MINISTRY OF ENERGY AND MINERAL RESOURCES
REPUBLIC OF INDONESIA

No.

THE STUDY
ON
ENERGY CONSERVATION
AND EFFICIENCY IMPROVEMENT
IN
THE REPUBLIC OF INDONESIA

FINAL REPORT
SUPPLEMENT

AUGUST 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

ELECTRIC POWER DEVELOPMENT CO., LTD.

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Comparison of Energy Manager Program in Various Countries

No.	Item	Japan	Korea	China	Turkey
1	Energy conservation law	Energy conservation law	Rational Energy utilization Act	Energy law in 1998 Energy conservation law in 2007	Regulation in 1995, Energy efficiency law in 2007
1.1	Eneacted	22/6/1979	10/1979	1/1/1998	1995
	Revised date	10/8/2005		10/2007	18/4/2007
2	Designated energy management enterprise				
2.1	Energy consumption in enterprise (factory and building)	Type 1 enterprise: 3,000 kL/y or more Type 2 enterprise: 1,500 kL/y or more Building:floor area: 2,000m2 or more	Energy Management-Required user (EMRU): 1,000 toe/y or more of fuel, or 4,000,000 kWh/y of	Factory: 10,000 toc/y or more, and 5,000 – 10,000 toc/y specified by local government	Factory: 2,000 toe/y or more, Building: 500 toe/y or more with floor area of 20,000m2 or more
2.2	Number of designated factory	Type 1 enterprise: 7,457 Type 2 enterprise: 6,094	Special EMRU: 200 companies, whose energy consumption shears 50% in industry sector.		
2.3	Nominated number of energy manager	Type 1 enterprise: 1 to 4 persons Type 2 enterprise: 1 person			1 person
2.4	Duty of designated factory	(1) Nomination of energy manager (2) Annual report submission (3) Medium- and long-term plan submission	(1) Nomination of energy manager (2) Annual report submission (3) Medium-term plan submission	(1) Nomination of energy manager (2) Annual report submission (3) Medium-term plan submission	(1) Nomination of energy manager (2) Annual report submission (3) Accceptance of on-site survey by Ministry (4) establishment of energy management unit in factory of 50,000 toe/y or more
3	Qualification of energy manager				
3.1	Calassificatio n of license	(1) Person for energy management (2) Energy management officer		Energy manager	Energy manager
3.2	Compentence	(1) Person for energy management: - examination and work experience of 1 year - training course and examination for 7 days with work experience of 3 years (2) Energy management officer: - trainig course for 1day	(1) Energy management engineer (2) Energy manager: training course for 1day by KEMCO	(1) Middle- and high- class engineer who graduate university with work experience.	Trainig course with practice lesson by Ministry for 10 days with graduate of university

No.	Thailand	India	Vietnam	Malaysia
1	Energy conservation promotion law	Energy Conservation Act 2001l	Decree on Thrifty and Efficient use of Energy	Energy efficient regulation (under discussion)
1.1	1992	1/10/2001	3/9/2003	
	10/2002			
2				
2.1	Enterprise: 1,000 kW or more in contract demand power, or 1,175 kVA or more in equipment capacity	Factory: 500 kW or more in equipment capacity, or 600 kVA or more in contract demand power, in 15 sub-sectors	Factory: 1,000 toe/y or more in fuel and heat, 3,000,000 kWh/y or more in electricity	Type 1 enterprise: 12,000,000 kWh/y or more Type 2 enterprise: 6,000,000 kWh/y or more
2.2				
2.3			Factory: 900 in electricity	Type 1 enterprise: 1 energy manager Type 2 enterprise: 1 energy management officer
2.4	(1) Nomination of energy manager (PRE) (2) Annual report submission (3) Accceptance of energy audit by Energy auditor (RC), or conduct of energy audit by energy manager (S-PRE)	(1) Nomination of energy manager (2) Annual report submission (3) Accceptance of energy audit by Energy auditor	(1) Accceptance of energy audit by Energy auditor with subsidy of 30%	
3				
3.1	(1) PRE (2) Senior PRE from 2005			(1) Energy manager (2) Energy management officer
3.2	(1) S-PRE: - training course and examination for 7 days with graduate university (2) PRE: - trainig course for 1day with graduate college and work experience of 3 years, or - Graduate university	Energy maanger: examination with graduate university Energy auditor: examination with graduate university Qualified number: Energy manager: 713 persons, Energy auditor: 2,033 persons	Under planning	(1) Energy manager: - examination - training course and examination (2) Energy management officer: - trainig course for 1day

Form 1 (Pertaining to Article 5)

* Date received	
* Date processed	

Energy use situation notification

Messer

Date:
Address
Name (Official stamp)

This report is presented in compliance with the provisions of Item 2 of Article 7 of the Law Concerning the Rational Use of Energy.

Name of factory							
Address of factory							
Business the factory is engaged in							
Consumption of energy	Fiscal year	Sum total		Fuel and heat		Electricity	
		kLoe (kilo liter of crude oil equivalent)		kLoe (kilo liter of crude oil equivalent)		MWh	
Remarks							
Designation number of Designated Energy Management Factory							

[Remarks]

1. The size of the form shall be the Japanese Industrial Standard A4.
2. Report shall be handwritten clearly in ink in printed style, or typed.
3. There shall be no entry in the column marked with (*) in this form.
4. Enter the classified name and number in the column of "business the factory is engaged in" according to the detailed classification of Japan Standardized Industrial Classification on the business conducted in the factory. Enter the number given by Minister of Economy, Trade and Industry and Minister of Environment in the column of specific emission factory number in the beginning of Report.
5. In the calculation of energy consumption, if a calculation method of heat value of fuel to generate heat is used instead of the conversion factor specified in Annex Table 2, provide with the data used as a basis for the calculation method.
6. If the energy consumption is not to correspond to Item 2 of Article 2 after the following Fiscal Year, enter the corresponding matter and reason in the column of remarks.

7. In the case that the factory is already appointed as Type 2 Designated Energy Management Factory, enter the designation number of Designated Energy Management Factory of the factory in the column of “Designation number of Designated Energy Management Factory“

Contact to person in charge of notification

Address	Postal code
Name of factory	
Department and Section	
Name of person	
TEL	
FAX	

Form 9 (Pertaining to Article 17)

* Date received	
* Date processed	

Periodic Report

To MESSRS._____

Date

Address

Name (Official stamp)

This report is presented in compliance with the provisions of Item 1 of Article 15 (or Item 1 of Article 18 if applied) of the Law Concerning the Rational Use of Energy.

Designation Number of Designated Energy Management Factory		
Specific emission factory No.		
Name of factory		
Address	Tel (- -) Fax (- -)	
Business the factory is engaged in		Classified No.
Prepared by		
No. of Energy Manager License or No. of Lecture Certification of Responsible Person		

Table 1 Consumption of energy and byproduct energy sold

Type of energy, etc.			Unit	Fiscal year:					
				Consumption		Amount of byproduct energy etc. sold			
						Amount sold		Amount not contributed to the own production	
				Quantity	Heat value (GJ)	Quantity	Heat value (GJ)	Quantity	Heat value (GJ)
Fuel and heat	Crude oil (except for condensate)		kL						
	Condensate (NGL) of crude oil		kL						
	Gasoline		kL						
	Naphtha		kL						
	Kerosene		kL						
	Light oil (Diesel oil)		kL						
	Fuel oil A		kL						
	Fuel oil B/C		kL						
	Petroleum asphalt		t						
	Petroleum coke		t						
	Petroleum gas	Liquefied petroleum gas (LPG)	t						
		Petroleum-based hydrocarbon gas	1,000 m^3						
	Flammable natural gas	Liquefied natural gas (LNG)	t						
		Other flammable natural gases	1,000 m^3						
	Coal	Coking (stock) coal	t						
		Steaming (thermal) coal	t						
		Anthracite	t						
	Coal coke		t						
	Coal tar		t						

	Coke oven gas		1,000 m^3						
	Blast furnace gas		1,000 m^3						
	Basic oxygen furnace gas		1,000 m^3						
	Other fuels, etc.	City gas	1,000 m^3						
		(　　　　)							
	Steam for industry		GJ						
	Steam for other than industry		GJ						
	Hot water		GJ						
	Cold water		GJ						
	Sub-total of fuel and heat		GJ						
Electricity	General electricity enterprises	Purchased electricity in daytime	MWh						
		Purchased electricity in night time	MWh						
	Others	Purchased electricity other than above	MWh						
		In-house electricity generation	MWh						
	Sub-total of electricity		MWh/GJ						
GJ in total									
kL in crude oil terms					a		b		c
Change from the previous year (%)									

Table 2 Outline, operating conditions, new installations, modifications, or removal of equipment pertaining to rational use of energy and principal equipment that consumes energy

	Name of equipment	Outline of equipment	Operating conditions	New installation, modification or removal
Equipment pertaining to rational use of energy				
Principal equipment other than the above that consume energy				

Table 3 Production volume etc.

	Fiscal year:	Change from previous year (%)
Production volume, floor area or other value which has close relation with consumption of energy ( )	d	

Table 4 Energy intensity relating to the use of energy

	Fiscal year:	Change from previous year (%)
Energy intensity $= \frac{\text{Energy consumption (kL in crude oil terms) } (a - (b + c))}{\text{Production volume, floor area or other value which has close relation with consumption of energy } d}$		

Table 5 Change of energy intensity relating to the use of energy for past 5 years

	FY:	FY:	FY:	FY:	FY:	Average change of energy intensity in 5 fiscal years
Energy intensity in use						
Change from previous year (%)		A	B	C	D	

Table 6 If a 1% or more improvement in annual average value of energy intensity has not been attained for past 5 years (A) or improvement of energy intensity has not been attained compared with the previous year (B), provide the reason.

Reason of (A)
Reason of (B)

Table 7 Status of compliance with judgment standards for the rational use of energy

Item (Equipment)	Setting of management standards	Compliance status regarding measurement and recording	Compliance status regarding maintenance and inspection	Measures for new installation
Rationalization of fuel combustion <Combustion equipment>	Setting management standards for air ratios, etc. ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of combustion equipment ☐ Implemented ☐ Not implemented ☐ N.A.
Rationalization of heating, cooling and heat transfer <Heat utilization equipment>	Setting management standards for heating equipment, etc. ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of heating equipment ☐ Implemented ☐ Not implemented ☐ N.A.
	Setting management standards for air-conditioning equipment, etc. ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of air-conditioning equipment ☐ Implemented ☐ Not implemented ☐ N.A.
Use of recovered waste heat <Waste heat recovery equipment>	Setting management standards for waste heat recovery equipment, etc. ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of Waste heat recovery equipment ☐ Implemented ☐ Not implemented ☐ N.A.
Rationalization of conversion of heat into power <Dedicated power generation equipment and cogeneration system>	Setting management standards for gas turbines, etc. for dedicated power generation equipment ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of Dedicated power generation equipment ☐ Implemented ☐ Not implemented ☐ N.A.
	Setting management standards for boilers, etc. for cogeneration equipment ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of cogeneration equipment ☐ Implemented ☐ Not implemented ☐ N.A.

Prevention of energy loss due to radiation, heat transfer, resistance etc. <Heat utilization equipment and Power receiving and transforming equipment and distribution equipment >	Setting management standards for prevention of heat loss ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of heat utilization equipment ☐ Implemented ☐ Not implemented ☐ N.A.
	Setting management standards for prevention of electricity loss ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of power receiving and transforming equipment and distribution equipment ☐ Implemented ☐ Not implemented ☐ N.A.
Rationalization of electricity conversion into power, heat, etc. <Electricity consuming equipment>	Setting management standards for electric power consuming equipment, such as electrical power application equipment, electric heating equipment and electrolytic equipment ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of electrical power application equipment ☐ Implemented ☐ Not implemented ☐ N.A.
	Setting management standards for lighting equipment ☐ Already set ☐ In progress (__%) ☐ Not set yet	Implementation of measurements and recording stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of maintenance and inspection stipulated in management standards ☐ Periodically implemented ☐ Implemented as required ☐ Not implemented	Implementation of measures for new installation of lighting equipment ☐ Implemented ☐ Not implemented ☐ N.A.

Table 8 Other measures taken for rational use of energy

Outline of measures	
Head (Responsible person) of the energy conservation promotion organization	(Position) (Name)

Table 9 Emission volume of carbon dioxide (CO2) generated by the use of energy

1. Emission volume of carbon dioxide (CO_2) generated by the use of energy

Emission volume of carbon dioxide (CO_2) generated by the use of energy	t-CO_2

2. Emission volume of carbon dioxide (CO2) generated by the use of fuel in a factory, which an electric power generation plant for electric power business or a heat supply plant for heat supply business is installed.

Emission volume of carbon dioxide (CO_2) generated by the use of energy	t-CO_2

3. Contents of calculation method or coefficient different to the calculation method or the coefficient specified by the Order based on the Act relating to the promotion of the measures for global warming

4. Providing of information or requests relating to protection of right and profits

Does the report of the above item 1 or 2 relate to request in Item 1 of Article 21-3 of Act relating to the promotion of the measures for global warming? (Indicate the appropriate answer by mark (○).)	1.Yes 2.No	Is the information provided according to Item 1 of Article 21-8 of Act relating to the promotion of the measures for global warming? (Indicate the appropriate answer by mark (○).)	1.Yes 2. No

[Remarks]

1. The size of the form shall be the Japanese Industrial Standard A4.
2. Report shall be handwritten clearly in ink in printed style, or typed.
3. There shall be no entry in the column marked with (*) at the beginning of Report.
4. Enter the number given by Minister of Economy, Trade and Industry and Minister of Environment in the column of specific emission factory number in the beginning of Report.
5. Enter the classified name and number in the column of business related to the factory according to the detailed classification of Japan Standardized Industrial Classification on the business conducted in the factory.
6. Enter the value in each unit and value in terms of heat amount in the “Consumption” columns of Table 1 by kinds of energy.
7. The columns for unused energy may be left blank in Table 1.
8. Enter the sold amount by kinds of energy and energy that do not contribute to their own production in the column of “Amount of byproduct energy etc. sold” of Table 1.
9. Enter the type of fuel, such as oil refinery gas, in the parentheses in the column below the “City gas” in section “Other fuels, etc.” of Table 1, and the consumption. If two or more kinds of fuels have to be entered, provide new columns as required.
10. In the conversion to heat value form consumption of “Steam for industry”, “Steam for other than industry”, “Hot water” and “Cold water” column of Table 1, if a calculation method of heat value is used instead of the conversion factor specified in Annex Table 2 of the Energy Conservation Law, provide with the data used as a basis for the calculation method.
11. Enter the amount of electric power sold in the column of “Amount sold” of “In-house electricity generation”.
12. Converted heat value to be entered in the column of the amount of byproduct energy etc. sold of “In-house electricity generation” in Table 1 is the converted value on a basis of 9,830 kilojoules for 1 kilowatt-hour or the converted heat value of fuel used for the electricity generation.
13. Enter the calculation value in column of the amount of unused for production oneself by the kind of electricity in Table 1, in the case that the amount of unused for production oneself is not arranged by the kind of electricity in Table 1.
14. Regarding fuels to be entered in GJ in Table 1, the symbol T (for Tera) or P (for Peta) may be suffixed to the figures.
15. In calculating the total of consumption of energy in Table 1, it is not necessary to add energy and their byproducts together. In this case, the kind and the quantity of such energy that was not added should be noted below Table 1.
16. Enter the fiscal year in question in the upper columns of Tables 1, 3 and 4. In the “Change from the previous year” column of each table, enter the value calculated by using the value stated in the periodical report submitted in the previous year (for Table 3 and Table 4, the value for the previous year shall be, in principle, the value calculated based on the formula used for the calculation of the value for the year in question). The calculation method shall be as follows.

$$\text{Rate of change over previous year (\%)} = \frac{\text{Value for the fiscal year in question}}{\text{Value for the previous year}} \times 100 \text{ (\%)}$$

17. In Table 2, enter the matters so that energy whose annual consumption for the equipment concerned covers 80% of total energy consumption in the factory.
18. Enter production volume or amount or value which has close relation with floor area or consumption of other energy, etc. in the "Production volume, floor area or other value which has close relation with consumption of energy" of Table 3, and enter the unit in the parentheses. Whichever may be selected, the same unit shall be used throughout the year. If a report was made in the preceding fiscal year or before, in principle, the same unit as used in that report shall be used. A total of equivalents for individual products based on the quantity of energy, etc. required to produce the main products in the factory may be entered in the column.
19. "Energy intensity" in Table 4 refers to the amount of energy consumed per unit of production.
20. Enter the 5 fiscal years including the latest fiscal years in the upper column of Table 5. Enter the calculated value by the calculation formula used for the year in the column of "Energy intensity in use" and "Change from previous year".
21. Enter the value of 4^{th} root of multiplied value of "change from the previous year" for the past 5 years in the column of "Average change of energy intensity in 5 fiscal years" of Table 5. The calculation method shall be as follows.

    Average change of energy intensity in 5 fiscal years (%) = (A * B* C * D)^0.25 (%)

22. In Table 6, in the case that "Reason of (A)" is the same as "Reason of (B)", " Same as (A)" may be entered.
23. Indicate appropriate items by check mark (✓) and enter the value for a necessary item in Table 7. For equipment items that do not exist in the factory, their columns shall be indicated by shading with hatch lines.
24. Under translation
25. Under translation
26. Under translation
27. Under translation
28. Under translation
29. Under translation

Form 7 (Pertaining to Article 15)

* Date received	
* Date processed	

Middle- and Long-Term Plan

To Messers

Date

Address

Name

This report is presented in compliance with the provisions of Item 1 of Article 14 of the Law concerning the Rational Use of Energy.

Designated Number of Designated Energy Management Factory							
Name of factory							
Address	Tel (- -)						
Business the factory is engaged in							

I Plan Period

Fiscal year to Fiscal year

II The Contents of plan, and the expected effects of rationalization of energy use

Process	Contents of plan	Expected effects of rationalization of energy use

III Comparison with Previous Year Plan

Process	A plan to have been deleted	Reason
Process	A plan to have been added	Reason

IV The other matters relevant to Plan

[Remarks]

1. The size of the form shall be the Japanese Industrial Standard A4.
2. Plan shall be handwritten clearly in ink in printed style, or typed.
3. There shall be no entry in the column marked with (*) at the beginning of Plan.
4. Enter the classified name and number in the column of business related to the factory according to the detailed classification of Japan Standardized Industrial Classification on the business conducted in the factory.
5. Enter the name and quantity of equipment, system and technology etc. by the process unit in the column of “Contents of plan” of Item II. But if it is difficult to write the contents of plan by the process unit, enter the name of principal equipment in the column of “Process”, and enter the plan by equipment.
6. Enter “kL” of crude oil equivalent of the expected effects of energy use rationalization expected by the implementation of the improvement plan in the column of “Expected effects of energy use rationalization” of Item II.
7. Enter the contents compared with the previous year of Item II in Item III. In addition, if the corresponding process is plurality, enter the contents in newly prepared column.
8. When the higher ranked plans (the project relevant to two or more factories, the whole plan Type-1 specified entrepreneur, etc.) relevant to the plan entered in the column of II, enter the positioning of the factory concerned in the contents of a plan and plan etc. in Item IV. Moreover, when entry is difficult only in this column, attach the related data.

Completion Examination & Lecture Subjects for Energy Manager Training Course in 2007

A trainee is required to choose a training course of "Compulsory subject + Heat subject" or "Compulsory subject + Electricity subject" and receive the lecture for 52 units in total for 6 days. 1 unit of lecture hour is 40 minutes.
Completion examination is taken from 9:30 to 17:30 on 7th day.

Training Course	Completion examination subjects	Lecture subjects	Lecture hour (unit)
Compulsory subject	Compendium on energy management and laws	1. Compendium on energy management	7
		2. Laws & orders concerning rational use of energy	2
	Lecture hours of compulsory category in total		9

Training Course	Completion examination subjects	Lecture subjects	Lecture hour (unit)
Heat subject	Fundamentals of heat & fluid flows	1. Fundamentals of thermodynamics	8
		2. Fundamentals of fluidics	5
		3. Fundamentals of heat transfer engineering	5
	Fuel and combustion	1. Combustion and combustion control	4
		2. Combustion calculation	3
	Heat utilization facilities and their management	1. Measurement and control	5
		2. Boiler, steam transport and storage unit, steam motor, internal combustion engine, gas turbine	4
		3. Heat exchanger and heat recovery unit, freezing and air conditioning equipment	3
		4. Industrial furnace and thermal facilities materials	3
		5. Distillation・evaporation・condensation unit, drying unit, dry distillation and gasification unit	3
	Lecture hours of heat category in total		43

Training Course	Completion examination subjects		Lecture subjects	Lecture hour (unit)
Electricity subject	Fundamentals of electricity		1. Electric and electronic theories	3
			2. Automatic control and information processing	3
			3. Electrical measurement	2
	Electric facilities &	Factory power	1. Factory power distribution plan	2
			2. Operation of factory power distribution	2

	equipment	distribution	3. Energy conservation of factory power distribution	2
		Electric equipment	1. Electric equipment in general	2
			2. Rotating and stationary machines	2
			3. Energy conservation of electric equipment	2
	Electric power application	Electromotive power application	1. Electromotive power application in general	2
			2. Electromotive power application facilities	3
			3. Energy conservation of electromotive power application	2
		Electric heating	1. Theory and facilities of electric heating	2
			2. Energy conservation of electric heating	2
		Electric-chemistry	1. Theory and facilities of electrochemistry	2
			2. Energy conservation of electrochemistry	2
		Lighting	1. Theory and facilities of lighting	2
			2. Energy conservation of lighting	2
		Air conditioning	1. Theory and facilities of air conditioning	2
			2. Energy conservation of air conditioning	2
	Lecture hours of electricity category in total			43

Source: http://www.eccj.or.jp/mgr1/30ken_guide/index.html
Translation by JICA Study Team on 28 September 2007

Contents of Textbook of Training Course for Energy Management Officer in Japan

Source: "Textbook of training course for Energy Management Officer (not for sale)" published by Energy Conservation Center, Japan

Chapter 1 Basic knowledge and regulation on comprehensive energy management

Section 1 Meaning of Energy Conservation

1.1.1 Energy Conservation

1.1.2 The necessity for energy conservation
- (1) Fossil fuel resources
- (2) Energy conservation in a company

1.1.3 Energy Conservation and Environmental Issues
- (1) Global warming
- (2) Warming is advancing.
- (3) Future prediction
- (4) The outline of the Kyoto Protocol
- (5) The measure to global warming

1.1.4 Energy Cost

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1.2.5 Energy Consuming Structure of Factory and Building etc.
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1.3.2 Energy master plan

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(2) Job of an energy management officer
(3) Duty of an energy management officer, an entrepreneur, and an employee
(4) An entrepreneur's duty and role of an energy management officer

Section 4 Basis of Energy Management

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(3) A setup of target of energy conservation
(4) Grasp of an energy use situation
(5) Judgment standard and energy intensity management
(6) Planning of an improvement proposal
(7) Concrete plan and implementation of improvement proposal of equipment

(8) Equipment maintenance and equipment improvement

(9) The example of the job of the energy management officer for energy conservation promotion

1.4.3 Support Measures for Energy Conservation

(1) Support system of energy conservation

(2) Energy audit

(3) ESCO business

1 4.4 Practical use of the information about energy conservation

Chapter 2 Technique of energy management

Section 1 Basic Knowledge of Energy Management

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(1) Action of using energy in a factory and building etc.

(2) State of energy

(3) Conversion of state of energy

(4) Supply of the energy in factories and buildings etc.

(5) Conservation of energy and evaluation of quality of energy

2.1.2 Energy Resources Used in Factory and Building Etc.

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(2) Liquid fuel

(3) Solid fuel

(4) Natural energy

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2.1.3 Primary Energy Consumption

(1) Primary energy consumption

(2) Method of calculation of primary energy consumption

(3) Primary energy consumption intensity

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(2) Device for measurement of energy

(3) Automatic control

(4) Measurement and control of energy by BEMS (Building Energy Management System)

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(2) Basis of combustion
(3) Basis of heat transfer
(4) Characteristics of steam
(5) Basis of heat exchange technology
(6) Basis and characteristics of electric heating

2.2.2 Combustion Equipment

(1) Combustion control
(2) Adjustment of inner pressure of furnace
(3) Heat dissipation prevention from furnace wall
(4) Examination of the operation method

2.2.3 Steam use equipment

(1) Management of a boiler
(2) Management of steam transportation piping
(3) Optimization of heat insulation
(4) Effective use of steam
(5) Management of a steam trap

2.2.4 Exhaust heat recovery

(1) Outline
(2) Heat recovery of combustion exhaust gas
(3) Exhaust heat recovery of process
(4) Heat recovery of an incinerator
(5) Heat recovery from hot waste water

Section 3 Electric Energy

2.3.1 Basic Knowledge of electricity

(1) Electric power and work
(2) Difference between direct current and alternative current
(3) Expression of alternative current
(4) Electric power and power factor of alternative current circuit
(5) 3-phase alternative current circuit
(6) Electric power of 3-phase alternative current circuit

2.3.2 Power Receiving and Distributing Equipment

(1) Power receiving and distributing equipment

(2) Transformer
(3) The capacitor for power factor improvement
(4) Management of load

2.3.3 Leveling of Load
(1) Demand control
(2) Thermal accumulating system
(3) Electric power storage system

2.3.4 Electric Motor
(1) Slip of induction machine
(2) Characteristic of induction machine
(3) Inverter
(4) Energy conservation technique

2.3.5 Fluid Apparatus
(1) A fan and a pump

2.3.6 Lighting
(1) Basis of lighting
(2) Requirements for energy conservation lighting
(3) Energy consuming structure and examination item for energy conservation of lighting equipment
(4) Energy conservation technique

Section 4 Basic Knowledge of Air-conditioning

2.4.1 Basic Knowledge of Air Conditioner
(1) Air conditioning system
(2) Design conditions of an air conditioner
(3) Kind and calculating method of heat load of air-conditioning system
(4) Basic composition of an air conditioner
(5) A classification and kind of air-conditioning system
(6) The flow of the thermal energy in an air conditioner
(7) Thermal storage type air-conditioning system
(8) The evaluation index of air conditioner

Chapter 3 Service of energy management in a factory

Section 1 Energy Consumption Equipment in Factory

3.1.1 Energy Supply System

(1) Outline
(2) Fuel equipment
(3) Power receiving and distributing system
(4) Cogeneration

3.1.2 Industrial Furnace

(1) Outline
(2) Regenerative burner (thermal storage type burner)
(3) Low air ratio combustion
(4) Burner control
(5) Management of an operation situation
(6) Heat pattern improvement
(7) Reduction of heat loss of furnace
(8) Exhaust heat recovery

3.1.3 Drying Equipment

(1) Outline
(2) Change of drying system
(3) Change of heat source
(4) Change of process, medium and material
(5) Operation management
(6) Reduction of heat loss of furnace
(7) Exhaust heat recovery

3.1.4 Boiler and Steam Use Equipment

3.1.5 Air Conditioner

(1) Object and the purpose of air-conditioning
(2) Characteristics of air-conditioning
(3) Energy conservation of air-conditioning

3.1.6 Fluid Apparatus and Equipment

(1) Air compressor (compressor)
(2) Fan (fan and blower)
(3) Oil hydraulic equipment
(4) Vacuum pump
(5) Pump

(6) Water system

3.1.7 Electric Power Application Equipment (Excluding fluid equipment and transportation equipment)

3.1.8 Electric Heating

(1) Characteristics of electric heating

(2) Kind of electric heating

(3) Technique of energy conservation

3.1.9 Lighting

3.1.10 Conveyance Equipment

(1) Crane

(2) Belt conveyor

(3) Elevator

3.1.11 Check list for energy management (factory)

Section 2 Management Standard and Report Document

3.2.1 Judgment Standard and Management Standard in Factory

(1) A standard portion and a target portion

(2) 6 fields and 4 management items of standard portion

(3) Standard values and target values of 6 management items

(4) Equipment and management standard

3.2.2 Preparation of Management Standard in Factory

(1) Outline and composition of energy management standard

(2) Item to be set as management standard

(3) Composition and contents to be specified for management standard

(4) Preparation of the energy flow diagram and management of energy consumption of the whole factory

(5) Identity of management standard and application of other standards

(6) The consideration matter in the case of setup and operation of management standard

(7) Important meaning and education of management standard

3 2.3 Notification and reporting of the factory by Law Concerning Rational Use of Energy

(1) Submission of “Notification of energy use situation notification”

(2) Submission of "Notification of assignment (death or dismiss) of Energy management officer”

(3) Periodical report

(4) medium- and long-term plan

Chapter 4 Service of the energy management in building etc.

Section 1 Energy Consumption Equipment in Building etc.

4.1.1 Energy Management of Building to be aimed at Energy Conservation

(1) Importance of energy management

(2) Effective use of energy and resources, and useless loss

(3) Actual condition of consumption of energy and resources

4.1.2 Energy Management of Air Conditioner

(1) Energy management of air-conditioning individual equipment

(2) Energy management as the whole air-conditioning system

(3) Energy conservation in design, operation and renewal of an air conditioner

(4) Check list for energy-conservation of air conditioner

(5) Energy conservation management and trial calculation example of effect

4.1.3 Energy management of electric equipment

(1) Energy management of main equipment

(2) Energy conservation management and trial calculation example of effect

4.1.4 Energy management of water supply quipment

(1) Energy management of main equipment

(2) Check list for energy-conservation of water supply equipment

(3) Energy conservation management and trial calculation example of effect

4.1.5 Energy Management of Conveyance Equipment

(1) Elevator

(2) Escalator

4.1.6 Analysis and evaluation technique of energy consumption

4.1.7 Check list of energy management building etc.

Section 2 Management Standard and Report Document

4.2.1 Judgment Standard and Management Standard in Building etc.

(1) Standard portion and target portion

(2) 6 fields and 4 management items of standard portion

(3) Standard values and target values of 6 management items

(4) Equipment and management standard

4.2.2 Preparation of Management Standard of Building etc.

(1) Outline of management standard

(2) Judgment standard and management standard

(3) Composition of management standard

(4) Contents of management standard

(5) Grasping of actual condition of energy consuming

(6) Analysis of record and data

4.2.3 Notification and reporting of Buildings by Law Concerning Rational Use of Energy

(1) Submission of “Notification of energy use situation notification”

(2) Submission of "Notification of assignment (death or dismiss) of Energy management officer”

(3) Periodical report

(4) medium- and long-term plan

Supplement 7

Punishment in Energy Conservation Law in Japan

Punishment on factories, buildings and freight carriers — Enacted on 1 April 2006

No.	Contents of violation	Specified Atricle (Applied Article)	Punishment of violation
1	Violation to regulation of appointment of Energy Manager	Article 8 Paragraph 1	Fine of less than 1,000,000 yen
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
2	Violation to regulation of appointment of Energy Management Officer	Article 13 Paragraph 1 (Article 18 Paragraph 1)	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
	(Type 2 Specified Business Operator), (Type 2 Designated Energy Management Factory)		
3	Violation of instruction and order on rational plan	Article 16 Paragraph 5	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
4	Violation of order by regulation of recommendation on rational use of energy in freight	Article 57 Paragraph 3 (Article 69)	
	(Specified Freight Carrier)		
5	Violation of order by regulation of recommendation on rational use of energy in freight	Article 64 Paragraph 3	
	(Specified Carrier)		
6	Violation of order by regulation of recommendation on improvement of performance for energy conservation of Specified Equipment	Article 79 Paragraph 3	
	(Manufacturer/importer of Specified Equipment)		
7	Violation of order by regulation of recommendation on indication of energy consumption efficiency of Specified Equipment	Article 81 Paragraph 3	
	(Manufacturer/importer of Specified Equipment)		
8	No notification or a false notification by regulation, nevertheless energy consumption in the previous business year is more than the amount to be applied to Type 1 Designated Energy	Article 7 Paragraph 2	Fine of less than 500,000 yen
	(Business operator that has a Factory)		
9	No notification or a false notification by regulation, nevertheless energy consumption in the previous business year is more than the amount to be applied to Type 2 Designated Energy	Article 17 Paragraph 2	
	(Business operator that has a Factory)		
10	No notification or a false notification by regulation for each freight transportation category, when the transportation capacity is beyond the specified level	Article 54 Paragraph 2	
	(Freight Carrier)		
11	No notification or a false notification by regulation of volume of freight transportation, nevertheless volume of freight transportation that a Consigner make a Freight Carrier transport is beyond the level specified by Cabinet Order	Article 61 Paragraph 2	
	(Consigner)		
12	No notification or a false notification by regulation for efficient use of energy in new construction, reconstruction, extension, repairing, remodeling, or retrofitting of Specified Building beyond the size specified by a Cabinet Order	Article 75 Paragraph 1	
	(Specified Construction Client), (Specified Building)		
13	No notification by regulation of a medium- and long-term plan	Article 14 Paragraph 1	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
14	No notification by regulation of a medium- and long-term plan	Article 55	
	(Specified Freight Carrier)		
15	No notification by regulation of a plan for archieving the target for rational use of enegy in freight transportation consigned to a Freight Carrier	Article 62	
	(Specified Consigner)		
16	Violation to regulation of participation of a person who has a qualified Energy Manager's license in the preparing process of medium- and long-term plan	Article 14 Paragraph 2	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
17	No Reporting or a false reporting by regulation of periodical report	Article 15 Paragraph 1 (Article 18 Paragraph 1)	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
	(Type 2 Specified Business Operator), (Type 2 Designated Energy Management Factory)		
18	No Reporting or a false reporting by regulation of status of energy use in freight transportation for each Freight Transportation Category	Article 56 Paragraph 1 (Article 69)	
	(Specified Freight Carrier)		
19	No Reporting or a false reporting by regulation of status of energy use in freight transportation consigned to Freight Carrier	Article 63 Paragraph 1	
	(Specified Consigner)		
20	No Reporting or a false reporting by regulation on the status of maintenance of Specified Building	Article 75 Paragraph 4	
	(Specified Construction Client)		
21	No Reporting or a false reporting on the status of business in a Factory by regulation Refusal, obstruction or avoidance a inspection by regulation	Article 87 Paragraph 1 to 3	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
	(Type 2 Specified Business Operator), (Type 2 Designated Energy Management Factory)		
22	No Reporting or a false reporting on the status of business in a enterprise by regulation Refusal, obstruction or avoidance a inspection by regulation	Article 87 Paragraph 5 to 11	
	(Freight Carrier), (Specified Freight Carrier), (Consigner), (Specified Consigner),		
	(Specified Construction Client), (Manufacturer/importer of Specified Equipment) and others		

No.	Contents of violation	Specified Atricle (Applied Article)	Punishment of violation
23	When a violence to above matters is commited, not only the offender is punished but also the juridical person or individual is punished by the fine prescribed in the respective Articles	(Article 98)	
24	No notification or a false notification by regulation on appointment or dismissal of Energy Manager	Article 8 Paragraph 2	No-penal fine of less than 200,000 yen
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
25	No notification or a false notification by regulation on appointment or dismissal of Energy Management Officer	Article 13 Paragraph 3 (Article 18 Paragraph 1)	
	(Type 1 Specified Business Operator), (Type 1 Designated Energy Management Factory)		
	(Type 2 Specified Business Operator), (Type 2 Designated Energy Management Factory)		

Note: Penalty on passenger transportation and air transportation is not included in the above table.

