インドネシア共和国
エネルギー鉱物資源省

No.

インドネシア国
省エネルギー普及促進調査

ファイナルレポート
別　冊

平成 21 年 8 月
(2009 年)

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電源開発株式会社

産業
JR
09-046

目　　次

表リスト

図リスト

Comparison of Energy Manager System in 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 date	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: 2,000m^2 or more	Energy Management-Required user (EMRU): 1,000 toe/y or more of fuel, or 4,000,000 kWh/y of electricity,	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	Calassification 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.	Item	Thailand	India	Vietnam	Malaysia
1	Energy conservation law	Energy conservation promotion law	Energy Conservation Act 2001l	Decree on Thrifty and Efficient use of Energy	Energy efficient regulation (under discussion)
1.1	Eneacted date	1992	1/10/2001	3/9/2003	
	Revised date	10/2002			
2	Designated energy management enterprise				
2.1	Energy consumption in enterprise (factory and building)	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	Number of designated factory				
2.3	Nominated number of energy manager			Factory: 900 in electricity	Type 1 enterprise: 1 energy manager Type 2 enterprise: 1 energy management officer
2.4	Duty of designated factory	(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	Qualification of energy manager				
3.1	Calassification of license	(1) PRE (2) Senior PRE from 2005			(1) Energy manager (2) Energy management officer
3.2	Compentence	(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

日本研修カリキュラム

研修区分	修了試験課目		講義課目	講義時間
必須基礎区分	Ⅰ エネルギー総合管理及び法規		1 エネルギー総合管理	7時限
			2 エネルギーの使用の合理化に関する法律及び命令	2時限
熱分野専門区分	Ⅱ 熱と流体の流れの基礎		1 熱力学の基礎	8時限
			2 流体工学の基礎	5時限
			3 伝熱工学の基礎	5時限
	Ⅲ 燃料と燃焼		1 燃料及び燃焼管理	4時限
			2 燃焼計算	3時限
	Ⅳ 熱利用設備及びその管理		1 計測及び制御	5時限
			2 ボイラ、蒸気輸送・貯蔵装置、蒸気原動機・内燃機関・ガスタービン	4時限
			3 熱交換器・熱回収装置、冷凍・空気調和設備	3時限
			4 工業炉、熱設備材料	3時限
			5 蒸留･蒸発･濃縮装置、乾燥装置、乾留･ガス化装置	3時限
電気分野専門区分	Ⅱ 電気の基礎		1 電気及び電子理論 ※	3時限
			2 自動制御及び情報処理 ※	3時限
			3 電気計測 ※	2時限
	Ⅲ 電気設備及び機器	(工場配電)	1 工場配電の計画 ※	2時限
			2 工場配電の運用 ※	2時限
			3 工場配電の省エネルギー	2時限
		(電気機器)	1 電気機器一般 ※	2時限
			2 回転機と静止器 ※	2時限
			3 電気機器の省エネルギー	2時限
	Ⅳ 電力応用	(電動力応用)	1 電動力応用一般 ※	2時限
			2 電動力応用の設備	3時限
			3 電動力応用の省エネルギー	2時限
		(電気加熱)	1 電気加熱理論及び設備 ※	2時限
			2 電気加熱の省エネルギー	2時限
		(電気化学)	1 電気化学理論及び設備 ※	2時限
			2 電気化学の省エネルギー	2時限
		(照　　明)	1 照明理論及び設備 ※	2時限
			2 照明の省エネルギー	2時限
		(空気調和)	1 空気調和理論及び設備	2時限
			2 空気調和の省エネルギー	2時限

(備考)

1. この表において、1時限は、40分とします。
2. 各研修区分ごとの講義課目は必須とします。ただし、電気分野専門区分を選択する方のうち第一種電気主任技術者免状または第二種電気主任技術者免状の交付を受けている方に限り、※を付した講義課目の講義を受講しなくても、修了試験を受けることができます。

◆ 講義の時間割

講義の時間割は、受講票送付の際に同封されます。

講義時間は、9 時 30 分～17 時 30 分ですが、講義の時間割の都合により、この限りではありません。

◆ 修了試験課目および時間割

修了試験は、筆記試験（記述式）です。（マークシート方式ではありません。）

修了試験は、課目の順番（課目Ⅰ,Ⅱ,Ⅲ,Ⅳ）と時限の順番（1, 2, 3, 4 時限）とが異なっていますので、注意してください。

◇ 熱分野専門区分修了試験

試験時間	1時限 9：30～10：50 (80分)	2時限 11：20～12：50 (90分)	3時限 13：50～15：40 (110分)	4時限 16：10～17：30 (80分)
試験課目	Ⅰ エネルギー総合管理及び法規	Ⅳ 熱利用設備及びその管理	Ⅱ 熱と流体の流れの基礎	Ⅲ 燃料と燃焼
課目内容 ( )内は問題数	・エネルギーの使用の合理化に関する法律及び命令(1) ・エネルギー総合管理 ・エネルギー情勢・政策、エネルギー概論(1) ・エネルギー管理技術の基礎(1)	・計測及び制御(2) ・熱利用設備 ・ボイラ、蒸気輸送・貯蔵装置、蒸気原動機・内燃機関・ガスタービン(2) ＊熱交換器・熱回収装置(1) ＊冷凍・空気調和設備(1) ＊工業炉、熱設備材料(1) ＊蒸留・蒸発・濃縮装置、乾燥装置、乾留・ガス化装置(1)	・熱力学の基礎(2) ・流体工学の基礎(1) ・伝熱工学の基礎(1)	・燃料及び燃焼管理(2) ・燃焼計算(1)

＊印は選択問題であり、4問題の中から1問題を解答します。ただし、講義は、すべて受けなければなりません。

◇ 電気分野専門区分修了試験

試験時間	1時限 9：30～10：50 (80分)	2時限 11：20～12：50 (90分)	3時限 13：50～15：40 (110分)	4時限 16：10～17：30 (80分)
試験課目	Ⅰ エネルギー総合管理及び法規	Ⅱ 電気の基礎	Ⅳ 電力応用	Ⅲ 電気設備及び機器
課目内容 ( )内は問題数	・エネルギーの使用の合理化に関する法律及び命令(1) ・エネルギー総合管理 ・エネルギー情勢・政策、エネルギー概論(1) ・エネルギー管理技術の基礎(1)	・電気及び電子理論(1) ・自動制御及び情報処理(1) ・電気計測(1)	・電動力応用(1) ＊電気加熱(1) ＊電気化学(1) ＊照明(1) ＊空気調和(1)	・工場配電(1) ・電気機器(1)

＊印は選択問題であり、4問題の中から2問題を解答します。ただし、講義は、すべて受けなければなりません。

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

Section 2 Introduction to Energy

1.2.1 Kind of energy

1.2.2 Energy resources

(1) Fossil energy
(2) Non-fossil energy

1.2.3 Flow of energy

1.2.4 Energy situation of Japan

1.2.5 Energy consuming structure of factory and building etc.

(1) Energy consuming structure of a factory
(2) Energy consuming structure of building etc.

1.2.6 Long-term energy supply-demand outlook

Section 3 Energy Conservation Policy and Regulation

1.3.1 The premise of a policy

1.3.2 Energy master plan

1.3.3 The legal system of energy conservation

1.3.4 Main point of law concerning rational use of energy (law and related regulation)

(1) General provision
(2) Basic Policy
(3) Standards of judgment etc.
(4) Type 1 designated energy management factories
(5) Type 2 designated energy management factories
(6) Transportation
(7) Building
(8) Machinery and equipment, and miscellaneous provisions
(9) Penal provisions

1.3.5 System and operation of examination and training course

(1) Person for energy management
(2) Energy management officer

1.3.6 Role of energy management officer

(1) Factory and/or building, and basic policy
(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

1.4.1 Total management of energy

(1) Change of a system
(2) Selection of energy source

1.4.2 How to advance energy conservation activities

(1) Energy conservation and how to advance energy conservation
(2) Maintenance of an energy management organization
(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

2.1.1 Energy and Work

(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.

