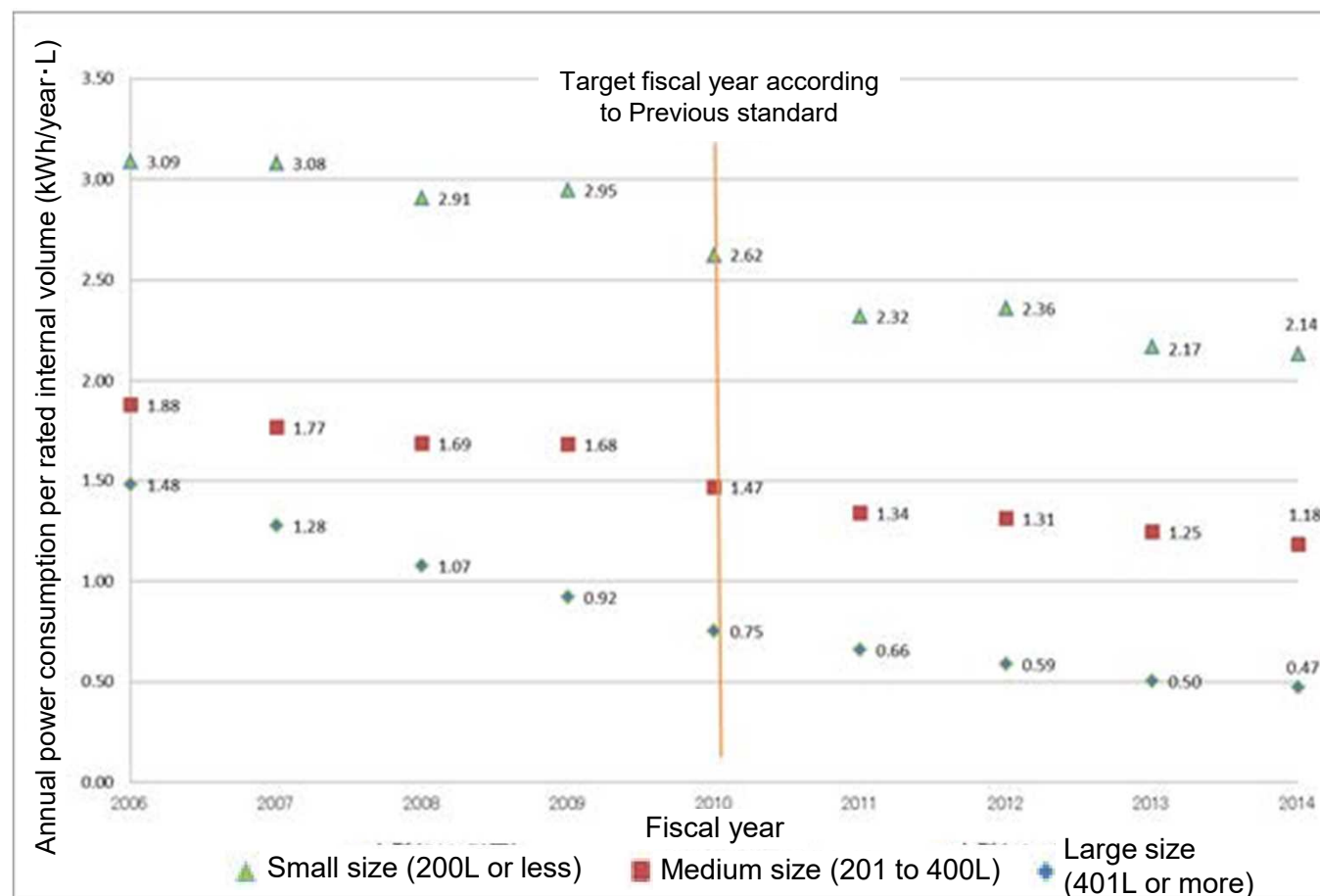
Chest freezer



The following refrigerators and freezers are exempted.

- (1) Those used for special purposes
- (2) Those without established measurement and/or evaluation methods
- (3) Those having an extremely low ratio of usage in the market
  - Peltier cooling refrigerators/freezers: Extremely low volume of shipment, and used for specific purposes including usage in hotels
  - Absorption cooling refrigerators/freezers: This type of refrigerators are used for specific purposes including usage in hospitals and hotels, and freezers are large sized and designed to be used in facilities. No electric refrigerators of this type are delivered for household use.
  - Electric wine cooler: Extremely low volume of shipment as electric refrigerators for household use

# 1-3. Changes in Energy Consumption Efficiency of Electric Refrigerators



\* Source: Energy-Saving Performance Catalog, summer editions in 2006 to 2014

**Changes in annual power consumption of electric refrigerators per liter of rated internal volume**

## 2

## Basic Ideas Concerning Revision of Target Standard Values

## 2-1. Approaches to Category Setting and Target Standard Value Setting (General Rules)

1. Categories for Specified Equipment shall be set on the basis of certain indicators. The indicators (basic indicators) shall be physical quantities, functions, etc. having a close relation to energy consumption efficiency and be determined taking account of, for example, what consumers use as a reference when they choose a product to purchase (i.e. elements representing consumer needs).
2. Target standard values shall be determined on the basis of a single numerical value or relational expression for each category of the proper basic indicators with which manufacturers can pursue the same energy consumption efficiency.
3. For category setting, supplemental functions shall be, as a rule, ignored. However, a different category may be used in the case where the energy consumption efficiency of a product without a certain supplemental function is set as a target standard, if it is highly probable that any products with the supplemental function will be withdrawn from the market because they would not be able to achieve the target standard value even though they are considered to be more needed in the market.
4. A separate category may be assigned to any types of equipment that are expensive and have high energy consumption efficiency because they incorporate advanced energy conservation Technologies. However, in order for manufacturers, etc. to make active sales of products with excellent energy consumption efficiency, it is desirable to treat them under the same category.
5. When setting a target standard value for a category, special-purpose products shall be excluded. However, in the examination of an efficiency improvement due to, for example, technological development, feasibility of the technology incorporated in the excluded products shall be taken into account.
6. A target fiscal year for each type of equipment shall be set to about three to ten years, taking account of the product development period for specified equipment, expected technical advancement in the future, etc.

## 2-2. Approaches to Target Standard Value Setting

The target standard values have been set on the basis of the approaches described on the previous page (page 58).

1. A correlation expression shall be obtained by examining distribution conditions and connecting distribution points of the most efficient products.
2. A target standard value shall be set for each category that has been properly set.
3. For any products expected to achieve an improved efficiency as a result of future technological progresses, a target standard value taking account of the improvement shall be set, whenever possible.
4. Target standard values shall be consistent among categories.

## 2-3. Approaches to Target Fiscal Year Setting

The target fiscal year has been revised on the basis of the approaches described on page 58.

- In general, an improvement of energy consumption efficiency is achieved when a new model is introduced.
- New product development (including other model development) aiming for higher energy consumption efficiency involves development of a new refrigeration cycle and related components, and requires a major change in the internal shape of a refrigerator/freezer.
- In order to complete the new product development, an enormous number of man-hours must be taken in designing and significant investment must be made in molds. Therefore, manufacturers take an approach in which they start with the new development for their core product model and, then, apply the developed energy conservation technologies to other models one by one.
- The period between the initial new development and the application of the technologies to other models is typically approximately 2 to 3 years in the case of electric refrigerators and approximately 2 to 4 years in the case of electric freezers. In addition, it is necessary to allow for at least one or two opportunities for remodeling before the target fiscal year.
- Considering the above, the target fiscal year for electric refrigerators is currently set to FY2021, which is seven years after the base year (FY2014).

**3**

## **Specific Method of Standard Setting and Background of Revision of the Standard**



## 3-1. Categories of Previous Standard and Standard Energy Consumption Efficiency

### Electric Refrigerators

Vadj: Adjusted internal volume (see next page)

Category	Cooling system	Rated internal volume	Number of doors in refrigerator section	Formula for calculating standard energy consumption efficiency	Shipments* (Component ratio)
A	Natural convection cooling	—	—	$E=0.844V_{adj}+155$	172,609 units (3.7%)
B		300L or less	—	$E=0.774V_{adj}+220$	1,536,391 units (32.9%)
C		Over 300L	1	$E=0.302V_{adj}+343$	818,258 units (17.6%)
D			2 or more	$E=0.296V_{adj}+374$	2,135,742 units (45.8%)

\* Source: JEMA's domestic shipment statistics (FY2013: 4,663,000 units)

### Electric Freezers

Category	Cooling system	Rated internal volume	Formula for calculating standard energy consumption efficiency	Shipments* (Component ratio)
A	Natural convection cooling	—	$E=0.844V_{adj}+155$	13,024 units (7.4%)
B	Forced-circulation cooling	300L or less	$E=0.774V_{adj}+220$	162,976 units (92.6%)
C		Over 300L	$E=0.302V_{adj}+343$	0 units (0.0%)

\* Source: JEMA's domestic shipment statistics (FY2013: 176,000 units)

## 3-2. <Reference> Adjusted Internal Volume

- An electric refrigerator consists of a refrigerator section, freezer section, and others, and the volume ratio between the refrigerator and freezer sections varies among products. In order to compare the different products under the same condition (by converting all volumes of different sections into the volume of refrigerator section), an internal volume corrected for outdoor temperature and temperature inside the refrigerator is defined as an adjusted internal volume, which is used as a basic indicator in the calculation with a target standard formula.
- The adjusted internal volume is calculated by multiplying a rated internal volume of each storage section by its adjusted internal volume coefficient, as shown below.

$$V_{adj} = \sum_{i=1}^{n_s} (K_{ci} \cdot V_i)$$

$K_{ci}$ : Adjusted internal volume coefficient  
 $V_i$ : Rated internal volume of each type of storage section

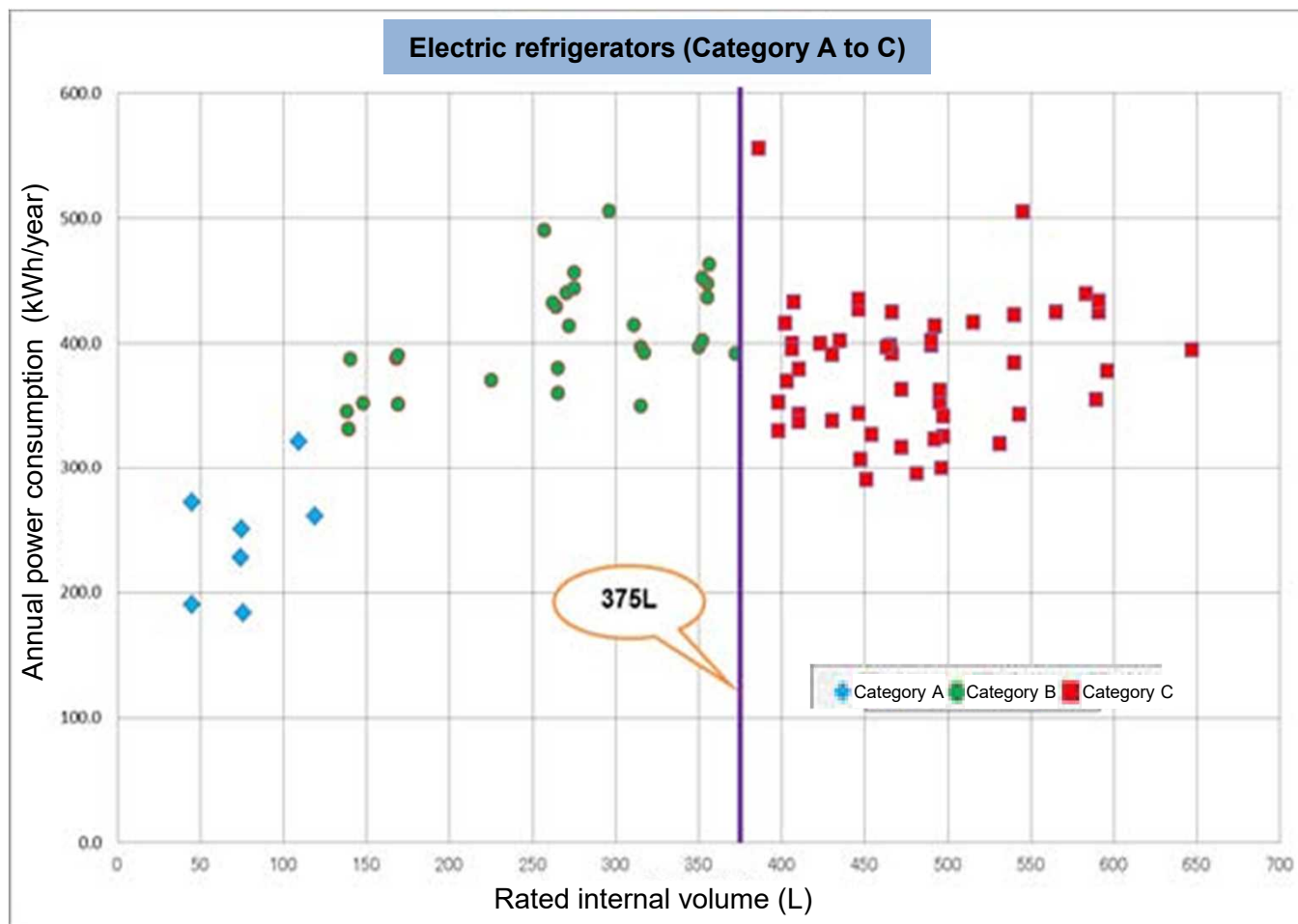
(Example calculation) In the case of rated internal volume 500L (250L in refrigerator section, 100L in Four Star section, 50L in Two Star section, and 100L in cellar section):  $V_{adj} = (1.00 \times 250L) + (2.05 \times 100L) + (1.76 \times 50L) + (0.62 \times 100L) = 250 + 205 + 88 + 62 = 605L$