Punishment on Designated Examination Body for Energy Manager and Registered Investigation Body

	Contents of violation	Specified Atricle (Applied Article)	Punishment of violation
26	Violation to regulation of obligation of confidentiality of officers or employees	Article 30 Paragraph 1 Article 51	Imprisonment with work for less than 1 year Fine of less than 1,000,000 yen
	(Designated Examination Body for Energy Manager)		
	(Registered Investigation Body)		
27	Violation to regulation of rescission of the registration or order of suspention of services	Article 49	
	(Registered Investigation Body)		
28	Violation to regulation of order of suspention of services	Article 32 Paragraph 2Article 36 Paragraph 2	
	(Designated Examination Body for Energy Manager)		
	(Designated Training Agency for Energy Management Officer)		
29	No notification or a false notification by regulation of susupention or abolishment of services	Article 46, Article 37	Fine of less than 500,000 yen
	(Registered Investigation Body)		
	(Designated Training Agency for Energy Management Officer)		
30	No Reporting or a false reporting on the status of business and accounting by regulation Refusal, obstruction or avoidance a inspection by regulation	Article 87 Paragraph 4 to 5	
	(Registered Investigation Body), (Designated Examination Body for Energy Manager)		
	(Designated Training Agency for Energy Management Officer)		
31	No Reporting or a false reporting on keeping of books and stating of matters in the books Refusal, obstruction or avoidance a inspection by regulation	Article 51, Article 33 Paragraph 1 to 2	
	(Registered Investigation Body), (Designated Examination Body for Energy Manager)		
	(Designated Training Agency for Energy Management Officer)		
32	Violation to regulation of abolishment of Examination Affairs without permission of Minister of Economy, Trade and Industry	Article 25	
	(Designated Examination Body for Energy Manager)		
33	Violation to regulation of keeping of finacial statement, or stating of matters in finacial statement Refusal of request of inspection or copy of finacial statement	atricle 47 Paragraph 1 to	No-penal fine of less than 200,000 yen
	(Registered Investigation Body)		

Supplement 8

Exploration into the Concepts of *Energy Intensity /Elasticity*

December, 2007

Electric Power Development Co. Ltd., Japan

Presentation Outline

- **Energy Intensity**
- What is Energy Intensity?
- How is it related to the policy issue?
- How to measure Energy Intensity?
- Is Aggregate Energy Intensity a good indicator to measure energy efficiency?
- How about the Sectoral and Sub-sectoral Energy Intensities?
- **Energy Elasticity**
- What is Energy Elasticity?
- How is it related to the policy issue?
- Difference in energy elasticity between developed and developing countries
- **Indonesia's Energy Intensity and Energy Elasticity**
- Data availability for the calculation
- Tentative results of calculation
- Doubtful points needed to be clarified
- Further request for desirable data

What is Energy Intensity?

The term "**energy intensity**", also called "**energy ratio**", indicates the ratio of energy use to GDP, meaning the total energy being used to support economic and social activity. It represents an aggregate of energy consumption resulting from a wide range of production and consumption activities. Therefore, it could be called "**aggregate energy intensity**" or "**economy-wide energy intensity**".(With reference to the definition given by ***the UN Department of Economic and Social Affairs***)

How is it related to the policy issue?

•Purpose:

Trends in overall energy use relative to GDP indicate the general relationship of energy consumption to economic development and provide a rough basis for projecting energy consumption and its environmental impacts with economic growth. ***For energy policy –making, however, sectoral or sub-sectoral energy intensities should be used***.

•International Conventions and Agreements :

UNFCCC (United Nation Framework for Climate Change Convention) and its **Kyoto Protocol** call for limitations on total greenhouse gas emissions, which are dominated by CO2 from fossil fuels.

How is it related to the policy issue?

•International Targets/Recommended Standards :

There are no specific targets for energy intensity. The Kyoto Protocol sets targets for total greenhouse gas emissions for developed countries only.

•Linkages to Other Indicators :

The ratio of energy use to GDP is an aggregate of sectoral energy intensity indicators and is thus linked to the energy intensities for the manufacturing, transportation, commercial/services and residential sectors. This indicator is also linked to ***indicators for total energy consumption, greenhouse gas emissions and air pollution emissions***.

How to measure Energy Intensity?

•Measurement of Energy Use :

Total and sectoral energy consumption is obtained from national energy balances. Household and services/commercial consumption should be carefully separated, and manufacturing should be separated from other industries and agriculture.

Unit: Energy is measured in terajoules (TJ, 1012J), petajoules (PJ, 1015J), or exajoules (EJ, 1018J).

•Measurement of Output :

Components of GDP should be deflated to constant dollars by chaining each component, not simply by deflating each component by the overall GDP deflator.

Unit: GDP is measured in US dollars, converted from real local currency at purchasing power parity (PPP) for the base year to which local currency was deflated.

Energy Intensity

Is Aggregate Energy Intensity a good indicator to measure energy efficiency?

----No, because of the limitations below.

- **Susceptibility to Changes in the Economic Structure and Sectoral Energy Intensities**
- **Differences among Products Complicating Energy Intensity Measurement**
- **Geographical Factors Influencing the Comparison of Energy Intensity among Countries**
- **Difference of Energy Sources Confusing the Interpretation of Energy Intensity**

Energy Intensity

How about the Sectoral and Sub-sectoral Energy Intensities?

----Opinions given by the UN Department of Economic and Social Affairs:

- **The ratio of sectoral or sub-sectoral energy use to the output or activity of the sector or sub-sector provides a more useful indicator of energy intensity.**
- **Total energy use should be disaggregated into components, by sector (manufacturing, transportation, residential, commercial/services, industry, agriculture, construction, etc.) or sub-sector.**
- **For each sector or sub-sector, energy use can be related to a convenient measure of output to provide a sectoral or sub-sectoral energy intensity.**

E.g. > energy use for steel-making relative to tonnes of steel produced
> energy consumption by passenger vehicles relative to passenger- or vehicle-kilometers
> energy consumption in buildings relative to their floor area.

What is Energy Elasticity?

•The term "**energy elasticity**", also known as "**energy coefficient**", refers to the susceptibility (or sensitivity) of energy consumption in response to the growth of GDP, or in other words, the percentage change in energy use associated with one percent change in economic activity. (***F. Gerard Adams and Peter Miovic***)

•While "**energy intensity**" is a concept with implication of "**average**", "**energy elasticity**" is a concept with implication of "**marginality**". ***(Ozawa Masaharu)***

How is it related to the policy issue?

•The long term forecast of energy consumption is usually based on functional relationships between energy consumption and economic activity, regarding which past studies in Western Europe and the United States have frequently used the "**energy elasticity**".

•**The implicit "energy elasticity"** remains an important consideration in judging the reasonableness or consistency of the forecast, though recent work has tended toward increased methodological sophistication.

(F. Gerard Adams and Peter Miovic)

Energy Elasticity

Difference in energy elasticity between developed and developing countries

•Since **in advanced economies fuel use appears to grow more slowly than GNP**; the elasticities generally have been found to be less than 1.0. Gross elasticities of energy consumption with respect to GNP have been estimated variously as between 0.7 and 0.9 and somewhat lower with respect to industrial production. In the developing countries, in contrast, the elasticity is frequently substantially above 1.0.

•**The substitution of more efficient fuels for less efficient fuels** in developed countries is considered the major reason for the lower energy elasticity in developed countries as compared with the developing countries.

(F. Gerard Adams and Peter Miovic)

Indonesia's Energy Intensity and Energy Elasticity

Data availability for the calculation

----For the Calculation of Energy Intensity (1)

•For the Calculation of "Economy-wide Energy Intensity"
> Total Final Energy Consumption: APERC Database
> Nominal and Real GDP (Rp): The IMF "International Financial Statistics"
> GDP Deflator(Index:2000=100): The IMF "International Financial Statistics"
> Implied PPP Conversion rate (Rp/$)

•For the Calculation of "Sectoral Energy Intensities"
>Final Energy Consumption by Sector: APERC Database, MEMR
(Agriculture, residential & commercial sector, industry, transport available)
>Output by Sector Expressed in Value Added: Statistics Indonesia,
(Constant Prices with 2000 as the Base Year, available from 2003~2005)

Indonesia's Energy Intensity and Energy Elasticity

Data availability for the calculation

----For the Calculation of Energy Intensity (2)

•For the Calculation of "Sub-sectoral Energy Intensities"
>Final Energy Consumption by Sub-sector: MEMR
(Metal, paper, chemistry, textile, food, commerce, etc. available, but iron & steel not available)
> Output by Sub-sector Expressed in Value Added: Statistics Indonesia,
(Constant Prices with 2000 as the Base Year, available from 2003~2005)
> Output by Sub-sector Expressed in Physical Output or Built Area:
Not available

Indonesia's Energy Intensity and Energy Elasticity

Data availability for the calculation

----For the Calculation of Energy Elasticity

•Growth Rate of Real GDP:
The IMF "International Financial Statistics"

•Growth Rate of Total Final Energy Consumption:
APERC Database

Indonesia's Energy Intensity and Energy Elasticity

Tentative results of calculation

•Result of the "Economy-wide Energy Intensity" Calculation (Figure 1, Figure 2)

The economy-wide energy intensity rose sharply in 2004, and kept in a high level in 2005.

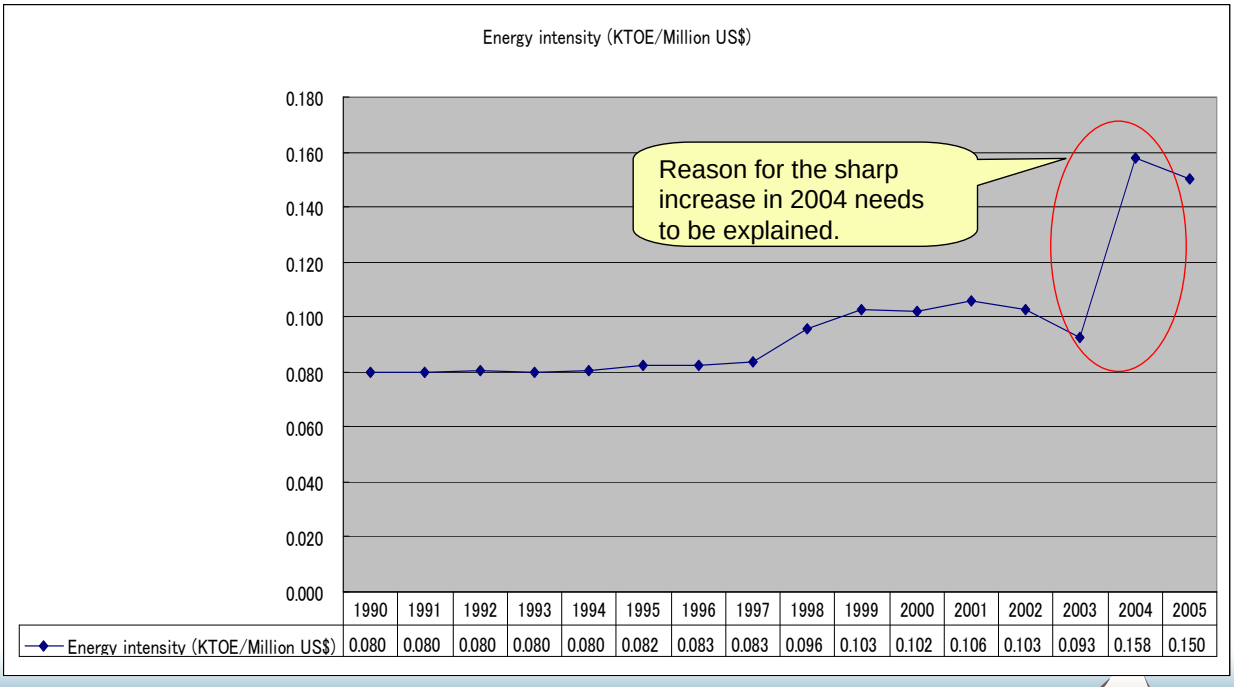
•Results of the Calculation of Energy Intensity in the Sectors of Industry and Commerce (Figure 3, Figure 4)

The energy intensity in industry sector reached the peak in 1999 and has since then gone down gradually, while that in commercial sector has nearly always been in the increase since 1990.

•Result of the Calculation of Energy Elasticity (Figure 5)

The energy elasticities in 1991, 1993, 1998, 2000, 2002, 2003 and 2005 were lower than 1, while all the others were above 1, with those of 1999 and 2004 in extremely high levels.

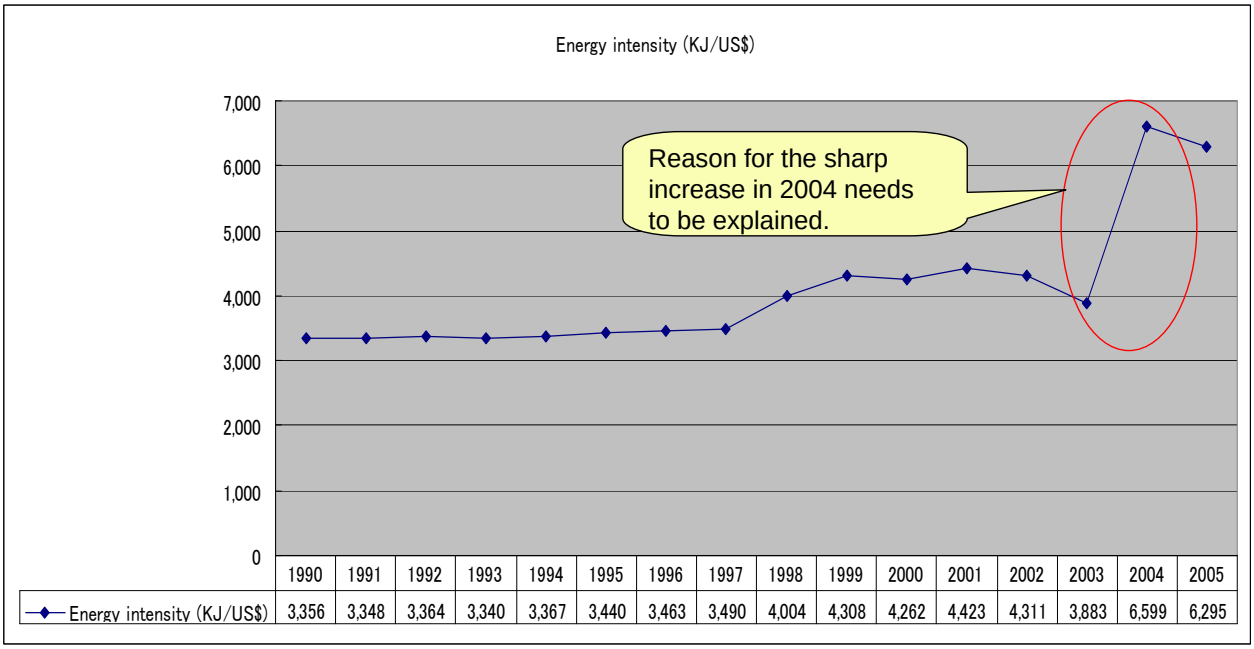
Figure 1: Economy-wide Energy Intensity (KTOE/Million US$)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy intensity (KTOE/Million US$)	0.080	0.080	0.080	0.080	0.080	0.082	0.083	0.083	0.096	0.103	0.102	0.106	0.103	0.093	0.158	0.150

Sources: The IMF "International Financial Statistics"; APERC Database

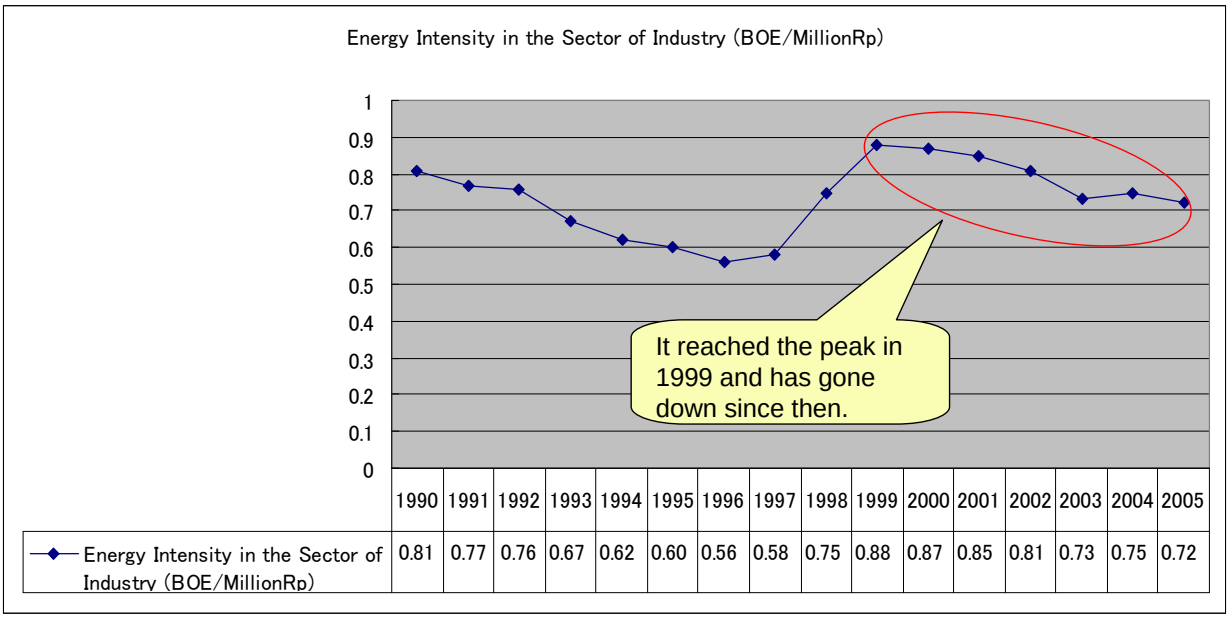
Figure 2: Economy-wide Energy Intensity (KJ/US$)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy intensity (KJ/US$)	3,356	3,348	3,364	3,340	3,367	3,440	3,463	3,490	4,004	4,308	4,262	4,423	4,311	3,883	6,599	6,295

Sources: The IMF "International Financial Statistics"; APERC Database

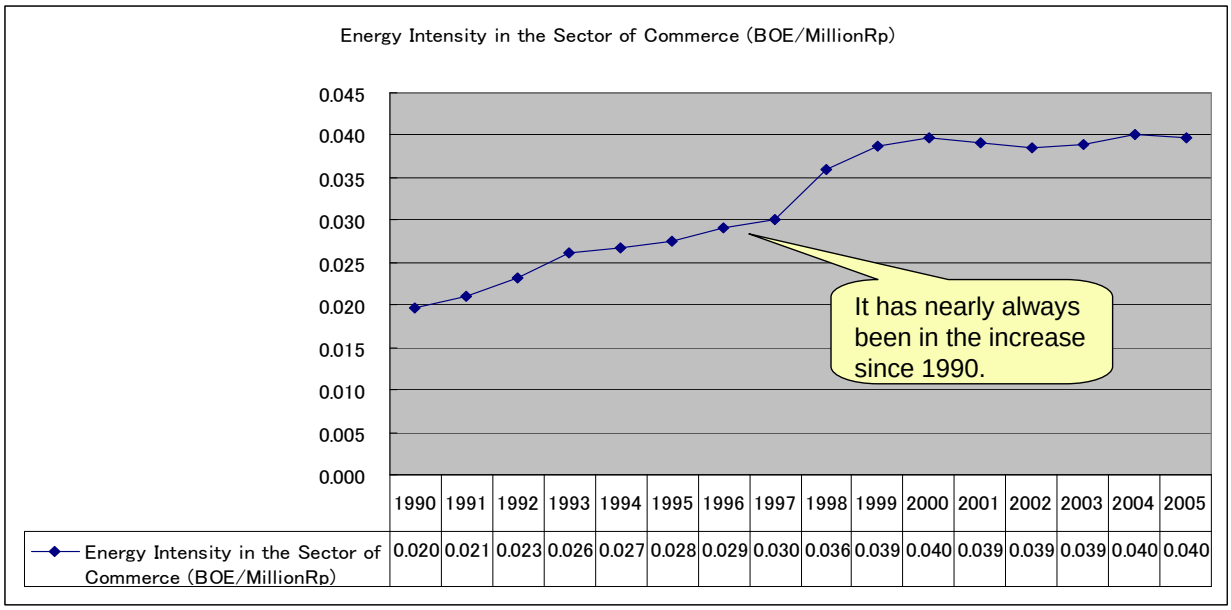
Figure 3: Energy Intensity in the Sector of Industry (BOE/Million Rp)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy Intensity in the Sector of Industry (BOE/MillionRp)	0.81	0.77	0.76	0.67	0.62	0.60	0.56	0.58	0.75	0.88	0.87	0.85	0.81	0.73	0.75	0.72

Source: MEMR Data

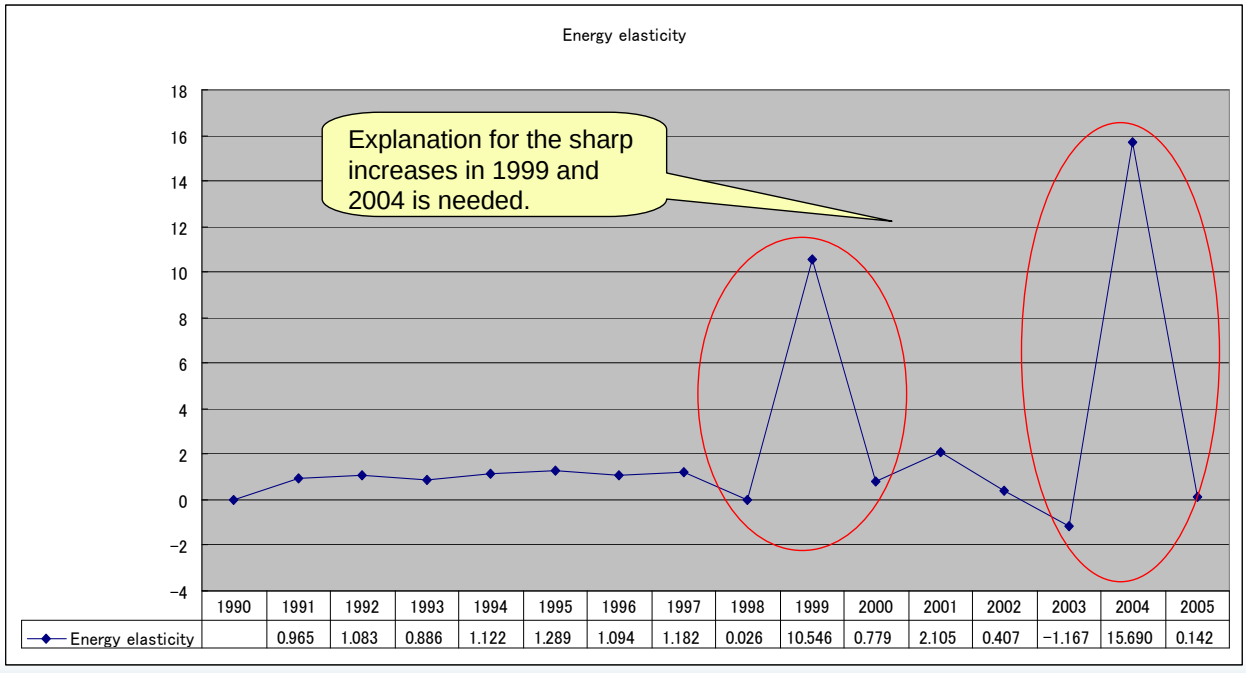
Figure 4: Energy Intensity in the Sector of Commerce (BOE/Million Rp)



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy Intensity in the Sector of Commerce (BOE/MillionRp)	0.020	0.021	0.023	0.026	0.027	0.028	0.029	0.030	0.036	0.039	0.040	0.039	0.039	0.039	0.040	0.040

Source: MEMR Data

Figure 5: Energy Elasticity



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy elasticity		0.965	1.083	0.886	1.122	1.289	1.094	1.182	0.026	10.546	0.779	2.105	0.407	−1.167	15.690	0.142

Sources: The IMF “International Financial Statistics”; APERC Database

Indonesia's Energy Intensity and Energy Elasticity

Doubtful points needed to be clarified

•Why the "Economy-wide Energy Intensity" rose so sharply in 2004 as seen in Figure 1 and Figure 2?

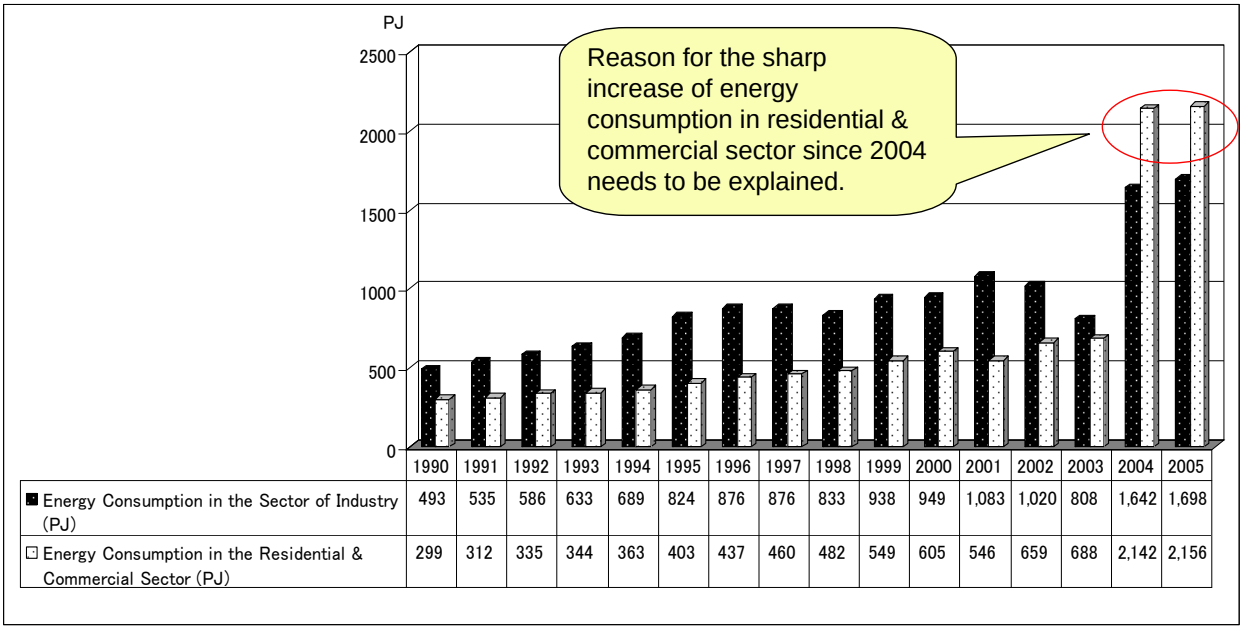
----The reason for this sharp increase might be explained by the change of relative energy consumption among sectors which might have been brought about by the structural change of the economy, but two more questions arise.

•As shown in Figure 3, it is in the year of 2004 that energy consumption in the residential & commercial sector soared to the level well above that of the industry sector which had always been the top energy consumer by that year. But **why the "Economy-wide Energy Intensity" should increase rather than decrease, since normally the growth of commercial sector relative to manufacturing would contribute to the long-term reduction in the total**

•Even the **reason for the drastic increase of energy consumption in the residential & commercial sector in the year of 2004** itself is hard to understand. This puzzle needs to be solved. (Figure 6)

•The reason for the sharp increase of energy elasticity in 2004 needs to be explained.

Figure 6: Energy Consumption in the Industry Sector and Residential & Commercial Sector



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
■ Energy Consumption in the Sector of Industry (PJ)	493	535	586	633	689	824	876	876	833	938	949	1,083	1,020	808	1,642	1,698
□ Energy Consumption in the Residential & Commercial Sector (PJ)	299	312	335	344	363	403	437	460	482	549	605	546	659	688	2,142	2,156

Sources: APERC Database

Indonesia's Energy Intensity and Energy Elasticity

Further request for desirable data

In addition to the clarification of the afore-mentioned doubtful points, it would be highly desirable to acquire the following data for the calculation of Indonesian sectoral and sub-sectoral energy intensities:

- **Final energy consumption in the sub-sector of iron & steel**
- **Output by sub-sector expressed in physical output or built area**
- **Way of calculation regarding the data of energy intensities in the sector of industry and the sector of commerce already provided**
- **Deflators for the sectors of industry and commerce**

(It would be grateful if MEMR or MOI or BPS could provide these data.)

2007/11/13

Introduction of BEMS

§ 1. Transition of system of building management

(1) In 1980's, the building monitoring system has positively been adopted.

① The displays to the monitor of the information of the operating condition and the breakdown of equipment, etc.

② Automatic alarm function to management center with phone line.

③ The system has evolved to BAS by adding the control function to this.

④ Furthermore, the prototype of today's building management system has been completed adding the function of the quantitation and measurement.

(2) In 1990's, FM (Facility Management) has been introduced for strategic maintenance.

① The reduction of LCC(Life Cycle Cost)

② The offer of amenity building environment.

③ The security function of the building is also enhanced, too.

(3) In 2000's, the energy management system which can efficiently manage and control energy has been introduced.

① The system which integrates functions of the system of the past building management and that of the system of the energy management is called BEMS.

② It seems that BEMS will be grew up and developed as a system of the type in the future in the 21st century.

③ The access of data becomes possible on the Internet and Intranet recently, and the effect is being improved by the opening (Sharing of protocol) further.

§ 2. What is BEMS?

① BEMS (Building and Energy Management System) is a term used widely in EC block, and considered that past management system; BA(S) (building automation (system)), EMS (energy management system), and BMS(building management system), etc were integrated.