(1) Gaseous fuel
(2) Liquid fuel
(3) Solid fuel
(4) Natural energy
(5) Unused energy

2.1.3 Primary energy consumption

(1) Primary energy consumption
(2) Method of calculation of primary energy consumption
(3) Primary energy consumption intensity

2.1.4 Measurement and control of energy

(1) The object of measurement and measurement device
(2) Device for measurement of energy
(3) Automatic control
(4) Measurement and control of energy by BEMS (Building Energy Management System)

Section 2 Thermal Energy

2.2.1 Basic knowledge of heat

(1) Character of fuel
(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 equipment

(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

省エネルギー法における罰則の例

（平成18年4月1日施行）

工場、ビル及び貨物輸送業に関する罰則

	違反の内容	指定されている関連の条項 （カッコ内は準用規定）	遅反した場合の罰則
1	エネルギー管理者の選任の規定に違反した	第8条第1項	100万円以下の罰金
	(第一種特定事業者)(第一種エネルギー管理指定工場)		
2	エネルギー管理員の選任の規定に違反した	第13条第1項	
	(第一種指定事業者)(第一種エネルギ_管理指定工場)	(第18条1項)	
	(第二種特定事業者)(第二種エネルギ_管理指定工場)		
3	合理化計画に係る指示,その指示に係る規定による命令に違反した	第16条第5項	
	(第一種特定事業者)(第一種エネルギー管理指定工場)		
4	輸送に係るエネルギーの使用の合理化に関し勧告に係る規定による命令に違反した	第57条第3項	
	(特定貨物輸送事業者)	(第69条)	
5	貨物の輸送に係るエネルギーの使用の合理化に関し勧告に係る規定による命令に違反した	第64条第3項	
	(特定荷主)		
6	特定機器の省エネに関して性能の向上に関する勧告に係る規定による命令に違反した	第79条第3項	
	(特定機器の製造事業者)		
7	特定機器のエネルギー消費効率の表示に関する勧告に係る規定による命令に違反した	第81条第3項	
	(特定機器の製造事業者)		
8	前年度のエネルギー使用量が第一種指定要件に定める数値以上であるのに,規定による届出をせず,又は虚偽の届出をした	第7条第2項	50万円以下の罰金
	(工場を設置している者)		
9	前年度のエネルギー使用量が第二種指定要件に定める数値以上であるのに,規定による届出をせず,又は虚偽の届出をした	第17条第2項	
	(工場を設置している者)		
10	貨物輸送能力が基準以上であるとき,当該貨物輸送区分ごとに規定による届出をせず,又は虚偽の届出をした	第54条第2項	
	(貨物輸送事業者)		
11	荷主が貨物輸送事業者に輸送させる量が政令で定める量以上であるのに規定による輸送量の,規定による届出をせず,又は虚偽の届出をした	第61条第2項	
	(荷主)		
12	政令で定める規模以上(以下,特定建築物)の新築,改築,増築,修繕,模様替又は改修において,エネルギーの効率的利用のための規定による屈出をせず,又は虚偽の届出をした	第75条第1項	
	(特定建築主等)(特定建築物)		
13	中長期的な計画の規定による提出をしなかった	第14条第1項	
	(第一種特定事業者)(第一種エネルギー管理指定工場)		
14	中長期的な計画の規定による提出をしなかった	第55条	
	(特定貨物輸送事業者)		
15	貨物輸送事業者に行わせる輸送の合理化の達成のための計画の,規定による提出をしなかった	第62条	
	(特定荷主)		
16	中長期的な計画を作成するときに,エネルギー管理士の参画をさせる規定に違反した	第14条第2項	
	(第一種指定事業者)(第一種エネルギー管理指定工場)		
17	定期の,規定による報告をせず,若しくは虚偽の報告をした	第15条第1項	
	(第一種特定事業者)(第一種エネルギー管理指定工場)	(第18条第1項)	
	(第二種特定事業者)(第二種エネルギー管理指定工場)		
18	貨物の輸送に係るエネルギーの使用の状況を貨物輸送区分ごとに規定による報告をせず,若しくは虚偽の報告をした	第56条第1項	
	(特定貨物輸送事業者)	(第69条)	
19	貨物輸送事業者に行わせる輸送に係るエネルギーの使用の状況を,規定による報告をせず,若しくは虚偽の報告をした	第63条第1項	
	(特定荷主)		
20	特定建築物に係る維持保全の状況について,規定による報告をせず、若しくは虚偽の報告をし	第75条第4項	
	(特定建築主等)		
21	工場における業務の規定による状況報告をせず,若しくは虚偽の報告をした規定による検査を拒み,妨げ,若しくは忌避した	第87条	
	(第一種特定事業者)(第一種エネルギー管理指定工場)	第1項～第3項	
	(第二種特定事業者)(第二種エネルギー管理指定工場)		
22	業務の状況にかかる,規定による報告をせず,若しくは虚偽の報告をした。規定による検査を拒み,妨げ,若しくは忌避した	第87条	
	(貨物輸送事業者)(特定貨物輸送事業者)(荷主)(特定荷主)	第5項～第11項	
	(特定建築主等)(特定機器の製造事業者)ほか		
23	以上に違反した場合は,行為者を罰するほか,その法人又は人に対して各本条の刑を科する	(第98条)	
24	エネルギー管理者の選任,解任の,規定による届出をせず,又は虚偽の届出をした	第8条第2項	20万円以下の過料
	(第一種特定事業章)(第一種エネルギー管理指定工場)		
25	エネルギー管理者の選任,解任の,規定による届出をせず,又は虚偽の届出をした	第13条第3項	
	(第一種指定事業者)(第一種エネルギー管理指定工場)	(第18条第1項)	
	(第二種特定事業者)(第二種エネルギー管理指定工場)		

注:旅客輸送,航空輸送に関するものは省略

エネルギー管理士試験機関及び登録調査機関に関する罰則

	違反の内容	指定されている関連の条項	遅反した場合の罰則
26	役員もしくは職員が守秘義務違反	30条－1項	懲役1年以下又は罰金100万円以下
	(登録調査機関), (エネルギー管理士指定試験機関)	51条	
27	登録取消又は停止の命令に違反	49条	
	(登録調査機関)		
28	エネルギー管理士の試験機関の業務停止命令違反	32条－2項	
	(エネルギー管理士指定試験機関), (エネルギー管理員指定講習機関)	36条－2項	
29	休廃止届出違反	46条、37条	罰金50万円以下
	(登録調査機関), (エネルギー管理員指定講習機関)		
30	業務に関する報告及び立入検査違反	87条－5項	
	(登録調査機関), (エネルギー管理士指定試験機関), (エネルギー管理員指定講習機関)	87条－4項	
31	帳簿記載及び保存に関する報告及び立入検査違反	51条、33条－1項	
	(登録調査機関), (エネルギー管理士指定試験機関), (エネルギー管理員指定講習機関)	33条－2項	
32	経済産業大臣の許可無しで試験事務を休止又は廃止した	25条	
	(エネルギー管理士指定試験機関)		
33	財務諸表の備置き及び閲覧違反	47条－1項、2項	過料20万円以下
	(登録調査機関)		

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 m^3N)					
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, m^3N) / (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 × 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. 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

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 sector is indispensable for the stable energy supply and demand balance.

A long awaited Energy Law has been formally approved by the Parliament on 17th July 2007. Energy Law will be expected to nominate energy intensive building, appoint Energy Managers and regulate the submission of periodical reports for energy conservation. Thus the energy management in your building 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.

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　　㎡,　Building area　　㎡ Gross floor space　　㎡

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 ①, 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 (1) _____ Budget _____
(2) _____ _____
(3) _____ _____

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

1. 電力・DSM関連資料

(1) 住宅部門料金

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 energy conservation. 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)

表 1-1　2004 年住宅部門基本電気料金 (BET)

<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 colspan="2">275</td><td rowspan="3" colspan="3">445</td></tr>
<tr><td>1,300</td><td>30,100</td><td colspan="2">385</td></tr>
<tr><td>2,200</td><td>30,200</td><td colspan="2">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) 業務部門電気料金

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

◆ ピーク時とオフピーク時の電気料金

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.

◆ 過剰kVArh使用料（力率）[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)

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”

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 0.85 (eighty five percent).

表 1-2　2004 年業務部門基本電気料金

<table>
<tr><td colspan="2" rowspan="2">VA</td><td>Demand Charge</td><td colspan="4">Energy Charge</td></tr>
<tr><td>Rp./kVA /Month</td><td colspan="4">Rp./kWh</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="4">0　30　108　146　264　kWh</td></tr>
<tr><td rowspan="4">B1/ LV</td><td>~450</td><td>23,500</td><td>254</td><td colspan="3">420</td></tr>
<tr><td>900</td><td>26,500</td><td colspan="2">420</td><td colspan="2">465</td></tr>
<tr><td>1,300</td><td>28,200</td><td colspan="2">470</td><td colspan="2">473</td></tr>
<tr><td>2,200</td><td>29,200</td><td colspan="3">480</td><td>518</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="4">0　100　Hours</td></tr>
<tr><td>B2/ LV</td><td>2,200 – 200,000</td><td>30,000</td><td colspan="2">520</td><td colspan="2">545</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="2">PP (Peak Period)</td><td colspan="2">OPP (OFF Peak Period)</td></tr>
<tr><td rowspan="2">B3/ MV</td><td rowspan="2">>200,000</td><td rowspan="2">28,400</td><td colspan="2">K ×452</td><td colspan="2">452</td></tr>
<tr><td colspan="4">Power Factor < 0.85　616Rp/kVArh</td></tr>
</table>

(3)　産業部門電気料金

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.