Adjusted internal volume coefficients for different types of storage sections

Type of storage section	Target temperature of each section (°C)	Formula for calculation adjusted internal volume coefficient (Ambient temperature $T_{ka} = 25^{\circ}\text{C}$ )	Adjusted internal volume coefficient $K_{ci}$
Pantry	17	$(T_{ka} - 17) / (T_{ka} - 4)$	0.38
Cellar	12	$(T_{ka} - 12) / (T_{ka} - 4)$	0.62
Refrigerator	4	1	1.00
Chiller	2	$(T_{ka} - 2) / (T_{ka} - 4)$	1.10
Zero Star	0	$(T_{ka} - 0) / (T_{ka} - 4)$	1.19
One Star	-6	$(T_{ka} - (-6)) / (T_{ka} - 4)$	1.48
Two Star	-12	$(T_{ka} - (-12)) / (T_{ka} - 4)$	1.76
Three or Four Star	-18	$(T_{ka} - (-18)) / (T_{ka} - 4)$	2.05

### 3-3. Problems with Old Standard (1)

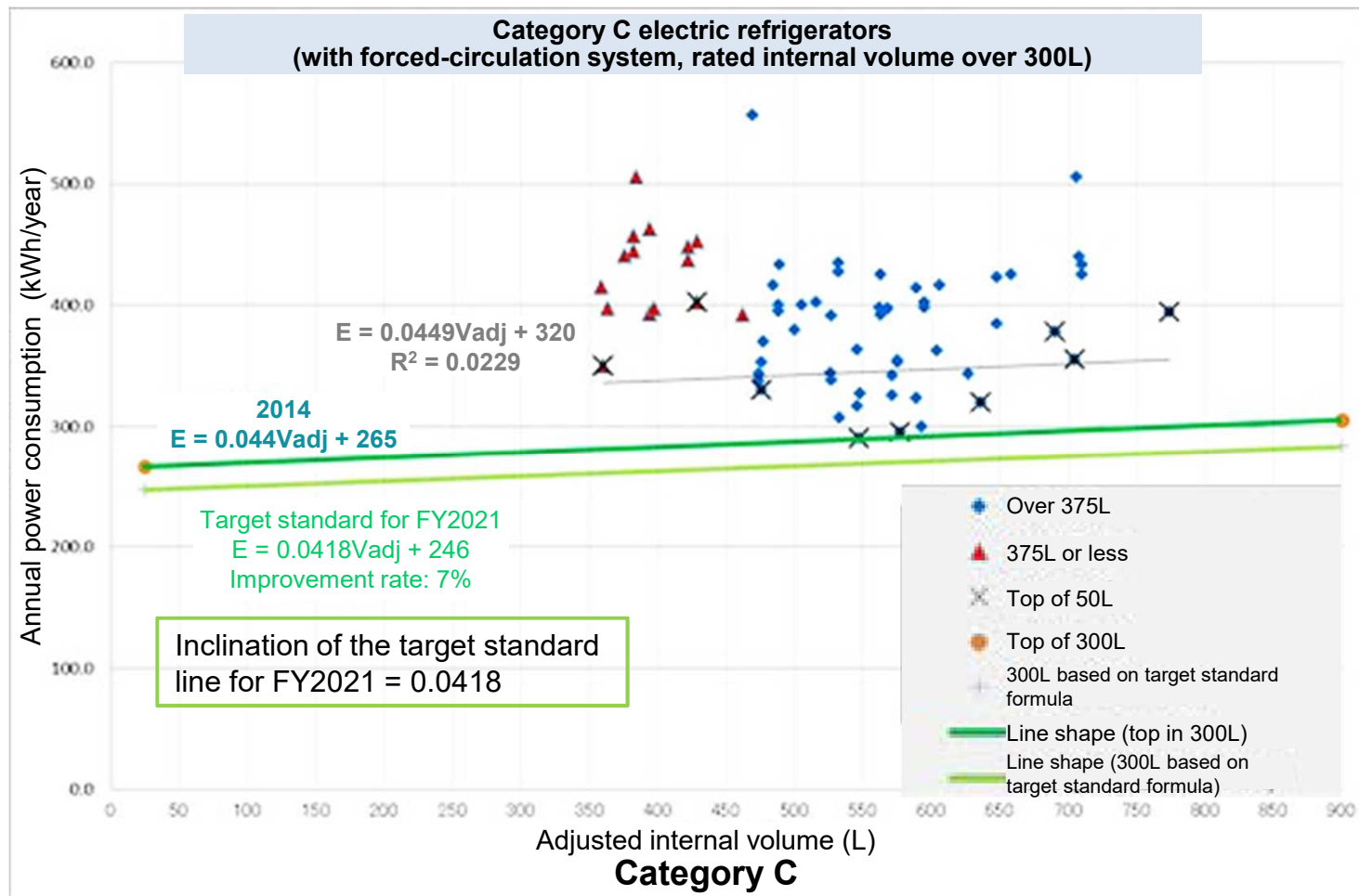
- In the distribution of (2014) annual power consumptions for different rated internal volumes of electric refrigerators in categories A to C, their distribution profiles for the volumes less than and more than 375L are different.



Distribution chart of annual power consumption per rated internal volume

## 3-4. Problems with Old Standard (2)

- When Category C is defined with respect to the volume of 300L in accordance with the Previous standard, inclination of the target standard line is very small. Thus, the line will not properly reflect the general characteristic of electric refrigerators in which they have larger annual power consumptions as their adjusted internal volumes increase.

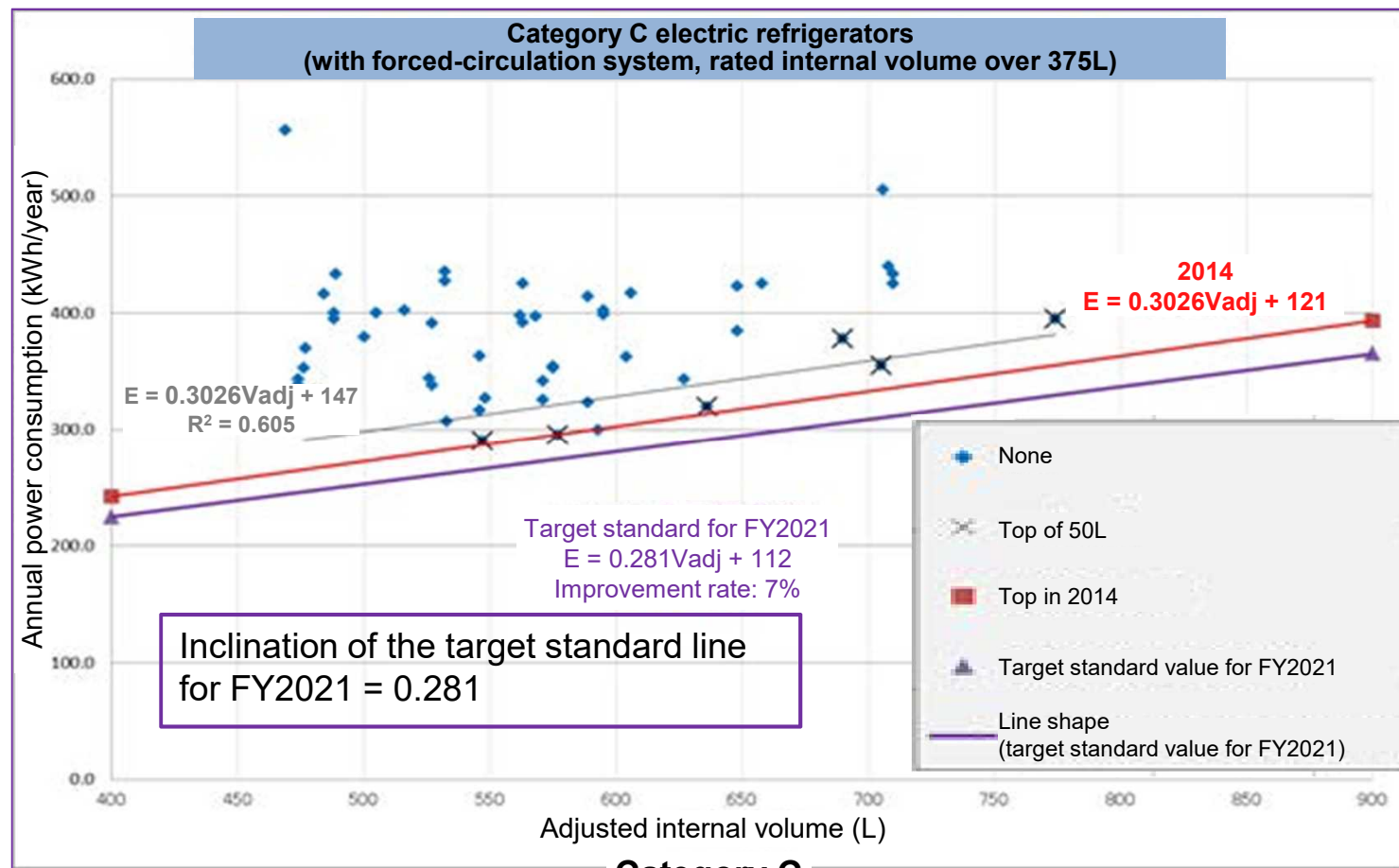


### 3-5. Approaches to Category Setting in Consideration of the Problems

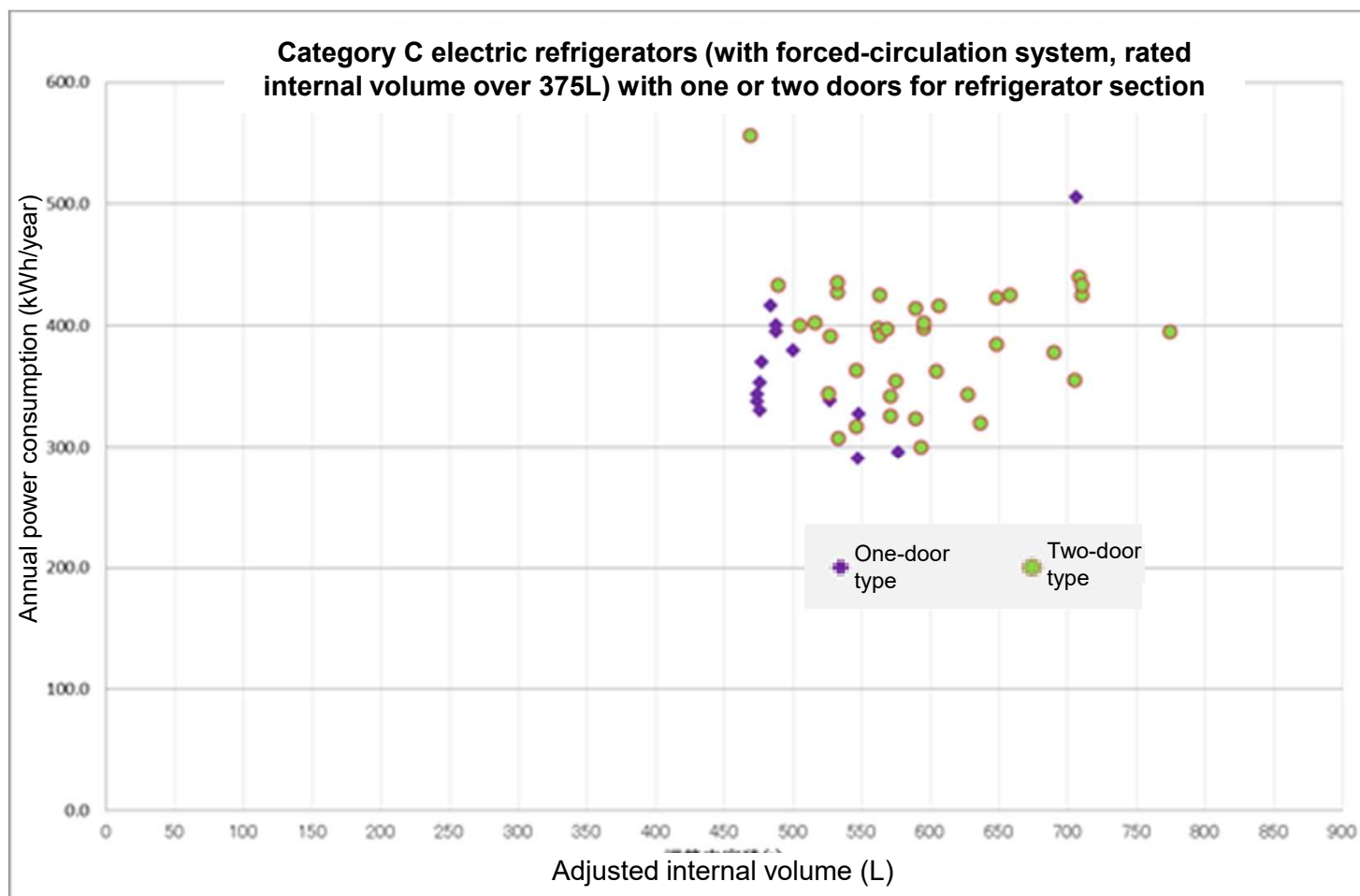
- (1) Electric refrigerators shall be classified into “Refrigerators and refrigerator-freezers”.
- (2) Categories of cooling systems shall be determined, taking account of structural differences that may impact annual power consumptions (categories of natural convection cooling and forced-circulation cooling)
- (3) In recent years, inverter technology and vacuum insulation materials have been widely incorporated into products in order to achieve better energy conservation performance. Thus, categories based on rated internal volumes taking account of such energy conservation technologies shall be set.
- (4) “Category based on the number of doors in a refrigerator section” included in the existing categories shall be consolidated to others, in consideration of the recent trend in product shipment volumes.