② BEMS is a system to understand the consumption energy and the indoor environment in the building, and to contribute for energy conservation, that is, to achieve the best environment by minimum energy.

③ Concretely, it is consisted of the measurement and quantitative device, the controller, the monitor, the data save or analysis, and the audit device, etc.

§ 3. Role of BEMS

① The main feature of BEMS is in the point of view on the energy conservation law, and in the optimization of the primary energy.

That is, BEMS can be called a system which intends to optimize or minimize all demand in the building like the building environment, the building use, the equipment maintenance, the energy consumption, and the operating cost, etc, and also to enable the self-diagnosis such as the breakdown detection and the prediction, etc.

② To always keep an optimum state the environment and energy conservation in the building corresponding to the outside conditioned change, the fluctuation of the load, and the characteristic of equipment system, the measurement, control, and monitoring, of various state values are done, and in addition, the performance of the system is evaluated.

③ The building more than a certain scale, the building group, and DHC(district heating and cooling), etc, is in the trend planned as an integrated information system with the energy management by the introduction of BEMS and with the facility management by the common information network and computing system, etc. (Refer to Fig-1 Composition of integrated BEMS, Table-1A & B Abbrev of integrated BEMS)

④ Information on the environment and energy management reaches even at an individual level by introducing BEMS, and it becomes possible achieving energy conservation optimizing an individual environment.

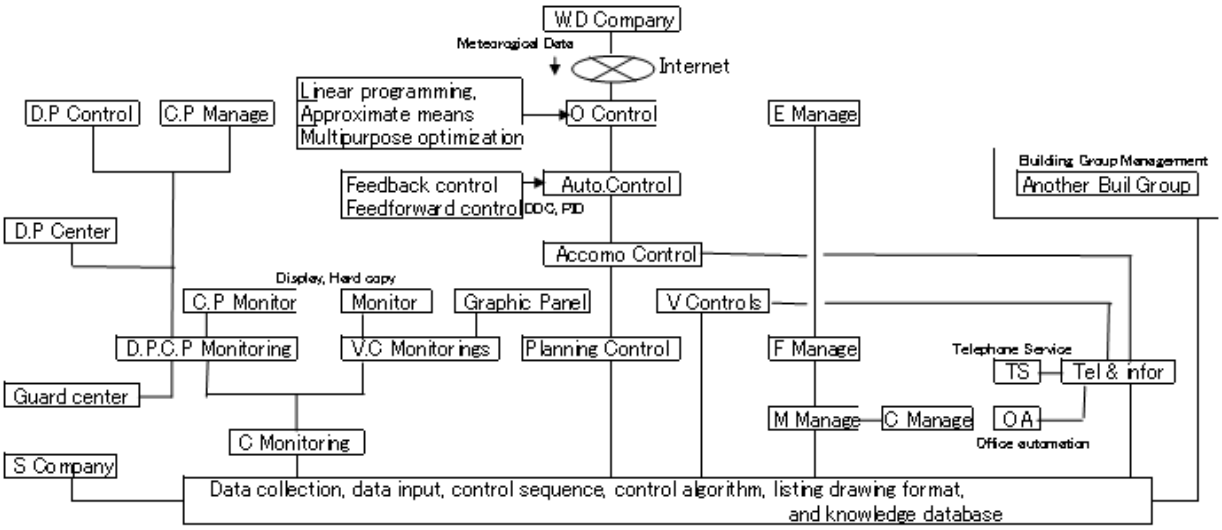


Fig 1 Composition of integrated BEMS

Table 1A Abbrev of integrated BEMS

Abbrev	Function	Details
D.P Control	Disaster prevention control	Flue gas system, air-conditioning, ventilation system, extinction system, emergency elevator, and power supply system
D. P Center	Disaster prevention center	Disaster prevention information
C.P Manage	Crime prevention management	Entering/leaving to a room, the keeping of key, invasion monitoring, and inter locking control
D.P.C.P Monitoring	Disaster prevention and crime prevention monitoring	
S Company	Specialized company	Remote monitoring, remote control, and remote meter-reading
C.P Monitor	Crime prevention monitor	
C monitoring	Condition monitoring	
V.C Monitorings	Various condition monitorings	Environment measurement information, energy measurement and quantitation information, equipment drive situation (display, warning, and daily report), system state, and maintenance situations
W.D Company	The weather deliver company	
O Control	Optimizing control	Environmental condition value, thermal storage situation, and equipment drive situation
Auto Control	Automatic control	The temperature and humidity, control of air, and illuminance management
Accommo Control	Accommodative control	

Table 1B Abbrev of integrated BEMS

Abbrev	Function	Details
Planning control		Scheduled control, sequential control, remote ON/OFF, and inter locking control (crime prevention and telephone)
V Controls	Various controls	Parking lot management, Specific work operations(hotel system and hospital system)
E Manage	Executive management	Cost calculation(utility bill, tenant fee), Real property management (building, equipment, drawing, and fixture), Rentable management, Personnel management (Going to /leaving from office) Safety management
F Manage	Facilities management	Life Cycle Cost management
M Manage	Maintenance management	Energy, equipment efficiency, preventive maintenance, equipment drawing, ledger, and breakdown and repair history
C Manage	Cleaning management	
Tel & Inform	Telephone and information	Telephone accounting, telecontrol (air-conditioning and lighting), and conferencing systems

§ 4. Current state of BEMS in Japan

■ In the revision of “the Law Concerning Rational Use of Energy” enforced in April, 2003,

Criterion The following regulations were added as "Point of the criteria revision" about the utilization of BEMS.

An appropriate air conditioning should be able to control, by understanding the state such as temperature and humidity at each air-conditioning division, by installing the quantitative device and a sensor, etc necessary for measuring, and by adopting the system such as BEMS.

Target Examine efficient use of energy by the measures such as the following matter about BEMS.

① The energy management should be executed every year, every season, every month, every week, every day and every time, etc according to the system, and considered to understand the energy consumption trends compared in the numerical value and the graph, etc with past results.

② A comprehensive energy control in the air conditioners and electric equipment, etc should be carried out.

③ Compare and study the maintenance situation and operation time etc of the instrument and equipment, and consider to understand the deterioration situation and the maintenance time etc of the instrument and equipment.

■ About the public advertisement of the house and the building highly effective energy system introduction promotion enterprise (BEMS introduction support enterprise)

(1) Outline of enterprise

When BEMS to conduct the best management of the energy demand is introduced, a part of the cost is subsidized.

(2) Subsidized object person

Construction owner and ESCO entrepreneur etc. when BEMS is introduced into commercial sector building of existing building, new construction, addition to a building, and rebuilding.

(3) Subsidized requirement

① To introduce BEMS into the new construction, existing building, the addition to a building, and rebuilding.

② To be able to reduce the amount of the consumed energy by introducing BEMS.

However, based on "Law Concerning Rational Use of Energy", fill the performance based on "Criteria of the construction owner concerning rationalization of use of energy which affect the building" in the building of the new construction, the addition to a building, and rebuilding.

③ To be able to quantitate energy at each equipment division of the heat source (refrigerating machine, heat pump, and cooling tower), the pump, the lighting, the outlet, and others .

④ To be able to collect and save data of the measurement and quantitation.

⑤ To be maintain the system of the energy management.

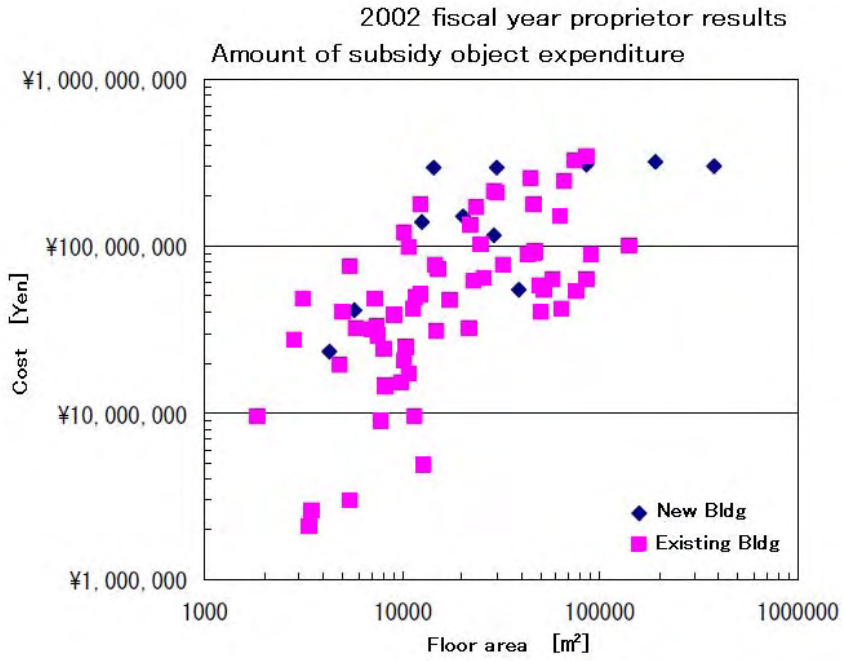
⑥ After introducing BEMS, to be able to be executed the report concerning energy conservation continuously for three years

(4) Subsidization rate in 2004 fiscal year is within 1/3 of expenditure, and the upper limit for one is 100,000,000 yen.

(5) where to call ; NEDO

(6) 2002 fiscal year proprietor result

Refer to FIg-2 Management point, Cost, and Floor area



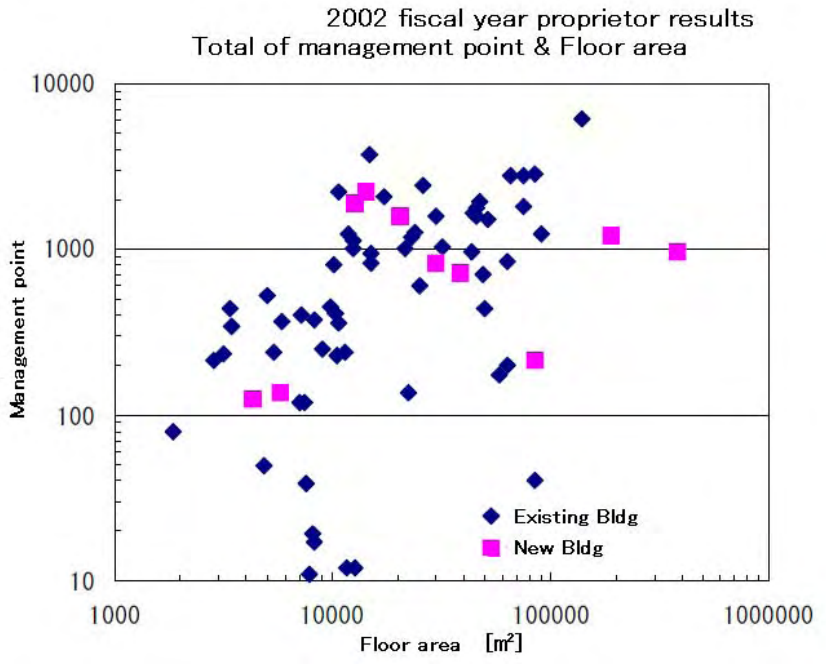


Fig 2 Management point, Cost, and Floor area

§ 5. The feature of BEMS

① BEMS is a system which can plan and control the way of best driving the primary energy cost in the minimum by analyzing and forecasting the energy demand.

Here, as an element of the energy demand, it is a external information, and an energy price composition etc. on the monitoring and measured data of the equipment, the weather (outside temperature and absolute humidity), and day of the week, etc.

② There were the following problems because the drive and the operation of equipment is done by the experience of the engineer so far.

- It is not possible to follow to a rapid workload fluctuation.
- It is drive management intended for the few numbers of equipment.
- It is not considered the primary energy cost.

However, because BEMS can arbitrarily select the peformance function (objective function) and the management target value as a standard of the system optimization, the operation mode of the energy conservation priority or the cost saving priority can be changed requesting the amenity or more.

③ The Man-machine function with the drive manager

Integrated energy management including the demand equipment can execute by the man-machine function's joining a past building management function (monitoring, control, quantitation, and measurement of individual local information).

④ Moreover, to satisfy these functions, hierarchization and decentralization are constructed properly as a coupling system as shown in fig-1.

Decentralization contributes to promotion of the standardization of the device, and hierarchization guarantees the structure of optimization, but n ever lack mobility and optimization due to bias to these either too much.

§ 6 About the energy quantitation

① The energy device is installed to understand the realities and the composition of the amount of the energy consumption in the building, find and examine of a necessary part of the energy conservation measures, and verify the effect after measures implementation.

② To do the energy measurement effectively, it is necessary to measure and quantitate as much as possible at each small division of the usage and system.

Moreover, the measurement should be executed continuously over a long period of time to reflect effectively in maintenance and the management of this result.

③ In case BEMS is set up more than the medium scale building, it is necessary to carry out the effective or more energy management of the trend and forecast by adding the collection preservation function and the analysis function of data in the automatic processing function of the monitoring and record of the energy quantitation.

④ As energy of quantitative object, all kind of the amounts of energy and volume of water input to the building, a measurable device is installed in of each.

However, the sun solar radiation energy which becomes a thermal loading directly, energy by

heat conduction and the thermal transfer from the atmosphere and earth, and energy by the intake air, etc are excluded from the quantitative object.

§ 7. Quantitative division

To examine the quantitative division, the realities in the building, and possibility of energy conservation, etc. needs the plan along the following like becoming of the clearness.

① The amount of the whole energy consumed in the building is quantitated indirectly or directly according to the use kind of energy. the building use and the floor, etc.

② The electric power is quantitated to three kinds distinguishing for the heat source of air-conditioning and sanitary, the lighting and outlet, and others.

Moreover, the electric power for the air-conditioning transportation such as the blower power in for the heat source is measured in the building more than medium scale distinguishing.

Similarly, the electric power for the illumination in for lighting and outlet, the elevator in for others, etc. is necessary for weighable independently.

③ The gas and oil are quantitated to 2 varieties for the heat source of air-conditioning and sanitary distinguishing.

Moreover, the electric power is quantitated for air-conditioning in for the heat source independently in the building more than medium scale

④ Water is quantitated to 2 varieties for the air-conditioning and for others in the building more than medium scale distinguishing.

⑤ When the thermal energy supply is received from district facilities etc. , should be weighable distinguishing 2 varieties for air-conditioning and for others.

Similarly, when the supply of electricity is received, is quantitated according to above-mentioned ① and ②.

§8. Meters (measuring instrument and quantitative device)

In general, the one to measure instantaneous value (temperature, electric current, voltage, and flowing quantity, etc.) is called a measuring instrument, and the one to measure the integrated value (electric energy and calorie, etc.) is called a quantitative device.

① Though the quantitative division is set as in detail as possible as described in §7 the meter always set up limits the use frequency a lot, the one with a little frequency is measured by diverting a portable meter.

② As for the meter always set up, durability and reliability are especially demanded because operating ratio is high and the use environment is bad,

Moreover, when installing the meters, the instrumentation should be considered never to pick up the inducement noise from the power line,

③ Because a portable meter use a lot of the general purpose type, when measuring, the measurement value should be suitable in the measuring range of the meter.

④ Because the meter used in BEMS is allowed to a relative value of the amount of the energy consumption, accuracy equal with the supply meter is not necessarily needed.

However, it is necessary to use the same one of the measurement principle.

⑤ It is necessary that the measurement of efficiency of the refrigerator, boiler, and heat exchanger, etc, and the flow-meter and integrating type calorimeter used to energy management for exclusive use are chosen considering flowing quantity measuring range and temperatures fluctuate tolerance enough.

⑥ The amount of consumption at oil (Water) is measured by integrating flow-meter or the ultrasonic flow-meter, etc set up in oil feed pipe (Water pipe).

⑦ Because a lot of kinds of systems are being sold by each company for the energy measurement and management recently, what suitable for the fact is selected.

§ 9 Measurement point of energy management

Table (refer to Table-2 Measurement point of energy management) shows the content of the measurement of typical energy management.

It is necessary to apply the control system and the control instrument which corresponds to the controlled object when actually measuring.

(1) Application of control system

① The scale and the character, etc of equipment are ascertained enough, and adopt the system to satisfy economical and desired accuracy.

② When the offset (steady-state deviation) in the proportional control negatively affects energy conservation or the environment, and correct the action by the integral control action.

③ It is necessary to adjust a gain at least every season because the optimum value changes into the parameter (gain) for the control by the change in the outside circumference.

The consideration such as making the self adjustment adding the learning function is necessary.

④ The installation position of the indoor temperature sensor is avoided near the doorway and the window, and should be installed in the position where the controlled object zone is represented.

⑤ When the plane or up and down in the indoor is forecast the unbalance of the temperature distribution, and set the sensor up noting the common position.

Depending on circumstances, it is necessary to divide the controlled object and set up two or more temperature sensors.

(2) Selection of control instrument

The selection of the control instrument is assumed to be the following priority levels.

① When the system can use with self action type enough, should be used as much as possible for the self action type control instrument.

② It is effective to use electronic, that there is no moving element, the measurement accuracy is good, and the amount of the energy consumption is a little.

③ The digital control by the computer is generalized.

Decentralized control becomes possible because of the extensibility and making to low-cost.

④ When the complex control modes like the amenity and energy saving, etc. are needed, the adoption of DDC(Direct Digital Control) is effective.

⑤ When aiming at optimum control, in addition to DDC, the statistical technique and the mathematical programming, etc. are researched and have been put to practical use.

Table 2A Measurement point of energy management

Equipment			
	Control item	Measuring item	The way of measuring, etc.
Electric			
	Power incoming	The electric usage of the entire building, and receiving voltage, current, power	Measure at the appointed time of every day and compare the data with the standard value, in addition, manage the demand.
	Transformer	Primary voltage, secondary voltage and current	Measure at the appointed time of every day and record in the daily inspection table, in addition, manage the load factor calculating.
	Phase-advanced condenser	Power factor	Measure at the appointed time, record in the daily inspection table and manage to become 100%.
	Distribution feeder	Voltage, current, power, and electric energy	
	Lighting	Illuminance	Deside, measure, and record the measurement point beforehand.
Boiler			
	Combustion equipment	Exhaust gas temperature, supply air temperature	Analyze and record the boiler exhaust gas, and manage the air ratio.
	Operation management	Quantity consumed of fuel, amount of water supply, water quality, and starting frequency	Manage the combustion efficiency of the boiler.

Table 2B Measurement point of energy management

Equipment			
	Control item	Measuring item	The way of measuring, etc.
Air-conditioning			
	The indoor supercooling and overheating	The indoor temperature and humidity	Install the meter in the place where the realities of the temperature and humidity can be detected according to each system.
	Right or wrong of air-conditioning by outdoor air.	The outdoor temperature and humidity.	Avoid the influence of direct sunshine, ground, and the building.
	Amount of ventilation	Density of carbon dioxide	Measure the density of carbon dioxide of the indoor or return air, and control the intake air dumper, the ventilation dumper, and the exhaust dumper.
	Crogging of air filter	Difference pressure of air filter	Manage the twice an initial static pressure as a limit.
	The indoor load	The air volume, temperature, humidity, and volume of water in a doorway of air conditioning machine.	Check the dirt situation of the heat exchanger, and examine the cleaning time.
	Fan	Temperature, number of revolution of fan, intake pressure, dumper opening, discharge pressure, voltage, current, and electric energy	Confirm whether the rotation of the fan is proper.

Table 2C Measurement point of energy management

Equipment			
	Control item	Measuring item	The way of measuring, etc.
Refrigerator			
	COP of refrigerator	Evaporation pressure and condensation pressure of refrigerant, temperature of cold water, and temperature of cooling water, etc.	Calculate COP in the Mollier diagram, etc. and execute maintenance to become proper.
	Cold water temperature control	Cold water outlet temperature	The temperature of cold water is set to 7□ at the midsummer maximum output, and set cold water to be relatively high at light-load.
	Cooling water temperature control	Cooling water inlet temperature to refrigerator	Lower as much as possible though the design maximum temperature is 32□.
	Pump	Flow volume, temperature, number of revolution of pump, inlet pressure, discharge pressure, voltage, current, and electric energy, etc.	Confirm whether the drive of the pump is proper.
General of equipment			
	Energy consumption	Power, gas, oil. and water consumption of the entire building、each section, each tenant, and each building use	Understand the trend of three years.
	Energy intensity	Per floor area, per “output of work”	Understand the trend of three years.
	LCC	The operating time of equipment	Examine the drive efficiency of equipment and the maintenance interval is examined.

§10. Facility and equipment management systems

Details are omitted though divided into the monitoring, the operation, the control, the record, and the energy management, etc as a function of the facility and equipment management system.

§11. Energy conservation control item

It is necessary to select the necessary and sufficient control items to achieve energy conservation cooperating with the equipment system design in BEMS effectively as shown in Table -3 (refer to Table-3 Control contents for energy conservation)

Moreover, it is also important to be able to verify the operation and the effect about the software for that.

Table 3 Control contents for energy conservation

Kind of equipment	Classification of content	Control items	Remark
Air conditioning equipment	The one which concerns amount of intake air	Outdoor air cooling	The middle period
		Intake of minimum outdoor air	CO2 Density standard Intake outdoor air stop at pre-cooling
		Night purge	Air-conditioning at nighttime
		Heat recovery	Total enthalpy heat exchanger
	The one which concerns air conditioning secondary	Capacity control	VWV
		Air volume control of fan	VAV
		Intermittent operation control	Note the air environmental condition.
		The best start/stop control	Note the air environmental condition.
		Water supply temperature setting control	
	The one which concerns air conditioning heat source system	Control of the number of heat source equipment	
		Heat source temperature setting control	COP(coefficient of performance) management
		Thermal storage operation control	Load forecast
		Heat recovery control	
		Pre-cooling & pre-heating control	Optimizing control
Electric equipment	The one which concerns receiving and transforming equipment	demand supervisory control	
		Power factor improvement control	
		Load control of generator	At power failure、or at power return control
	The one which concerns lighting equipment	Blinking control by daylight use	Relation to window shade control
		Remote lighting control	
		Blinking control by interlock with crime prevention system	
		Absence room control by human sensor	
Sanitary equipment	The one which concerns sanitary equipment	The number control of pump	
		Pressurizing water supply device control	VWV
		Thermal storage amount control of hot water tank	

August 2007

Questionnaire on Energy Conservation Activity in Industrial Sector by MEMR DGEEU

Recently, there is something to be amazed in the sudden rise of the electricity rates and the price of oil. The Government of Indonesia is judging that promotion of energy conservation in each industry is indispensable for the stable energy supply and demand balance which secures competitiveness of domestic industries.

A long awaited energy law has been formally approved by the Parliament on 17th July 2007. Energy law will be expected to nominate intensive energy consumption factories, appoint Energy Managers and regulate the submission of periodical reports for energy conservation. Thus the energy management in your factories shall be promoted as very important activity.

This Questionnaire is made to obtain basic information to promote energy conservation and reduce energy cost. Please continue your favors toward the answer.

The result of this questionnaire is not used except the above-mentioned purpose. Moreover, individual and corporate names are not indicated.

We will inform you the analysis result of this questionnaire later. Please utilize it as a help to promote energy conservation.

Company	***/ President***
Replied by ***Name*** ***Section*** ***Phone***	***/ Email***
Date	

1. General

Name of factory	
Address	
Factory Manager name	
Energy Manager name	
Kind of products	
Annual production capacity	
Number of engineers	
Number of employees	
Fuel consumption in 2006 (kilo liter of oil equivalent)	
Power receiving transformer capacity in 2006 (kVA)	

2. Annual energy consumption and energy intensity

	2002	2003	2004	2005	2006
Production (ton, sets)					
Sales Amount (Rp)					
Fuel oil (kilo liter)					
Fuel gas (1000 m3N)					
Coal (ton)					
Other fuel (ton)					
Electricity (MWh)					
Contract demand (kVA)					
Fuel intensity					
Electricity intensity					

Note 1. Other fuel means saw dust, rice husks, palm oil shell etc.
Note 2. Fuel intensity = Fuel consumption (kilo liter, ton, m3N) / (Production or Sales amount)
Note 3. Electricity intensity = Electricity consumption (kWh) / (Production or Sales amount)

3. Annual energy cost and energy cost ratio

	2002	2003	2004	2005	2006
Fuel oil (Rp)					
Fuel gas (Rp)					
Electricity (Rp)					
Total energy cost (Rp)					
Sales Amount (Rp)					
Energy cost ratio (%)					

Energy cost ratio = Total energy cost / Sales amount X 100

4. Energy consuming equipment

No.	Equipment	Quantity	Main specifications
1	Steam boiler, Hot water boiler		
2	Heat media boiler, Dowtherm boiler		
3	Industrial furnace		
4	Air compressor		
5	Pump		
6	Blower		
7	Chiller		
8	Power receiving transformer		Capacity in total : kVA, Voltage: kV
9			
10			

5. Energy management

5.1 Is annual energy conservation target established in your factory, such as 10% reduction of energy consumption ?

(1) Yes
(2) Not yet

When the target is decided, please describe the content of the target.
(Target;)

5.2 Please describe the implemented measures for energy conservation in last 5 years.

- Year: Item:
- Year: Item:
- Year: Item:
- Year: Item:
- Year: Item:

5.3 Please describe energy conservation plan coming 5 years.

Item	Budget:
Item	Budget
Item	Budget:
Item	Budget

5.4 Which Section and Department organizes energy conservation activities in your factory ?

(1) Factory Manager
(2) Energy Manager
(3) Production Department
(4) Maintenance Department
(5) Committee of energy management
(6) Others ( )

5.5 How many times are energy management meetings with managers held in your factory ?

(1) Once a month
(2) Once or twice a year
(3) Others ( )

5.6 How is energy consumption data used for energy management ?

(1) Preparation of trend curve of energy consumption
(2) Calculation of energy cost
(3) Analysis of energy usage
(4) Analysis of relationship between production and energy consumption
(5) Others ( )

5.7 What kind of portable type measurement device is used for energy management ?

(1) Surface thermometer of thermo-couple
(2) Radiation thermometer
(3) Oxygen analyzer for exhaust gas of furnaces
(4) Ultrasonic flow meter
(5) Pressure gage
(6) Current meter with cramp
(7) Electric power meter

(8) Others ( )

5.8 How is training of employee implemented in energy conservation area ?

(1) Training items:
   a. Law and regulation on energy conservation
   b. Technology on energy conservation
   c. Energy management
   d. Others ( )

(2) Interval of training:
   a. Once or twice a year
   b. Once a month
   c. c. Others ( )

5.9 What are governmental supports and assistance for energy conservation promotion required for your factory ?

(1) Financial support such as low interest loan to purchase energy efficient equipment
(2) Energy audit with free of charge
(3) Training course on energy management and energy conservation technology
(4) Database on energy efficient equipment and technology
(5) Others ( )

5.10 Do you have any basis of simple pay-back year for investment on energy conservation ?

(1) 1-2 years
(2) 3-4 years
(3) More than 5 years, if effective

5.11 Have you ever conducted any energy audit ?

(1) Yes (Year; Energy auditor;)
(2) Never
(3) Never, but I want to get

5.12 What are obstacles of energy conservation activities ?

Please mark the items of obstacle in your factory.

A Management of factory

A-1 Uncertainty of energy prospect
A-2 Less impact of energy cost to the whole cost of the enterprise
A-3 The increasing energy cost can be covered by raising the price of products
A-4 Little possibility of energy shortage
A-5 Little potential for promoting further energy conservation
A-6 Insufficient system of research and development
A-7 Shortage of fund for facility improvement and modification
A-8 No time to analyze energy consumption rate

B Equipment and information

B-1 Difficulty in obtaining good energy efficient equipment
B-2 Unreliable results from energy efficient equipment
B-3 Uncertainty about return of investment in energy conservation facilities
B-4 Difficulty in getting such information as successful case of energy saving activities
B-5 Out-of-date facilities
B-6 Shortage of measuring equipment

C Personnel

C-1 Shortage of numbers of engineers
C-2 Low awareness of employees in energy conservation
C-3 Lack of personnel who can educate the employees

D Government assistance

D-1 Shortage of information on government's measures
D-2 Shortage of government's subsidiary measures

6. Energy Manager System

Energy manager system is specified in the Energy Law which has been approved in the Parliament on 17 July 2007.

6.1 Is an energy manager appointed in your factory according to RIKEN 1995 and 2005 (Rencana Induk Konservasi. Energi 1995 dan 2005) ?

(1) Yes
(2) Not yet

6.2 What is the job and responsibility of Energy Manager in your factory ?

(1) Planning and implementation of energy conservation activity
(2) Implementation of energy audit
(3) Preparation of annual report to government
(4) Secretary of energy management meeting
(5) Other ( )

6.3 What are training items necessary for Energy Manager ?

(1) Law and regulation on energy conservation
(2) Energy management
(3) Energy conservation technology in heat and electricity management
(4) Practice of measurement of temperature, current, pressure etc. with measurement devices
(5) Successful case of energy conservation

6.4 Which procedure is acceptable for your factory in the national license of qualified person for energy management ?

(1) Examination (Paper test) certificate and work experience in factories
(2) Training course certificate and engineer license of mechanical, chemical and electrical engineering and skilled technician
(3) Examination (paper test) certificate and training course certificate
(4) Others ( )

6.5 Do you have any persons for energy manager, such as mechanical engineers, chemical engineers, electrical engineers and skilled technicians ?

(1) Sufficient
(2) Not sufficient
(3) Others ( )

7. Demand side management

7.1 What type of electricity contract do you make with PLN (PT Perusahaan Listrik Negara) ?

(1) TOU (Time of Use)
(2) Not TOU

7.2 If you have data of typical daily electric demand, please fill them in the table below

Typical power curve

Time	0	1	2	3	4	5	6	7	8	9	10	11
kW												
Time	12	13	14	15	16	17	18	19	20	21	22	23
kW												

7.3 Have you introduced following equipment which reduces the maximum power consumption ?

(1) Heat accumulation
(2) Mono-generation
(3) Co-generation
(4) Demand-controller
(5) Night sifting of the production
(6) Others ( )

8. Greenhouse gas emission

8.1 Do you count annually greenhouse gas emission such as CO_2 ?

(1) Yes
(2) No

8.2 Are you interested in CDM (Clean Development Mechanism)?

(1) Yes
(2) No

Thank you for your cooperation to us.

Questionnaire on Energy Conservation Activity of Commercial Sector by MEMR DGEEU

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The result of this questionnaire is not used except the above-mentioned purpose. Moreover, individual and corporate names are not indicated.

We will inform you the analysis result of this questionnaire later. Please utilize it as a help to promote energy conservation.

To MEMR DGEEU

Answer on Energy Conservation Activity

Company	***/ President***
Replied by ***Name*** ***Section*** ***Phone***	***/ Email***
Date	

1. Building outline

Name of building	
Address	
Building Manager	
Energy Manager	
Usage of building	Public office, Only for office, Department store, Food supermarket, Hotel, Hospital, Shopping center, School, Laboratory, Others(_____)
Number of visitor	Weekday_____persons (Holiday_____persons)
Number of enrollment	
Operating time of building	Opening time_____Closing time_____
Operating time of air conditioning	[Heating]Opening time_____Closing time_____ [Cooling]Opening time_____Closing time_____
Setting temperature and humidity of air conditioning	[Heating] _____ _____% [Cooling] _____ _____%
Building structure	Steel-frame / Reinforced concrete / _____
Building scale	Ground _____floors, Basement_____floors
Area which relates to building	Site area _____m^2, Building area _____m^2 Gross floor space _____m^2

2. Energy consuming equipment

No.	Equipment	Qty	Main specifications
1	Receiving system		Receiving voltage___ kV, Contract demand_____kW
2	Receiving transformer		Voltage___/___, capacity_____kVA
3	Private generator		Type_____,Capacity_____kW_____ kV
4	Heat or cold source		Type_____, Capacity_____USRT
5	Air conditioning		System Central/Individual, Indoor unit_____
6	Thermal storage tank		System Water/Ice , Capacity _____t
7	Elevator		Speed _____m/m Capacity _____kg ____Persons
8	Boiler		Type _____Capacity _____MJ/h
9	Air compressor		Type _____Capacity _____kW
10	Pump		Type _____Capacity _____kW
11	Ventilation fan		Type _____Capacity _____kW

3. Annual data

3.1 Annual energy consumption

	2004	2005	2006	Total
Gross floor space(m^2)				
Fuel oil (kilo liter)				
Fuel gas (1000 m^3N)				
Electricity (MWh)				
City water (Ton)				
Fuel intensity (MJ/m^2)				
Electricity intensity (kWh/m^2)				
Energy basic unit (MJ/m^2)				
Water intensity (kg/m^2)				

Note 1. Fuel intensity = Fuel consumption (MJ) / (Gross floor space(m^2))
Note 2. Electricity intensity = Electricity consumption (kWh) / (Gross floor space(m^2))
Note 3. Energy basic unit = Fuel intensity(MJ/m^2) + Electricity intensity(MJ/m^2)
Note 4. Water intensity = City water consumption (kWh) / (Gross floor space(m^2))

3.2 Annual energy cost

	2004	2005	2006	Total
Fuel oil (Rp)				
Fuel gas (Rp)				
Electricity (Rp)				
City water (Rp)				

4. EE&C for Buildings

If you have ever introduced following countermeasures for EE&C, please check them.