◆　ピーク時とオフピーク時電気料金

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

◆　過剰 kVArh 使用料（力率）

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).

表 1-3　2004 年産業部門基本電気料金

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)　多目的電気料金（オプション電気料金）

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.

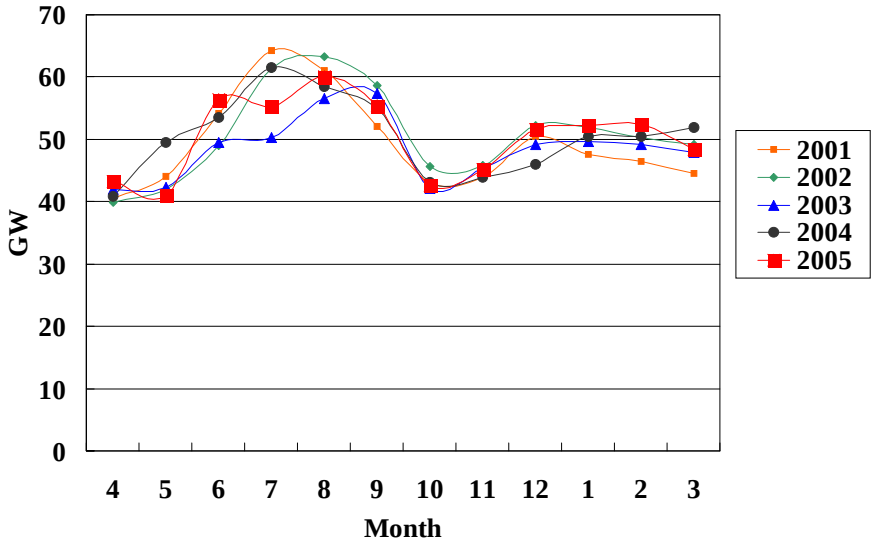
- Electricity export-import deal prices between the PLN with other counterparts to foster relationship for mutual benefit
- Electricity, which under customers' request demanded to be more than the standards or as agreed by PLN to have the standardized quality, reliability or service delivery
- The customers 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. 日本の電気会社料金制度

(1) 日本の電力需給の特徴（関東地方）

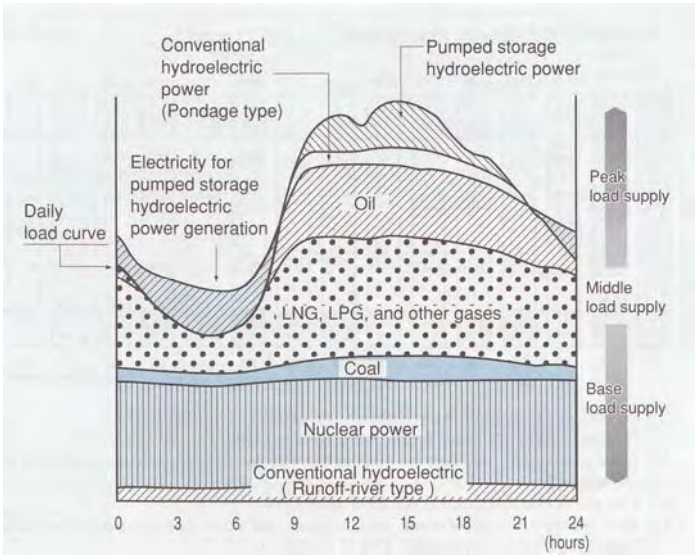
Understand the features of Japanese tariff system is effective to review Indonesian tariff.



Source: TEPCO Illustrated 2006

図 2-1　月別ピーク需要（2001～2005 年度）

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

図 2-2　需要変動に対応した 3 段階電力供給システム

- 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) コストベース電気料金システム

Fig. 2-3 shows average cost and tariff of fiscal 2005. The difference between tariff and cost is allotted as sales cost.

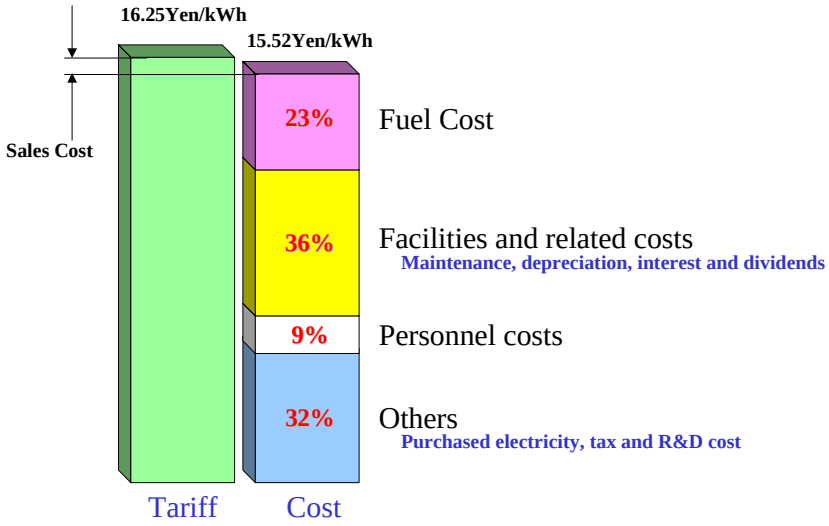


図 2-3　平均コストと電気料金

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) 家庭向け電気料金システム

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

表 2-1　家庭向け電気料金システム

	Items	Calculation method
A	Basic fee	Based of contracted ampere
B	Power volume fee	One month consumption
C	Compensation fee of fuel price change	Automatically adjusting fee corresponding to fuel price and currency rate change
D	Bank account transfer discount	Fixed amount (Saving for collecting cost)
E	Consumption & local tax	5%
F	Green electricity donation	Natural energy supporting fund
	Total	A+B±C－D＋E＋F

◆ 容量料金および使用量料金

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

表 2-2　容量料金および使用量料金

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 energy conservation. (Fig. 2-4)

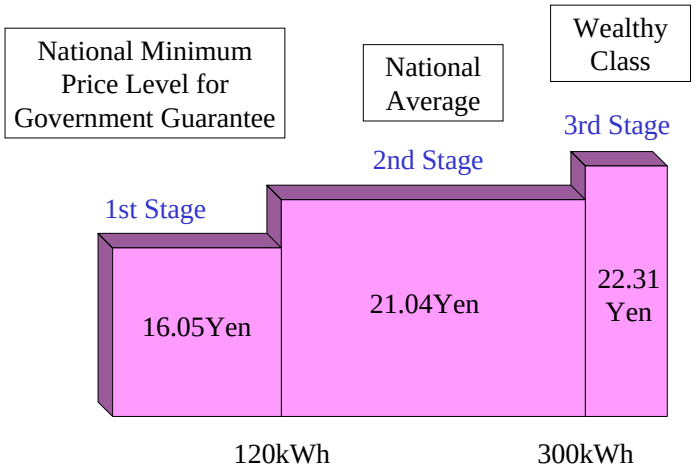


図 2-4　3 段階使用量料金

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 consumption. 銀行引落し割引

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.

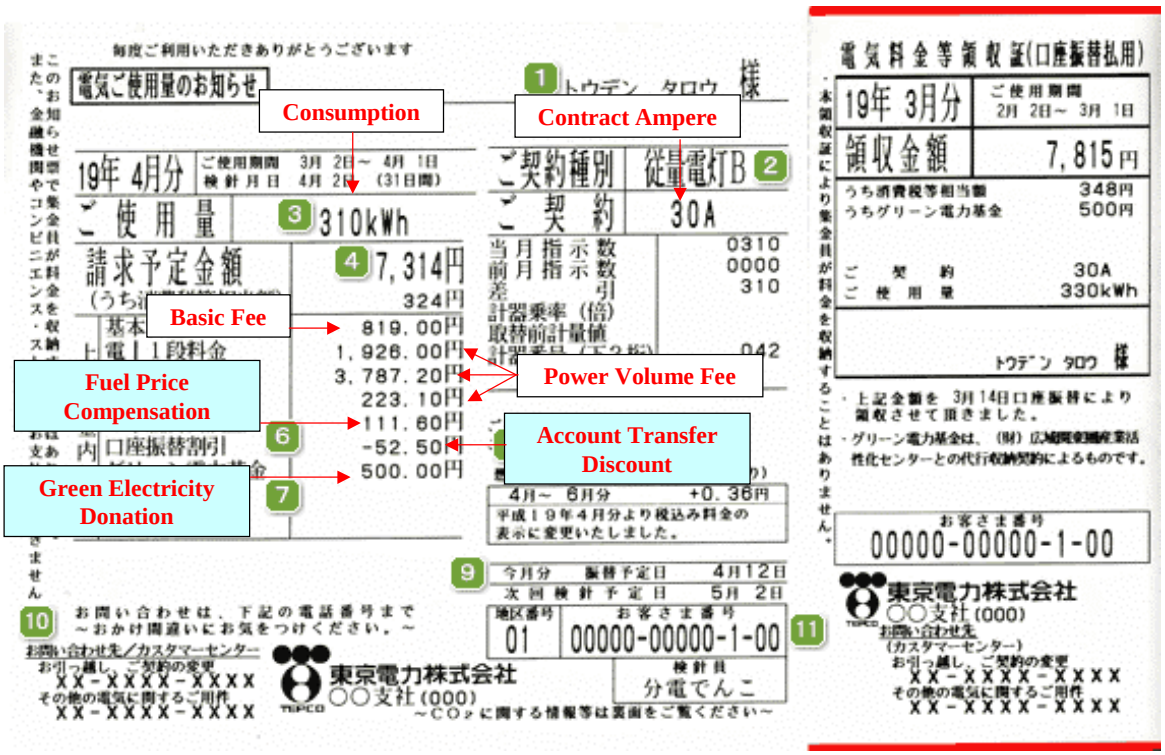


図 2-5　電気料金請求書と領収書サンプル

◆　燃料価格変動補正

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 2-3. Average fuel price in the table is calculated by following formula.