## 3-6. Proposed New Categories - Categorization based on Internal Volume

- With the ongoing increase in the size of refrigerators in recent years, a vacuum insulation material having a larger energy conservation effect is increasingly applied to refrigerators with a rated internal volume of approximately 375L or more.
- When refrigerators are classified into categories for the rated internal volumes of 375L or more and over 375L on the basis of whether a vacuum insulation material is used, the target standard line shows a similar inclination as those of other categories, which appropriately reflect the characteristic in which electric refrigerators have larger annual power consumptions as their adjusted internal volumes increase.



### 3-7. Proposed New Categories - Categorization based on Number of Doors in Refrigerator Section



## 3-8. Categories of New Standard and Standard Energy Consumption Efficiency

### Electric refrigerators

Category	Cooling system	Rated internal volume	Formula for calculating standard energy consumption efficiency	Shipments* (Component ratio)
A	Natural convection cooling	—	$E=0.735V_{adj}+122$	172,609 units (3.7%)
B	Forced-circulation cooling	375L or less	$E=0.199V_{adj}+265$	1,995,764 units (42.8%)
C		Over 375L	$E=0.281V_{adj}+112$	2,494,627 units (53.5%)

\* Source: JEMA's domestic shipment statistics (FY2013: 4,663,000 units)

### Electric freezers

Category	Cooling system	Formula for calculating standard energy consumption efficiency	Shipments* (Component ratio)
A	Natural convection cooling	$E=0.589V_{adj}+742$	13,024 units (7.4%)
B	Forced-circulation cooling	$E=1.328V_{adj}+80$	162,976 units (92.6%)

\* Source: JEMA's domestic shipment statistics (FY2013: 176,000 units)



## 3-9. Power Consumption Reduction Effect to be Resulted from New Standard

The improvement rate of energy consumption efficiency (evaluated based on the annual power consumption) in the target fiscal year is estimated to be approximately 22.0% with electric refrigerators and approximately 12.7% with electric freezers, on the assumption that the current shipment volumes and component ratio of each category remain the same.

<Overview of estimation>

	Estimation	Electric refrigerators	Electric freezers
(1)	Annual power consumption calculated from actual shipment volumes in FY2014	Approx. 363 kWh/year	Approx. 481 kWh/year
(2)	Annual power consumption for products to be shipped in the target fiscal year, estimated from the target standard values	Approx. 283 kWh/year	Approx. 420 kWh/year
(3)	Improvement rate of annual power consumption	$\frac{363 - 283}{363} \times 100 = \text{Approx. } 22.0\%$	$\frac{481 - 420}{481} \times 100 = \text{Approx. } 12.7\%$

# 4

## Major Technologies for Improving Energy Consumption Efficiency

[illegible]

## 4-2. Room for Improvement in Energy Consumption Efficiency of Electric Refrigerators

Category	Factors for improving efficiency, etc.	Future room for improvement (2015)	
		Electric refrigerator	Electric freezer
A	(1) Improvement in efficiency of constant speed compressors Reduction of mechanical loss Further reduction of viscosity of refrigerant oil	1 to 3%	1 to 3%
B	(1) Improvement in efficiency of variable speed compressors Reduction of mechanical loss Further reduction of viscosity of refrigerant oil Reduction of input by further lowering speed (2) Improvement in efficiency of constant speed compressors Reduction of mechanical loss Further reduction of viscosity of refrigerant oil	1 to 4%	1 to 4% (for only (2))
C	(1) Improvement in efficiency of variable speed compressors Reduction of mechanical loss Further reduction of viscosity of refrigerant oil Reduction of input by further lowering speed (2) Expanded coverage by vacuum insulation material	2 to 7%	-

## 4-3. Energy Conservation Technologies for Refrigerators and Freezers - Compressor

### (1) Reduced mechanical loss of compressor

- Reduction of friction between a bearing and crank shaft and between a piston and cylinder  
(Reduction of an area of sliding part (optimization), lowering of viscosity of refrigerant oil, improvement of surface treatment on a sliding part, use of a ball bearing, etc.)

### (2) Reduced input to compressor

- Inverter compressors: Change of operation to a low-speed mode with a reduced number of revolutions
- High-efficiency compressor: Introduction of a structure that allows refrigerant oil to be supplied at a lower speed
- Use of vacuum insulation materials resulting in a lower capacity required to cool inside a refrigerator/freezer  
Reduction of input achieved by reducing the cylinder volume of a compressor

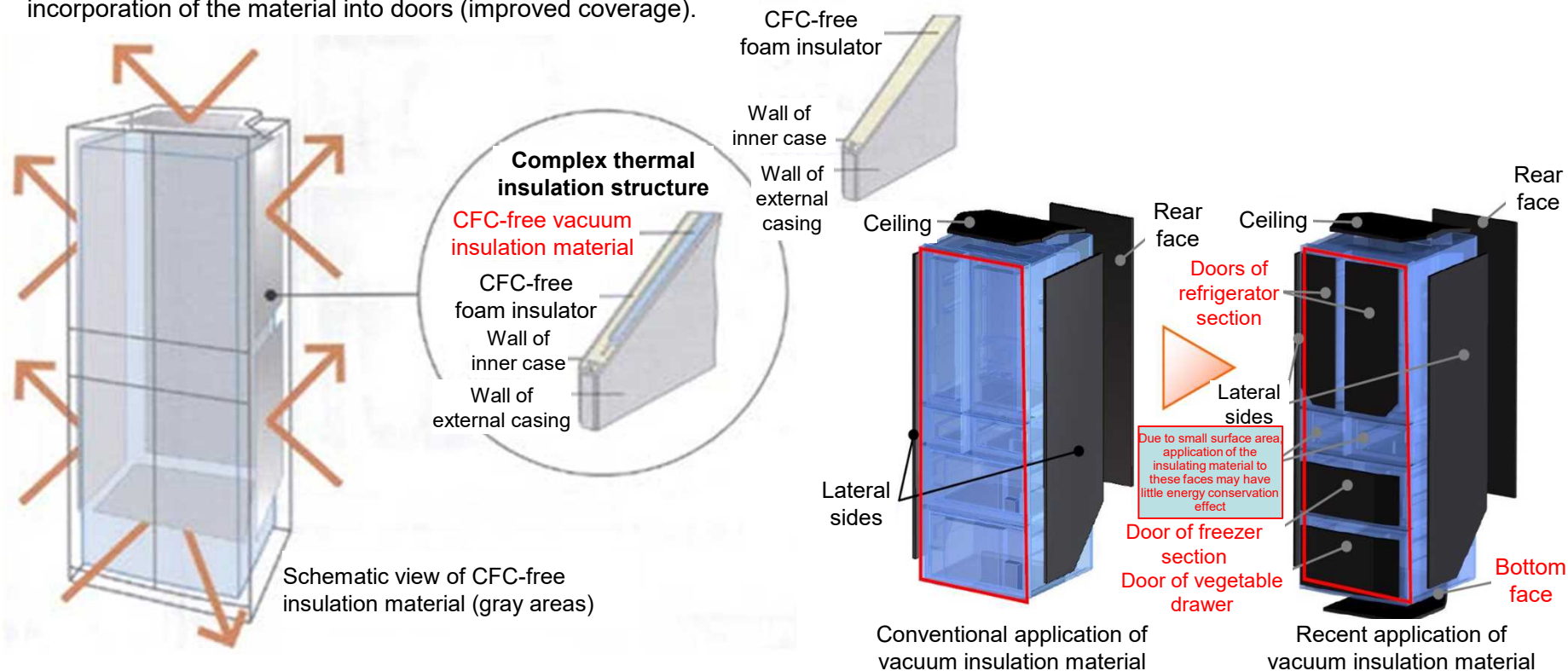
### (3) Compressor motors with increased efficiency

- Magnet shape: As a result of introduction of an interior permanent magnet (IPM) motor, the magnet is embedded to the iron core of a rotor, eliminating a need of a magnet cover and resulting in a higher efficiency.
- Improved coil: By increasing the cross-sectional area of a motor coil using the coil with an increased number of turns in a limited coil space, a larger magnetic attraction which improves a motor efficiency can be achieved.

## 4-4. Energy Conservation Technologies for Refrigerators and Freezers - Vacuum Insulation Material (1)

### Use of vacuum insulation materials and expansion of their application areas

- With a complex thermal insulation system which incorporates a vacuum insulation material having an insulating characteristic approximately 10 times higher than conventional urethane insulation used as an insulating material between an external casing and its inner case, an approximately 25% reduction of external heat transmitted to inside the inner case has been achieved, contributing to significant power saving.
- Usage of a vacuum insulation material has been increased in consequence of additional and appropriate application of the material to the bottom and rear faces of a refrigerator with irregularities, which has been difficult to achieve, as well as incorporation of the material into doors (improved coverage).

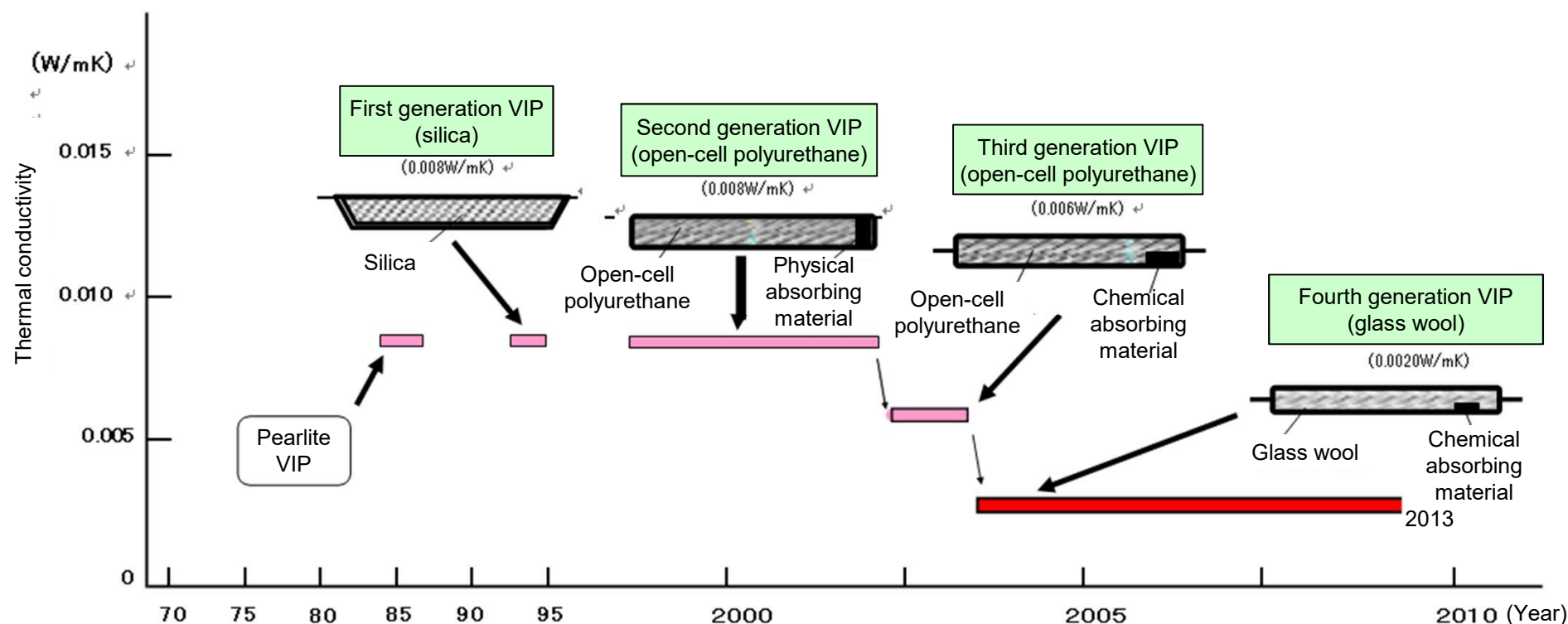


Structural drawing of vacuum insulation material

## 4-4. Energy Conservation Technologies for Refrigerators and Freezers - Vacuum Insulation Material (2)

### Technical transition of vacuum insulation material

- Previously, foam resin in an interconnected foam cell structure (open-cell polyurethane) was used as a core of a vacuum insulation material; however, currently, short fiber glass wool which is more suitable as a radiation prevention material is used as the core so as to achieve higher thermal insulation characteristics.