(1) Heat exchanger for outdoor air inlet
(2) Heat recovering heat pump
(3) High efficiency heat pump or air conditioner
(4) Outdoor air inlet control (Minimum supply of outside air)
(5) Drive control of pumps and fans (Inverter controller)
(6) High efficiency belt for fans
(7) High quality heat insulation on piping and ducting
(8) High efficiency illumination (Inverter ballast)
(9) Compact fluorescent lamp
(10) High quality reflector for lighting fixtures
(11) Automatic photo-electric switch for illumination system
(12) High efficiency transformer
(13) Inverter control for elevators
(14) Power factor improvement condenser
(15) Double glassing for windows
(16) Heat reflection film on glass
(17) High quality heat insulation for wall and roof
(18) Water conservation device

5. Energy management

5.1 Is annual energy conservation target decided in your building?

(1) Yes
(2) Not yet

when you selected item 、 please describe the content of the target.

(Target; _____

in energy consumption, energy cost or CO_2 emission)

5.2 Please describe the implemented measures for energy conservation in last 5 years.

(1) Year: Item:
(2) Year: Item:
(3) Year: Item:
(4) Year: Item:

5.3 Please describe the planned improvement measures for energy conservation.

- Item _____ Budget _____

_____ _____

_____ _____

5.4 Which Section and Department organizes energy conservation activities in your building?

(1) Manager of administrative department
(2) Maintenance Department
(3) Committee of energy management
(4) Others ( )

5.5 How many times are energy management meetings with managers held in your building?

(1) Once a month
(2) Once or twice a year
(3) Others ( )

5.6 How is energy consumption data used for energy management?

(1) Daily load curve of energy consumption
(2) Monthly trend curve of energy consumption
(3) Calculation of (energy cost, amount of CO_2 emission, specific energy consumption)
(4) Others ( )

5.7 What kind of portable type measurement instrument is used for energy management?

(1) Surface thermometer of thermo-couple
(2) Radiation thermometer
(3) Temperature-Humidity meter
(4) Lux meter

(5) CO_2 meter
(6) Anemometer
(7) Ultrasonic flow meter
(8) Pressure gage
(9) Current meter with cramp
(10) Wattmeter
(11) Others ( )

5.8 How is energy conservation training of employee?

5.8.1 Training items:

(1) Law and regulation on energy conservation
(2) Technology on energy conservation
(3) Energy management
(4) Others ( )

5.8.2 Interval of training:

(1) Once or twice a year
(2) Once a month
(3) Others ( )

5.9 What are governmental supports and assistance for energy conservation promotion required for your building?

(1) Financial support such as low interest loan to purchase energy efficient equipment
(2) Training course on energy management and energy conservation technology
(3) Database on energy efficient equipment and technology
(4) Others ( )

5.10 Do you have any basis of simple pay-back year for investment on energy conservation?

(1) 1-2 years
(2) 3-4 years
(3) more than 5 years, if effective

5.11 Have you ever received any energy audit?

(1) Yes (Year; Energy auditor;)
(2) Never
(3) Never, but I want to get

5.12 Is the drawing of the building, equipment, and the system maintained in your building for the energy conservation activity?

(1) Yes
(2) Not, yet

5.13 What are obstacles of energy conservation activities?

Please mark the items of obstacle in your building.

(1) Management of building
(2) Uncertainty of energy prospect
(3) Less impact of energy cost to the whole cost of the enterprise
(4) The increasing energy cost can be covered by raising the rent of room
(5) Little possibility of energy shortage
(6) Little potential for promoting further energy conservation
(7) Insufficient system of research and development
(8) Shortage of fund for facility improvement and modification
(9) No time to analyze energy consumption rate

(2) Equipment and information

(1) Difficulty in obtaining good energy efficient equipment
(2) Unreliable results from energy efficient equipment
(3) Uncertainty about return of investment in energy conservation facilities
(4) Difficulty in getting such information as successful case of energy saving activities
(5) Out-of-date facilities
(6) Shortage of measuring equipment

(3) Personnel

(1) Shortage of numbers of engineers
(2) Low awareness of employees and tenants in energy conservation
(3) Lack of personnel who can educate the employees

(4) Government assistance

(1) Shortage of information on government's measures
(2) Shortage of government's subsidiary measures

6. Energy manager

6.1 Is an energy manager nominated in your building according to RIKEN 1995 and 2005 (Rencana Induk Konservasi. Energi 1995 dan 2005)?

(1) Yes
(2) Not yet

6.2 What is the job and responsibility of Energy Manager in your building?

(1) Planning and implementation of energy conservation activity
(2) Preparation of annual report to government
(3) Secretary of energy management meeting
(4) Other ( )

6.3 What are training items necessary for Energy Manager?

(1) Law and regulation on energy conservation
(2) Energy management
(3) Audit technology
(4) Energy conservation technology in heat and electricity management
(5) Practice of measurement of temperature, current, pressure etc. with measurement devices
(6) Study of energy conservation successful case.

6.4 Which procedure is acceptable for your building in the national license of energy management engineer? ］

(1) Examination (Paper test) certificate and work experience in building or factory
(2) Training course certificate and engineer license of mechanical, chemical and electrical engineering and skilled technician
(3) Examination (paper test) certificate and training course certificate
(4) Others ( )

6.5 Do you have a person for energy management?

(1) Sufficient
(2) Not sufficient (Technical level is low)
(3) High technical level is needed

7. Demand side management

7.1 What type of electricity contract do you make with PLN (PT Perusahaan Listrik Negara)?

(1) TOU (Time of Use)
(2) Not TOU

7.2 If you have data of typical daily electric demand, please put them in the table below

Typical power curve

Time	0	1	2	3	4	5	6	7	8	9	10	11
kW												
Time	12	13	14	15	16	17	18	19	20	21	22	23
kW												

7.3 Have you introduced following equipment which reduces the maximum power consumption?

(1) Heat accumulation
(2) Mono-generation
(3) Co-generation
(4) Demand-controller
(5) Others ( )

8. Greenhouse gas emission

8.1 Do you count annually greenhouse gas emission such as CO_2?

(1) Yes
(2) No

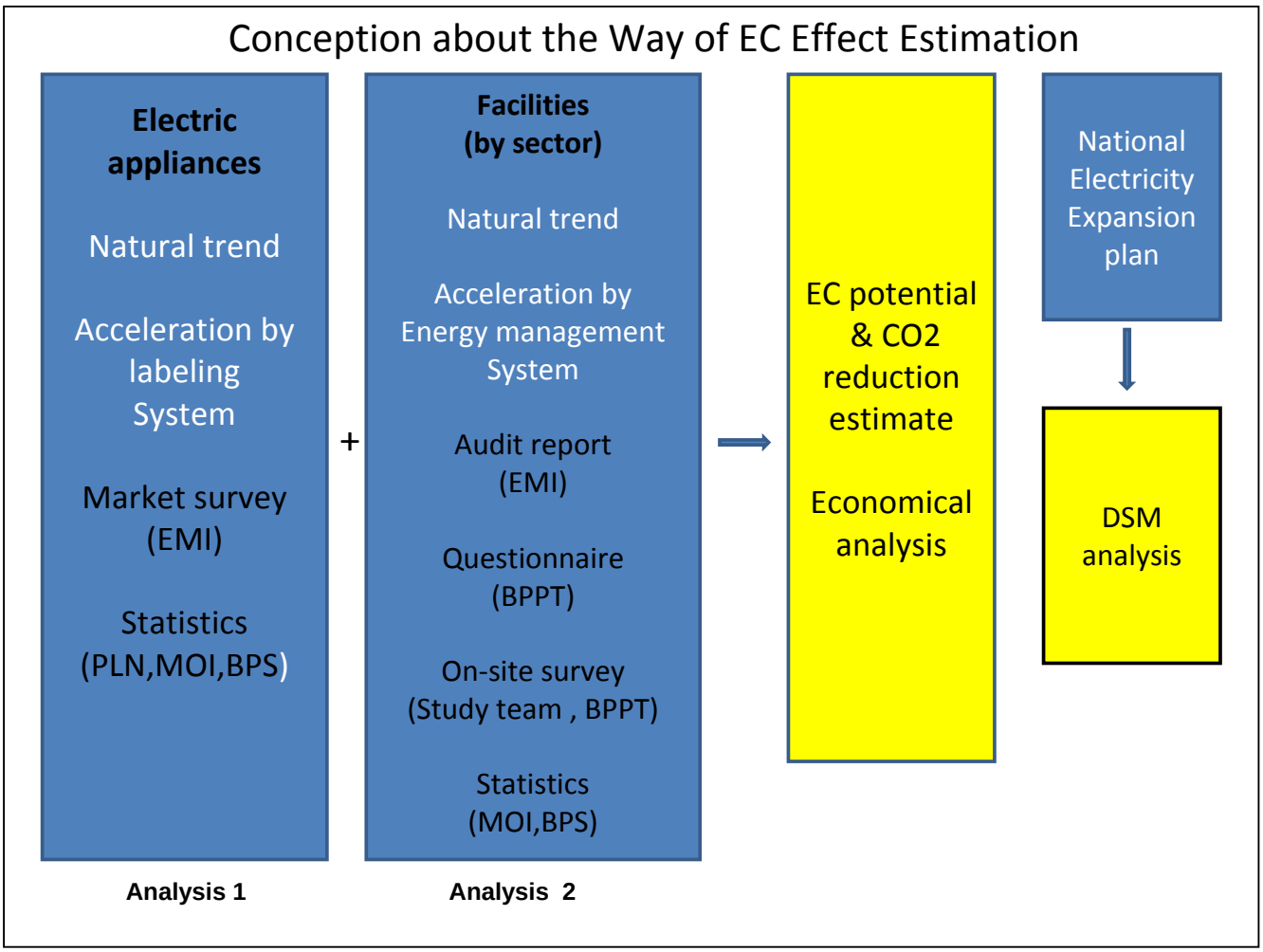
8.2 Are you interested in CDM (Clean Development Mechanism)?

(1) Yes
(2) No

Thank you very much for your cooperation

Supplement 12

Analysis Flow of the Economic and Financial survey



Estimation of EE&C Potential through Electric Appliances Market Survey (Approach 1)

Calculation of Electric Appliances LCC on one unit base

↓

Potential Penetration Rate Estimation Regarding high-efficiency Electric Appliances

↓

Potential Market Size for Respective high-efficiency Electric Appliances in 10years

↓

Economic Benefit for the Whole Country Resulted from the Spread of high-efficiency Electric Appliances

Calculation of Electric Appliances LCC on one unit base

Focus on the Products Below

1. Lighting Products
- CFL vs. Incandescent lamp
- Ballast (Electronic vs. Magnetic)
- Mercury Lamp vs. Sodium Lamp

2. Refrigerating Products
- Refrigerator
- Air-conditioner
- Chiller

3. Driving Related Products
- High-efficiency Motor
- VSD（Inverter）

4. AV Products
- High-efficiency TV

→

Calculate Annual Energy Cost
- Collect data of output & operating hour per year.
- Estimate annual energy consumption (kWh)
- Annual energy consumption × tariff = annual energy cost

↓

Compare LCC of High-efficiency Type with Conventional one
- Estimate lifetime energy cost
- Initial purchase cost + lifetime energy cost = LCC
- Calculate the lifetime saving by using high-efficiency products

Estimation of Parameters for the Calculation of Electric Appliances LCC (One Unit base)

Electric Appliances		Major Parameters Estimated
CFL	Incandescent	60w, 3h/day, 570Rp(tariff), 1000h (endurance), 0.91y(LT), 4y (LT for comparison)
	CFL (3 star)	15w, 3h/day, 570Rp (tariff), 6000h (endurance), 5.48y(LT), 4y (LT for comparison)
Electronic Ballast	Magnetic	45w, 7h/day, 220officeday, 575Rp (tariff), 10y (LT), 10y (LT for comparison)
	Electronic (5 star)	35w, 7h/day, 220 office day ,575Rp (tariff), 10y (LT), 10y (LT for comparison)
Street Lighting	Mercury (1)	125w, 10h/day, 635Rp (tariff), 12000h (endurance), 3.3y (LT),3.3y (LT for comparison)
	Sodium (1)	70w, 10h/day, 635Rp (tariff), 12000h (endurance), 3.3y (LT),3.3y (LT for comparison)
	Mercury (2)	250w, 10h/day, 635Rp (tariff), 12000h (endurance), 3.3y (LT),3.3y (LT for comparison)
	Sodium (2)	110w, 10h/day, 635Rp (tariff), 12000h (endurance), 3.3y (LT),3.3y (LT for comparison)
VSD	Normal Fan	7.5kw, 8h/day, 300workday, 617Rp (tariff), 10y (LT), 10y (LT for comparison)
	VSD (additional)	25%up, 8h/day, 300workday, 617Rp (tariff), 10y (LT), 10y (LT for comparison)
High efficiency Chiller	Chiller COP 4.0	350RT, 308kw, 2000h/year, 11Rp(tariff), 10y (LT), 10y (LT for comparison)
	Chiller COP 6.0	350RT, 205kw, 2000h/year 11Rp(tariff), 10y (LT), 10y (LT for comparison)
High efficiency Room A/C	A/C COP 2.5	2.5kw, 500kwh/year(2000h), 903Rp(tariff; 781Rp), 15y (LT), 15y (LT for comparison)
	A/C COP 3.3	25%, 375kwh/year(1500h), 903Rp(tariff ; 781Rp), 15y (LT), 15y (LT for comparison)
High efficiency Refrigerator	Normal Type	500kwh/year, 507Rp(tariff), 15y (LT), 15y (LT for comparison)
	High Efficiency	40%up, 300kwh/year, 507Rp(tariff), 15y (LT), 15y (LT for comparison)
High efficiency E.M.	Normal Type	10kw, 10h/day, 300d/year, 10Rp(tariff), 15y (LT), 15y (LT for comparison)
	High Efficiency	20%up, 10h/day, 300d/year, 10Rp(tariff), 15y (LT), 15y (LT for comparison)
High efficiency TV	Normal Type	200w, 3h/day, 570Rp(tariff), 10y (LT), 7y (LT for comparison)
	High Efficiency	150w, 3h/day, 570Rp(tariff), 10y (LT), 7y (LT for comparison)

Parameters for Potential Penetration Rate Estimation Regarding high-efficiency Electric Appliances

Electric Appliances		Parameters Estimated
CFL (3 star)		59.9mil.(Household), 67.5%(potential), 60% (penetration rate in 10years)
		11,350(hotel), 80% (potential)
Electronic Ballast (5 star)		1,549,542(business office) , 90%(potential), 70%(penetration rate in 10years)
Street Lighting	Mercury (1)	97,867, 100% (potential), 100% (penetration rate in 10 years)
	Sodium (1)	
	Mercury (2)	
	Sodium (2)	
VSD	Normal Fan	
	VSD (additional)	46,435(factory), 90%(potential), 75% (penetration rate in 10 years)
High efficiency Chiller	Chiller COP 4.0	
	Chiller COP 5.0	3,560 (max. office), 80% (potential), 80% (penetration rate in 10 years)
High efficiency Room A/C	A/C COP 2.5	
	A/C COP 3.3	81,026 (max. household),90% (potential), 30% (penetration rate in 10 years) 366,769 (max. household),50% (potential), 30% (penetration rate in 10 years)
High efficiency Refrigerator	Normal Type	
	High Efficiency	59.9mil.(Household), 80%(potential), 30% (penetration rate in 10years)
High efficiency E.M.	Normal Type	
	High Efficiency	46,435(factory), 80%(potential), 60% (penetration rate in 10 years)
High efficiency TV	Normal Type	
	High Efficiency	59.9mil.(Household), 80%(potential), 50% (penetration rate in 10years)

Electric Appliances		Data for the Energy Cost Calculation
CFL	Incandescent (household)	40w, 4.86h/day, 400~761Rp(tariff), 1500h (endurance), 0.85y(LT), 3y (LT for comparison)
	CFL(household)	9w, 4.86h /day, 400~761Rp(tariff), 5000h (endurance), 2.82y(LT), 3y (LT for comparison)
	Incandescent (business)	40w, 4.18h/day,659~780Rp(tariff), 1500h (endurance), 0.85y(LT), 3y (LT for comparison)
	CFL (business)	9w, 4.18h/day, 659~780Rp(tariff), 5000h (endurance), 2.82y(LT), 3y (LT for comparison)
Electronic Ballast	Magnetic (household)	20w,40w, 5h/day, 5000h (endurance), 2.7y (LT), 4y (LT for comparison)
	Electronic (household)	18w,32w, 5h/day, 6000h (endurance), 3.3y (LT), 4y (LT for comparison)
	Magnetic (business)	40w, 10h/day, 5000h (endurance), 1.4y (LT), 2y (LT for comparison)
	Electronic (business)	32w, 10h/day, 6000h (endurance), 1.6y (LT), 2y (LT for comparison)
	Magnetic (industry)	40w, 24h/day, 5000h (endurance), 1.4y (LT), 2y (LT for comparison)
	Electronic (industry)	32w, 24h/day, 6000h (endurance), 1.6y (LT), 2y (LT for comparison)
Street Lighting	Mercury	250w, 10h/day, 629Rp (tariff), 10y (LT),10y (LT for comparison)
	Sodium	150w, 10h/day, 629Rp (tariff),
VSD	VSD (industry)	7.5kw, 25%up 24h/day, 570Rp (tariff), 10y (LT)
High efficiency Chiller	Chiller 2.2~200KVA	COP4, 200RT, 175kw(potential saving), COP5, 140kw(potential saving) 10h/day, 780~804Rp(tariff), 15y (LT), 15y (LT for comparison)
	Chiller >200KVA	COP4, 350RT, 306kw(potential saving), COP5.5, 245kw(potential saving) 10h/day 659~700Rp(tariff), 10y (LT), 10y (LT for comparison)
	Chiller(Textile) (all KVA)	COP4, 350RT, 306kw(potential saving), COP5.5, 245kw(potential saving) 10h/day, 817Rp(tariff), 10y (LT), 10y (LT for comparison)

Electric Appliances		Data for the Energy Cost Calculation
High efficiency Room A/C	A/C (household) 1300VA	COP2.5, 500w, COP3.3,375w, 6h/day, 683Rp(tariff), 15y (LT), 15y (LT for comparison)
	A/C (household) >1300VA	COP2.5, 1000w, COP3.3,750w, 5.6h/day, 842Rp(tariff), 15y (LT), 15y (LT for comparison)
	A/C (business) 2.2~200KVA	COP2.5, 2000w, COP3.3,1500w, 12h/day, 1439Rp(tariff), 15y (LT), 15y (LT for comparison); medium hotel and medium office building
High efficiency Refrigerator	Household Up to 2200VA	125w(normal), 94w(high efficiency), 24h/day, 683Rp(tariff), 15y (LT), 15y (LT for comparison)
	Household >2200VA	200w(normal), 150w(high efficiency), 24h/day, 842Rp(tariff), 15y (LT), 15y (LT for comparison)
	Business >2200VA	75w(normal), 56w(high efficiency), 24h/day, 719Rp(tariff), 15y (LT), 15y (LT for comparison)
High efficiency E.M.	Normal Type	
	High Efficiency	20KW, 20%up, 12h/day, 782Rp(tariff for medium), 543Rp(tariff for large) 15y (LT), 15y (LT for comparison)
High efficiency TV	CRT(household)	10w, 24h/day, 400Rp(tariff for Up to 450VA), 601Rp(tariff for 900~1300VA), 787Rp(tariff for >1300w)10y (LT), 10y (LT for comparison)
	LCD(household)	1w, 24h/day, 400Rp(tariff for Up to 450VA), 659Rp(tariff for900~1300VA), 787Rp(tariff for >1300VA)10y (LT), 10y (LT for comparison)
	CRT(business)	10w, 24h/day, 780Rp(tariff for 2.2~200KVA), 601Rp(tariff for >200KVA), 10y (LT), 10y (LT for comparison)
	LCD(business)	1w, 24h/day, 780Rp(tariff for 2.2~200KVA), 601Rp(tariff for >200KVA), 10y (LT), 10y (LT for comparison)

1. Information of Electricity and DSM

(1) Residential Tariff

Basic electricity tariff (BET) of residential sector is shown in Table 1-1.

Both demand and energy charge increase stepwise subject to contracted power and consumption respectively. The higher consumption means higher tariff payment to promote EE&C. There are no Peak Period (PP) and Off Peak Period (OPP) tariffs for load management, which stipulated in other sectors. (Special consideration for residential sector) Share of R1 Category is the highest in terms of customer number, sold MVA and revenue in all tariff categories. Accordingly the level of R1 tariff influences the profitability of PLN significantly.

Average variable generation cost of PLN is 368Rp in 2005. Accordingly, energy charge colored in pink in the following tables could not recover variable cost. (More sales, more deficits)

Table 1-1 Basic Electricity Tariff (BET) of Residential Sector 2004

<table>
<tr><td colspan="2" rowspan="2">VA</td><td>Demand Charge</td><td colspan="7">Energy Charge</td></tr>
<tr><td>Rp./kVA /Month</td><td colspan="7">Rp./kWh</td></tr>
<tr><td colspan="2"></td><td></td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60 kWh</td></tr>
<tr><td rowspan="4">R1</td><td>450</td><td>11,000</td><td colspan="3">169</td><td colspan="2">360</td><td rowspan="3">495</td></tr>
<tr><td>900</td><td>20,000</td><td>275</td><td colspan="4" rowspan="3">445</td></tr>
<tr><td>1,300</td><td>30,100</td><td>385</td></tr>
<tr><td>2,200</td><td>30,200</td><td>390</td></tr>
<tr><td>R2</td><td>2,200 – 200,000</td><td>30,400</td><td colspan="7">560</td></tr>
<tr><td>R3</td><td>>200,000</td><td>34,260</td><td colspan="7">621</td></tr>
</table>

(2) Business Tariff

Basic electricity tariff (BET) of business sector is shown in Table 1-2.

◆ PP and OPP tariff

Over 200,000VA customers, energy charge during peak period (16:00 to 22:00 hrs) increases by multiplying K value. K value is comparative factor between PP and OPP in accordance with the load characteristics of the local electricity system. The Board of Director of PLN sets this K value between 1.4 and 2.0.

◆ Excessive kVArh Usage Charge (Power Factor)1

If customers of over 200,000VA use electricity as specified in followings, additional energy charge of 616Rp/kVArh* should be imposed. (*Reactive power) Total usage of kVArh in 1(one) month

1 Presidential Decree: No. 104 in 2003, dated December 31st, 2003 “On the prices of electricity provided by PLN”, The Ministry of Energy and Mineral Resources Decree No. 1616. K/36/MEM/2003, dated December 31st, 2003 “On the regulation on the Implementation of Electricity Prices provided by PLN”

was more than 0.62 (sixty two percent) of total kWh on such month, so the average power factor (Cos fl) was less than 0.85 (eighty five percent).

Table 1-2 Basic Electricity Tariff (BET) of Business Sector 2004

VA		Demand Charge	Energy Charge					
		Rp./kVA /Month	Rp./kWh					
			0	30	108	146	264	kWh
B1/ LV	~450	23,500	254	420				
	900	26,500	420	465				
	1,300	28,200	470	473				
	2,200	29,200	480	518				
			0	100	Hours			
B2/ LV	2,200 – 200,000	30,000	520	545				
			PP (Peak Period)	OPP (OFF Peak Period)				
B3/ MV	>200,000	28,400	K × 452	452				
			Power Factor < 0.85 616Rp/kVArh					

(3) Industrial Tariff

Basic electricity tariff (BET) of industrial sector is shown in Table 1-3.

Energy charge increases stepwise subject to power consumption. On the other hand, demand charge for high voltage customers decreases appreciating higher efficiency.

◆ PP and OPP tariff

Over 14,000VA customers, energy charge during peak period (16:00 to 22:00 hrs) increases by multiplying K value.

◆ Excessive kVArh Usage Charge (Power Factor)

If customers of over 14,000VA use electricity as specified in followings, additional energy charges should be imposed. Total usage of kVArh in 1(one) month was more than 0.62 (sixty two percent) of total kWh on such month, so the average power factor (Cos fl) was less than (eighty five percent).

Table 1-3 Basic Electricity Tariff (BET) of Industrial Sector 2004

VA		Demand Charge	Energy Charge
		Rp./kVA /Month	Rp./kWh
			0 30 72 104 196 kWh
I1/LV	450	26,000	160 / 395
	900	31,500	315 / 405
	1,300	31,800	450 / 460
	2,200	32,000	455 / 460
	2,200 – 14,000	32,200	0 80 Hours 455 / 460
I2/LV	14,000 – 200,000	32,500	PP OPP K × 440 / 440 Power Factor < 0.85 693Rp/kVArh
I3/LV	>200,000	29,500	0 350 Hours PP OPP PP OPP K × 439 / 439 / 439 Power Factor < 0.85 571Rp/kVArh
I4/LV	>30,000,000	27,000	434 Power Factor < 0.85 507Rp/kVArh

(4) Multi Purpose (Optional tariff)

The Multi Purpose tariff is designed for those who are, for various reasons, cannot be included in the new tariff as outlined above. This Multi Purpose tariff is imposed for numerous uses.

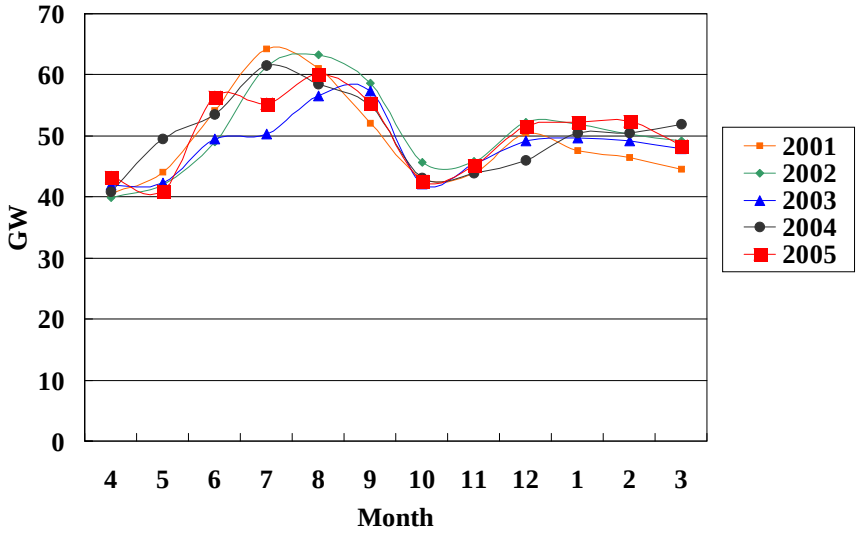
- Electricity export-import deal prices between the PLN with other counterparts to foster relationship for mutual benefit
- Electricity, which under customers' request demanded to be more than the standards or as agreed by PLN to have the standardized quality, reliability or service delivery
- The customers of PLN whose load is subject to adjustment, reduction and isolation from the system by the PLN as agreed on the memorandum
- Electricity for those who are willing to interconnect their own from PLN with or without power flow between the system
- Electricity for those who are willing to subscribe for electricity from PLN periodically or with particular load pattern as agreed on a memorandum
- Electricity, which cannot be charged with the basic tariff as outline above for the following reasons

  Only for short-term basis
  Depending on the condition and capacity of the PLN
  Availability for business for mutual benefit

2. Tariff System of Japanese Utility

(1) Features of Electricity Supply and Demand of Japan (Kanto Region)

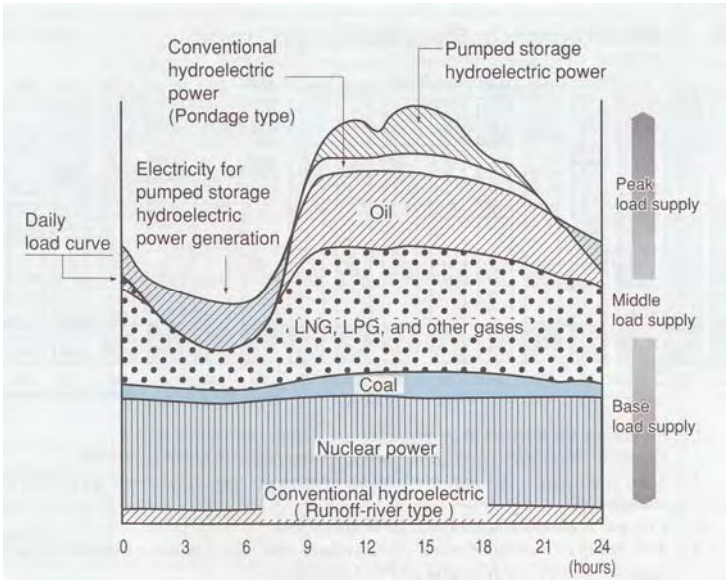
Understand the features of Japanese tariff system is effective to review Indonesian tariff.



Source: TEPCO Illustrated 2006

Fig. 2-1 Monthly Peak Demand (Fiscal 2001～2005)

Monthly peak demand is shown in Fig. 2-1. There exist two peaks, namely summer peak by cooling (July to August) and winter peak by heating (December to February). Yearly maximum peak takes place during daytime in summer. From daily load curve shown in Fig.2-2, minimum load taking place in the morning is about 47% of daily peak load. (Indonesia: about 60%) To cope with this significant daily load change, there are three stages of electricity supply system taking into accounts of operability and cost.



Source: TEPCO Illustrated 2006

Fig. 2-2 Three-Stage Electricity Supply System Coping with Demand Change

- Base load supply (Hydroelectric, nuclear, coal and gas)
- Middle load supply (Gas)
- Peak load supply (Oil, hydroelectric and pumped storage) Pumped storage hydroelectric is for peak shift.

(2) Cost Base Tariff System

Fig.-3 shows average cost and tariff of fiscal 2005. The difference between tariff and cost is allotted as sales cost.

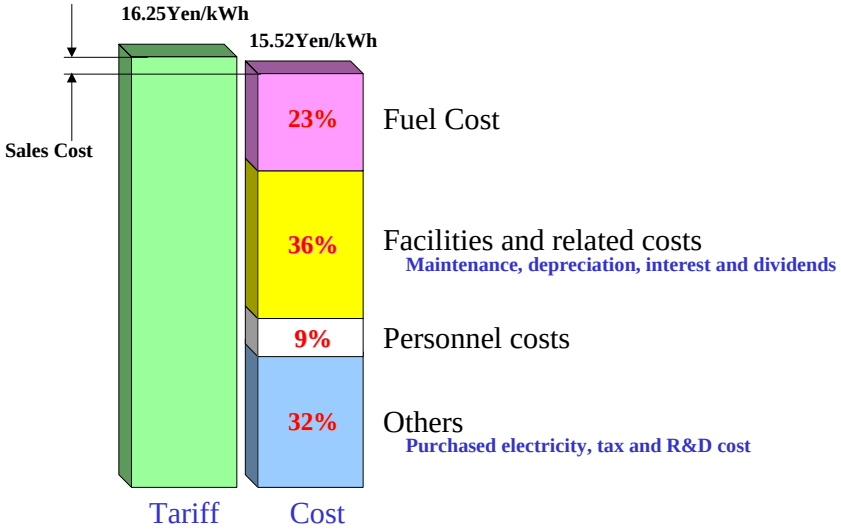


Fig. 2-3 Average Cost and Tariff

Japanese tariff system is established on cost base calculation. The change of fuel price could be reflected to electricity tariff under the condition described in fuel price adjusting system in this appendix.

(3) Tariff System for Household

Tariff system for households consists of six items shown in Table 2-1.