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

表 2-3　燃料価格帯による価格補正

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)　商業および産業部門の電気料金システム

There are 15 kinds of tariff according to sectors, receiving voltage, seasonal and time of day and contract as shown in Table 2-4.

表 2-4　商業および産業部門の電気料金

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

◆ 容量料金および使用量料金

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 2-5)

表 2-5　電気料金計算方法

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 2-6.

表 2-6　容量料金リスト

	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

◆　季節および時間低別料金

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.

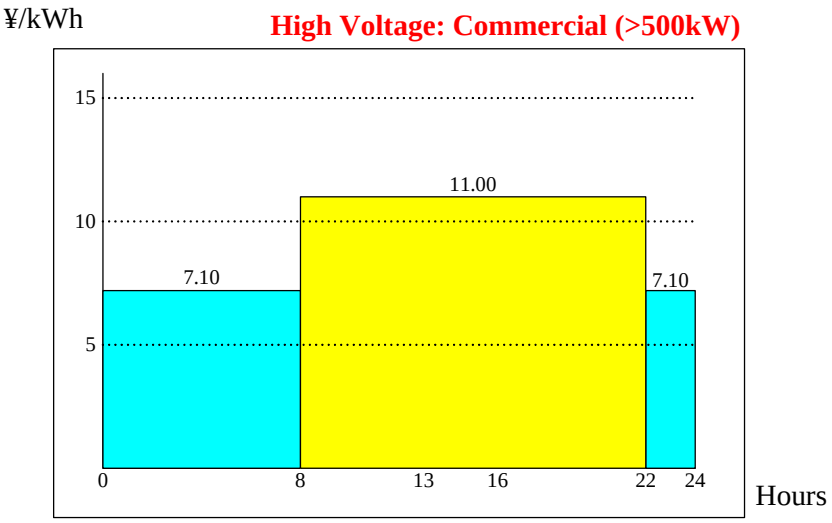


図 2-6　使用量料金（10 月 1 日から 6 月 30 日）

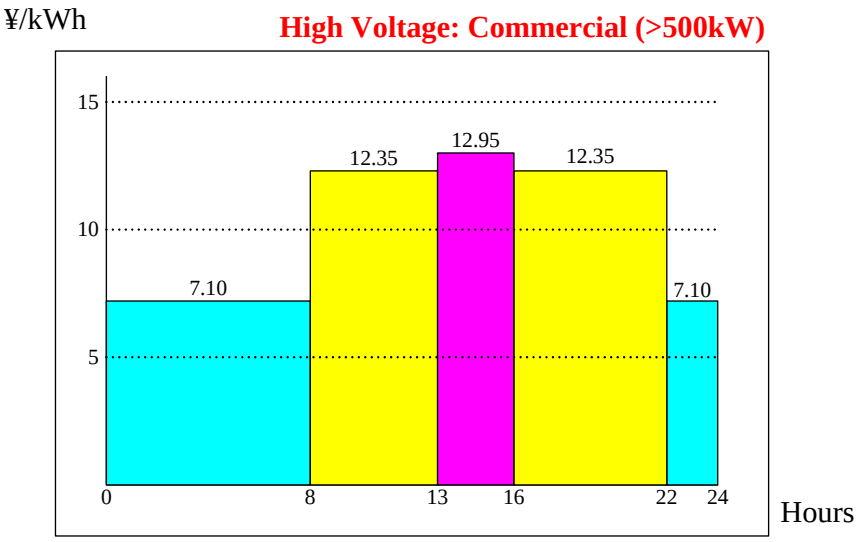


図 2-7　使用量料金（7 月 1 日から 9 月 30 日）

(4) オプション契約

◆ 家庭向け電気料金契約「お得なナイト 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.

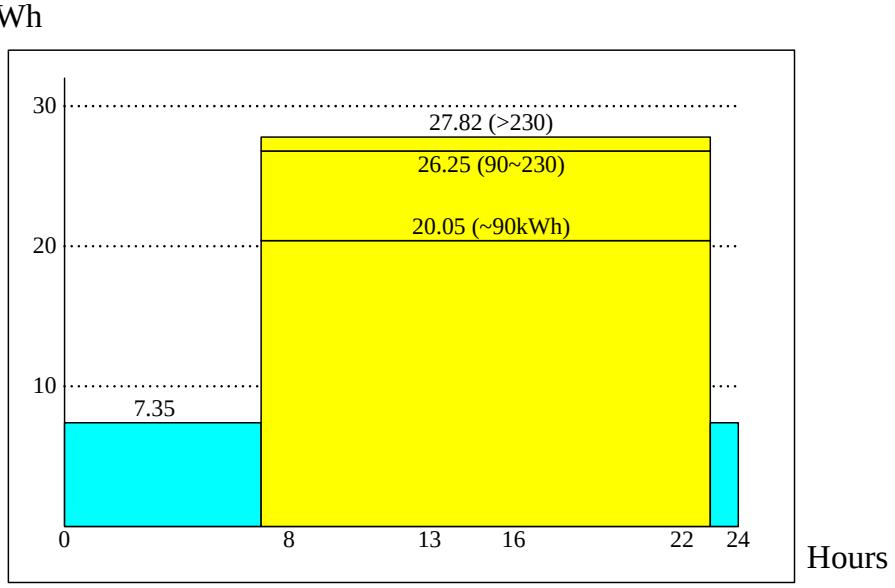


図 2-8 使用量料金「お得なナイト 8」（23 時から翌朝 8 時）

◆ 商業および産業向け契約「負荷調整」

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. 高効率電気製品採用による省エネルギー

This appendix describes the high efficiency electric appliance and energy conservation, 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) 日本における省エネ対象高効率電気製品

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 consumption 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 consumption 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.

表 3-1 省エネ基準達成結果

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) 「イ」国における省エネ対象電気製品

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

Energy Saving Lamp	Electronic Ballast	Street Lighting
Variable Speed Drive	Room Air Conditioner	Chiller
Refrigerator	Motor	Television

(3) ライフサイクルコスト

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.

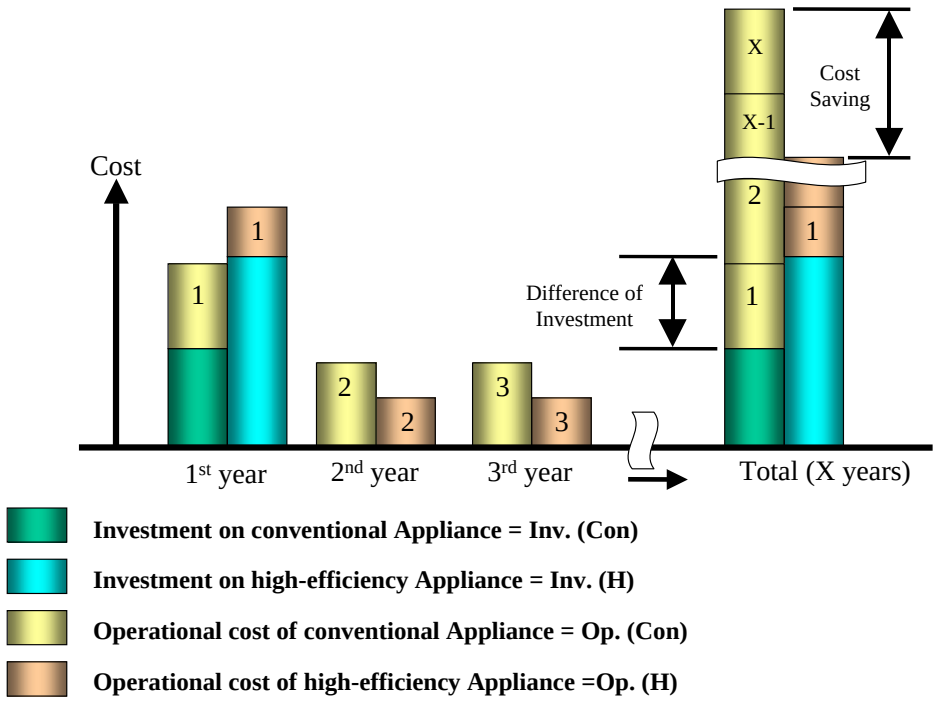


図 3-1　ライフサイクルコストの例

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 energy conservation, 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) 経済性計算条件