Technical transition of vacuum insulation material

## Lecture 5

# Incentives for manufacturers and retailers & Promotion measures

**Kunie Ikeda**

Energy Conservation Support Service Division  
The Energy Conservation Center, Japan



# Contents

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**1** Systematic support for the labeling

**2** Incentives for manufacturers and retailers

**3** Measures for raising awareness and total promotion of the labeling system

**4** Summary

## 2-2. Labeling Schemes (Top Runner Program & Labeling Programs)

### Types of label display regarding EE&C performance of equipments

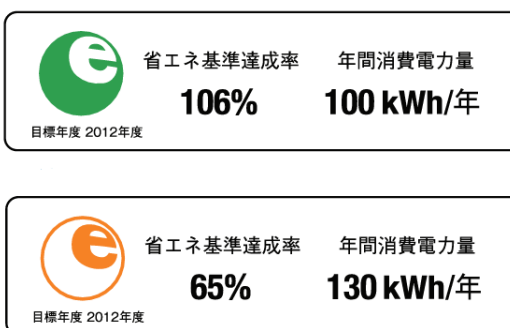
Enforced in 1999

**Mandatory display by  
manufacturers / importers**



Started in 2000

**Energy Saving Labeling  
Program**



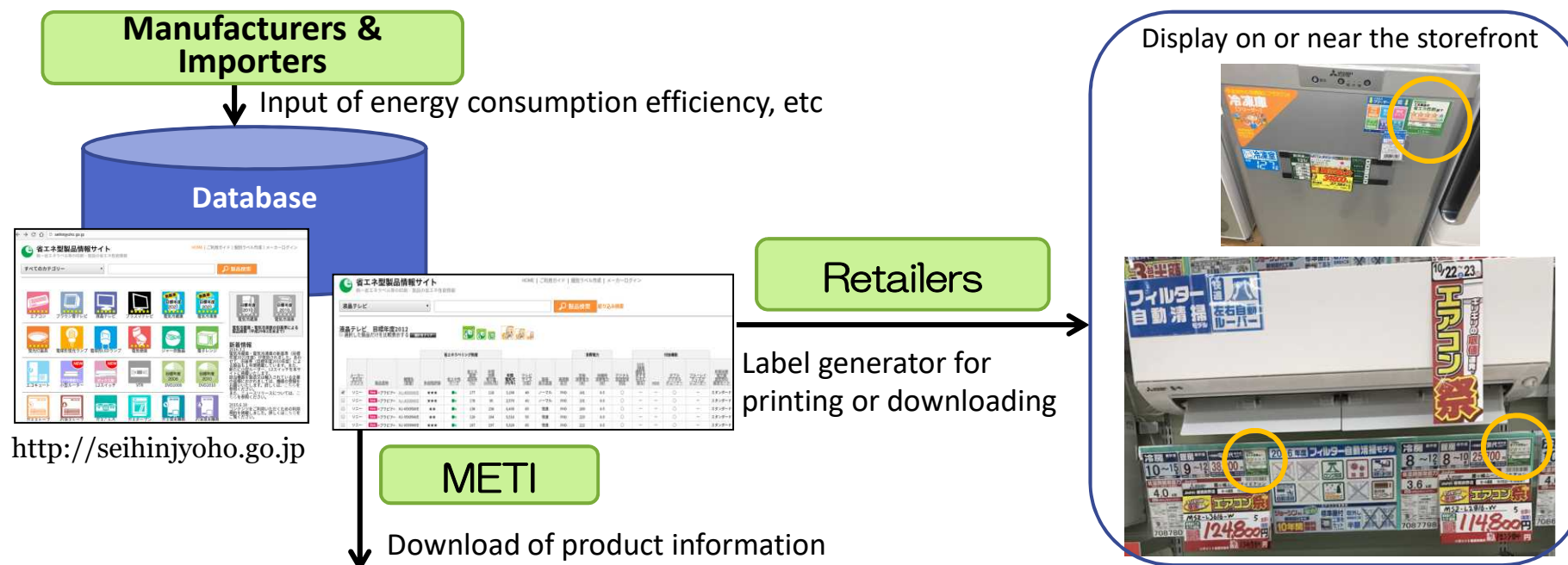
Started in 2006

**Retailers' Labeling  
Program**



Display the EE&C performance of the equipment in an easy-to-understand manner

# Support for label display (Creation of Database on EE&C performance)



## Information by “Energy Efficiency Performance Catalogue



(2019 version)

- Ranking list of models by energy efficiency
- How to choose a product well and use it well
- Annual power consumption of products
- Trends in national energy consumption, etc.
- Explanation of national EE&C policy
- Explanation of standby power consumption

**エアコン 省エネ性能一覧**

一覧表のA.P.F.、消費電力、省エネ率等は、JIS C 9812:2005に基づき算出されています。

※一覧表は部品の数（季節別評価）で区分しています。基本的に同じ部品の数で区分し、各社名50名、省エネ率達成率の高い順、A.P.F.の高い順です。

メーカー	製品名	消費電力 (kW)	A.P.F.	省エネ率 (%)	省エネ率 (%)	省エネ率 (%)	省エネ率 (%)	省エネ率 (%)	省エネ率 (%)
パナソニック	冷暖能力2.2kW (6~9畳) 寸法フリー	1.2	7.3	16,300	410	149	2.5	430	455
三菱電機	冷暖能力2.2kW (6~9畳) 寸法フリー	1.2	7.3	16,300	410	149	2.5	430	455
日立	冷暖能力2.2kW (6~9畳) 寸法フリー	1.2	7.3	16,300	410	149	2.5	430	455

Ranking List (e.g. AC)

**■ 暖房の上手な使い方**

冬の暖房時の室温は20℃を目安に。

年間電費 53.08kWhの省エネ 約 1,430円の節約

原油換算 13.38円 CO<sub>2</sub>削減量 26.54kg

※外気温6℃の時、エアコン(2.2kW)の暖房設定温度を21℃から20℃にした場合(使用時間9時間/日)

**■ 節約チェックポイント**

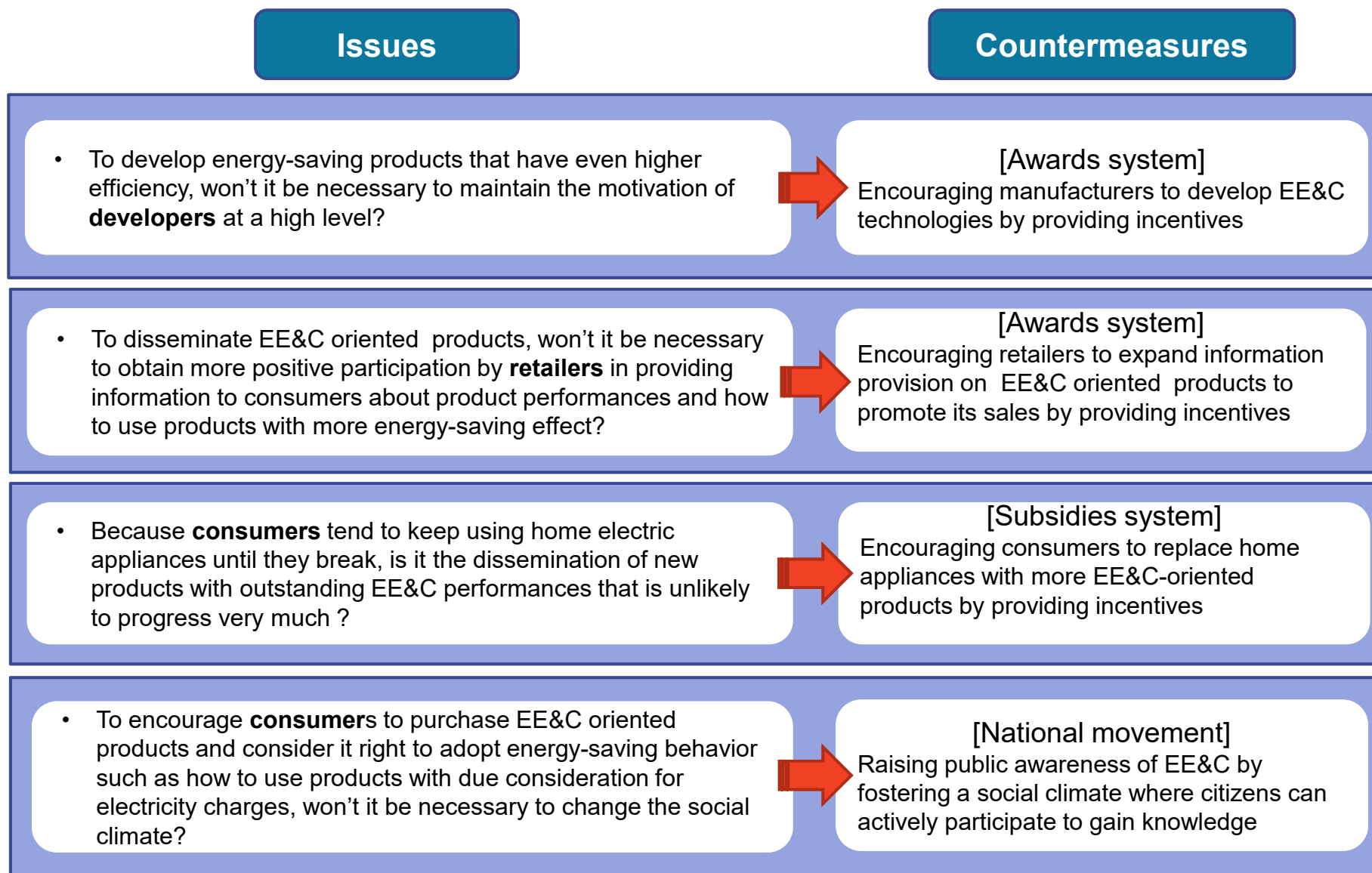
省エネのコツ

カーテンで窓からの熱の出入りを防ぎましょう。

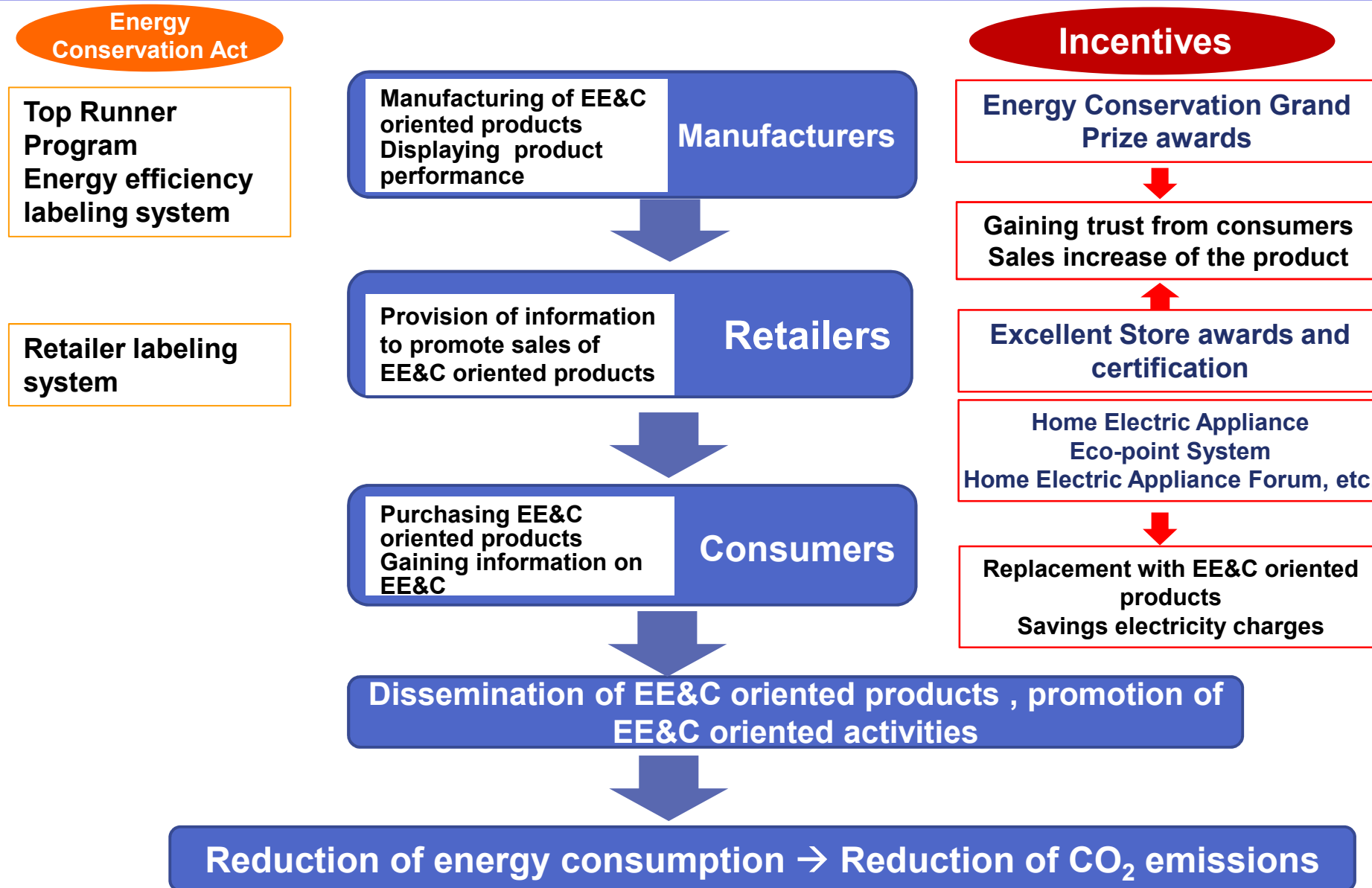
タイマーを上手に使い、必要な時間だけ運転しましょう。

Tips on energy efficient use (e.g. AC)

# Issues and Countermeasures for disseminating energy-saving equipment



# Incentives for dissemination of EE&C oriented equipment



### System details

System that gives award to advanced and highly efficient EE&C oriented products and to outstanding EE&C oriented activities implemented in factories and buildings