◆ Basic fee and power volume fee

Basic fee and power volume fee are calculated by contract ampere and monthly consumption respectively. Basic fee increases proportionally to the contract ampere. (Table 2-1)

Table 2-1 Basic Fee and Power Volume Fee

Items	Grade		Yen
Basic Fee	10A	1 Contract	273
	15A		409
	20A		546
	30A		819
	40A		1,092
	50A		1,365
	60A		1,638
Power Volume Fee	0-120	1kWh	16.05
	120-300		21.04
	>300		22.31

Power volume fee is calculated by three-stage method for promoting EE&C. (Fig. 2-4)

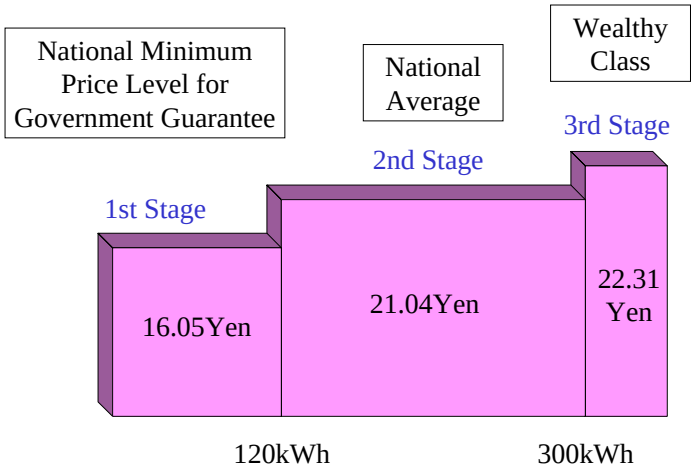


Fig. 2-4 Three-Stage Power Volume Fee

1st stage tariff is set for low consumption group. 2nd and 3rd stages are for average consuming customers and high consumption group respectively. Lower consumption tariff is cheaper for promoting energy use.

◆ Bank account transfer discount

Automatic transfer for paying the tariff could receive discounted bill because of cost saving of money collection. Green electricity donation is established for promoting natural energy dissemination.

Fig. 2-5 shows the invoice and receipt sample of household tariff.

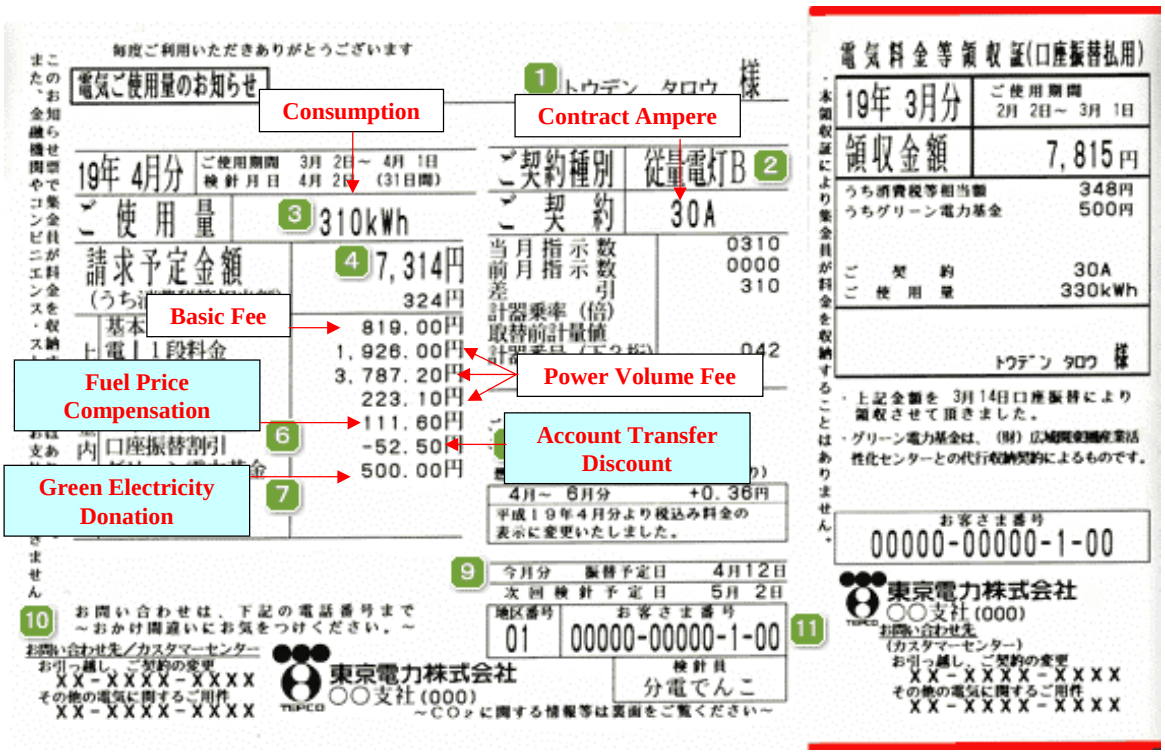


Fig. 2-5 Sample of Invoice and Receipt Tariff

◆ Fuel Price Change Adjustment

Electricity cost frustrates corresponding to the fuel price change (Oil, LNG: Liquefied Natural Gas and coal) and currency exchange rate. Fuel price adjustment system is established to reflect fuel price change to tariff automatically when the range of fuel price exceeds certain value. Tariff reflecting fuel oil price change is shown in Table 2-2. Average fuel price in the table is calculated by following formula.

$$\text{Average Fuel Price } A_f = 0.1837 \times P_{\text{Crude Oil}} \text{ (¥/KL)} + 0.4461 \times P_{\text{LNG}} \text{ (¥/Ton)} + 0.2582 \times P_{\text{Coal}} \text{ (¥/Ton)}$$

Table 2-2 Fuel Oil Price and Cost Conversion

Average Fuel Price (A_f)	Tariff Change	Rate
>¥41,100	Maximum 41,100	¥0.14/kWh/¥1,000 Change
¥41,100 ~ 28,700	Increase Tariff	
¥28,700 ~ 26,100	No Change	-
<¥26,100	Decrease Tariff	¥0.14/kWh/¥1,000 Change

(4) Tariff System of Commercial and Industrial Sectors

There are 15 kinds of tariff according to sectors, receiving voltage, seasonal and time of day and contract as shown in Table 2-3.

Table 2-3 Tariff of Commercial and Industrial Sectors

Sector	Voltage	Seasonal and time of day tariff	Contract
Buildings, stores, Department stores and supermarkets	Ultra high voltage	Yes	
		None	
	High voltage	Yes	Contract power: >500kW
			Contract power: <500kW
		None	Contract power: >500kW
			Contract power: <500kW
Stores and factories using motors	Low voltage	None	
			High load
			Thermal storage
Factories	Ultra high voltage	Yes	
		None	
	High voltage	Yes	Contract power: >500kW
			Contract power: <500kW
		None	Contract power: >500kW
			Contract power: <500kW

As shown in above table, there are many kinds of tariff to give consideration to situations and condition of each customer group. As representative tariff, specific tariff specified in the followings is explained.

Building, shop, department store and super market
High voltage electricity
Seasonal and time of day tariff
Contact power: Over 500kW

◆ Basic fee and power volume fee

Basic fee includes power factor adjustment. Power volume fee is calculated by multiplication of basic unit price to electricity consumption. In addition, fuel price adjustment is included. Tariff is the total of basic and power volume fee. (Table 2-4)

Table 2-4 Calculation of Tariff

Basic Fee	$\text{(Basic Unit Price)} \times \text{(Contracted kVA)} \times \frac{\text{(185-Power Factor)*}}{100}$
Power Volume Fee	(Unit Price of Season and time) × (Electricity Consumption) ±(Compensation Fee of Fuel Price Change)
Total	(Basic Fee) + (Power Volume Fee)

*Incentive/Disincentive by Power Factor

Detail of basic fee is shown in Table 2-5.

Table 2-5 Basic Fee List

	Contracted Capacity	Yen /kW
High Voltage	Commercial	1,560
	<500kW	1,175
	>500kW	1,650
Ultra-High Voltage	20kV Supply	1,510
	60kV Supply	1,460
	140kV Supply	1,410

◆ Season and time price

Power volume fee is shown in Fig. 2-6 and Fig. 2-7 by season and time of use. It aimed to promote electricity conservation during summer and peak hour.

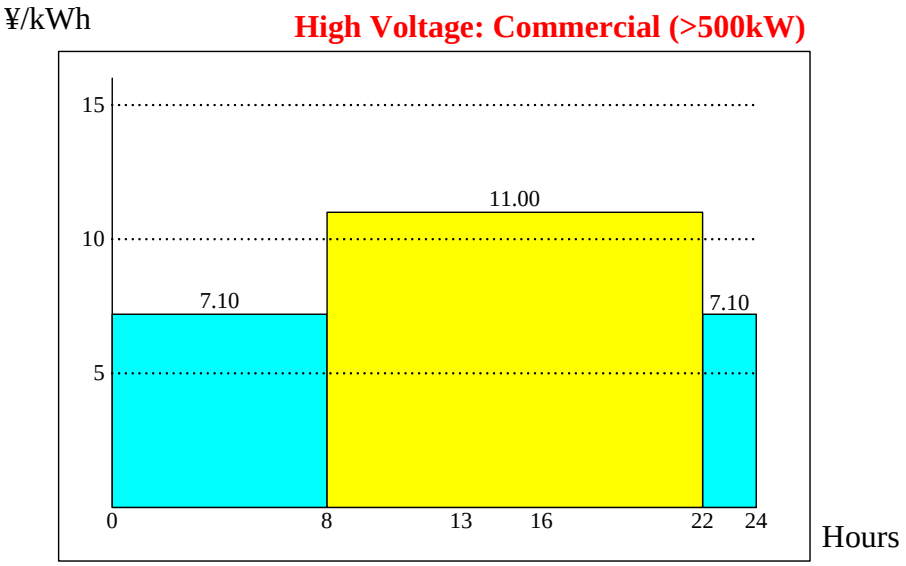


Fig. 2-6 Power Volume Fee (1st October to 30th June)

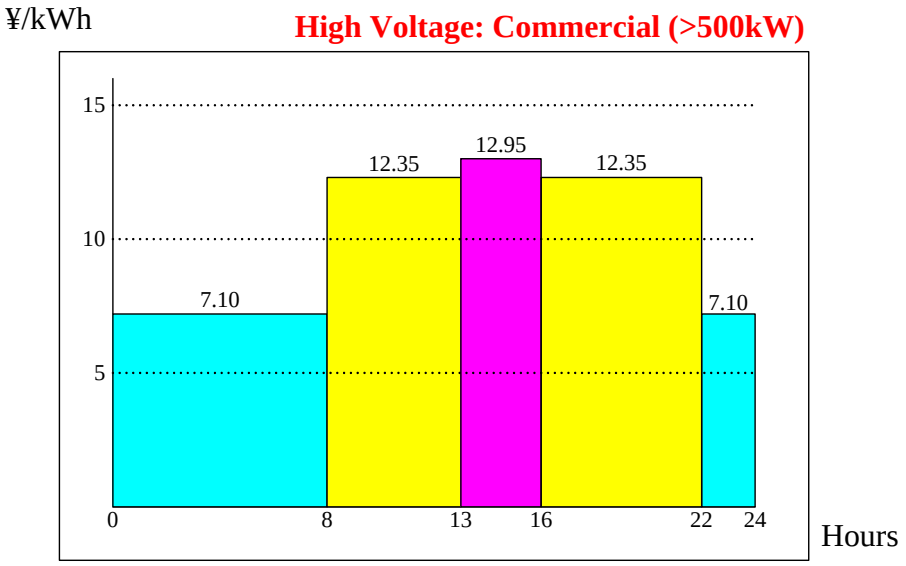


Fig. 2-7 Power Volume Fee (1st July to 30th September)

(5) Optional Contract

◆ Optional contract for household “Profitable Night 8”

(Representative example of optional contract for household)

“Profitable Night 8” is established for promoting nighttime consumption by decreasing night tariff (8 hours from 23pm to 7am of next morning) to one third of day one. In addition, increase of electricity consumption during daytime raises tariff.

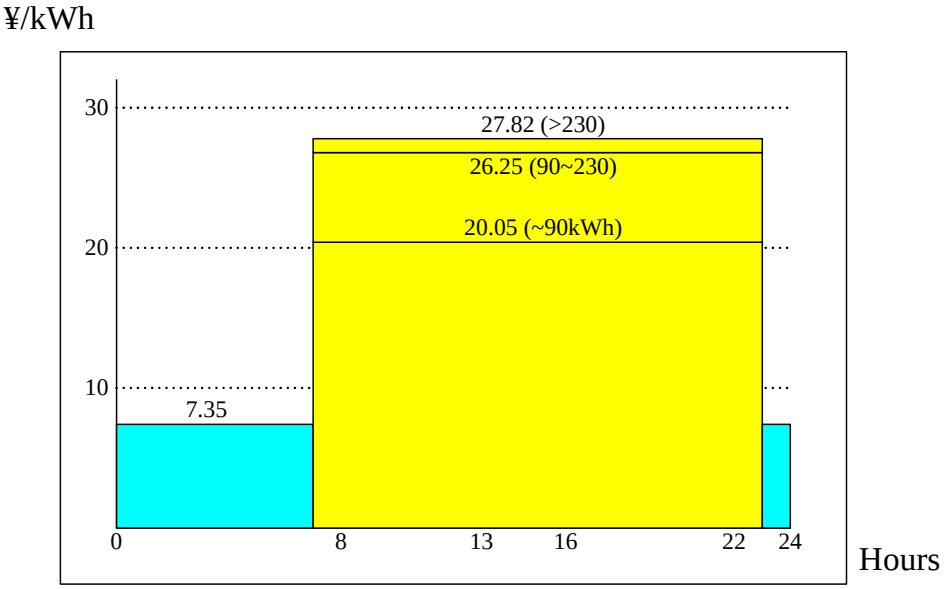


Fig. 2-8 Power Volume Fee “Profitable Night 8”
(8 hours from 23pm to 7am of next morning)

◆ Commercial and Industrial Option Contract “Load Adjustment”

Japanese utilities provide special contracts with specified customers to avoid the power shortage during demand increase by limiting or stopping power supply to customers. In return, customers could get cheaper tariff. These are planned load adjustment contract, emergency load adjustment contract and so on.

3. Electricity Conservation by the Adoption of High Efficiency Electric Appliance

This appendix describes the high efficiency electric appliance and EE&C, based on comprehensive work of PT. Energy Management Indonesia (EMI). Study is conducted on 2005 data as current situation of high efficiency appliance adoption and reasonable and expected replacement by high efficiency appliance in future.

(1) Target High Efficiency Electric Appliances in Japan

Adoption of high efficiency electric appliance for new installation and replacement of existing appliance could be effective measure to conserve electricity. As there are various kinds of electric appliances in the market for various sectors, target electric appliances for new installation and replacement should be carefully selected. The criteria of selection are such as degree of efficiency improvement, investment, technological reliability and economics.

There are three main methods for determining appliance energy use efficiency standards. Minimum standard value system, average standard value system and maximum standard values system (Top Runner Program).

Japan has adopted Top Runner Program. This Top Runner Program uses, as a base value, the value of the product with the highest energy use on the market at the time of standard establishment process and sets standard values by considering potential technological improvements added as efficiency improvement. Initially the types of appliance covered by regulations were limited to three items: electric refrigerators, air conditioners and passenger cars.

Table 3-1 Result of Achieving Standards Values

Product Category	Energy Efficiency Improvement			
	Result	Period		Initial Expectation
	(%)	From	To	(%)
TV Receivers (TV sets using CRT)	25.7	1997	2003	16.4
VCRs	73.6	1997	2003	58.7
Air Conditioners (Room type)	68.7	1997	2004	66.1
Electric Refrigerators	55.2	1998	2004	30.5
Electric Freezers	29.6	1998	2004	22.9
Gasoline Passenger Vehicles	22.8	1995	2005	22.8 (1995 - 2010)
Diesel Freight Vehicles	21.7	1995	2005	6.5
Vending Machines	37.3	2000	2005	33.9
Computers	99.1	1997	2005	83.0
Magnetic Disk Units	98.2	1997	2005	78.0
Fluorescent Lights	35.6	1997	2005	16.6

Source: ECCJ HP, 2008/10/10

Result of Top Runner Program is shown in Table 2-7, which compares the energy efficiency improvement between initial expectation and actual results. Results of every item is better than expected meaning the effectiveness of Top Runner Program.

Current target items of Top Runner Program are as follows.

Passenger Vehicles	Freight Vehicles	Air Conditioners
Electric Refrigerators	Electric Freezers	Electric Rice Cookers
Microwave Ovens	Fluorescent Lights	Electric Toilet Seats
TV Sets	Video Cassette Recorders	DVD Recorders
Computers	Magnetic Disk Units	Copying Machines
Space Heaters	Gas Cooking Appliances	Gas Water Heaters
Oil Water Heaters	Vending Machines	Transformers

(2) Target High Efficiency Electric Appliances in Indonesia

Through the discussion with EMI, preliminary target high efficiency electric appliances for this study are selected shown in the bellow.

EE&C Lamp	Electronic Ballast	Street Lighting
Variable Speed Drive	Room Air Conditioner	Chiller
Refrigerator	Motor	Television

(3) Life Cycle Cost

Generally speaking, the prices of high efficiency electric appliances are higher than low efficiency one. To calculate the economics of high efficiency appliance, life cycle cost should be taken into account.

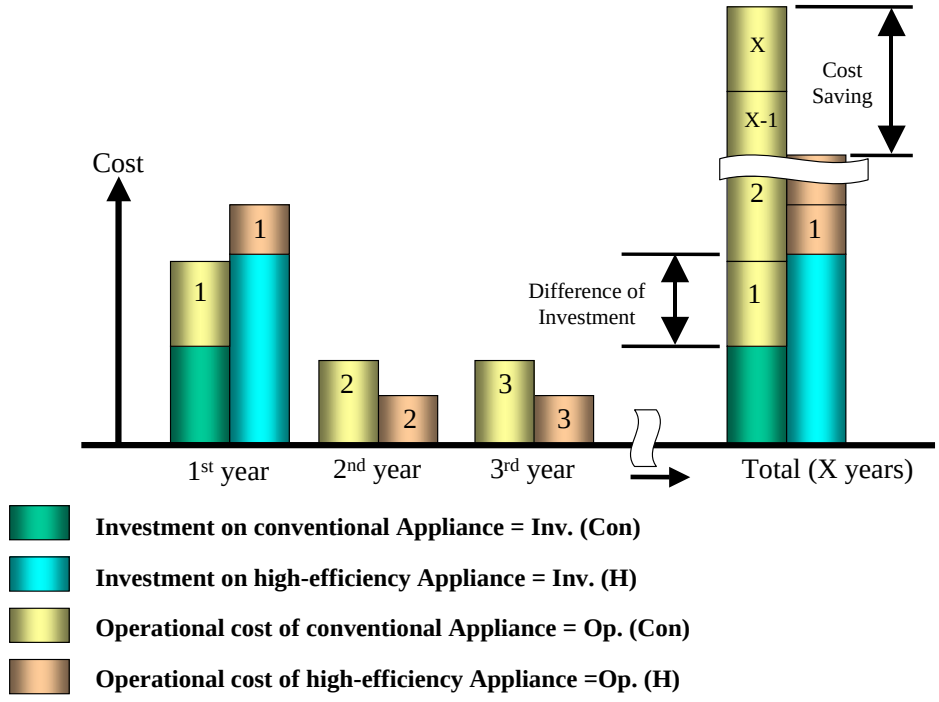


Fig. 3-1 Example of Life Cycle Cost

Fig. 3-1 shows the simple example of life cycle cost calculation. More precisely, other items such as interest, maintenance and labor cost should be taken into consideration. The interest rate on loan is about 12%/year and the deposit interest rate is about 6% in Indonesia. Medium- and small-scale enterprises facing fund shortage must calculate economics including interest rate. However to simplify the study, these items are neglected in this report. To estimate the possibility of high efficiency appliance and the contribution to national EE&C, the economics is the one of key factors. In this study, following three economic indicators are calculated.

$$\text{Cost reduction rate (\%)} = \frac{\text{Inv. (H)} + \text{Total Op. (H)}}{\text{Inv. (C)} + \text{Total OP (C)}} \times 100$$

$$\text{Payout time for replacement (Year)} = \frac{\text{Inv. (H)}}{\text{Total Op. (C)} - \text{Total Op. (H)}}$$

$$\text{Payout time for initial selection (Economics of additional investment) (Year)} = \frac{\text{(Inv. (H)} - \text{Inv. (C))}}{\text{Total Op. (C)} - \text{Total Op. (H)}}$$

(4) Economics Calculation Condition

Table 3-2 Life, EL Consumption and Price of Selected Electric Appliance

Appliance	Capacity	Country	Life		Electricity Consumption		Price	
			Hours		W		Rp	
Electricity Saving Lamp (CFL)	W		Incandescent	CFL	Incandescent	CFL	Incandescent	CFL*
	40	Indonesia	1,000	6,000	40	8	6,000	25,000
	40	Japan[2][3]	1,000-2,000	8,000	40	8	10,800	70,100
	60	Japan[2][3]	1,000-2,000	8,000	60	12	10,800	70,100
	100	Japan[2][3]	1,000-2,000	8,000	100	22	12,600	125,600
Electronic Ballast	W		Magnetic	Electronic	Magnetic	Electronic	Magnetic	Electronic
	20	Indonesia	10,000	50,000	20	18	15,000	75,000
	40	Indonesia	10,000	50,000	40	32	15,000	75,000
Street Light	W		Mercury	Sodium	Mercury	Sodium	Mercury	Sodium
	250		5.5	5.5	250	150	2,500,000	3,000,000
Air Condition	W		Standard	High Efficiency	Standard	High Efficiency	Standard	High Efficiency
			Year					
	COP				2.5	3.3 & 5.0	2.5	3.3 & 5.0
	500	Indonesia	15	15	500	375	2,000,000	3,000,000
	1,000	Indonesia	15	15	1,000	750	3,000,000	4,000,000
	1,000	Indonesia	15	15	1,000	750	4,000,000	5,000,000
	2,000	Indonesia	15	15	2,000	1,500	4,000,000	5,000,000
	500	Indonesia	15	15	500	250	2,000,000	3,000,000
	1,000	Indonesia	15	15	1,000	500	3,000,000	4,000,000
	1,000	Indonesia	15	15	1,000	500	4,000,000	5,000,000
	2,000	Indonesia	15	15	2,000	1,000	4,000,000	5,000,000
		Japan[4]			Yearly Electricity Consumption		Price	
					Yen		Yen	
					H	B	H	B
					16,700	19,800	45,800	69,800
Chiller	W		Standard	High Efficiency	Standard	High Efficiency	Standard	High Efficiency
	52,500	Indonesia	15	15	52,500	42,000	150,000,000	180,000,000
	306,000	Indonesia	15	15	306,000	245,000	1,000,000,000	1,200,000,000
Refrigerator			Standard	High Efficiency	Standard	High Efficiency	Standard	High Efficiency
	125	Indonesia	15	15	125	94	2,500,000	3,500,000
	200	Indonesia	15	15	200	150	3,000,000	4,500,000
	200	Indonesia	15	15	200	150	2,000,000	3,000,000
	75	Indonesia	15	15	75	56	2,000,000	3,000,000
VSD					Base	VSD	VSD	
	7,500	Indonesia	10		7,500	5,625	21,000,000	
Motor	KW		Standard	High Efficiency	Standard	High Efficiency	Standard	High Efficiency
	20,000		15	15	20,000	15,000	4,000,000	5,000,000
Television	W		Standard	High Efficiency	Standard	High Efficiency	Standard	High Efficiency
	100	Indonesia	10	10	100	75	2,500,000	7,500,000
	150	Indonesia	10	10	150	113	3,000,000	9,000,000
	200	Indonesia	10	10	200	150	4,000,000	12,000,000
	100	Indonesia	10	10	100	75	2,500,000	7,500,000
	150	Indonesia	10	10	150	113	2,500,000	7,500,000

[2] Mass Retailer Price as of 20th July, 2008
[3] Exchange Rate: One Yen = 85.46 Indonesian Rp.
[4] Refer above Table A1-10

(5) Economics Calculation Result by Tariff Category

Table 3-3 Economics Calculation Result by Tariff Category

Appliance	Tariff Category		Tariff	Cost Reduction Rate	Payout time for Replacement		Payout time for Initial Selection	
			Rp/Unit	%	Year		Year	
CFL	R1	~450VA	400	36.8	1.10	○	0.07	◎
		900~2,200VA	601	32.0	0.73	◎	0.04	
	R2-3	>2,200VA	761	29.8	0.58		0.03	
	B2	2.2~200kVA	780	29.6	0.60		0.03	
	B3	>200kVA	659	31.1	0.78		0.04	
Ballast	R1	450~900VA	469	91.4	21.91	×	0.00	◎
	R2-3	>900VA	694	81.0	3.70	△		
	P2	2.2~200kVA	804	80.9	3.19			
		>200kVA	700	81.0	3.67			
	S2	2.2~200kVA	683	81.0	3.76			
	S3	>200kVA	578	81.2	4.44			
	B2	2.2~200kVA	780	80.9	3.29			
	B3	>200kVA	659	81.1	3.90			
	I3	>200kVA	576	81.2	4.46			
Street Light	P3		629	86.5	13.28	×	3.28	△
Air Conditioner	R1-2	>1,300VA	683	83.8	12.03	×	5.48	×
	R3	>6,600VA	842	79.8	7.23		2.06	○
	B2	2.2-200kVA	719	78.9	6.35		1.39	
	B3	>200kVA	659	77.2	3.46	△	0.73	◎
Air Conditioner (Improved COP)	R1-2	>1,300VA	683	61.8	6.02	×	2.32	○
	R3	>6,600VA	842	56.9	3.62	△	0.96	◎
	B2	2.2-200kVA	719	55.9	3.18		0.66	
	B3	>200kVA	659	53.3	1.73	○	0.35	
Chiller	B2	2.2-200kVA	780	82.5	6.02	×	1.08	○
	B3	>200kVA	659	83.4	8.18		1.50	
	S2	2.2~200kVA	683	82.8	6.88		1.24	
	S3	>200kVA	578	83.8	9.32		1.73	
	P2	>200kVA	700	83.2	7.70		1.40	
	I3-4	>200kVA	700	81.8	4.04	×	0.70	◎
Refrigerator	R1	-2,200VA	683	87.0	18.87	×	8.42	×
	R2-3	>2,300VA	842	84.0	12.20		5.58	
	B2	2.2~200kVA	719	82.2	9.53		4.03	△
	B3	>200kVA	719	91.2	25.07		18.87	×
VSD	I1	2.2-14kVA	817	78.9			1.56	○
	I2	14-200>kVA	747	79.3			1.71	
	I3	>200kVA	576	80.5			2.22	
	I4	>300,000kVA	510	81.3			2.51	
Motor	I1	2.2-14kVA	817	75.5	0.28	◎	0.06	◎
	I2	14-200kVA	747	75.5	0.31		0.06	
	I3	>200kVA	576	75.7	0.40		0.08	
	I4	>300,000kVA	510	75.7	0.45		0.09	
TV	R1	-450VA	400	217.1	85.19	×	8.52	×
	R1	900-1,300VA	601	189.1	57.70		5.77	
	R1-3	>1,300VA	787	178.0	50.45		5.05	
	B2	2.2-200kVA	780	162.7	39.38		3.94	△
	B3	>200kVA	659	155.0	36.37		3.67	

1) CFL

- Total life cycle cost of CFL decreases to about 30% of incandescent, which value is quite drastic reduction.
- Economics of replacement from incandescent to CFL is also excellent.
- In case of new lamp selection, CFL should be definitely selected.
- Sensitivity Analysis of Incandescent Lamp Replacement by CFL However, there are some rumor or comments that some CFL can't last one year. It is probable that the reasons why some CFL could not last long are quality of CFL itself and/or quality of supplied electricity. In the calculation, the life of CFL is assumed as 6,000hours. If the life of CFL become 1,000 hours, the economics of CFL could not be secured.

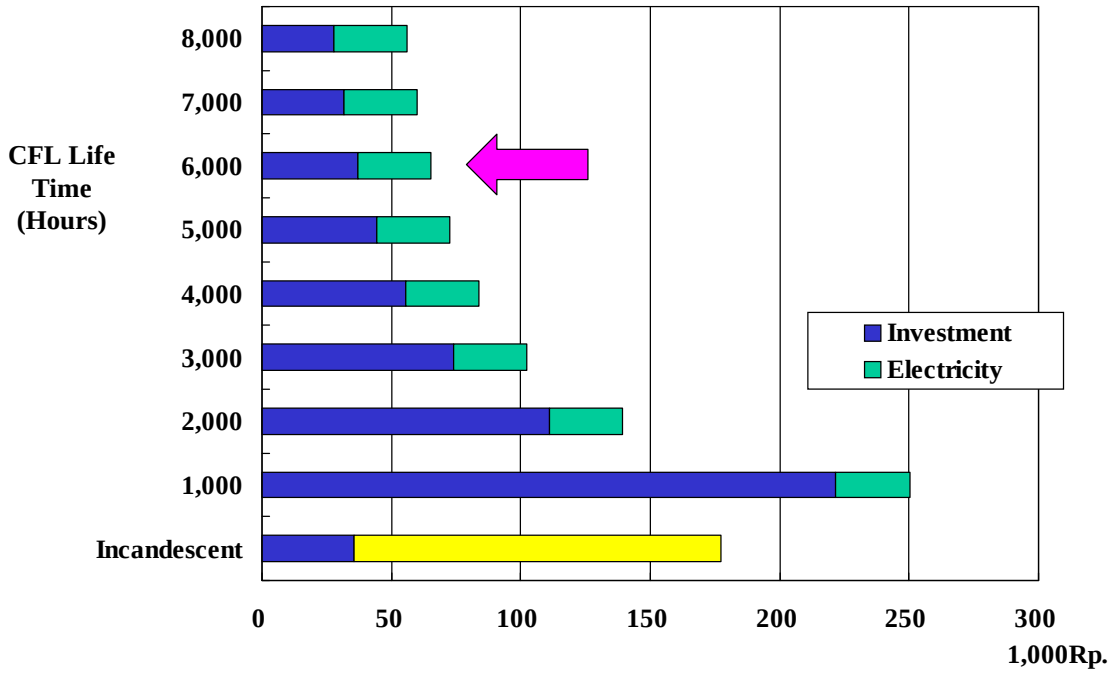


Fig. 3-2 Sensitivity Analysis of Incandescent Replacement by CFL (5 Years)

2) Electronic Ballast

- Total life cycle cost of electronic ballast decreases to about 80% of magnetic ballast.
- Economics of replacement from magnetic to electronic ballast is recommended.
- In case of new ballast selection, electronic one should be selected.

3) Street Light

- Total life cycle cost of sodium streetlight decreases to about 87% of mercury streetlight.
- Economics of replacement from mercury to sodium is not good but further study is required.
- In case of new streetlight selection, sodium type is recommended.

4) Air Conditioning

- Total life cycle cost of high efficiency air conditioner decreases to about 80% of standard one.
- Economics of replacement from standard to high efficiency one is not good.
- In case of new air conditioner selection, high efficiency one is recommended.
- More high efficiency air conditioner should be sold in Indonesian market with reasonable price.

5) Chiller

- Total life cycle cost of high efficiency chiller decreases to about 80% of standard one.
- Economics of replacement from standard to high efficiency one is not good. Other measures such as CDM and EPPs (Efficiency Power Plants) should be studied.
- In case of new chiller selection, high efficiency one should be selected.

6) High Efficiency Refrigerator

- Total life cycle cost of high efficiency refrigerator decreases to about 87% of standard one.
- Economics of replacement from standard to high efficiency one is not good.
- In case of new refrigerator selection, high efficiency one should be selected.

7) VSD

- Total life cycle cost decreases to about 80% by VSD.
- VSD adoption in industrial sector should be studied.

8) Motor

- Total life cycle cost of high efficiency motor decreases to about 75% of standard one.
- Economics of replacement from standard to high efficiency one is recommended.
- In case of new motor selection, high efficiency one should be selected.

9) Television

- Total life cycle cost of high efficiency TV increases to about over 150% of standard one.
- Economics of replacement from standard to high efficiency one is bad.
- In case of new TV selection, high efficiency one is recommended.

Fig. 3-3 and 3-4 shows payout time of replacement and initial purchase of high efficiency electric appliance. Economics of street light, air conditioner, chiller, refrigerator and television are not good unexpectedly. There are two reasons of this bad economics. First one is the reliability of calculation condition such as efficiency and price. Second one is the high price setting by manufacturers and dealers of high efficiency electric appliances. Price should be set at reasonable value reflecting electricity consumption.