表 3-2 選定された電気製品の寿命、電力消費および価格

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
	60	Japan[2][3]	1,000-2,000	8,000	60	12	10,800	70,100
	100				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				40	32		
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				1,000	750	3,000,000	4,000,000
	1,000				1,000	750	4,000,000	5,000,000
	2,000				2,000	1,500	4,000,000	5,000,000
	500				500	250	2,000,000	3,000,000
	1,000				1,000	500	3,000,000	4,000,000
	1,000				1,000	500	4,000,000	5,000,000
	2,000				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				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				200	150	3,000,000	4,500,000
							2,000,000	3,000,000
	75				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				150	113	3,000,000	9,000,000
	200				200	150	4,000,000	12,000,000
	100				100	75	2,500,000	7,500,000
	150				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) 電気料金分類別経済計算結果

表 3-3 電気料金分類別経済性計算結果

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.

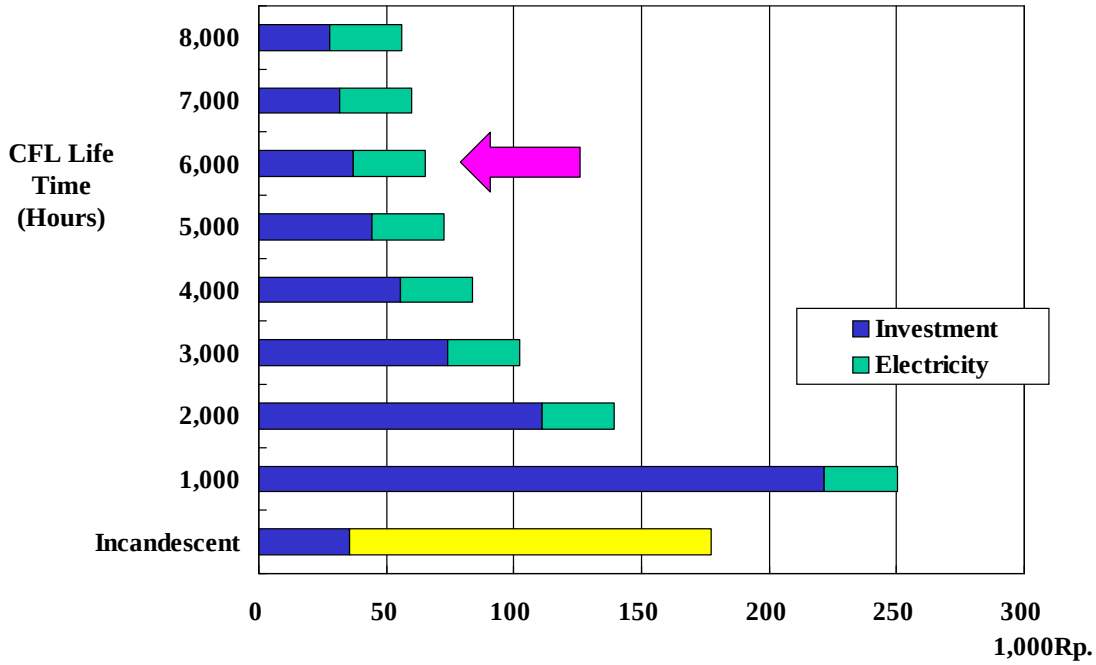


図 3-2　CFL による白熱灯置き換え感度分析（5 年）

2) 電子安定器

- 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) 街灯

- 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) 空調

- 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) チラー

- 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) 高効率冷蔵庫

- 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) モーター

- 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) テレビジョン受信機

- 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.

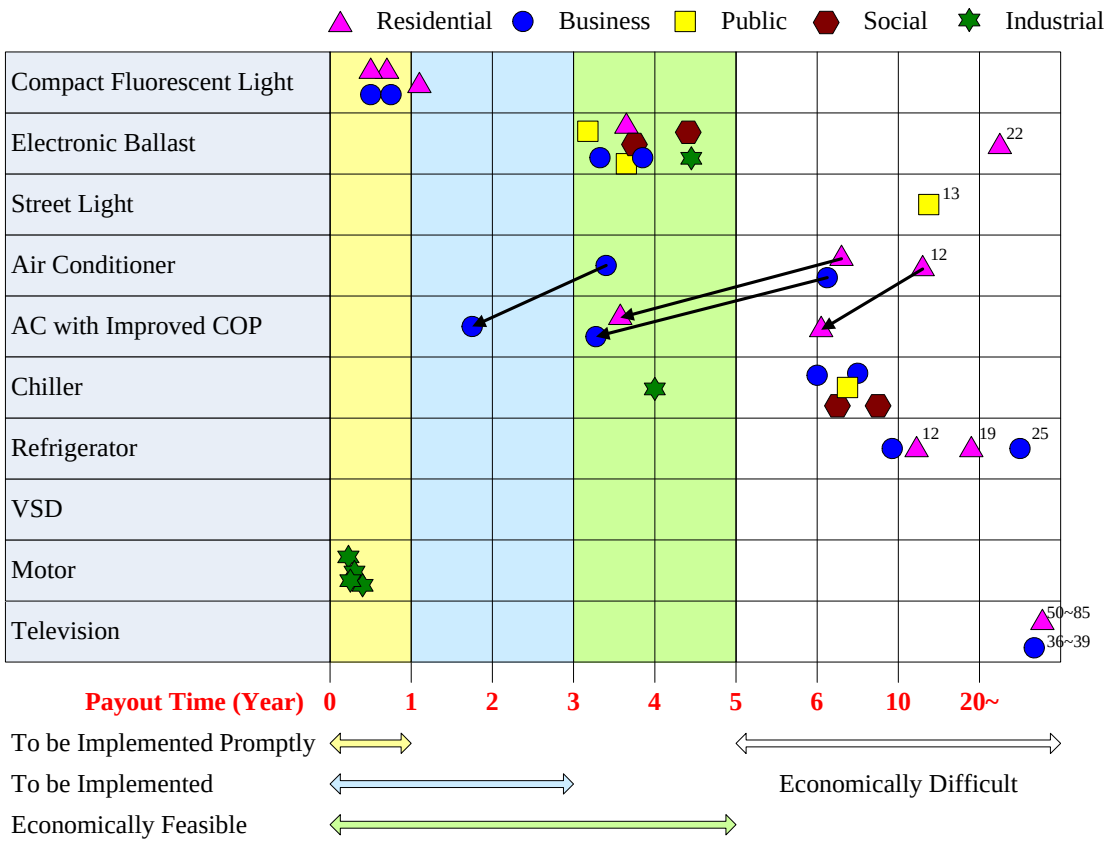


図 3-3　置換えの投資回収期間

- 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.
- Energy conservation by replacing CRT to LC or plasma is rather suspicious. Further study is necessary.