### Changes in system

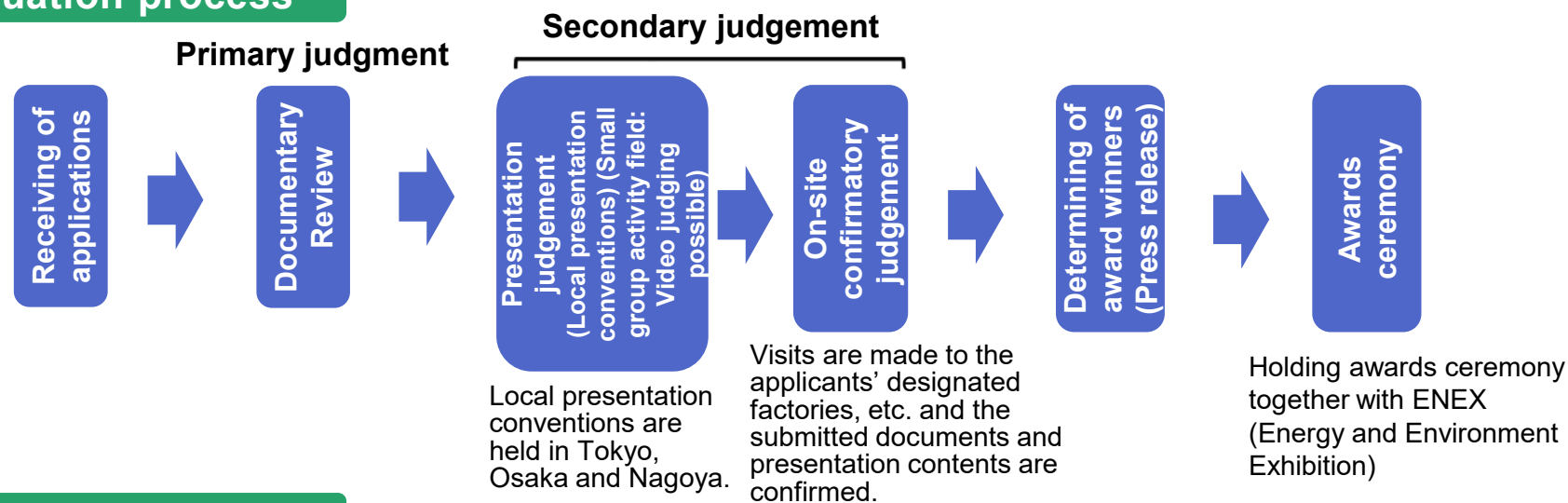
FY1990 to FY1997	21 <sup>st</sup> Century Energy Conservation Equipment and Systems Awards (Energy-Saving Vanguard 21)	Implemented by ECCJ as government-funded programs, etc.
FY1998 to FY2000	21st Century Energy Conservation Equipment and Systems Awards (Energy Conservation Grand Prize)	
FY2001 to FY2008	Energy Conservation Grand Prize (Energy conservation equipment and systems awards)	
FY2009	Changed name to the Energy Conservation Grand Prize (Addition of Best Practice category)*	
FY2010	Energy Conservation Grand Prize Award program stopped	Implemented by ECCJ as an independent program
FY2011 onwards	Energy Conservation Grand Prize Award restarted (Excellent Energy Conservation Equipment and Business Model and Best Practice in Factory & Building)	

\* It was combined with the “Presentation of EE&C Best Practices” started since 1975. It had been awarding outstanding EE&C activities in factories and buildings since then.

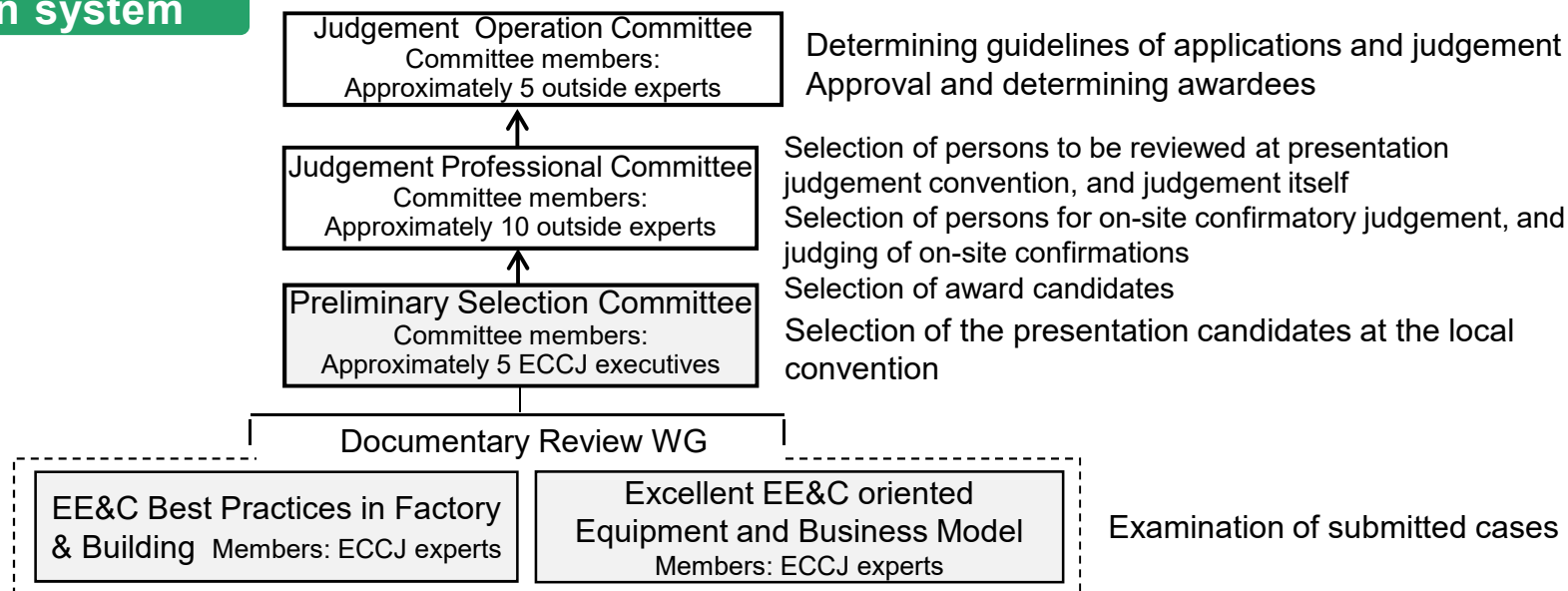
**Restarted due to the requests of manufacturers!**



## Evaluation process



## Evaluation system



## Evaluation items

	Excellent Energy Conservation Equipment and Business Model	EE&C Best Practices in Factory & Building
1	Process of development*	Spirit of innovation and originality*
2	Spirit of innovation and originality	Potential of energy conservation*
3	Potential of energy conservation*	General versatility, spreading effect
4	Potential of resource saving and recycle	Potential of upgrade and continuation
5	Marketability and economic efficiency	Presentation technique (Presentation judging only)
6	Environmental friendliness and safety	* Small group activity field • Reason for theme selection • Energy-saving effect • Originality and ingenuity in activities*
7	Presentation technique (Presentation judging only)	

\* Items that are given precedence

## Numbers of awards

Category	METI Minister's Prize	METI/ARNE Director General's Prize	SME Agency Director General's Prize	ECCJ Chairman's Prize	Judgement Committee's Special Prize
Excellent Energy Conservation Equipment and Business Model	Up to 4 cases	Up to 5 cases	Around 1 case	Approx. 10 to 15 cases	Approx. 2 cases
EE&C Best Practices in Factory & Building	Up to 4 cases	Up to 6 cases	Around 1 case	Approx. 10 to 15 cases	Approx. 2 cases



## Local presentation conventions

Evaluation session also serves as an dissemination occasion of recent EE&C technologies



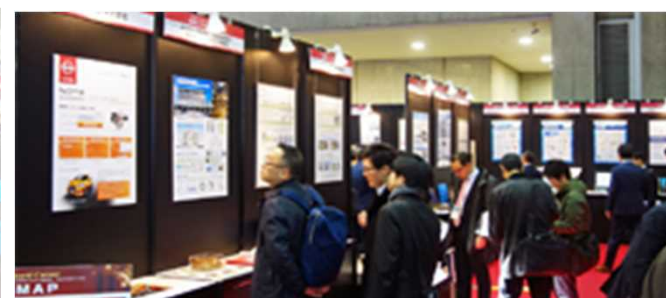
## Awards Ceremony

Prize-winners are made widely known.



## ENEX

Details of awarded cases are made widely known.



## Utilization of award-winner's symbol mark



By allowing winners of Energy Conservation Grand Prize Awards to display the award-winner's symbol mark in their pamphlets, websites, and in television commercials, award winners can generate appeal among consumers for their prize-winning products.

In home electric appliances stores, the symbol marks are affixed to the product bodies.

→ This provides a reference for consumers when selecting products.

The award-winner's symbol mark was established through seeking applications from the general public. The concept embodies a design representing the abundant future of the earth using a blue sky and a green shape full of vitality.

The symbol mark's usage period extends over the time period that the product is being sold.

Winner of the Energy Conservation Grand Prize  
METI/ARNE Director General's Prize!  
Recognizing technologies including the "Move Eye mirA.I."



Example advertisement (Mitsubishi Electric Corporation website)

# Excellent store for promoting dissemination of EE&C oriented products

### Details of system

Sales stores which actively encourage sales of energy-saving products and provide appropriate information relating to EE&C are recognized as “Excellent store for promoting dissemination of EE&C oriented products”. Additionally, stores that are recognized to be implementing particularly outstanding activities are given awards. These stores are commonly known as “Excellent Stores”.

This system was implemented by ECCJ as a government-funded program, etc.

### Implementation period

From FY2003 to FY2010

### Targeted stores

**Large-sized home electric appliances stores:** Stores that have floor areas which exceed 500 m<sup>2</sup>, and which realize 50% or more of their total sales volume from home electric appliances .

**Small and medium-sized home electric appliances stores:** Stores that have floor areas which are 500 m<sup>2</sup> or less, and which realize 50% or more of their total sales volume from home electric appliances .

\* Small and medium-sized home electric appliances stores were added from FY2005.

### Application categories

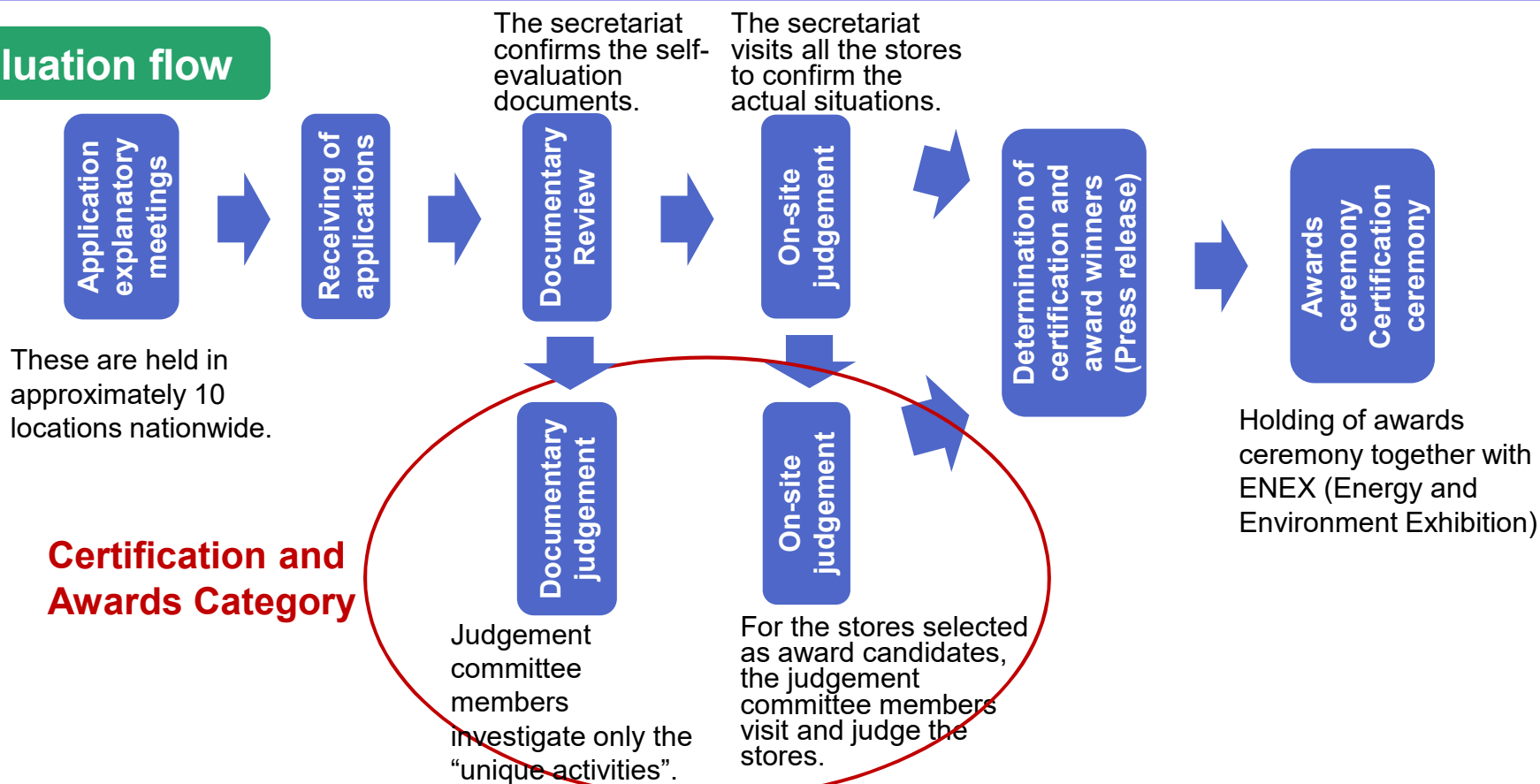
“Certification Category” and “Certification and Awards Category”

\* Stores that applied for the Certification Category are not given awards.