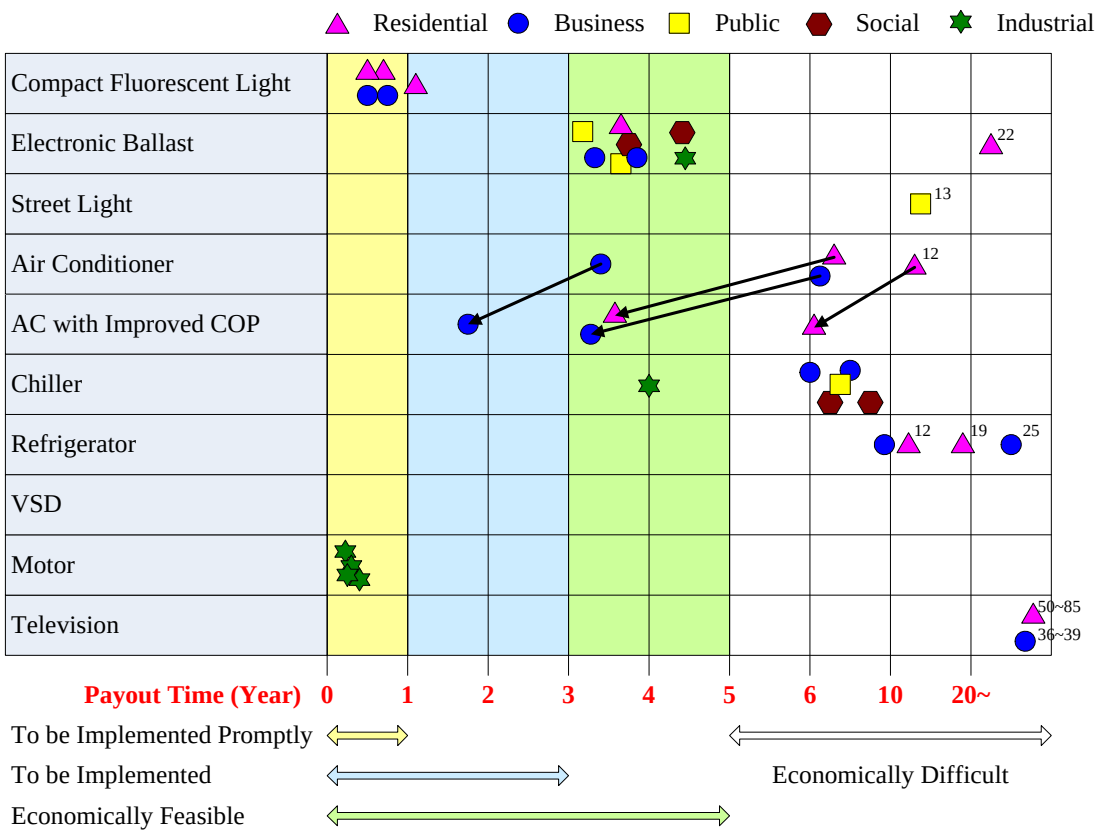


Fig. 3-3 Payout Time of Replacement

- CFL is the most profitable to be promoted with the highest priority. And technologically easy.
- Electronic ballast seems to be profitable. Technological points of replacement should be checked.
- The change from mercury to sodium light is not attractive. Further study is required.
- Air conditioner is the biggest possibility of electricity conservation. In addition, the introduction of inverter air conditioner, which is not popular in Indonesia, will conserve electricity drastically. Introduction of labeling system is indispensable to promote air conditioner replacement.
- High efficiency chiller is better. However, the replacement is not easy work securing operation during construction and space.
- The economics of refrigerator replacement looks bad. But it's depending greatly on calculation condition. It is difficult to promote it without labeling system.
- VSD and high efficiency motor for industrial sector is economical. Also labeling and energy manager system should be studied for these measures implementation.
- EE&C by replacing CRT to LC or plasma is rather suspicious. Further study is necessary.

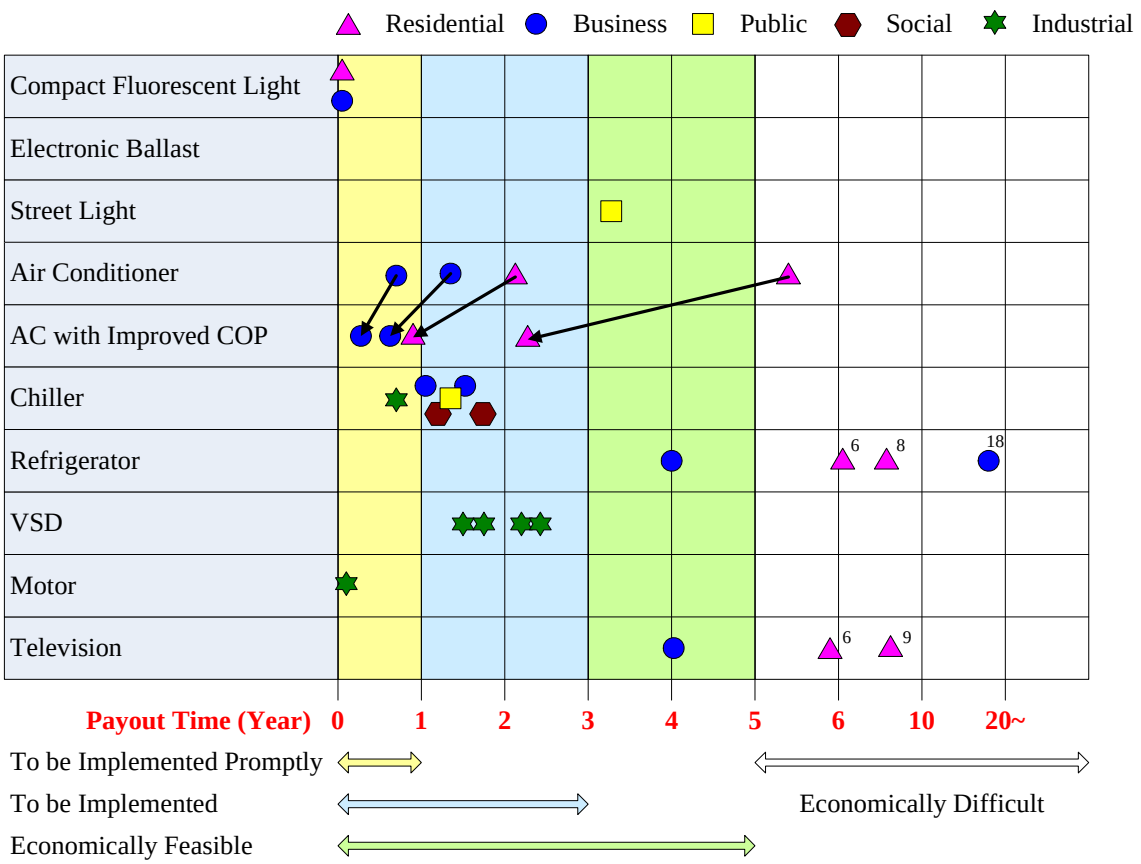


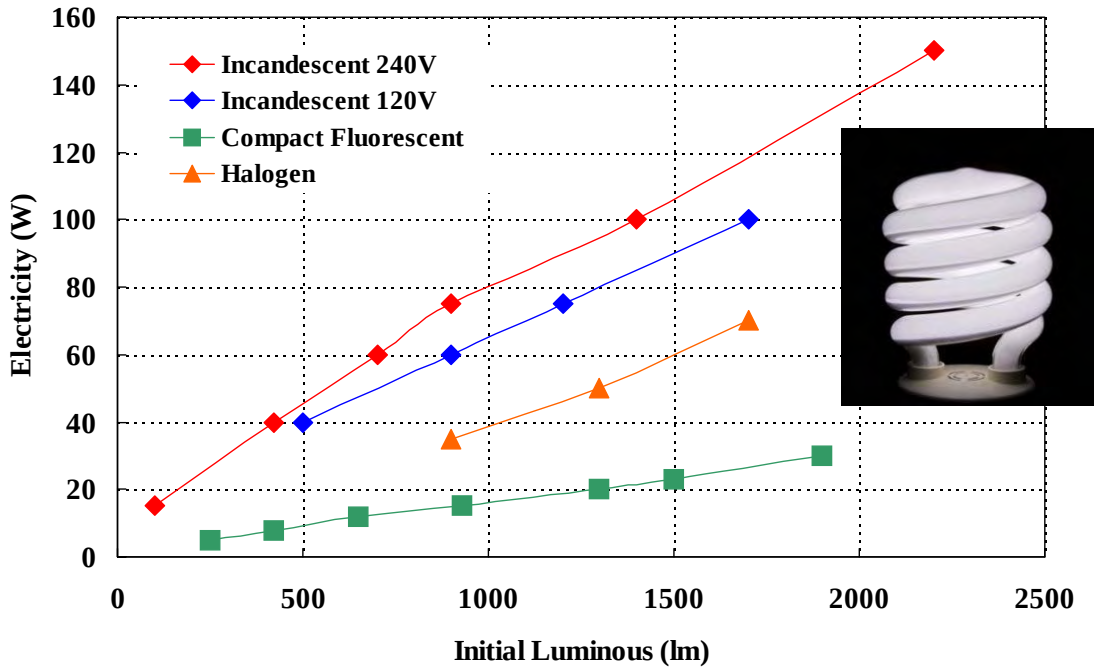
Fig. 3-4 Payout Time of Initial Purchase of High Efficiency Appliances

4. Technological and Economical Review of Selected High Efficiency Electric Appliances

(1) EE&C Lamp

Indonesian government, PLN and people focused compact fluorescent lamp (CFL) as the most prospective EE&C lamp and DSM measure. Currently there are 15 CFL manufacturers in Indonesia, total production capacity of which is about 150,000,000 unit/year.[5]

Fig. 4-1 shows the comparison of electricity consumption by bulb type. CFL could drastically reduce the electricity consumption.



Source: Widpekia

Fig. 4-1 Electricity Consumption by Bulb Type

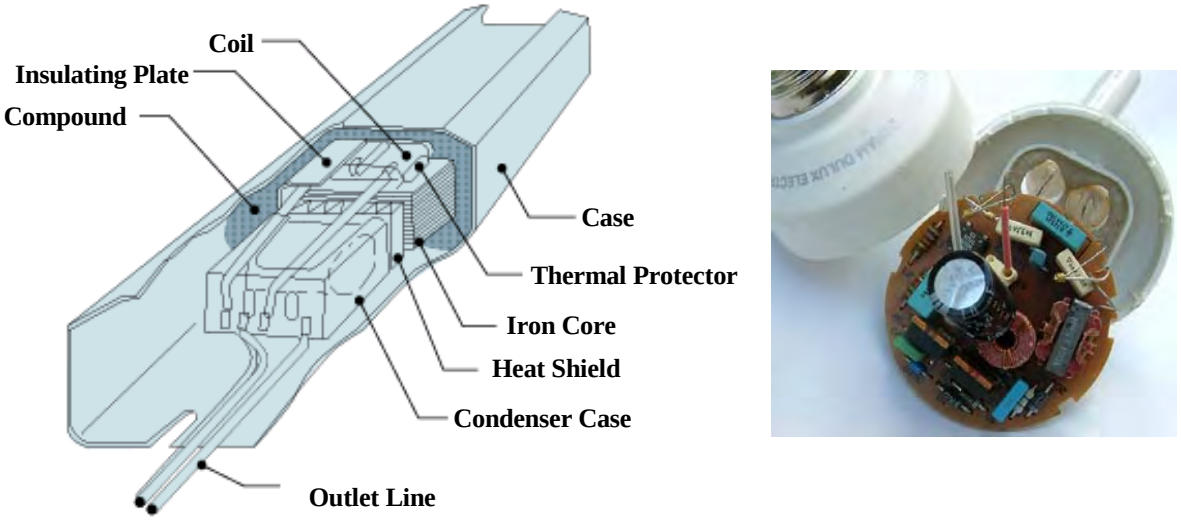
CFLs, like all fluorescent lamps, contain small amounts of mercury and it is a concern for landfills and waste incinerators where the mercury from lamps is released and contributes to air and water pollution. In Indonesia, used CFLs and fluorescent lamps are disposed to landfills. To cope with this environmental issues, production of low mercury containing CFL and recovery of mercury should be studied.

(2) Electronic Ballast

Ballast of fluorescent lamp controls electric current at proper value suitable for the lamp and supplies initiating voltage necessary for putting on light and preheating voltage suitable for electrode. And some of ballast has condenser for improving power factor and preventing radio disturbance. Ballast is the core appliance of fluorescent lamp directly influencing efficiency and life. Most of (90%) ballast is still imported and 10% is produced in Indonesia. The structure of

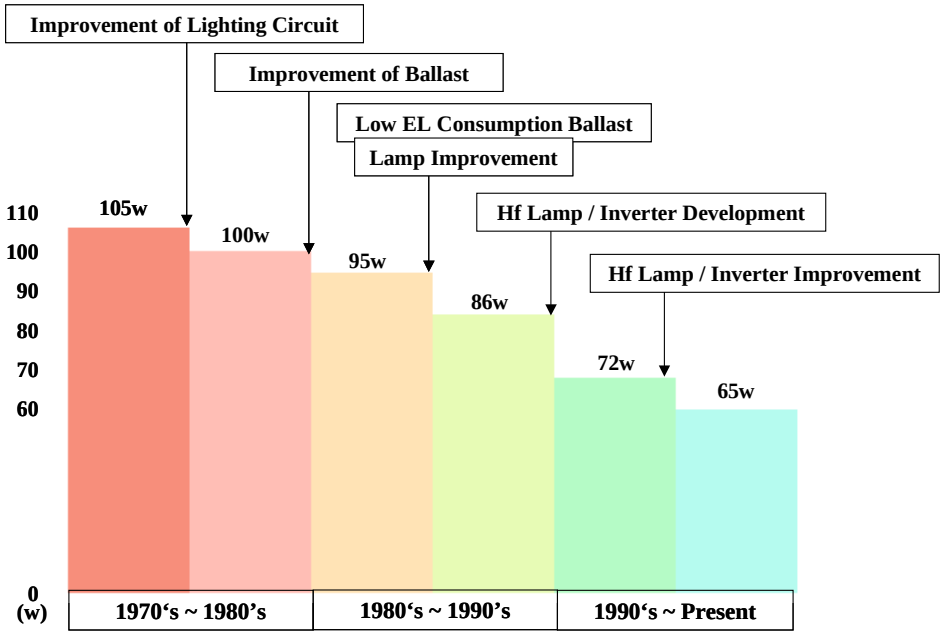
[5] APERLINDO (Indonesian Electric Lamp Industry Association)

electronic ballast is shown in Fig. 4-2.



Source: http://www.iwasaki.co.jp/kouza/142

Fig. 4-2 Structure of Electronic Ballast with Condenser



Source: http://www.decora.jp/environmen/environmen03.html

Fig. 4-3 Improvement of Electricity Consumption Efficiency for Fluorescent Lamp[6]

As shown in Fig. 4-3, the electricity consumption of fluorescent lamp improved by technology development steadily.

Comparison of electricity consumption by fluorescent lamp[7]

6

- ✓ High Power Factor Iron Core Ballast (Long Term Usage): 100W
- ✓ High Power Factor Iron Core Ballast (New Product): 85W
- ✓ General Electronic Ballast: 72W
- ✓ Advanced Electronic Ballast: 62W

(3) Street Lights

Generally streetlight uses HID (High Intensity Discharge) lamps such as high-pressure mercury, metal halide and high-pressure sodium. Among them, the luminous efficiency of high-pressure sodium lamp is the largest shown in Table 4-1. In Indonesia, 50% of installed streetlight use sodium type and the rest are non-sodium for village and housing environment.

Table 4-1 Luminous Efficiency of Various Light Sources

Kind of Lamp		Luminous Efficiency
		lm/W
Fluorescent Lamp	Heated Cathode Type	40~110
Incandescent Lamp (Filament Type)	5W	2~4
	40W	11~13
	100W	16~18
	Halogen	20
Discharge Lamp	High Pressure Mercury	50
	High Pressure Fluorescent Mercury	40~50
	Xenon	25~35
	Metal Halide	60~100
	High Pressure Sodium	110~130
Light-Emitting Diode	Pseudo White (Blue/Yellow)	30~100
	Pseudo White (Power)	20~80

(4) Air Conditioning

There are four domestic manufactures of air conditioner in Indonesia. Total production capacity is 206,000 units per year.

Table A1-4 shows performance and price of currently available air conditioner (less than 1HP) in Japanese market. It should be noted that in Japanese market, there are no low COP (Coefficient of Performance) air conditioner such as 2.5 or 3.3 available. It is believed that Top Runner System and Labeling System contributed to this high efficiency product oriented market.

[7] Source: http://www.decora.jp/environmen/environmen03.html

Table 4-2 Price, Performance and Electricity Consumption of Air Conditioner in Japan

Unit for 10~15m²

	COP	Electricity Consumption					Yearly Electricity Cost	Price
		Cooling	Heating	Cooling	Heating	Total		
		W		kWh/Year			Yen	Yen
A	5.66	395	435	185	575	760	16,700	125,000
B	5.80	390	420	189	571	760	16,700	69,800
C	5.80	390	420	186	574	760	16,700	118,000
D	5.28	435	455	217	599	816	18,000	99,800
E	5.28	435	400	210	654	864	19,000	92,800
F	5.28	470	375	243	639	882	19,400	49,800
G	5.28	455	385	232	668	900	19,800	79,800
H	5.28	455	385	242	658	900	19,800	45,800
Max	6.22	470	465	295	735	958	Data of 42 products including above A-H	
Avg.	5.37	436	415	216	629	844		
Min	5.27	360	375	162	529	700		

Source: Mass Retailer Price as of 20th July 2008

Fig. 4-4 shows COP and price of air conditioner in Japanese and Indonesian market. By the increase of COP, price could be increased. The price difference between Japanese and Indonesian products is reasonable (blue line). But the price difference among Japanese product of same COP is peculiar. The price of products is decided by each manufacturer's strategy. It is probable that manufacturers want to get profit through adding advanced IT technology, beautiful design and unnecessary function. The most important responsibility for electric appliance manufacturers is to provide high efficient product with reasonable price, by which mass production become realistic and profit could be secured.

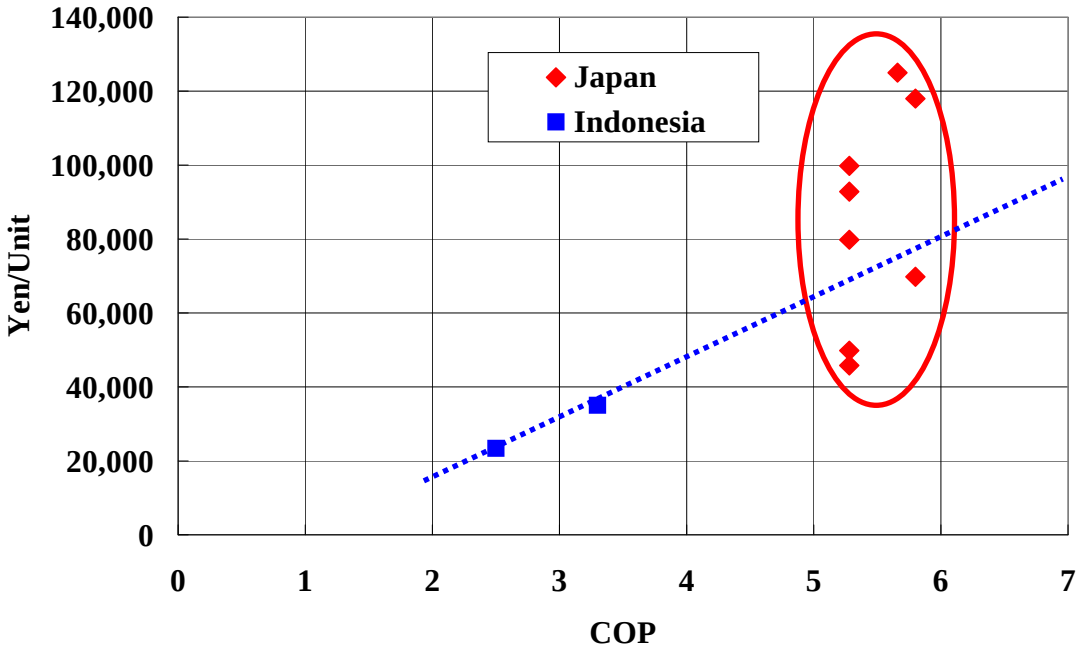


Fig. 4-4 COP and Price of Air Conditioner in Japan and Indonesia

Rather large COP difference between products available in Indonesian and Japanese market likely comes from the adoption of inverter system. Inverter air conditioning adopts control system of rotating speed on compressor.

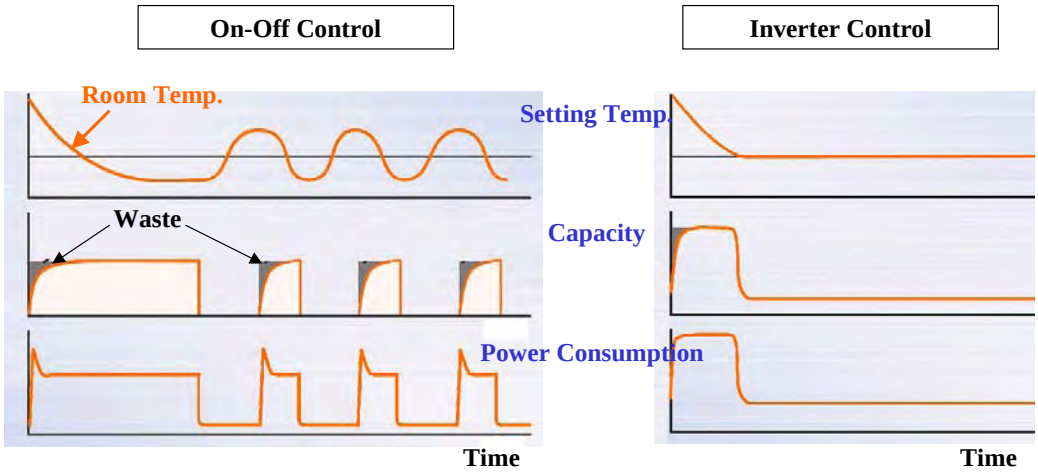


Fig. 4-5 Difference between On-Off and Inverter Control of Air Conditioner

(5) Chiller

A chiller is a machine that removes heat from a liquid via a vapor-compression or absorption refrigeration cycle. Most often water is chilled, but this water may also contain ~20% glycol and corrosion inhibitors. Fully Chilled water is used to cool and dehumidify air in mid- to large-size commercial, industrial, and institutional facilities. Most chillers are designed for indoor operation, but a few are weather-resistant. In air conditioning systems, chilled water is distributed to heat exchangers, or coils, in air handling units, and used water is returned to the chiller. These cooling coils transfer sensible heat and latent heat from the air to the chilled water, thus cooling and usually dehumidifying the air stream. A typical chiller for air conditioning applications is rated between 15 to 1500 tons (180,000 to 18,000,000 BTU/h or 53 to 5,300 kW) in cooling capacity.

Almost all chillers are imported, only small amount is assembled in domestic.

Fig. 4-6 Chiller System

(6) High Efficiency Refrigerator

As shown in Fig. 4-7, the increase of capacity (freezer-refrigerator volume) increases electricity consumption. However there are some deviations even in same level of capacity. It's because of EE&C technology difference. Labeling system is helpful for customer to select EC appliances.

And it is better to install large-size refrigerator than to install multi small refrigerators to decrease fix portion of electricity consumption.

Source: EE&C Catalog of 2008, EE&C Center Japan

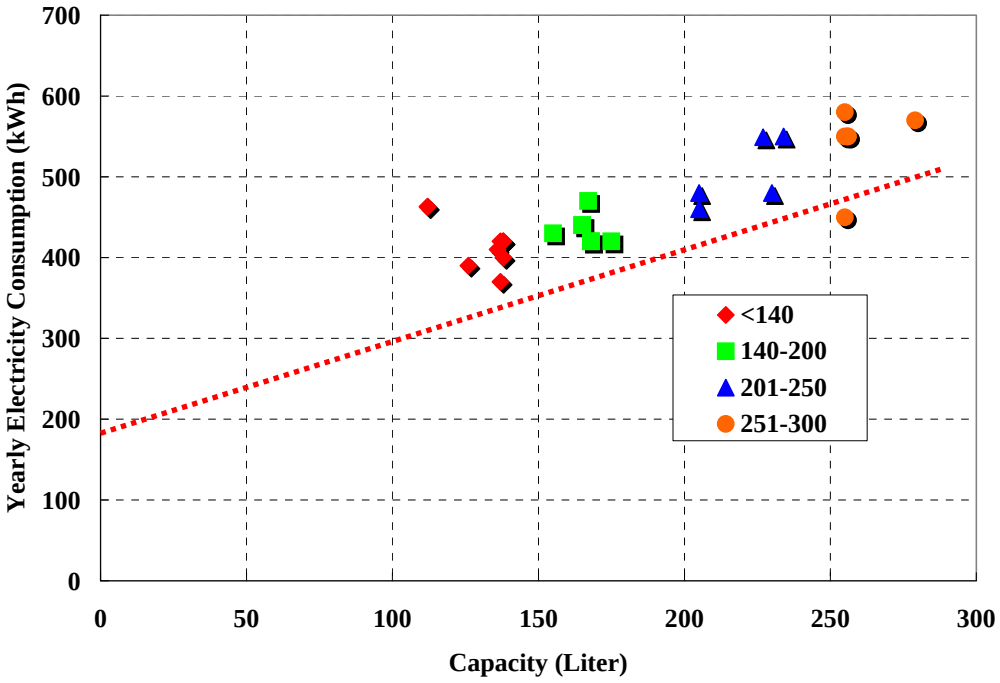


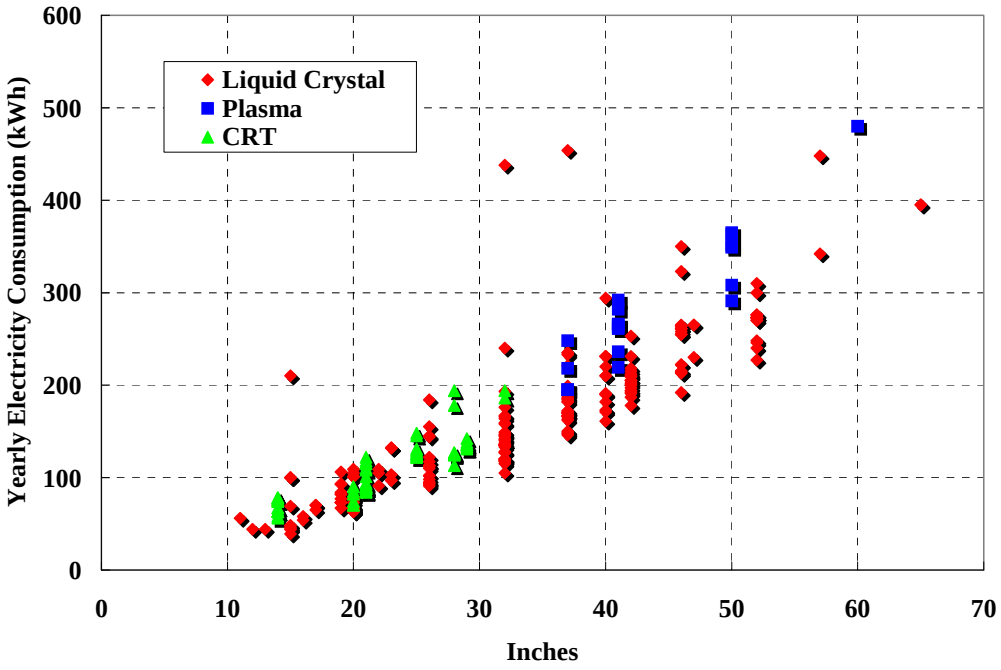
Fig. 4-7 Yearly Electricity Consumption by Capacity of Refrigerator-Freezer in Japan

(7) Television

Fig. 4-8 shows the electricity consumption of televisions, which are available in Japanese current market. (Almost all TV in Japan)

- Generally speaking, increase of display size of TV increases electricity consumption.
- CRT TV does not necessarily consume higher electricity than LC or plasma.
- Plasma TV consumes more electricity than LC.
- There are big deviation of electricity consumption among same size and same kind TV.

Customers should realize such difference among products through labeling system. It is strongly recommended to initiate labeling system as soon as possible.



Source: EE&C Catalog of 2008, EE&C Center Japan except CRT. CRT data is from 2006 catalog.

Fig. 4-8 Electricity Consumption of Television by the Display Kinds in Japanese Market

5. Contribution of High Efficiency Electric Appliance to National EE&C

Based on above study in Appendix 3 and 4, the contribution of high efficiency electric appliance to national EE&C is estimated. Estimation procedure is shown in Fig. 5-1.