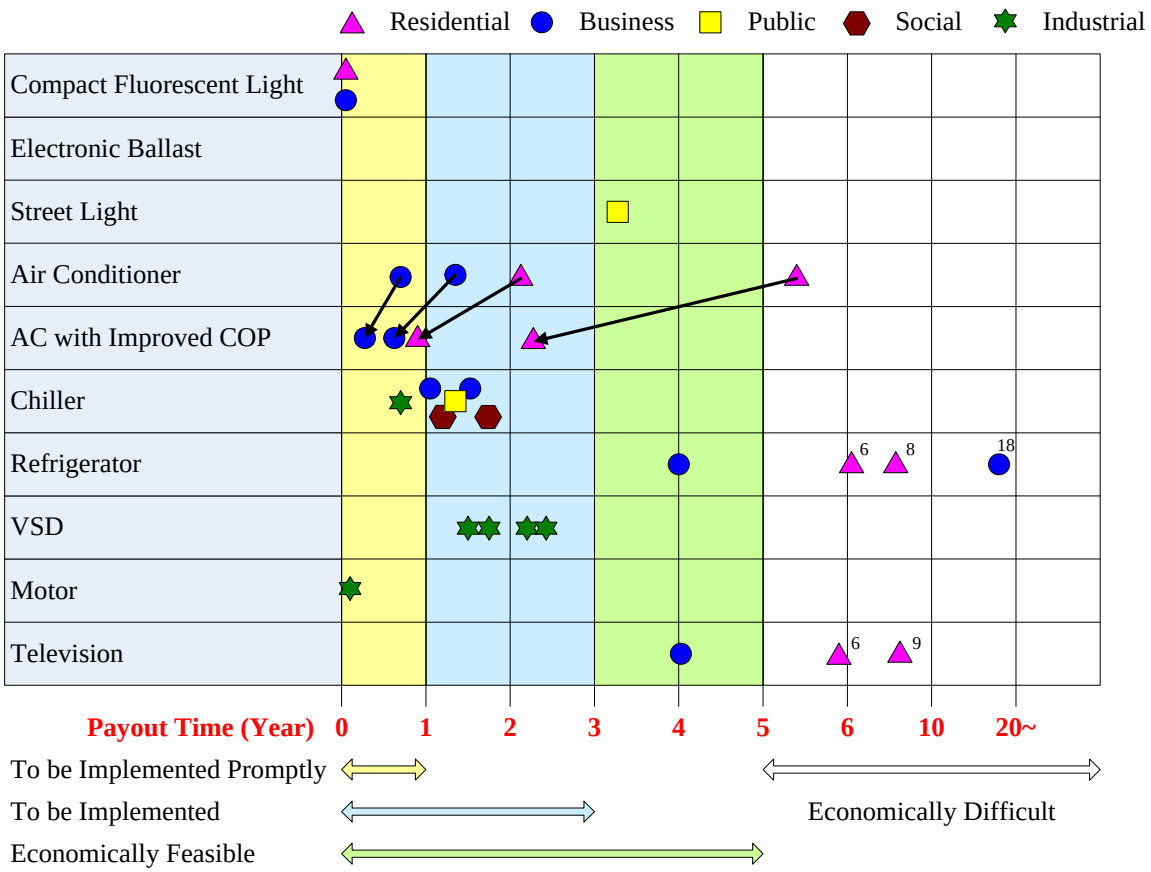


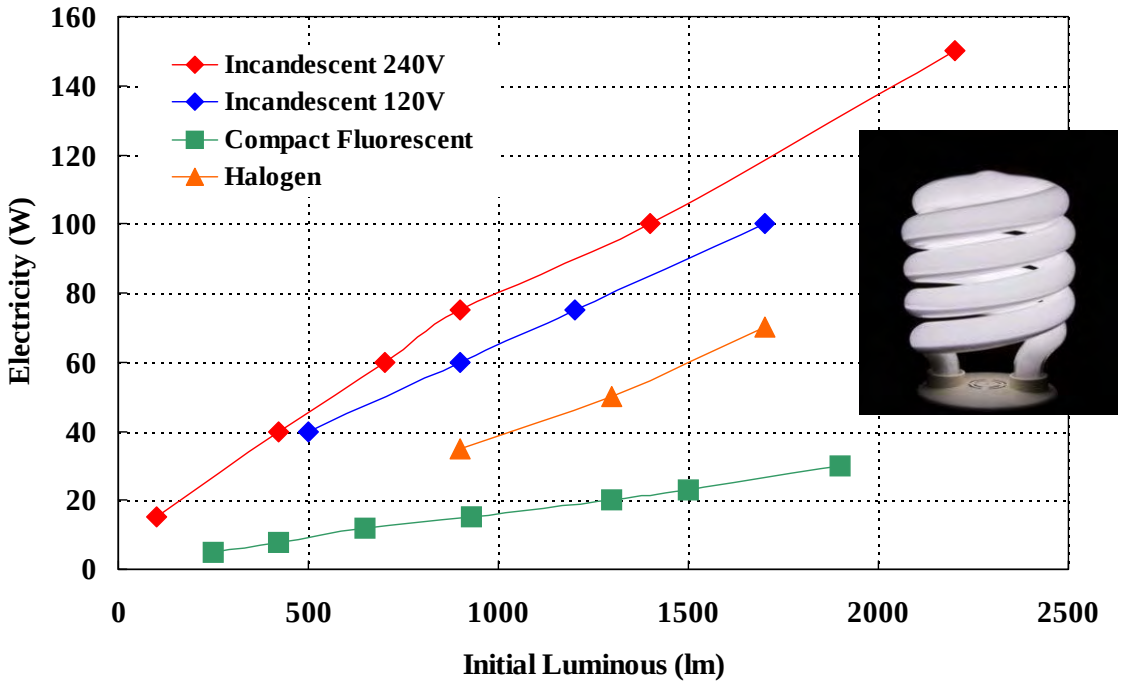
図 3-4　高効率機器の新規購入の投資回収期間

4. 選定された高効率電気製品の技術・経済性

(1) 省エネランプ

Indonesian government, PLN and people focused compact fluorescent lamp (CFL) as the most prospective energy saving 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. A4-1 shows the comparison of electricity consumption by bulb type. CFL could drastically reduce the electricity consumption.



Source: Widpekia

図 4-1 Electricity Consumption by Bulb Type

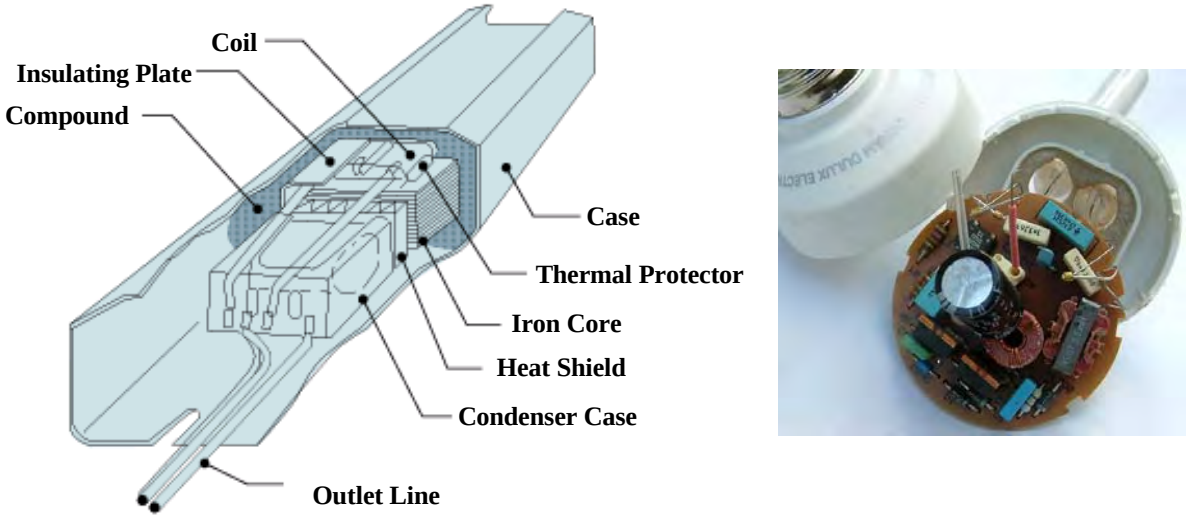
CFLs, like all fluorescent lamps, contain small amounts of mercury and it is a concern for landfills and waste incinerators where the mercury from lamps is released and contributes to air and water pollution. In Indonesia, used CFLs and fluorescent lamps are disposed to landfills. To cope with this environmental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

(2) 電子式安定器

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

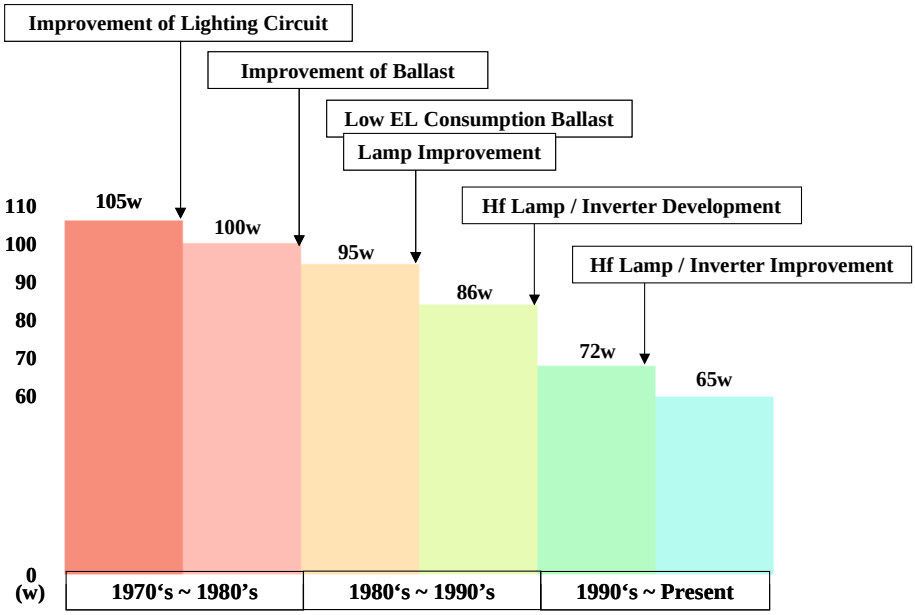
[5] APERLINDO (Indonesian Electric Lamp Industry Association)

electronic ballast is shown in Fig. 4-2.