## Awards system

# Excellent store for promoting dissemination of EE&C oriented products

## Evaluation flow



## Judgement system

**Judgement committee:** Comprised of 15 members including university professors, distinguished academics, consumer groups, and representatives of the Ministry of Economy, Trade and Industry and the Ministry of the Environment who are highly knowledgeable about home electric appliance distribution and energy conservation. The committee meets three times.

**Site investigators:** Approximately 100 energy conservation dissemination advisors who have been trained in different projects by ECCJ

## Evaluation items

Evaluation items	Certification	Certification and Award
A: Management policies of stores (store managers) for energy-saving product dissemination (sales)	○	○
B: Increasing of store staff energy conservation knowledge (interest)	○	○
C: Ease of purchasing energy-saving products	○	○
D: Implementation of activities by the store in consideration of the environment	○	○
E: Actual sales results of energy-saving products	—	○
F: Unique activities implemented by individual stores or companies (Description style)	—	○

\* Implemented by judgement committee members

## Numbers of awards

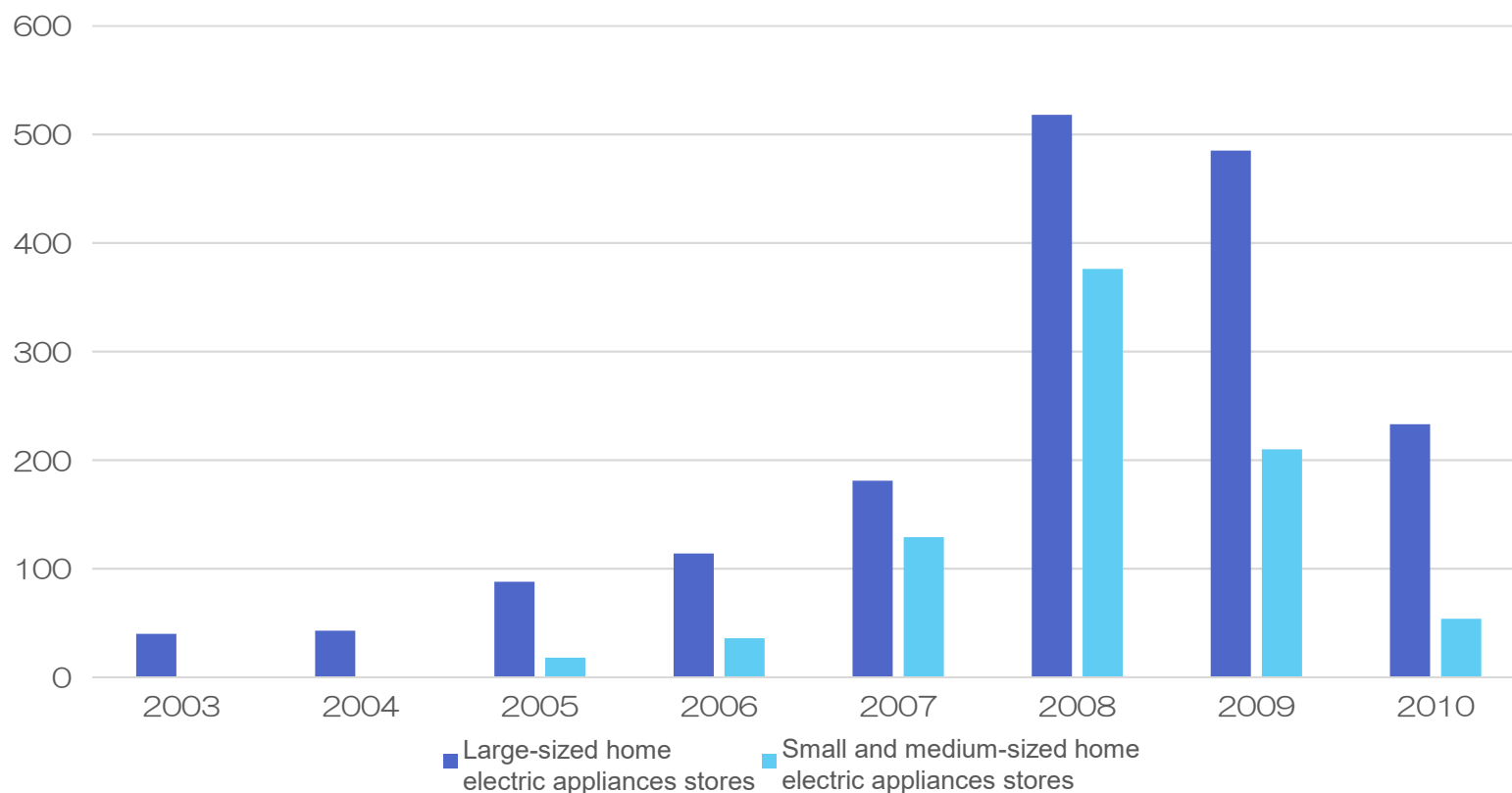
Category	METI Minister's Prize	Environment Minister's Prize	METI/ARNE Director General's Prize	ECCJ Chairman's Prize
Certification and Awards	0 to 2 cases	0 to 2 cases	2 to 4 cases	2 to 6 cases

\* The numbers of award cases are the actual figures.



## Changes in numbers of certified stores

Changes in numbers of Excellent Stores



## Utilization of symbol mark



By showing the symbol mark in stores, on websites, and in advertisements, certified stores can generate appeal among consumers as being stores which are trustworthy.

→ Consumers will be more likely to use these stores.

The certification symbol mark was established through offering from the general public.

The mark is formed by combining the initial letter “e” of the words “energy” and “excellent” with the word “Shop” representing the stores, using a snail as a motif. The snail motif was utilized due to its approachability and because it makes people think of leaves and rain, representing cleanliness.



Example advertisement (Joshin Denki Co., Ltd. flyer)

## Details of system

- In this system, purchasers of air conditioners, refrigerators, and terrestrial digital broadcast-compatible televisions that had outstanding energy-saving performances were awarded Home Electric Appliance Eco-points which could be exchanged for other products.
- The products subject to the system were determined as those that had been awarded four or more stars in the relative evaluation standards of the retailer labeling system.

## Implementation period

2009 to 2011 (Purchasing period)

## Key points

- This was a cooperative project between the Ministry of the Environment and the Ministry of Economy, Trade and Industry.
- While the aims of introducing the system were to promote global warming countermeasures, stimulate the economy, and popularize terrestrial digital broadcasting, as a result of the system implementation progress was made in disseminating energy-saving equipment.
- Due to the case of a home electric appliances subsidy system, extensive coverage was received in the mass media. This increased interest among consumers in the star ★ labeling and EE&C oriented equipment.





## National movement

# Forum for disseminating and promoting EE&C oriented home electric appliances

## Details of movement

- In cooperation with government organizations such as Ministry of the Environment and the Ministry of Economy, Trade and Industry, home electric appliances manufacturers, home electric appliances retailers, and consumer groups, national movement was implemented to realize a greater degree of promotion of the dissemination of EE&C oriented home electric appliances.
- The participating companies and groups implemented activities including “EE&C oriented home electric appliances dissemination events”, “utilization of common logo marks”, “further development of EE&C oriented home electric appliances information provision”, “visiting lecture courses”, and “EE&C contests at homes and schools”.

## Implementation period

2007 to 2012

## Key points

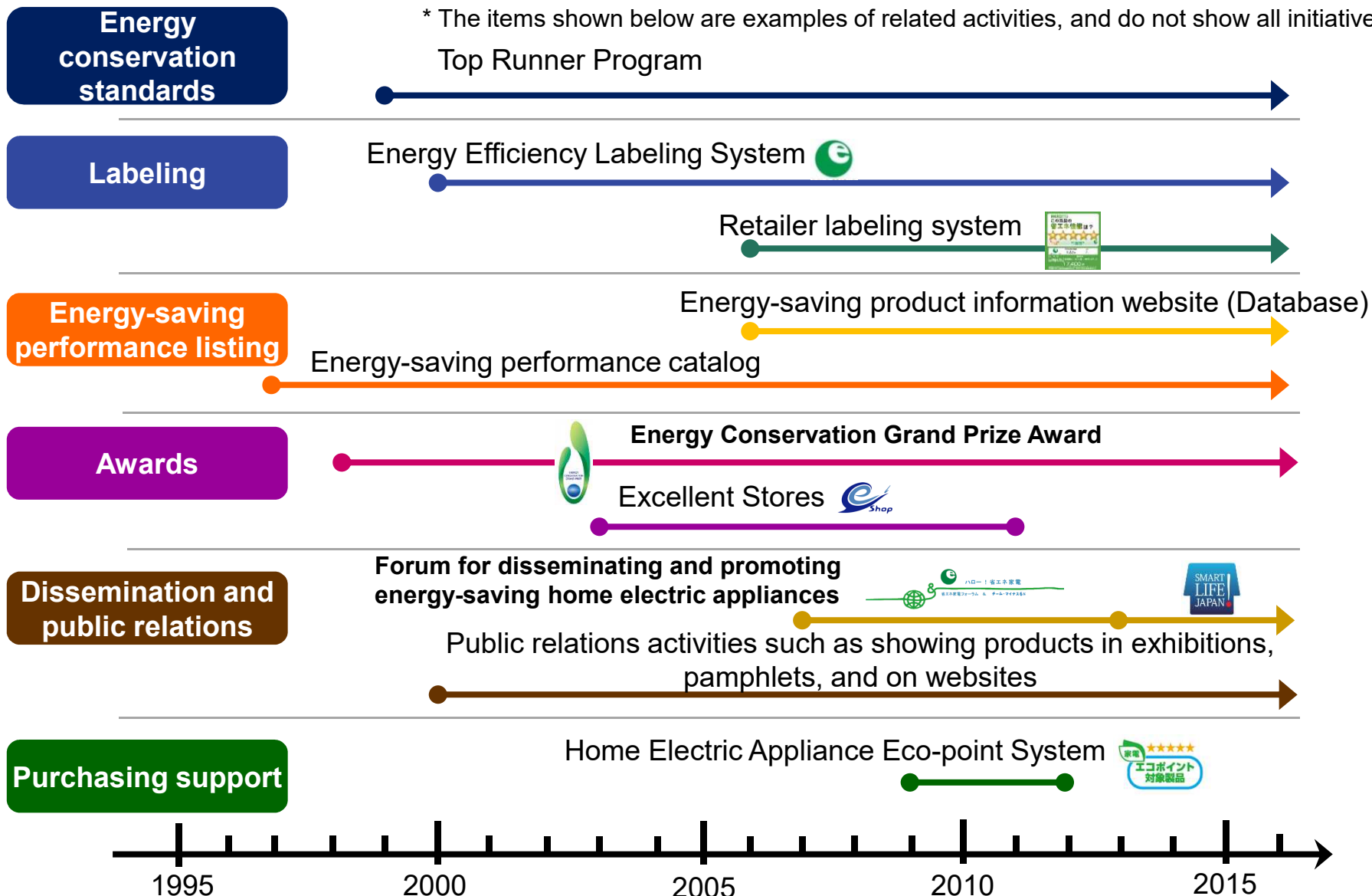
- Because a variety of business operators conducted advertisement utilizing the common logo and catchphrase, the opportunities for consumers to see these increased, which was effective for improving consumer knowledge related to EE&C oriented home electric appliances.
- Although this project finished once in 2012, the topics of “new energy” and “energy storage” were added to “EE&C” from the following year and activities are being developed as the “Smart Life Japan Promotion Forum”.



## Summary

# Changes in initiatives and types of the Program

\* The items shown below are examples of related activities, and do not show all initiatives.



## Lecture 6

**EE&C related lessons from Behavioral Science and finding  
from recent surveys in Japan regarding the Program  
including nudge effect of label display**

**Tanaka Yasushi**

International Cooperation Division  
The Energy Conservation Center, Japan

# EE&C related lessons from Behavioral Science and finding from recent surveys regarding the Program including nudge effect of label display

## 1 EE&C related lessons from Behavioral Science

- (1) Why EE&C efforts don't work smoothly even if profitable
- (2) Effective measures to promote more EE&C from the viewpoint of Behavioral Science

## 2 Findings from recent surveys regarding Top Runner Program

- (1) Label display information that may lead to purchase motivation (ECCJ)
- (2) The effects of behavioral changes through information provision in the label esp. effect of annual electricity charges(MURC)
- (3) ) Cost-benefit analysis of Top Runner Program (RIETI)

### 【Reference】

**One of the check lists of the “Nudge” proposed by BIT(Behavioral Insights Team in UK)**

E:easy (easy to accept? Not too much amount of information? Time-consuming?)

A:attractive (attractive enough? attract people's attention? Interesting?)

S:social (use social norms? emphasize the actions of the majority? appealing to reciprocity?)

T:timely (the best time to make a decision? feedback fast?)