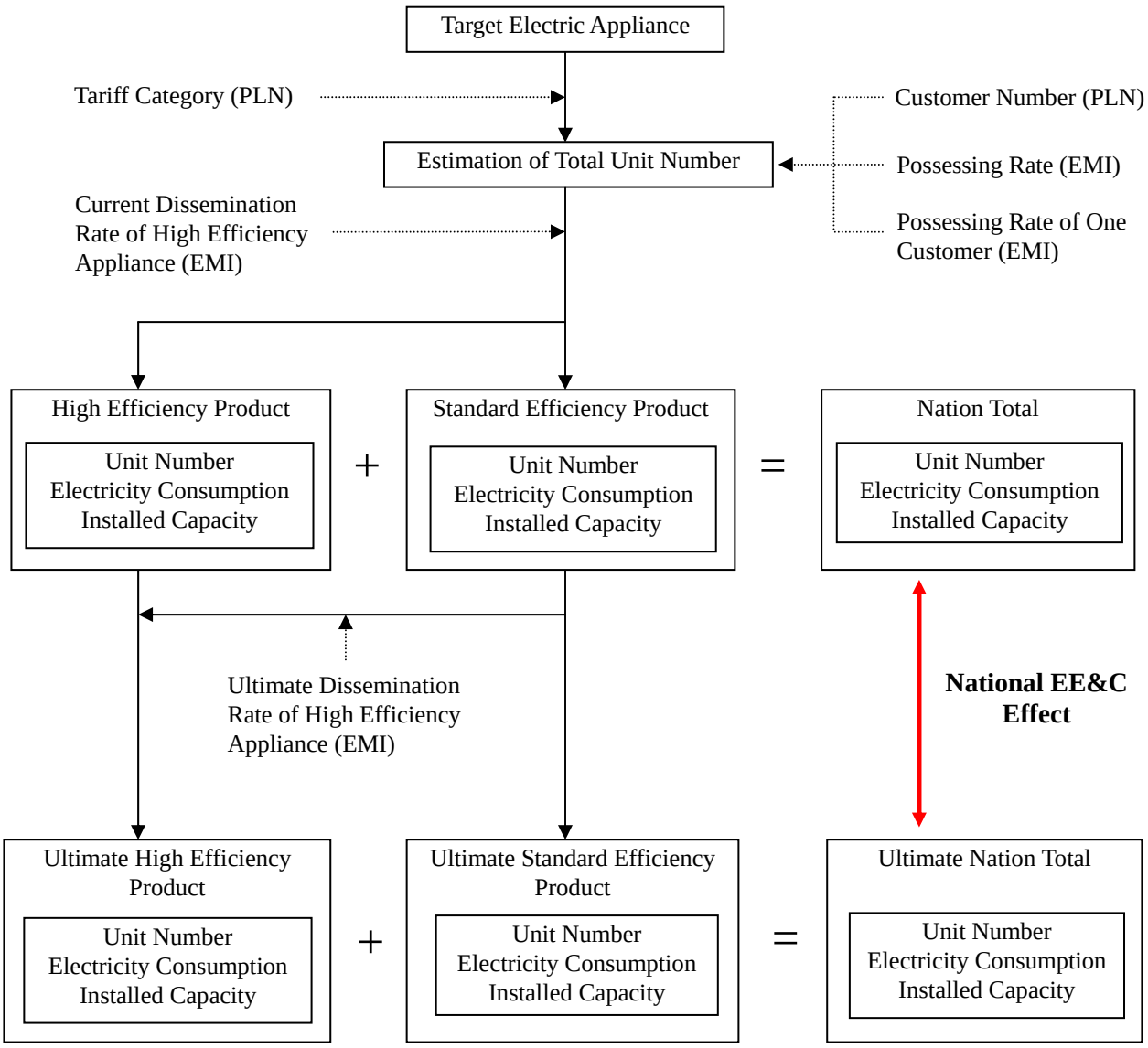


Fig. 5-1 Calculation Procedure of National EE&C Effect

(1) Residential Sector

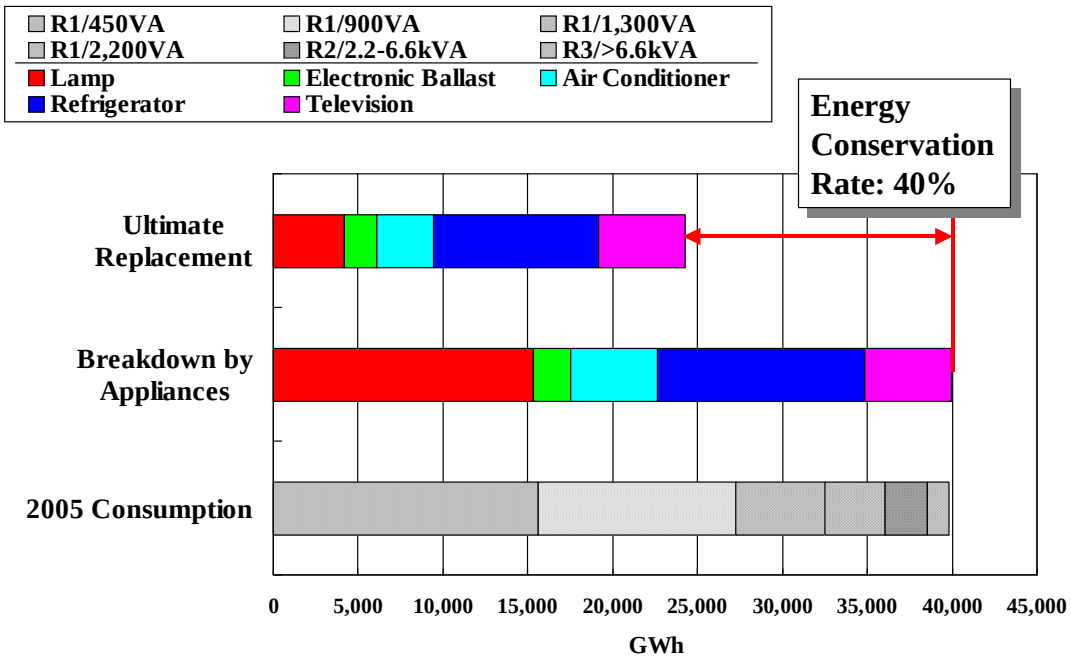


Fig. 5-2 Contribution to Electricity Conservation in Residential Sector

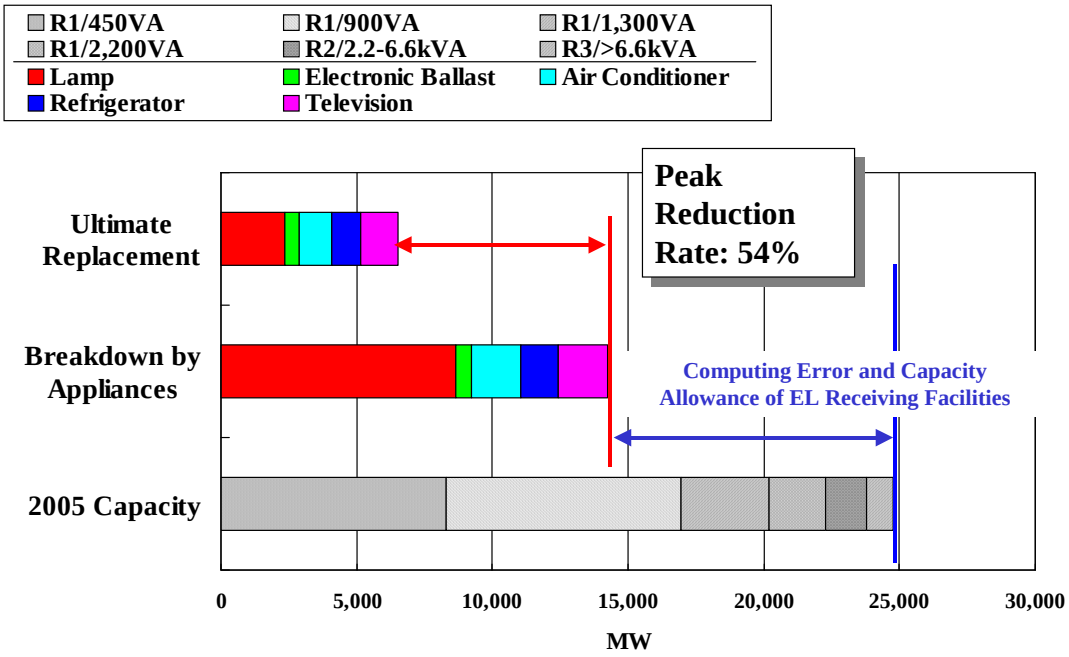


Fig. 5-3 Contribution to Peak Reduction in Residential Sector

(2) Social Sector

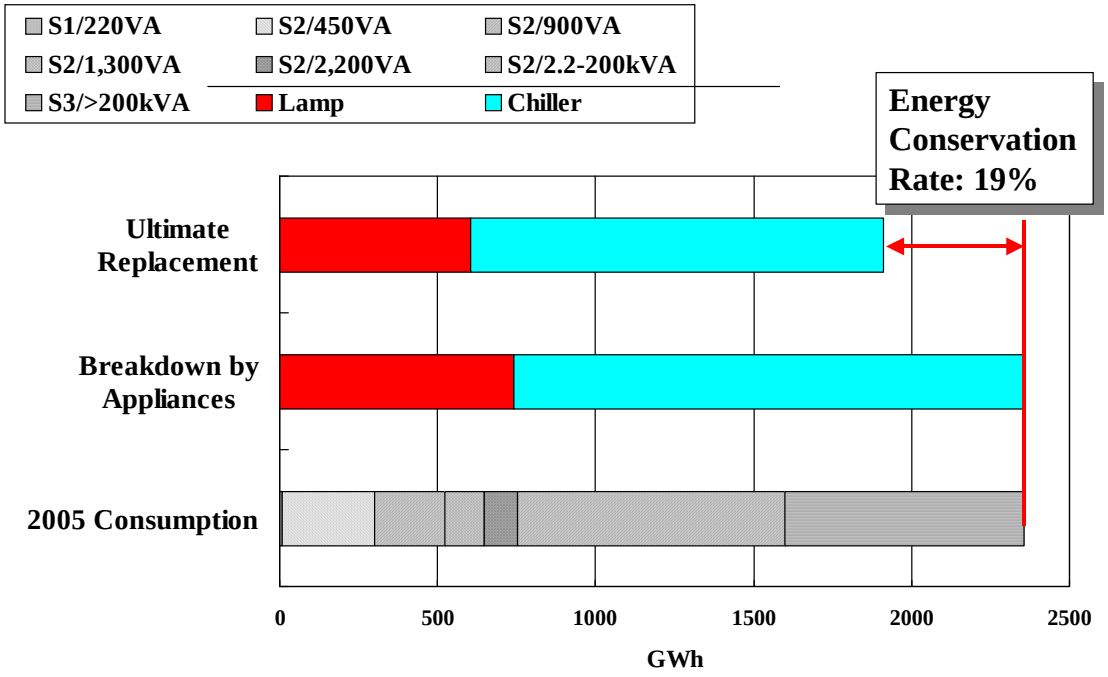


Fig. 5-4 Contribution to Electricity Conservation in Social Sector

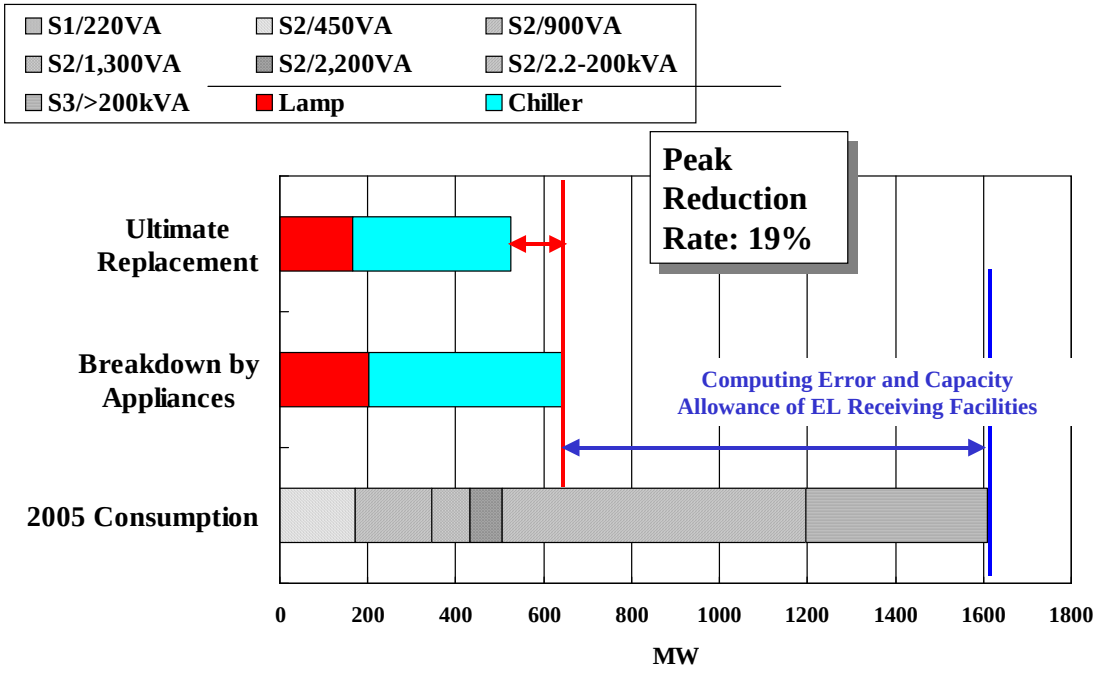


Fig. 5-5 Contribution to Peak Reduction in Social Sector

(3) Public Sector

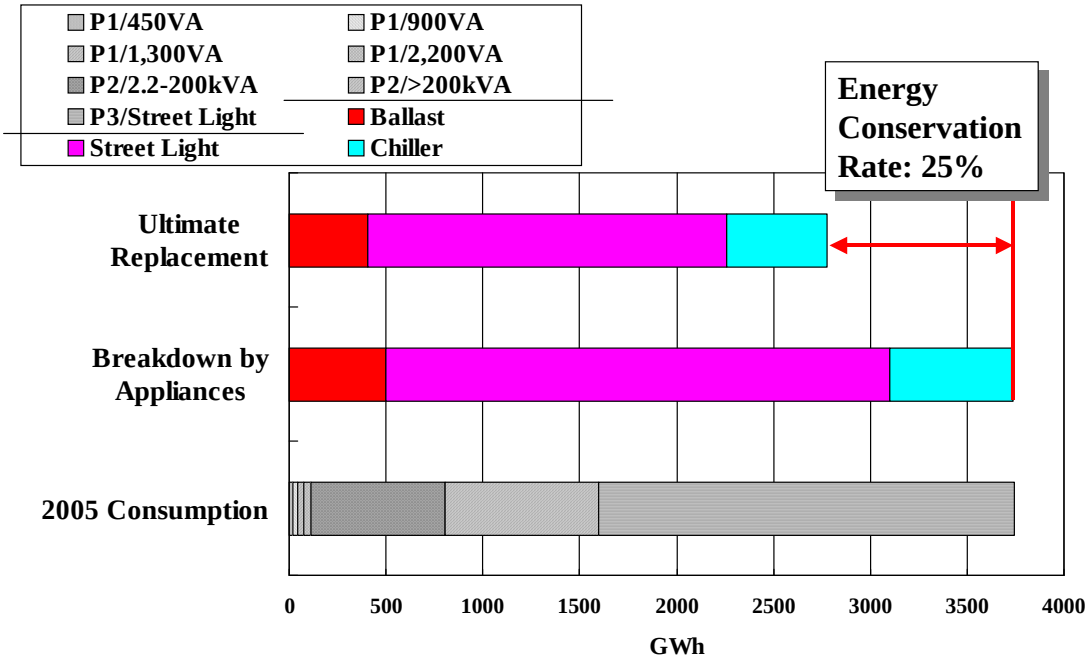


Fig. 5-6 Contribution to Electricity Conservation in Public Sector

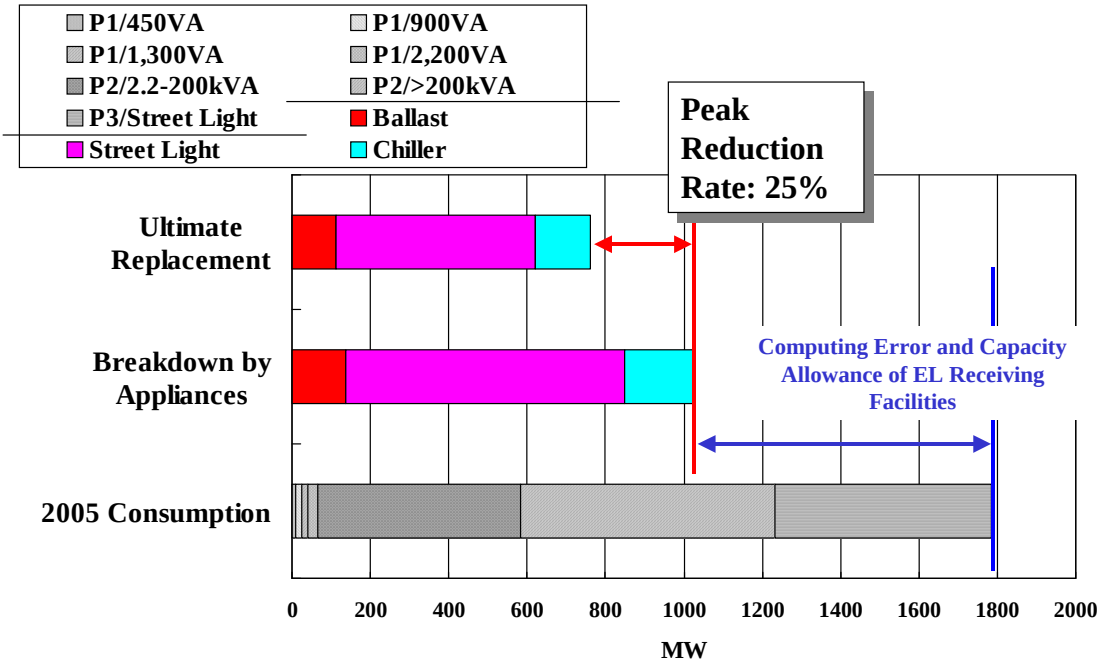


Fig. 5-7 Contribution to Peak Reduction in Public Sector

(4) Business Sector

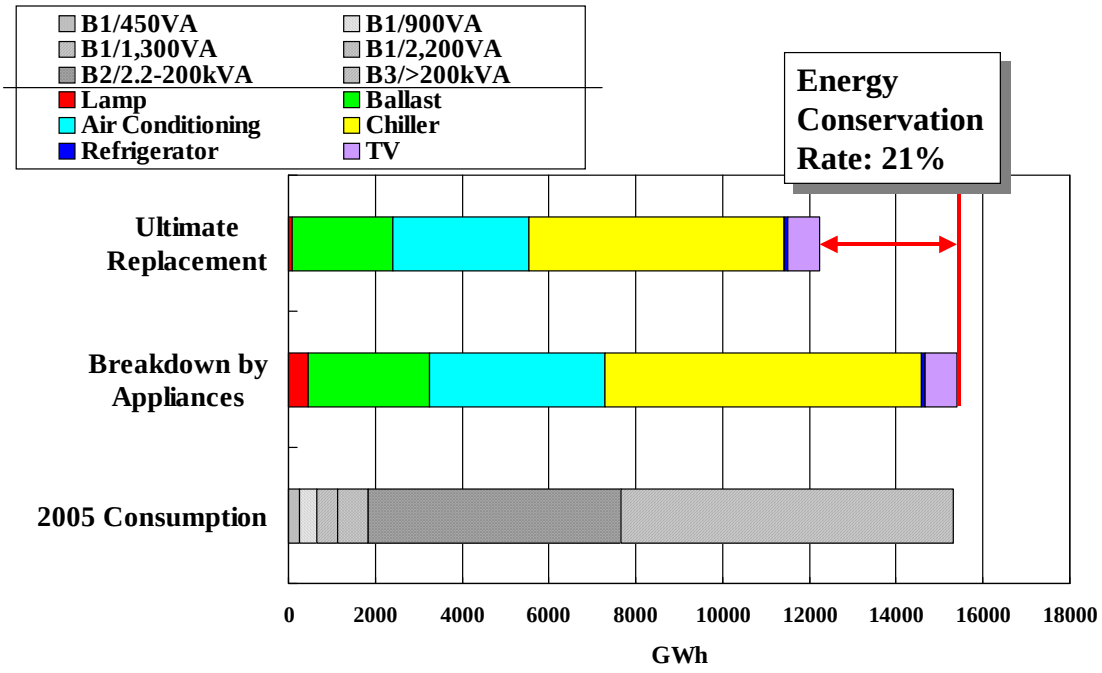


Fig. 5-8 Contribution to Electricity Conservation in Public Sector

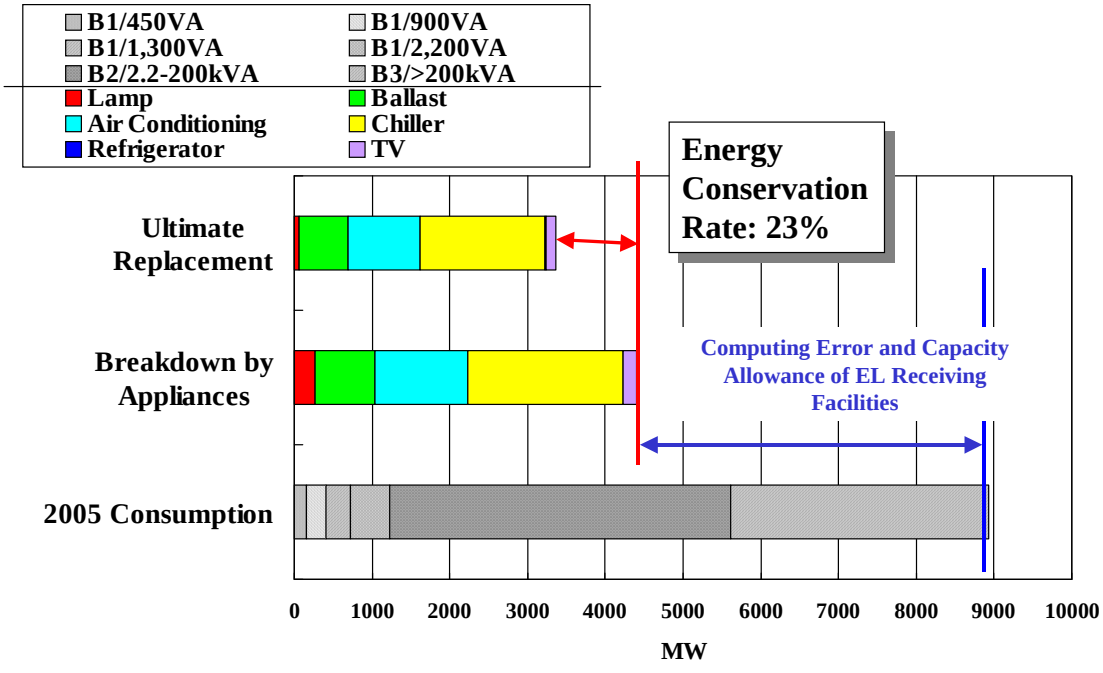


Fig. 5-9 Contribution to Peak Reduction in Business Sector

(5) Industrial Sector

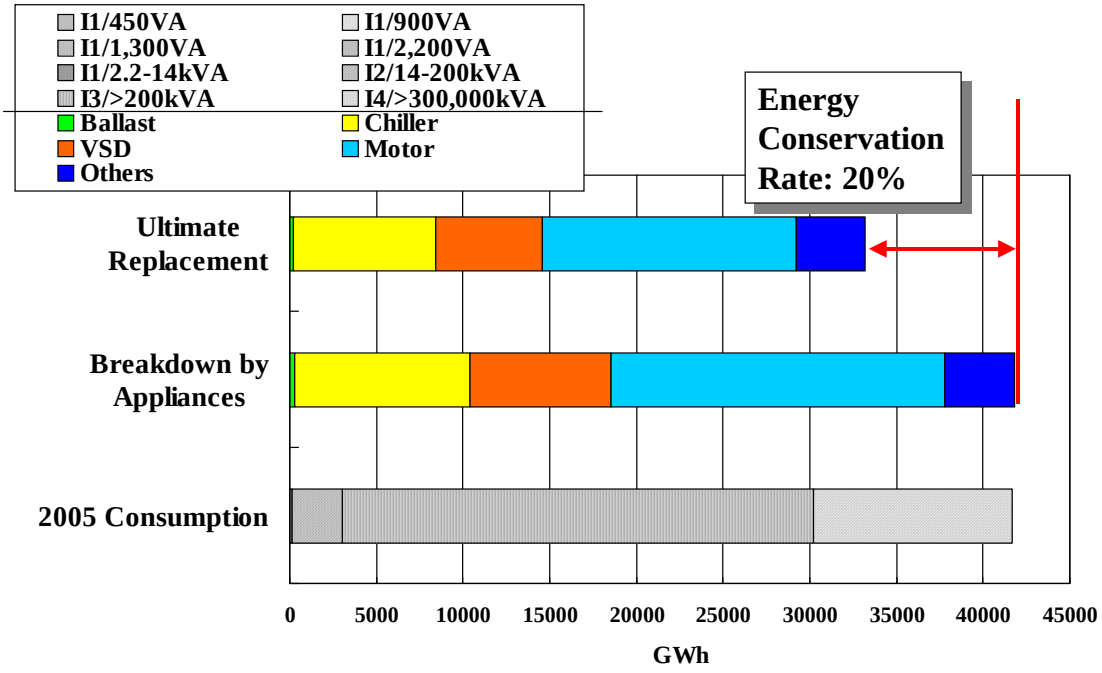


Fig. 5-10 Contribution to Electricity Conservation in Industrial Sector

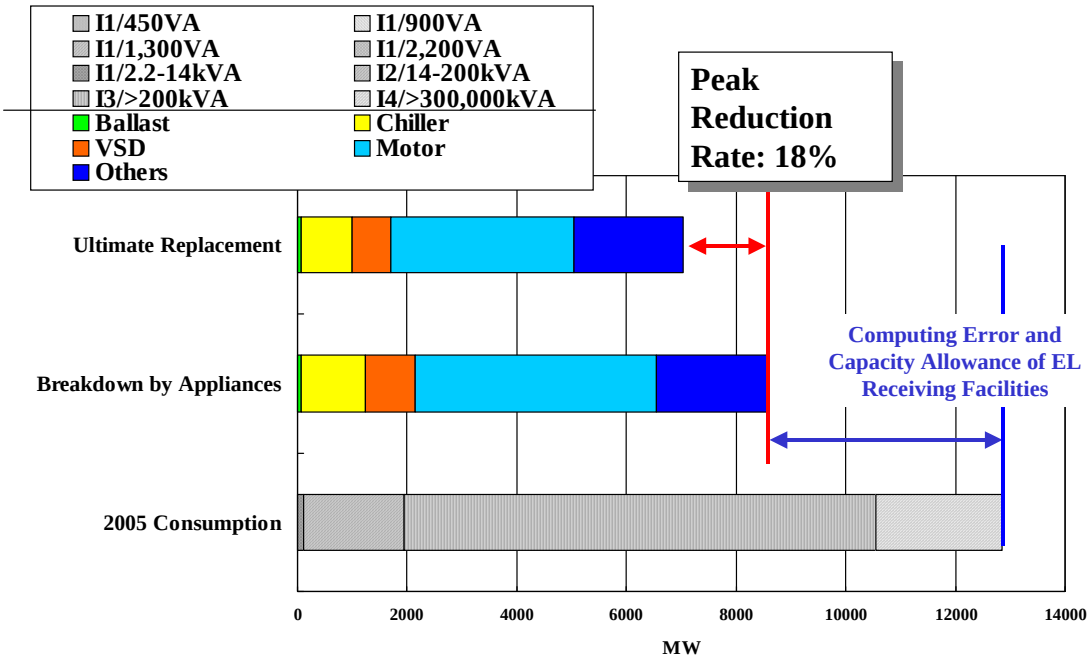


Fig. 5-11 Contribution to Peak Reduction in Industrial Sector

(6) High Efficiency Electric Appliances Contribution to EE&C in Indonesia

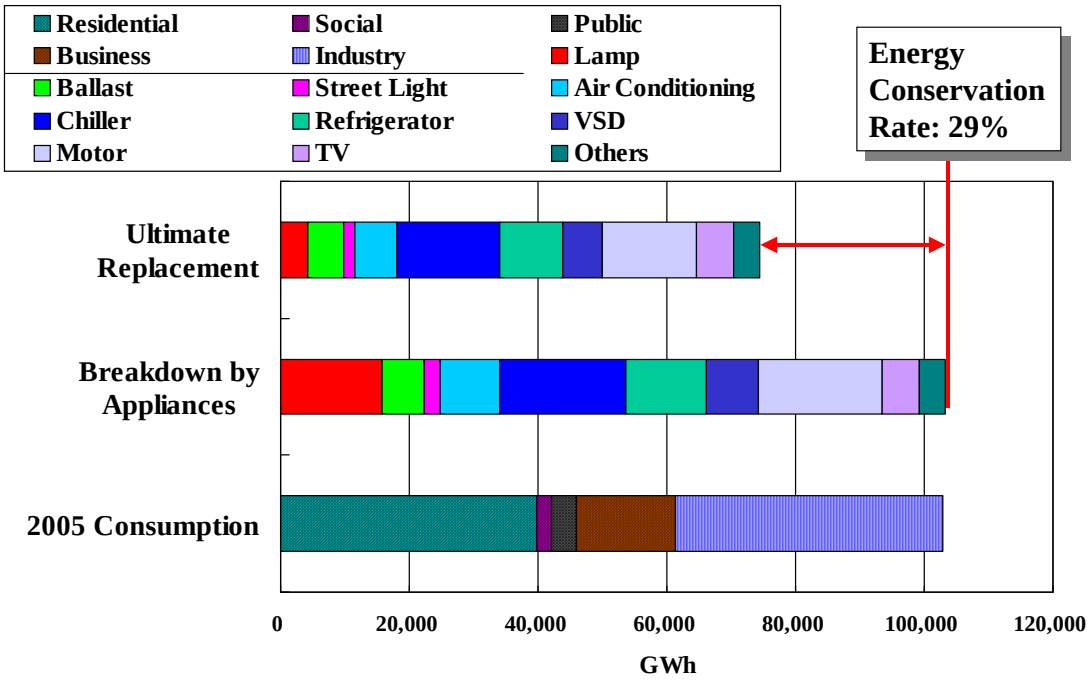


Fig. 5-12 Contribution to Electricity Conservation in Indonesia

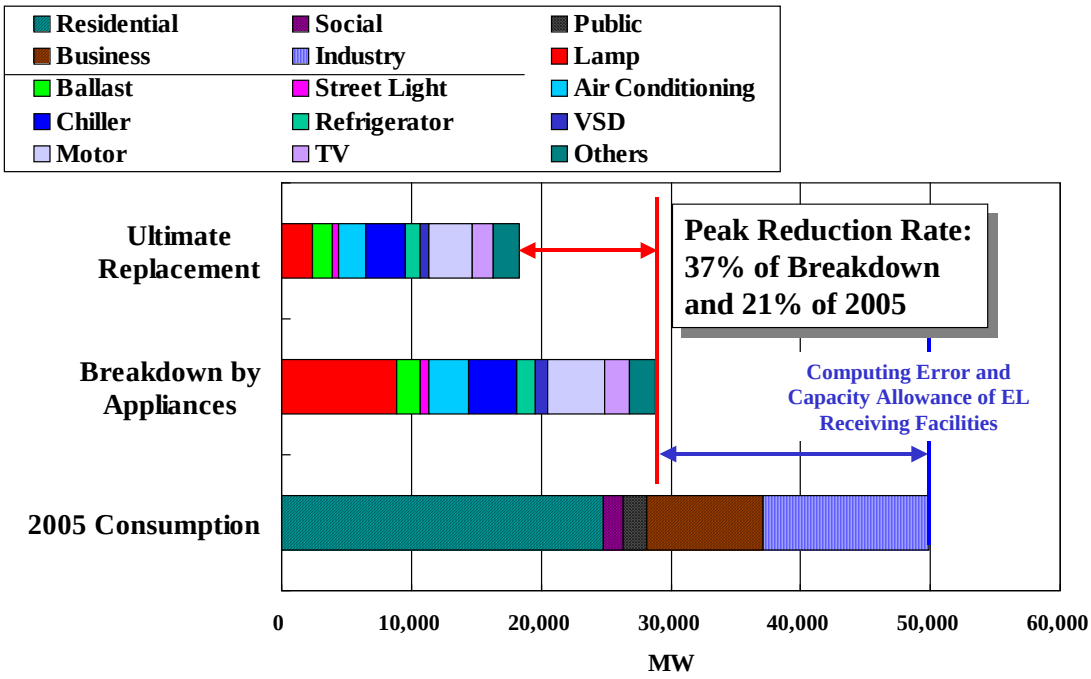


Fig. 5-13 Contribution to Peak Reduction in Indonesia

6. Energy Intensity and Elasticity Including International Comparison

Energy (Electricity) intensity and elasticity are effective indicators to judge the degree of EE&C. These both indicators the lower the better. In this report, energy intensity means energy use divided by GDP and energy elasticity means growth rate of energy use divided by growth rate of GDP.

(1) Energy (electricity) intensity and elasticity of Indonesia

Fig. 6-1 shows recent trend of energy intensity of Indonesia. Transportation sector improved very much, although other sectors are stagnant.

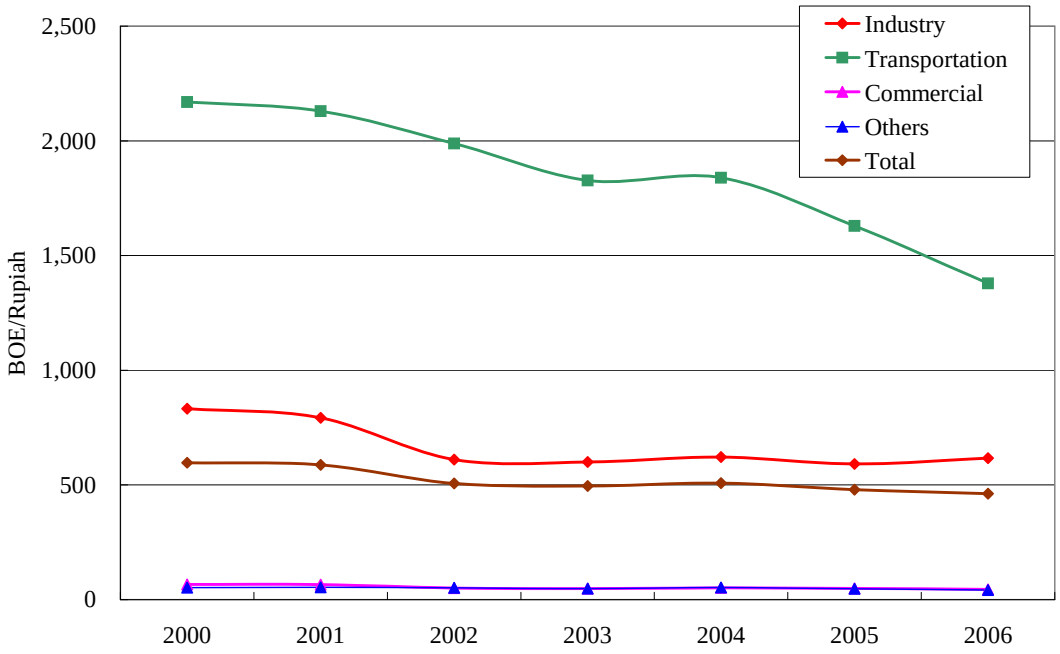


Fig. 6-1 Energy Intensity by Sector (Final Energy Consumption/GDP)

Fig. 6-2 (6-3) shows energy (electricity) elasticity of Indonesia. Different from energy intensity, the value changes significantly year by year. Theoretically elasticity seems preferable indicator to evaluate the degree of EE&C. But as shown in Fig. 6-1, yearly fluctuation is too large to evaluate. The reason of this fluctuation comes from GDP growth rate, which reflects too many factors of economic activities. This elasticity is not suitable as yearly indicator, but could be applied as long-term one utilizing moving averages such as five year.