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

図 4-2　コンデンサー付き電子式安定器の構造



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

図 4-3　蛍光灯の電気消費改善[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]

- ✓ High Power Factor Iron Core Ballast (Long Term Usage):　100W

6

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

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

(3) 街灯

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.

表 4-1 光源別照度

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) 空調

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.

表 4-2　空調の価格、性能および電力消費

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.

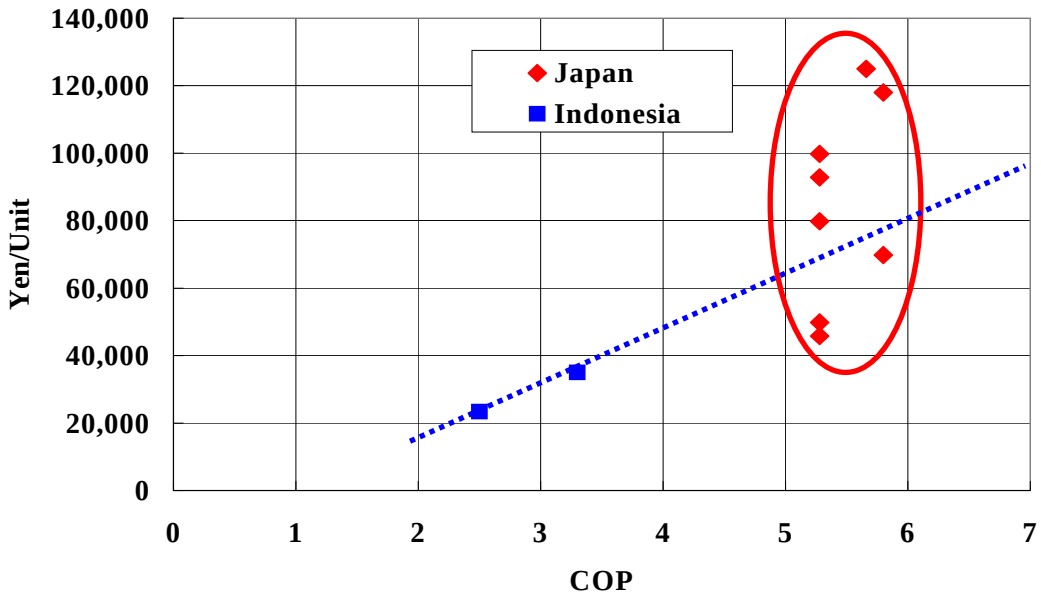


図 4-4　日本と「イ」国の空調と COP および COP

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.

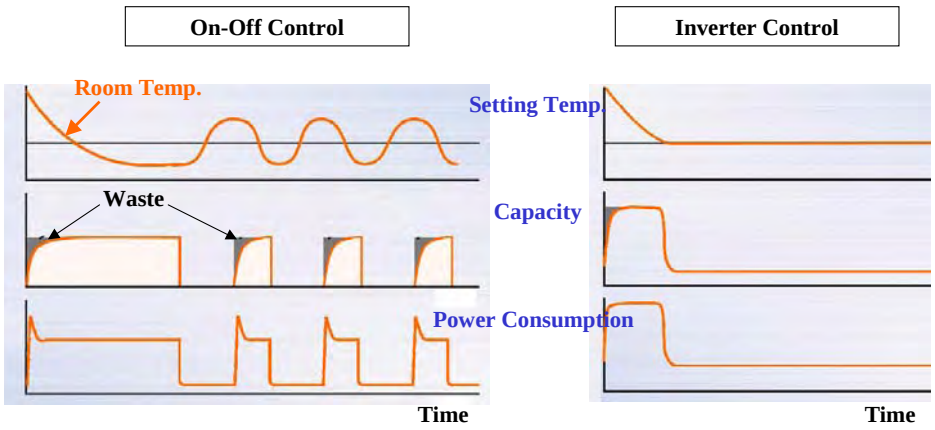


図 4-5　オンーオフおよびインバータ空調の性能比較

(5)　チラー

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.

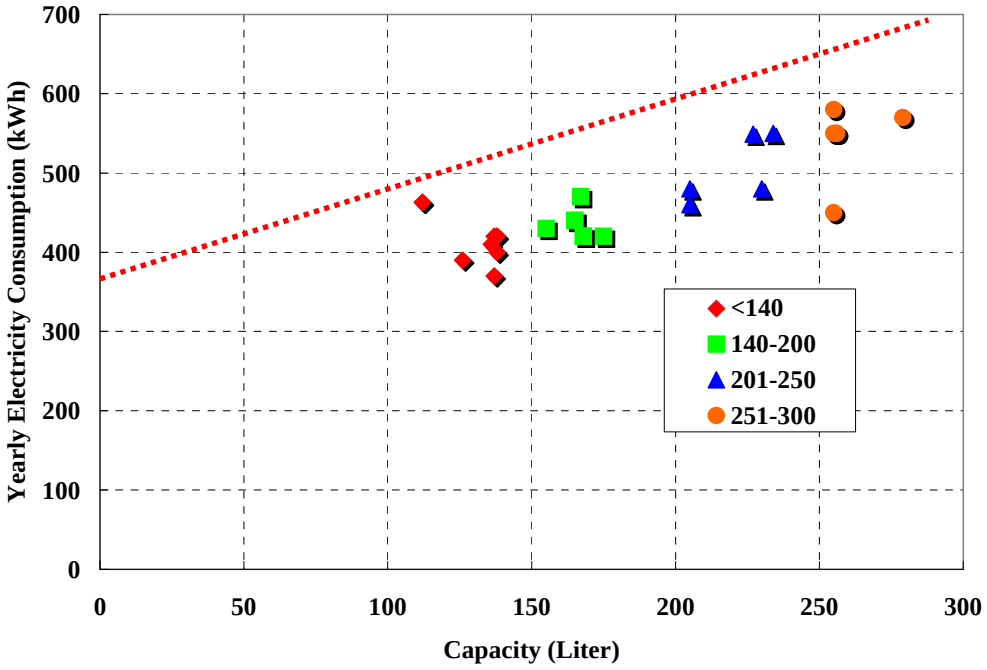
Almost all chillers are imported, only small amount is assembled in domestic.

図 4-6　チラーシステム

(6) 高効率冷蔵庫

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 energy conservation 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: Energy Conservation Catalog of 2008, Energy Conservation Center Japan

図 4-7　日本における冷凍庫付き冷蔵庫の年間電力消費比較

(7) テレビジョン受信機

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: Energy Conservation Catalog of 2008, Energy Conservation Center Japan except CRT. CRT data is from 2006 catalog.

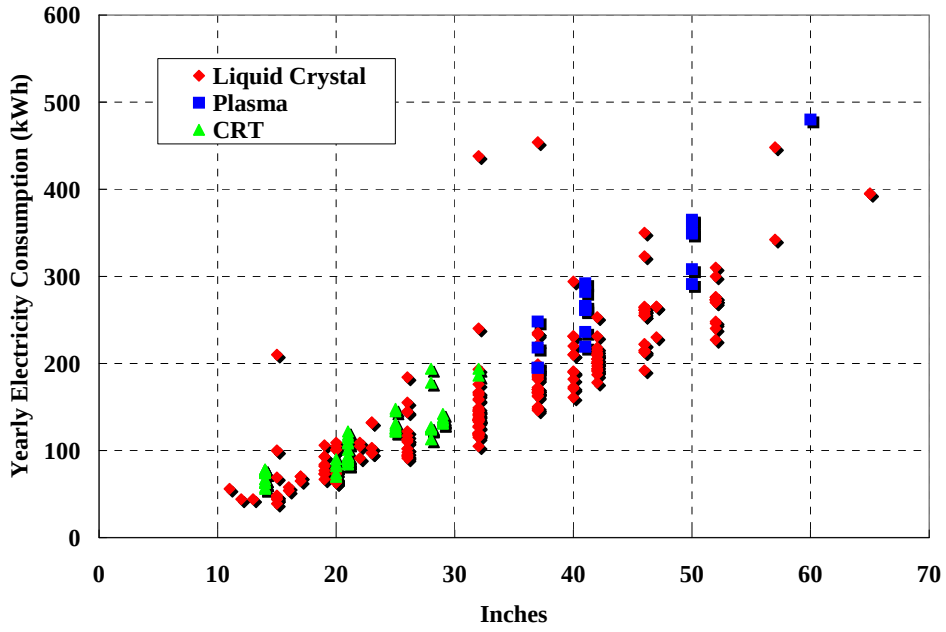


図 4-8　日本のテレビジョン受信機のディスプレイ種類による電力消費

5. 高効率電気製品の国家省エネへの貢献

Based on above study in Appendix 3 and 4, the contribution of high efficiency electric appliance to national energy conservation is estimated. Estimation procedure is shown in Fig. A5-1.