# “Nudge”

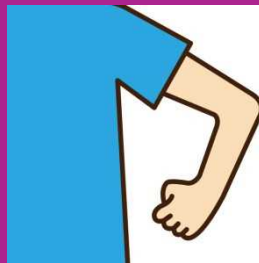
Broad  
sense,  
general

**nudge**  
[nʻdʒ]

Push someone gently with elbow, push gently; draw someone’s attention; approach to a certain state, etc.  
(Progressive English-Japanese Dictionary)



Narrow  
sense,  
exclusive



Choice architecture to change people’s behavior in a predictable manner without prohibiting a choice or greatly changing an economic incentive  
(“Nudge”, Thaler and Sunstein, 2008; Japanese title “Practical Behavioral Economics”)

Behavioral science approach proposed in the latter 2000s as a method to guide people’s behavior in a better direction

Source: CRIEPI 2017

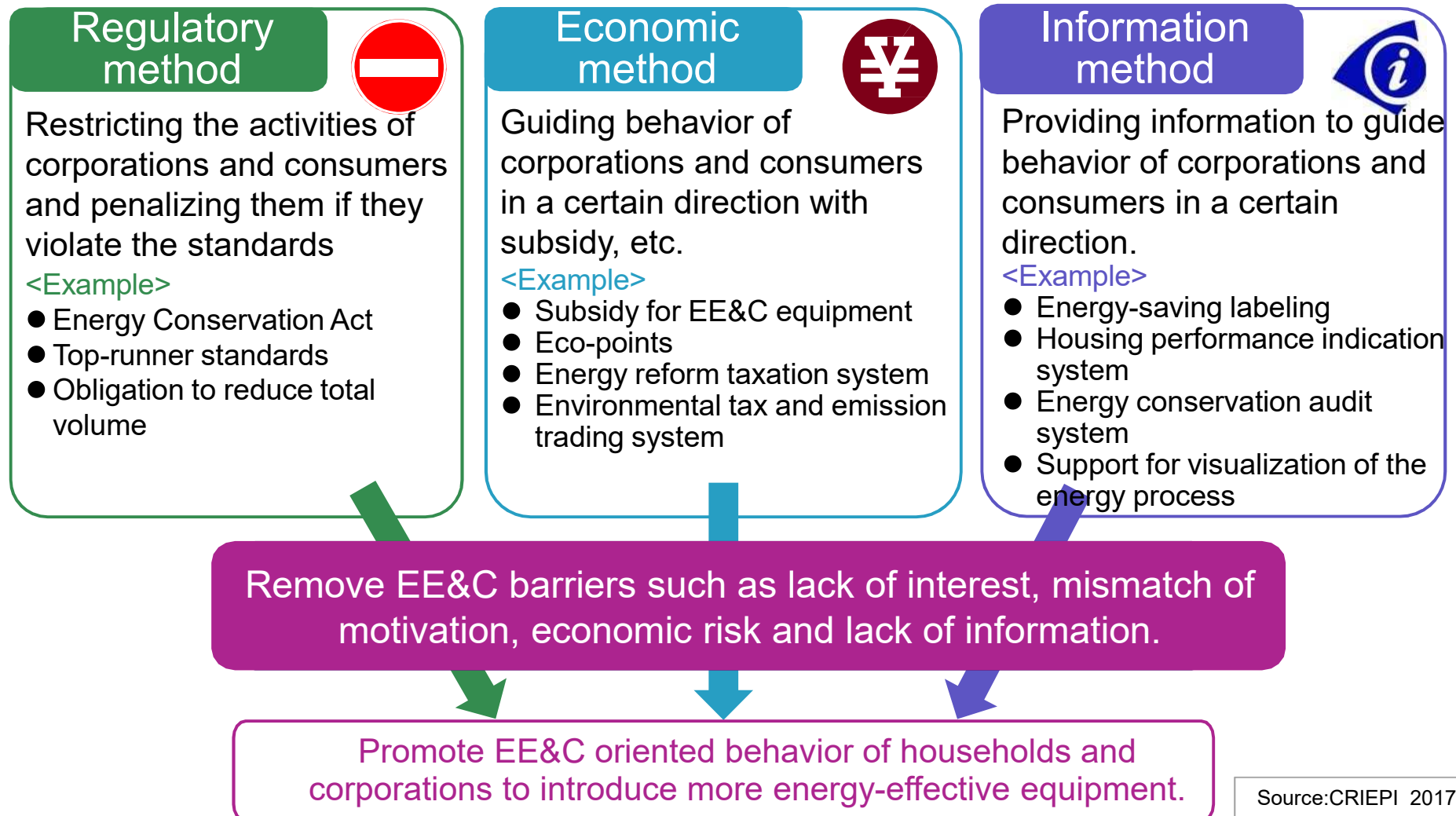
# Why EE&C efforts don't work smoothly even if profitable

EE&C Barriers	Description
Investment money and payback period	Difficulty in investment finance/Difficulty in the case where payback period is over a few years time
Economic risk	May lead to a trouble or a complaint.
Lack of information	Insufficient information and know-how on EE&C methods
Mismatch of motivation among stakeholders	As in the owner tenant problem, the thoughts among stakeholders do not match and EE&C efforts do not progress.
Limited rationality	Limited ability to study due to lack of sufficient time and psychological room
Hidden costs	Other costs than equipment (transaction cost, opportunity cost etc.)
Inertia	Resistance to changing a conventional method.
Interest and awareness	Lack of interest in EE&C activities (particularly the management)
Organizational structure	Organizations sometimes are unable to take measures even though they know what to do because of the unflexible structure

\*EE&C Energy Efficiency & Conservation

Source:CRIEPI 2017

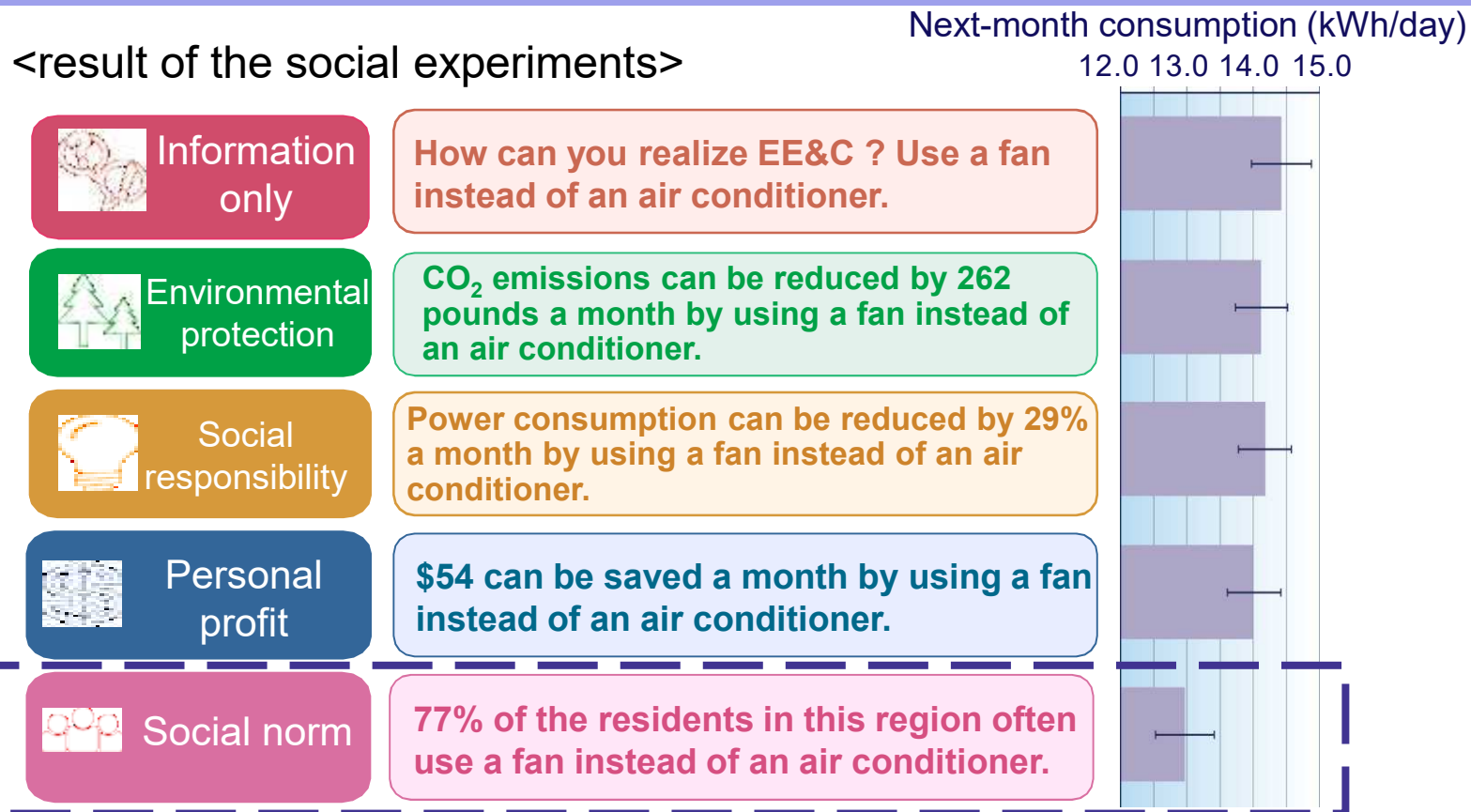
# Typical patterns of EE&C related Policy and Program



Source: CRIEPI 2017

Behavioral science is expected to help enhance the effect of the above-mentioned efforts.

# Comparison between several causes to stimulate EE&C-oriented attitude



Recently there comes an understanding that comparison with next door people is more effective than simple information based on the human tendency to take similar actions to others.

Source: CRIEPI 2017



# <outcome of the researches>

## 1. Label display information that may lead to purchase motivation (ECCJ)

- (1) Some cases were compared from the viewpoint of nudge effect.
- (2) Outcome was estimated annual electricity charges showed most realistic and effective nudge effect.

## 2. The effects of behavioral changes through information provision in the label esp. effect of annual electricity charges (MURC)

- (1) Experience of purchasing air conditioners and female consumers tend to increase the selection rate of energy-saving products by referring to the electricity cost information.
- (2) Even when comparing annual income of less than 3 million yen and annual income of 8 million yen or more, there was no significant difference in improving the purchasing rate of energy-saving products by providing energy-saving information

## 3. Cost-benefit analysis of Top Runner Program (RIETI)

- (1) Benefits outweighed the costs to find that annual merit of the policy is about 180 billion yen and a CO2 reduction effect of about 25 million tons.
- (2) Electric refrigerators, lighting equipment, air conditioners, VTRs, etc. have a relatively long usage time, and there is a lot of room for energy savings due to technically improved energy efficiency. For these devices, the direct benefits of electricity savings outweigh the additional costs of complying with regulations and have the benefit of reducing CO2, for that the “Top Runner Program” is evaluated to be a cost-effective policy measure.

## 2 Findings from surveys on S & L system in Japan

### (1) Label display information that may lead to purchase motivation (ECCJ)

#### Methodology & conclusion of the research

##### 1. Conducted a web questionnaire on the following items;

- (1) recognition and design of the unified energy-saving label
- (2) interest in selecting and purchasing energy-saving products
- (3) the concept of energy-saving mode

##### 2. Among them, we tried to see the following 2 items;

- (1) contents of the label display that they thought would lead to purchase motivation
- (2) the difference between the indicators that seemed to be more appealing than the display of the estimated annual charges

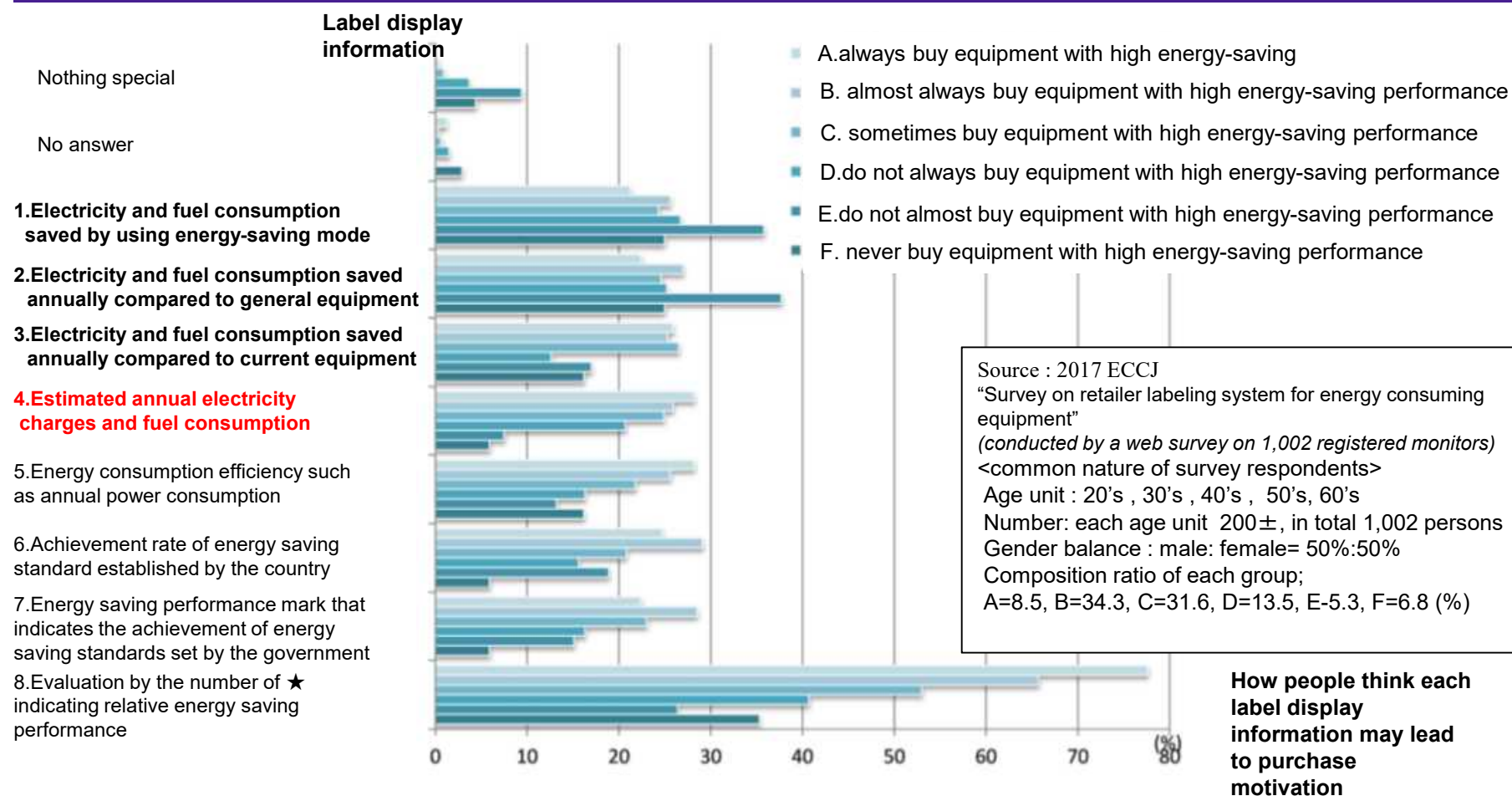
##### 3. Conclusion

- (1) Some cases were compared from the viewpoint of nudge effect.
- (2) Outcome was estimated annual electricity charges showed most realistic and effective nudge effect.