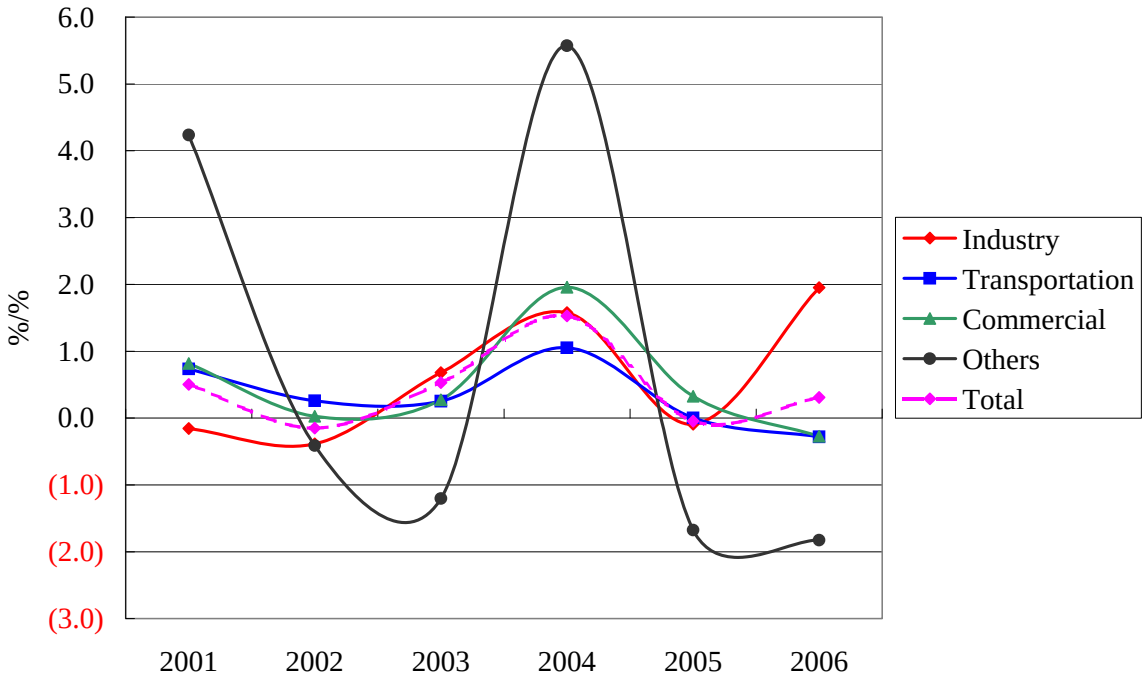


Fig. 6-2 Energy Elasticity of Indonesia

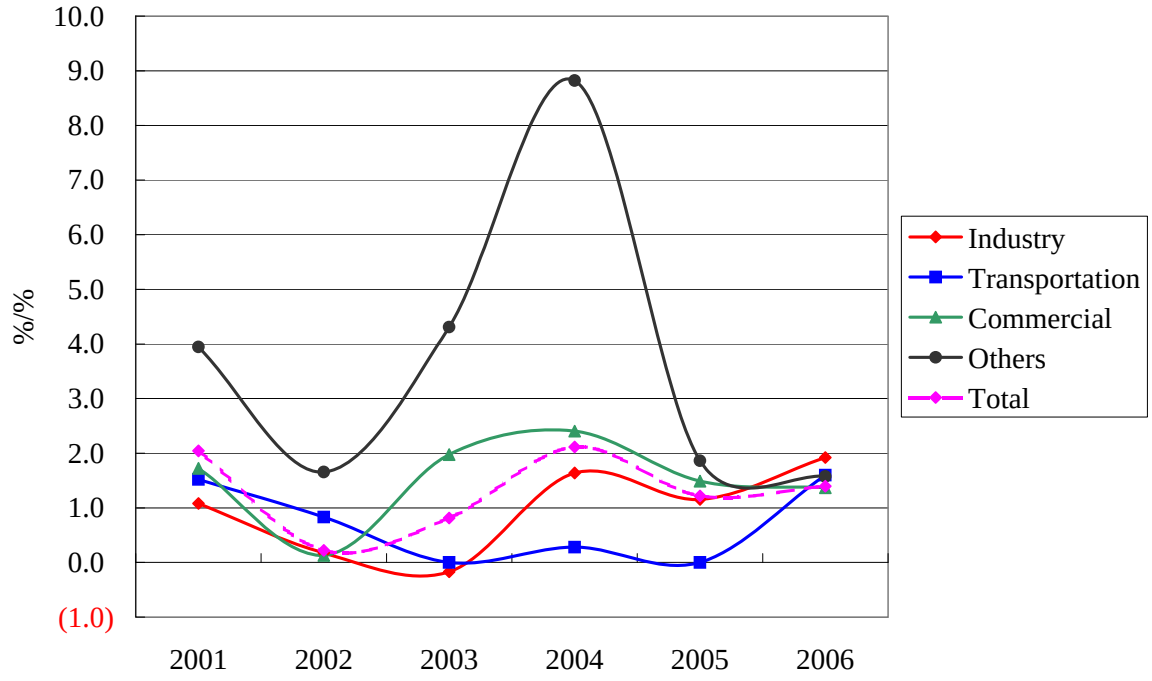


Fig. 6-3 Electricity Elasticity of Indonesia

Table 6-1 shows moving averages of energy and electricity elasticity of Indonesia from 2000 to 2006.

Table 6-1 Energy and Electricity Elasticity by Sector (2000 ~ 2006 Average)

	Growth Rate (%/Year)			Elasticity (%/%)	
	GDP	Energy	Electricity	Energy	Electricity
Industry	**9.16**	**2.15**	**5.25**	**0.24**	**0.57**
Transportation	**13.09**	**3.44**	**7.26**	**0.26**	**0.55**
Commercial	**10.38**	**3.18**	**9.68**	**0.31**	**0.93**
Others	**3.68**	**-0.71**	**9.26**	**-0.19**	**2.51**
Total	**7.26**	**1.83**	**6.46**	**0.25**	**0.89**

(2) International Comparison of Intensity[8]

Fig. A6-4 shows national total energy intensity of Asian countries. Almost countries show the trend of decreasing or remain unchanged.

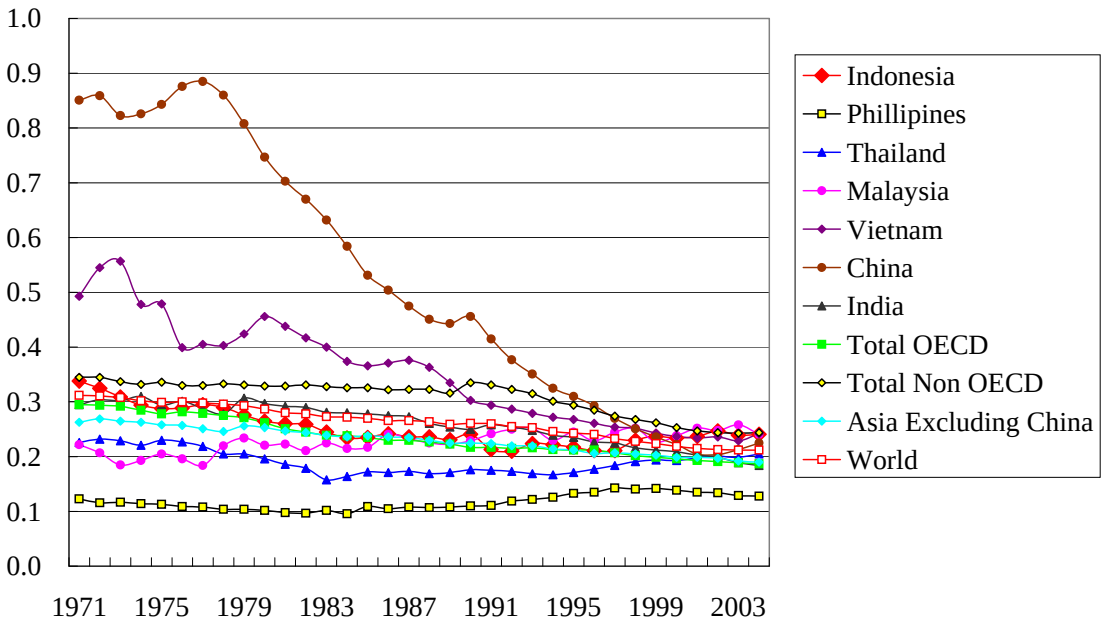


Fig. 6-4 Energy Intensity Comparison of Asian Countries (TOE/US$ GDP at 2000 Price)[9]

Fig. 6-5 shows energy use per capita of Asian countries. OECD countries show much higher consumption per capita. Energy use per capita of Asian countries grows steadily.

[8] IEA Energy Balance of Non-OEDC countries and OECD countries, 2006

[9] PPP: Purchasing Power Parties

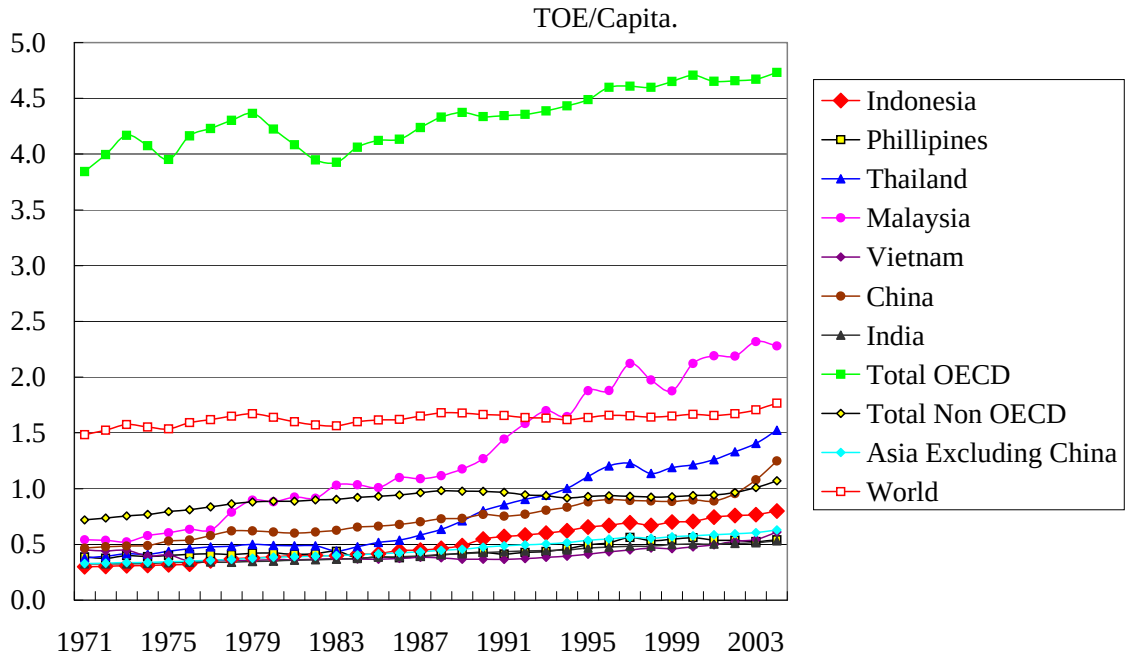


Fig. 6-5 TOE per Capita of Asian Countries

Fig. 6-6 shows electricity intensity of Asian countries. Indonesia shows the lowest intensity in Asian countries.

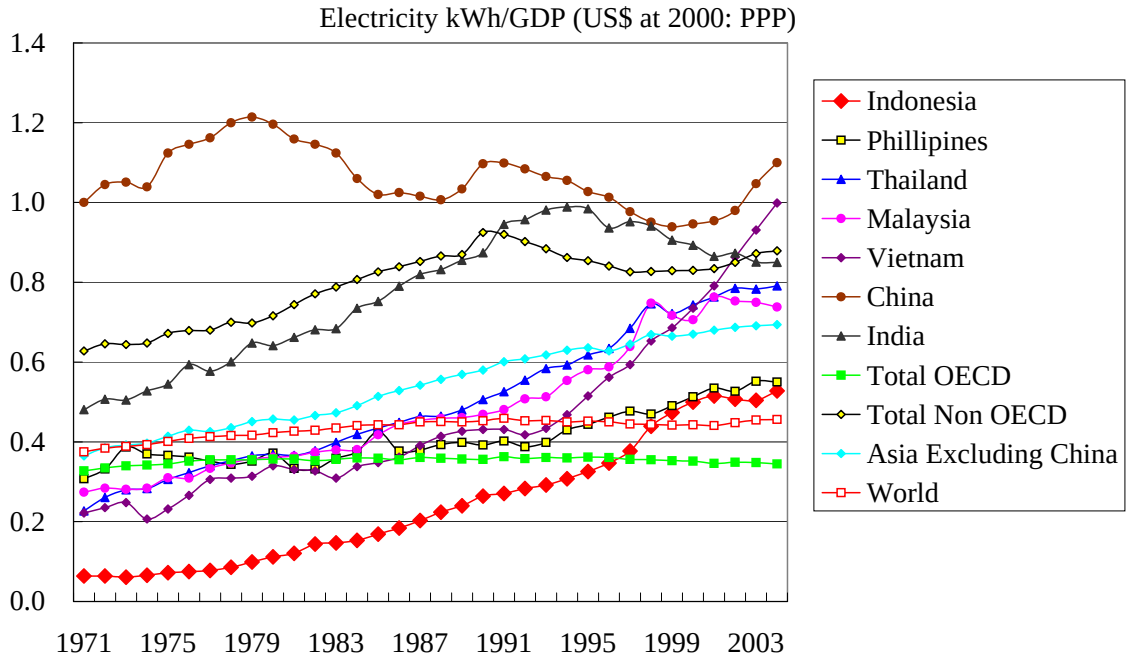


Fig. 6-6 Electricity Intensity of Asian Countries

It is rather difficult to evaluate the energy (electricity) intensity clearly by just comparing the intensity trends of each country. On the other hand, GDP capita represents the level of economic activity and people's life. Fig. 6-7 is the correlation between intensity and GDP per capita, showing

interesting tendency. In the below 10,000US$ of GDP capita countries, energy intensity increases clearly by the increase of GDP. In above 10,000US$ countries, intensity seems to stop increasing. The energy intensity of Japan is decreasing by the increase of GDP per capita. To increase GDP per capita, which is reasonable target of developing countries, it is required to increase energy intensity. In low GDP countries, it is rather difficult to decrease intensity than developed countries.

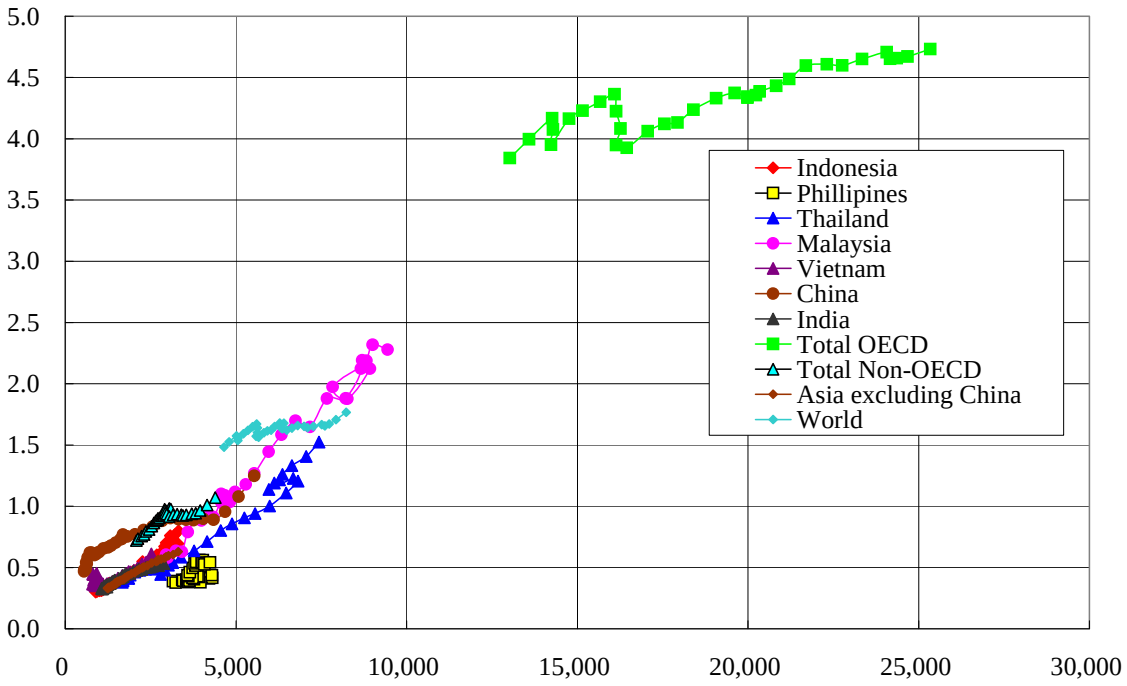


Fig. 6-7 Energy Intensity versus GDP (TOE/Capita.)/(GDP/Capita)

Fig. 6-8 shows same graph as Fig. 6-7, but scaled up for focusing on Asian countries. Thailand, Malaysia and China show steady intensity increase by GDP per capita. Indonesia show middle position and better performance than total Non-OECD and china.

Fig. 6-9 shows electricity intensity by GDP capita. Same as energy intensity, electricity intensity increases by the increase of GDP capita. But in the countries of above 10,000US$ GDP per capita, intensity is still increasing. GDP per capita greatly depends on electricity intensity. In other word, electricity conservation is more difficult than EE&C. Fig. 6-10 shows Asian version.

To set target of Indonesian energy (electricity) conservation, these comparison could be one measure of evaluation.

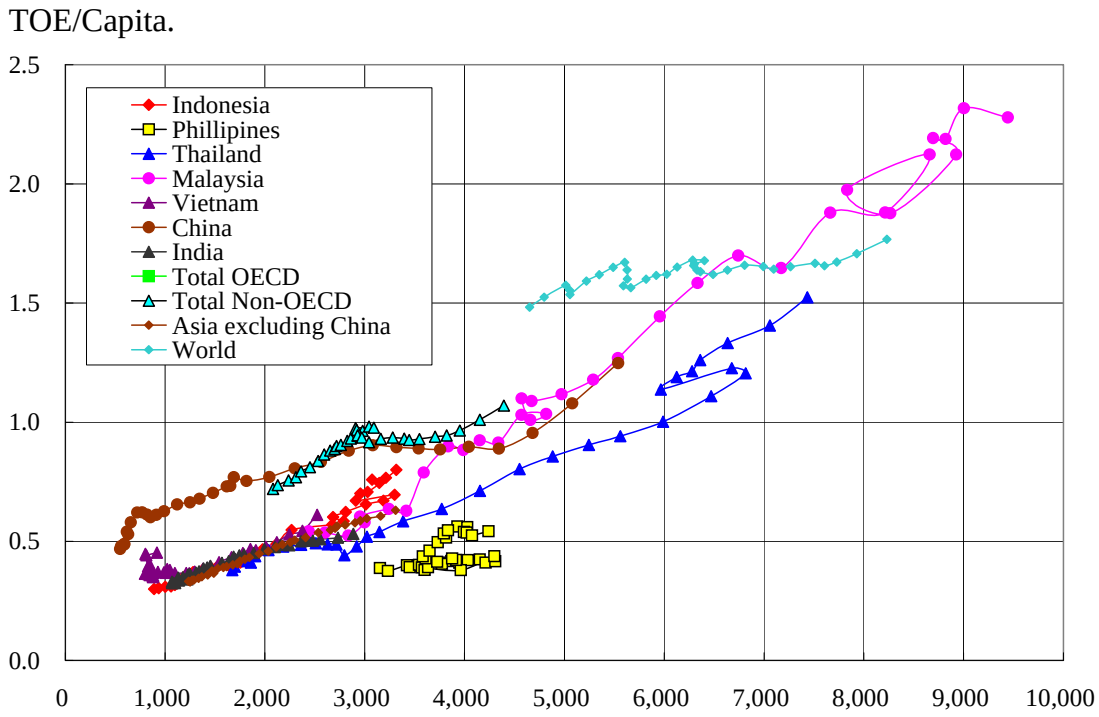


Fig. 6-8 Energy Intensity versus GDP (TOE/Capita.)/(GDP/Capita): Scale-Up

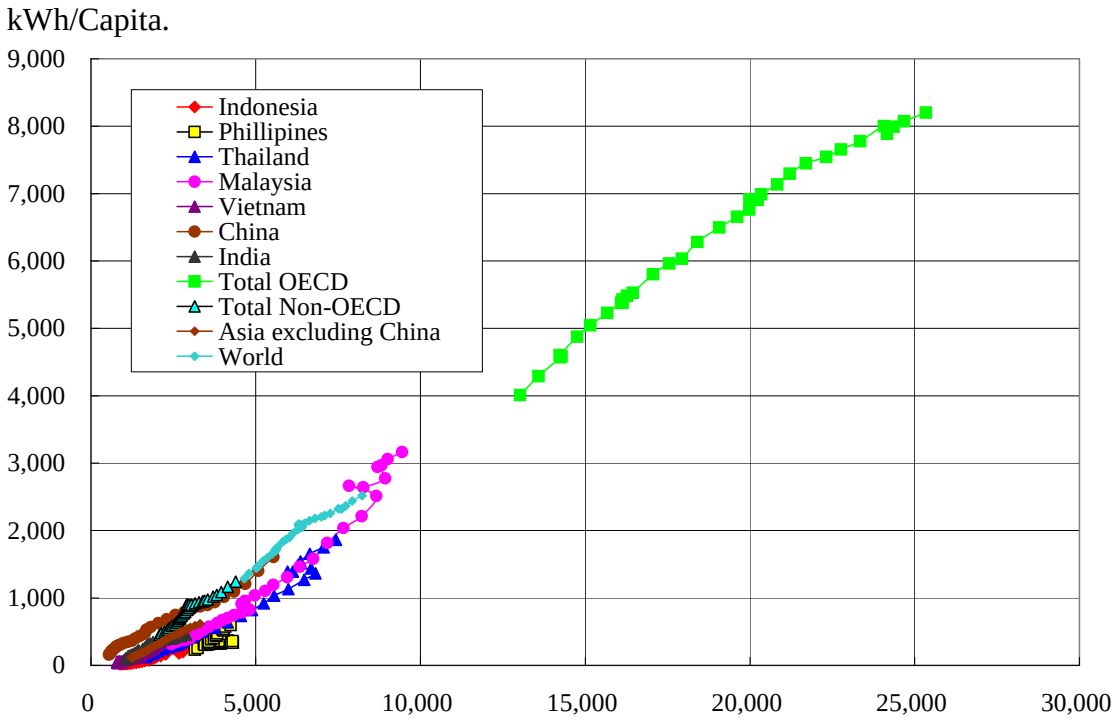


Fig. 6-9 Electricity Intensity versus GDP (TOE/Capita.)/(GDP/Capita)

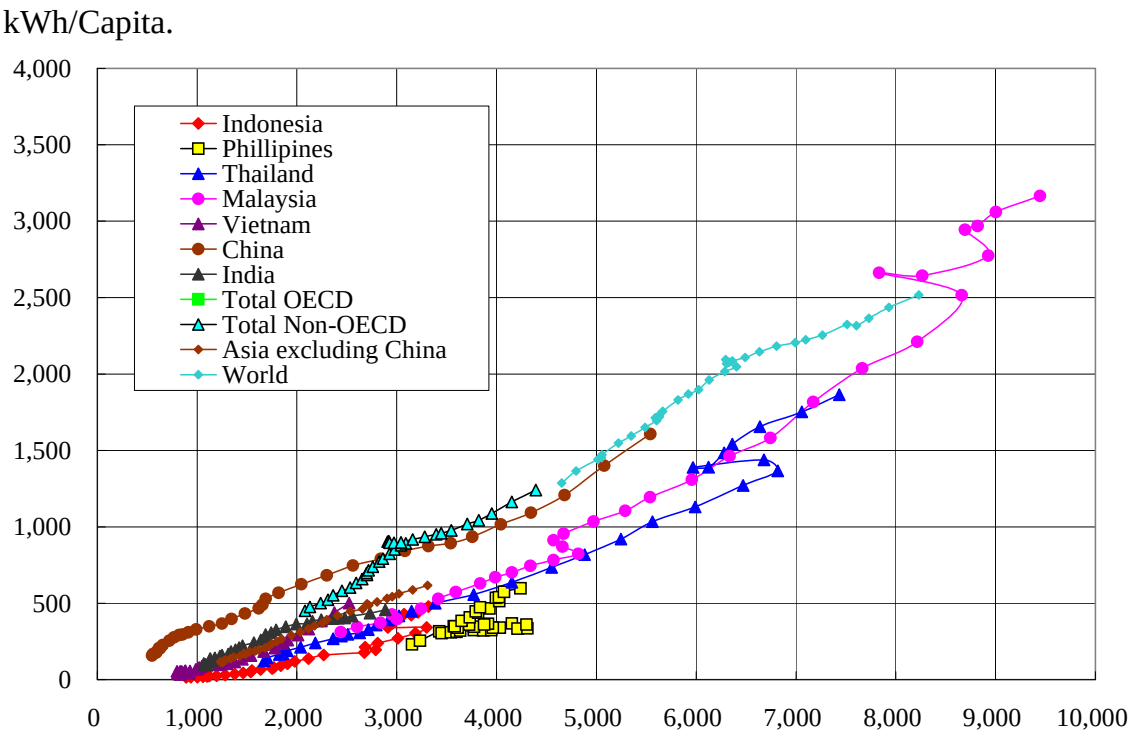


Fig. 6-10 Electricity Intensity versus GDP (TOE/Capita.)/(GDP/Capita): Scale-Up

Supplement 14

Toward Realization of Energy Efficient Society all over the Viet Nam

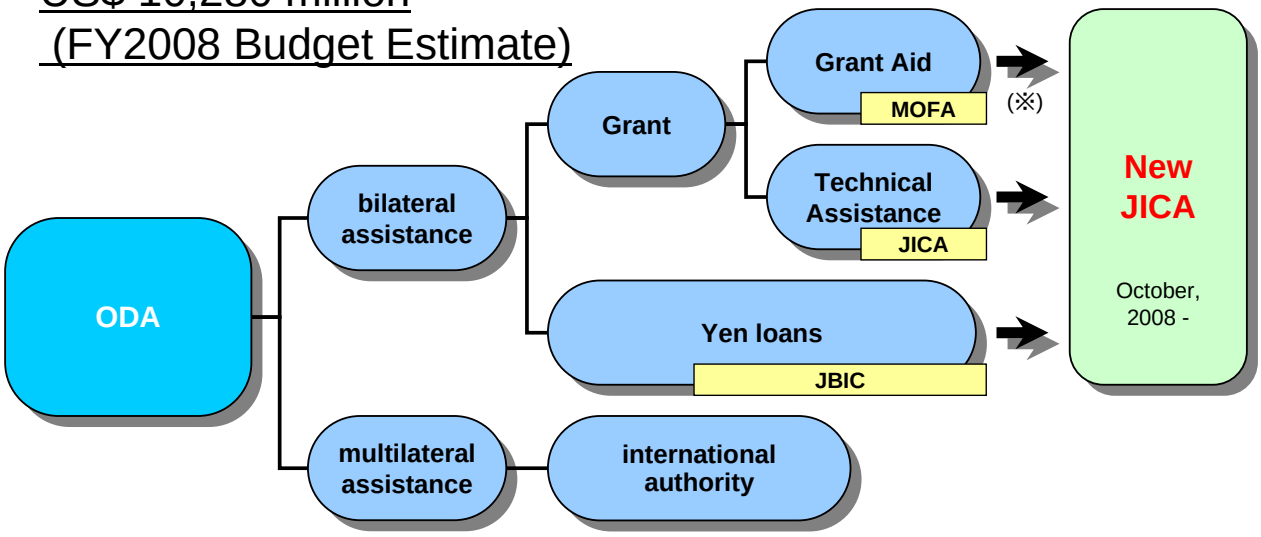
- Exclusive Cooperation by Japanese ODA – (Abstract)

Saishu MATSUDA

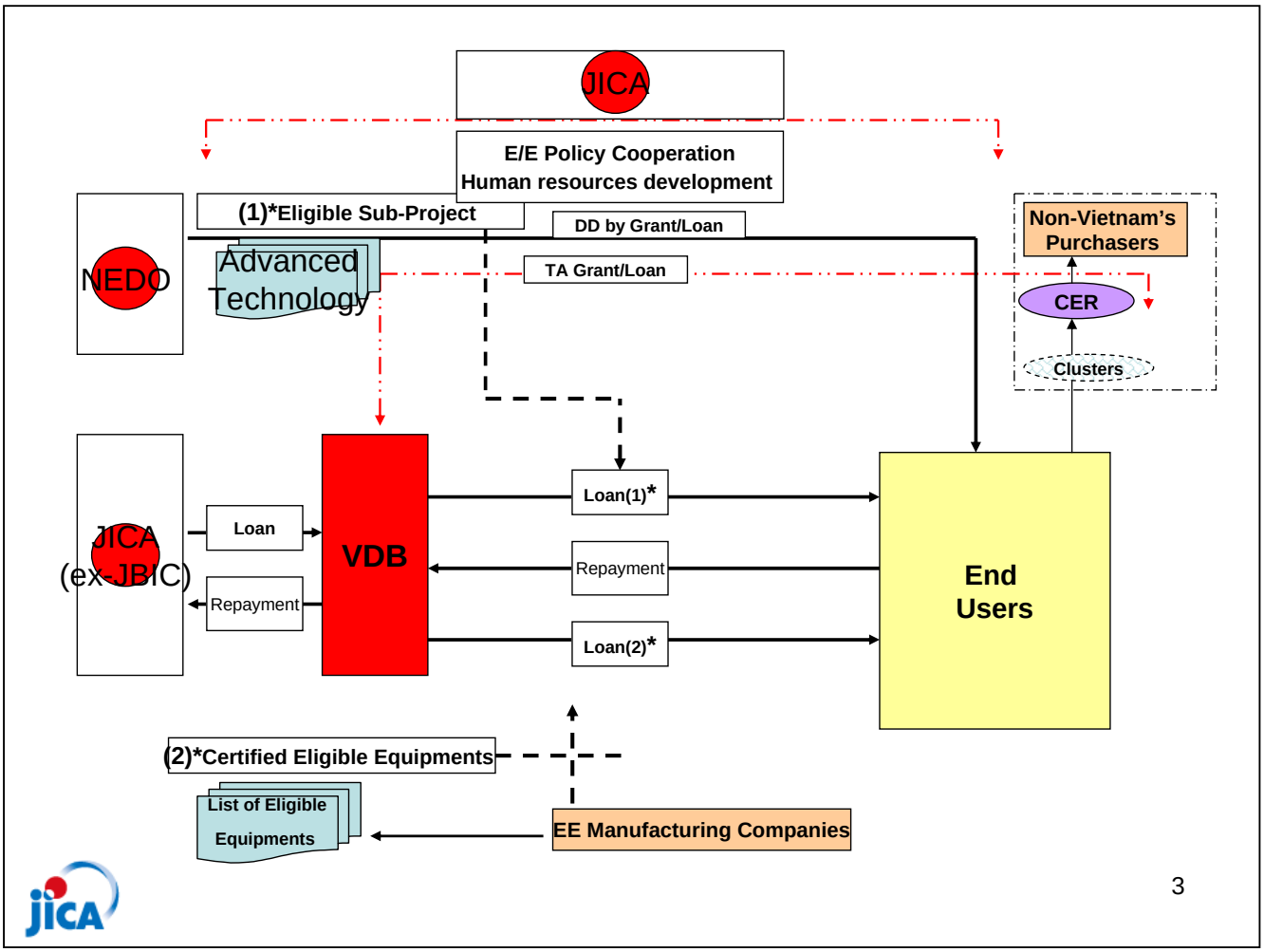
Assistant Director, Natural Resources and Energy Conservation Division
Japan International Cooperation Agency (JICA)

"New JICA": The World's Largest Bilateral Aid Agency

US$ 10,280 million
(FY2008 Budget Estimate)



(※) A part of grant assistances will be provided by MOFA and the rest of the financial assistances will be shifted to JICA.



FUTURE ROAD MAP
for promoting Energy Efficiency and Renewable energy use