# Effect of relevant information on purchasing behavior

- Comparison was made between items 4 and the ones thought to be more appropriate than it ie. Items 1~3. Outcome was Item 4(estimated annual electricity charges) was supposed to be most realistic one in terms of effect and availability.

<Opinions of respective groups regarding how label display information may lead to purchase motivation >



## 2

## Findings from surveys on S & L system in Japan

### (2) The effects of behavioral changes through information provision in the label esp. effect of annual electricity charges(MURC)

#### <methodology & conclusion of the research>

1. Purchase candidate selection experiment in virtual EC site conducted by a web survey on registered monitors

#### 2. Specific analysis

(1) Purchase candidate selection experiment

(2) Analysis of candidate selection experiments by attributes(experiences of buy energy saving products, gender and salary level), based upon following hypotheses, we analyzed by attribute;

- a. men with experience of purchasing energy saving air conditioner may know that energy-saving air conditioners are cost-effective
- b. Women often manage their households, so they may focus on running costs
- c. High-income people may purchase high-priced products by showing high performance

#### 3. Conclusion

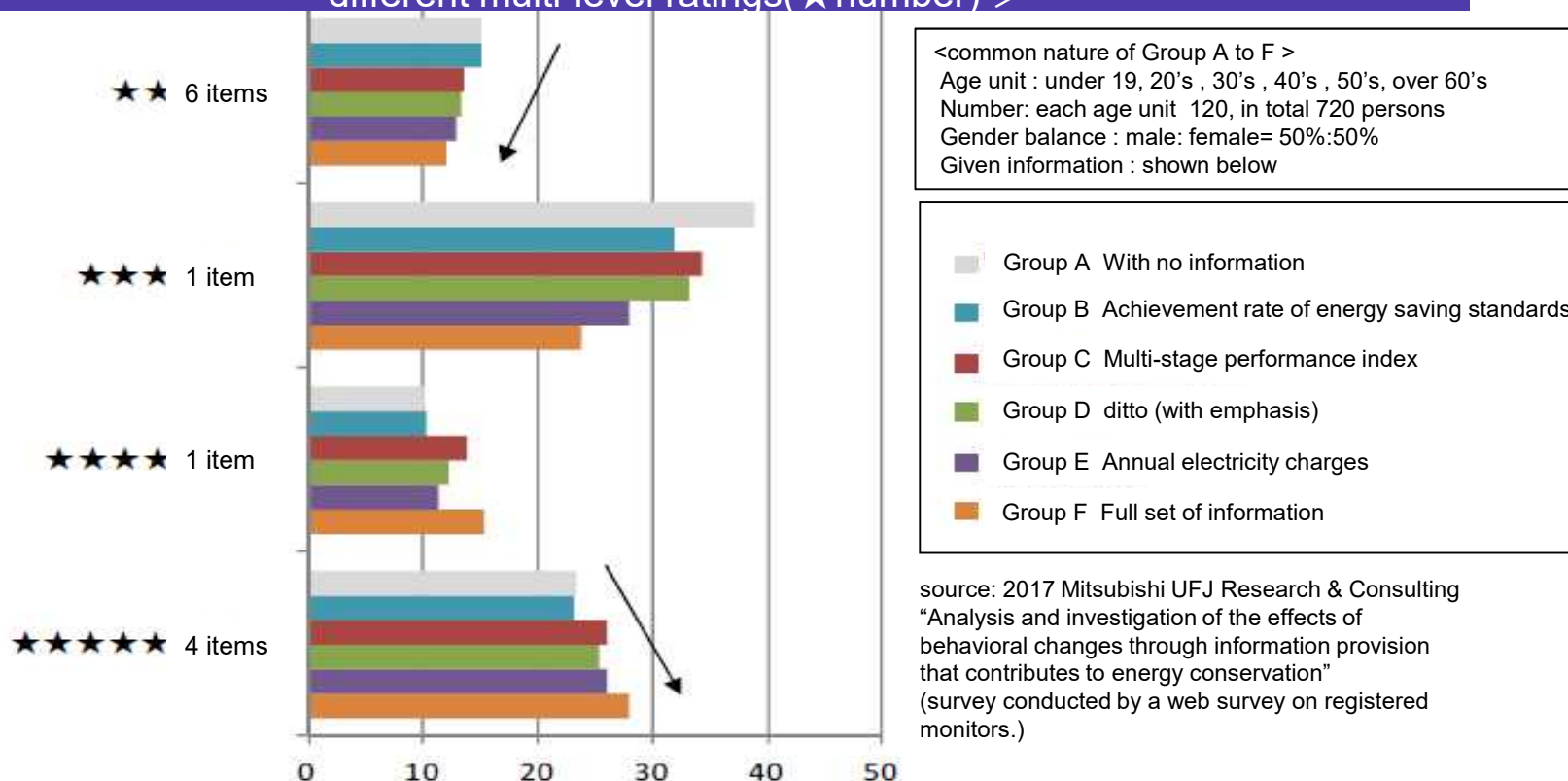
Looking at average energy-saving performance by participant's following features, it can be said that;

- (1) Experience of purchasing air conditioners and female consumers tend to increase the selection rate of energy-saving products by referring to the electricity cost information.
- (2) On the other hand, even when comparing annual income of less than 3 million yen and annual income of 8 million yen or more, there was no significant difference in improving the purchasing rate of energy-saving products by providing energy-saving information

# Effect of relevant information on purchasing behavior

- In the case of a product group (\* 2) with a low multi-level evaluation, the selection rate tends to be low when information on the multi-level evaluation and the annual electricity charges are displayed comparing with the case without energy saving information
- In the case of a product group (★ 5) with a high multi-level evaluation, the selection rate tends to increase when information on the multi-level evaluation and the annual electricity charges are displayed comparing with the case without energy saving information.

< Average selectivity of measured for each statistical group\* regarding products with different multi-level ratings(★number) >



## <Experience-wise difference> Influence on purchasing more energy efficient products by referring to energy saving related information

- Looking at average energy-saving performance by participant's experience of purchasing air conditioners, there was no significant difference when information on energy-saving performance was not given.
- It is significantly explained that consumers who have purchased air conditioners tend to increase the selection rate of energy-saving products by referring to the electricity cost information.

< Average energy-saving performance of products selected by each group depending on whether they have purchased air conditioners in the past or not >

	① No information	② Multi-stage performance index	③ Multi-stage performance index (emphasized)	④ Annual electricity charges	⑤ Achievement rate of energy saving standard	⑥ Full information display
<b>Purchase experience</b>	3.48	3.70	3.66	3.81	3.55	3.84
<b>No purchase experience</b>	3.39	3.52	3.60	3.49	3.45	3.73

source: Mitsubishi UFJ Research & Consulting(2017)

## <Gender-wise difference> Influence on purchasing more energy efficient products by referring to energy saving related information

- Looking at the average energy saving performance by gender, there is no significant difference when information on energy saving performance is not given.
- It is significantly explained that female consumers tend to increase the selection rate of energy-saving products by referring to the electricity cost information.

### < Average energy-saving performance of products selected by each group depending on different genders >

	①no information	②Multi-stage performance index	③Multi-stage performance index (emphasized)	④annual electricity charges	⑤Achievement rate of energy saving standard	⑥full information display
Male	3.45	3.60	3.59	3.57	3.47	3.71
Female	3.44	3.65	3.68	3.79	3.55	3.87

Source: Mitsubishi UFJ Research & Consulting(2017)

## <Salary-wise difference> Influence on purchasing more energy efficient products by referring to energy saving related information

- Looking at the average energy saving performance by participant's annual income, if energy saving information is not given, the average energy saving performance of participants with annual income of 8 million yen or more i.e. 3.63 is more than that of participants with annual income of less than 3 million yen i.e. 3.29.
- On the other hand, even when comparing annual income of less than 3 million yen and annual income of 8 million yen or more, there was no significant difference in improving the purchasing rate of energy-saving products by providing energy-saving information.

### < Average energy-saving performance of products selected by each group depending on different annual salary >

	①no information	②Multi-stage performance index	③Multi-stage performance index (emphasized)	④annual electricity charges	⑤Achievement rate of energy saving standard	⑥full information display
No income, annual income less than 3 million yen	3.29	3.28	3.45	3.38	3.26	3.56
Annual income of 3 million yen to less than 8 million yen	3.45	3.69	3.66	3.78	3.53	3.83
Annual income over 8 million yen	3.63	3.85	3.87	3.74	3.78	4.04

source: Mitsubishi UFJ Research & Consulting(2017)



## 2

## Findings from surveys on S & L system in Japan

### (3) Cost-benefit analysis of Top Runner Program (RIETI)

#### <methodology & conclusion of the research>

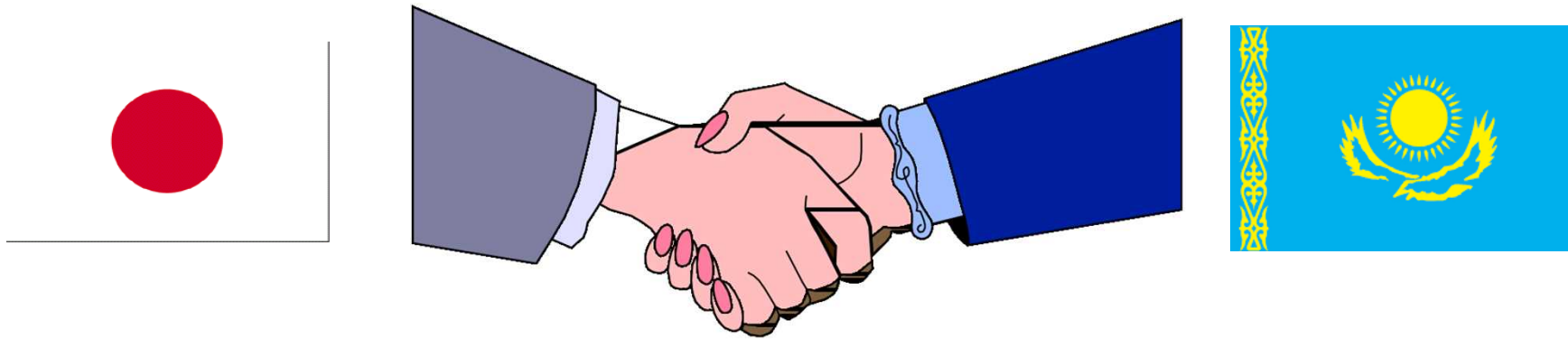
##### 1. Methodology

We estimated the difference between the direct benefits associated with the reduction in electricity consumption of the equipment covered by the “Top Runner Program” and the additional costs for regulatory compliance. From the difference, the cost-effectiveness of the program due to the electricity consumption reduction was estimated. For all regulated devices, benefit was estimated converted to present value at a discount rate of 3%.

##### 2. Conclusion

- (1) As a result, the benefits outweighed the costs to find that annual merit of the policy is about 180 billion yen and a CO2 reduction effect of about 25 million tons.
- (2) Electric refrigerators, lighting equipment, air conditioners, VTRs, etc. have a relatively long usage time, and there is a lot of room for energy savings due to technically improved energy efficiency. For these devices, the direct benefits of electricity savings outweigh the additional costs of complying with regulations and have the benefit of reducing CO2.  
→ For these devices, the “Top Runner Program” is evaluated to be a cost-effective policy measure.

# Thank You Very Much



**For More Information;**  
**The Energy Conservation Center, Japan <from 1996>**  
<https://www.eccj.or.jp>  
**Asia Energy Efficiency and Conservation Collaboration Center**  
**(Established in April 2007)**  
<https://www.asiaeec-col.eccj.or.jp>  
**Japanese Business alliance for Smart Energy-Worldwide**  
**(Established in October 2008)**  
<https://www.jase-w.org/>  
**SEforALL (Sustainable Energy for All)**  
**(Established in September 2015)**  
<https://seforallateccj.org/>



The Symbol of Energy Conservation Since 2005ECCJ has been spread the symbol mark with the visual image of a four-leaf clover which is thought to bring happiness named as “SMART CLOVER”, representing everyone’s energy conservation activities.

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