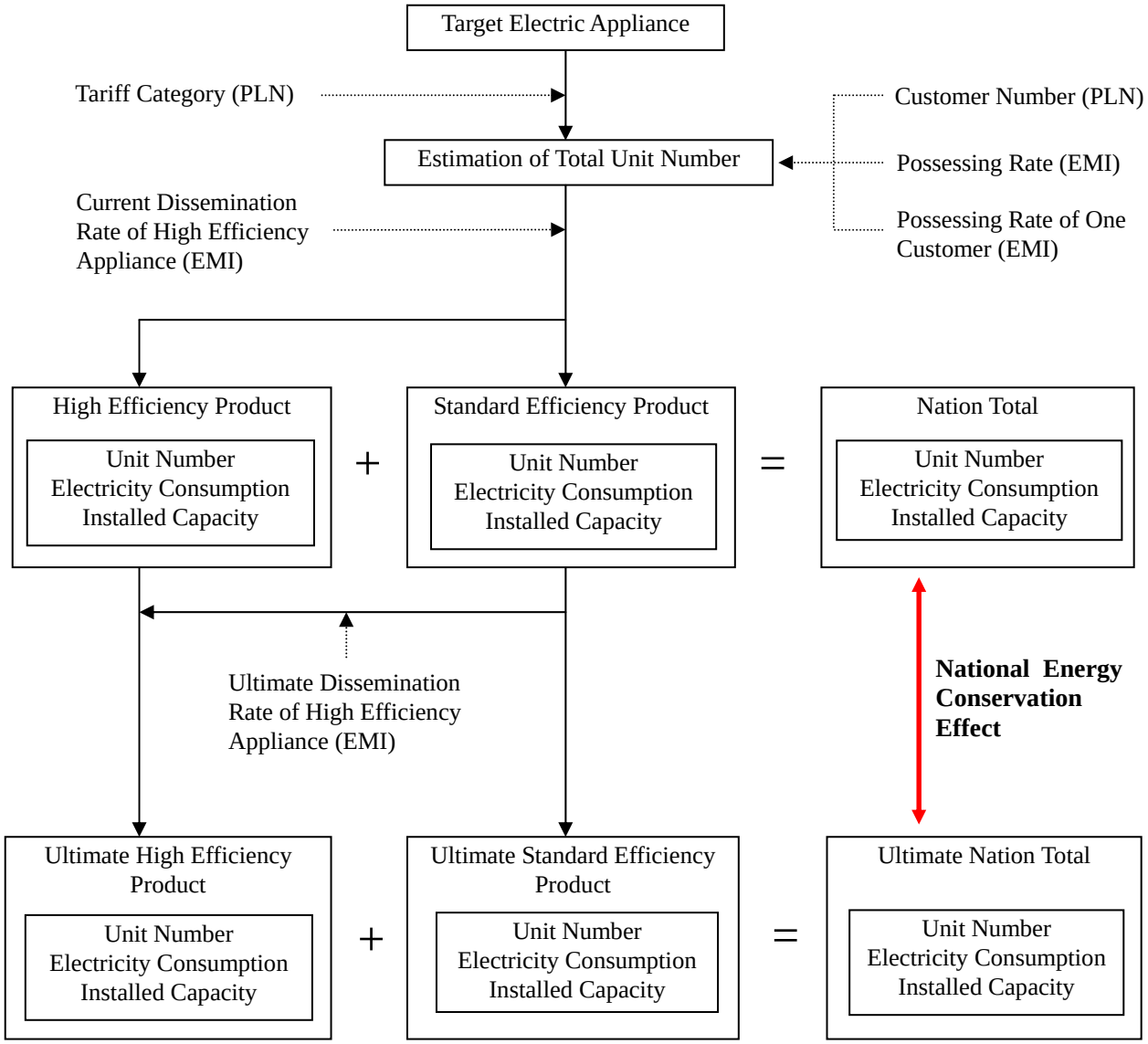


図 5- 1　国家省エネ効果計算方法

(1) 住宅部門

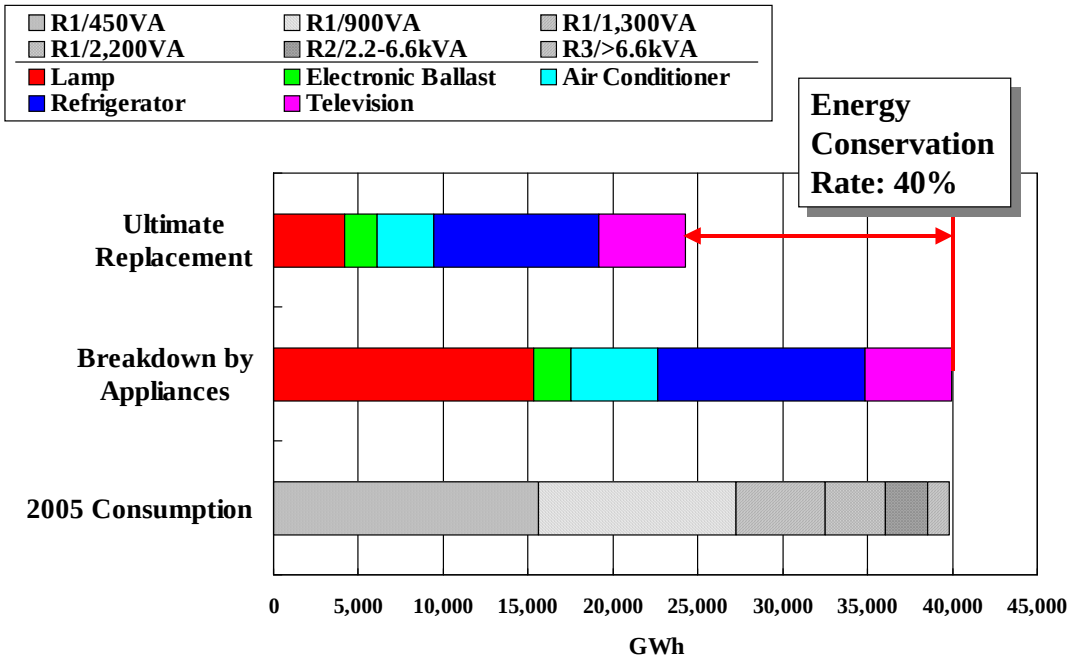


図 5-2 住宅部門における省エネ貢献度

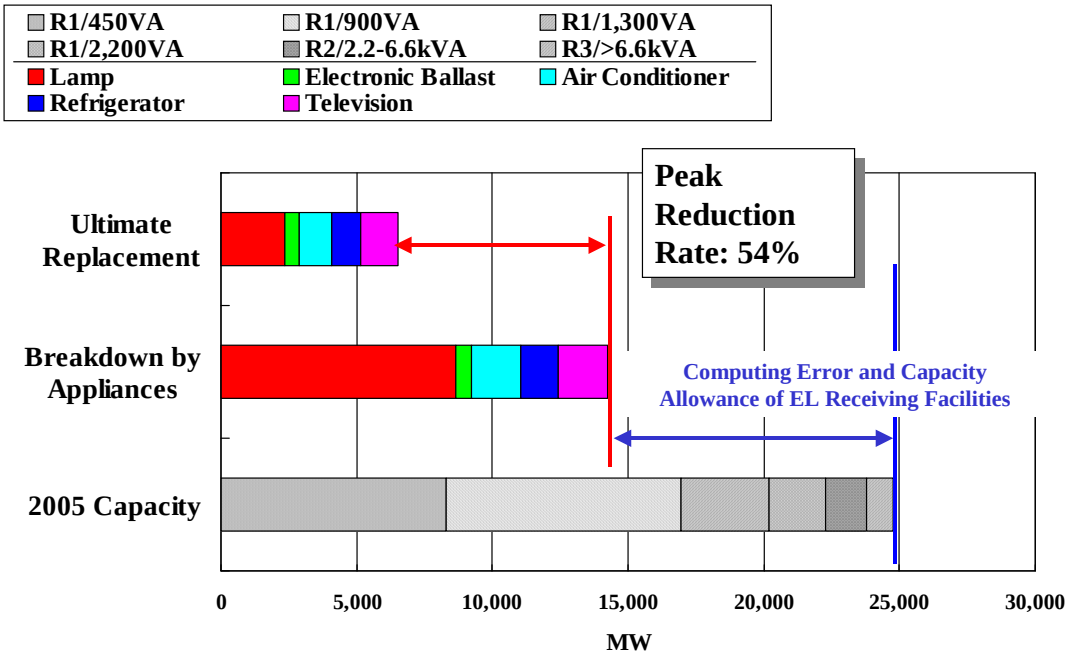


図 5-3 住宅部門におけるピーク削減貢献度

(2) 社会部門

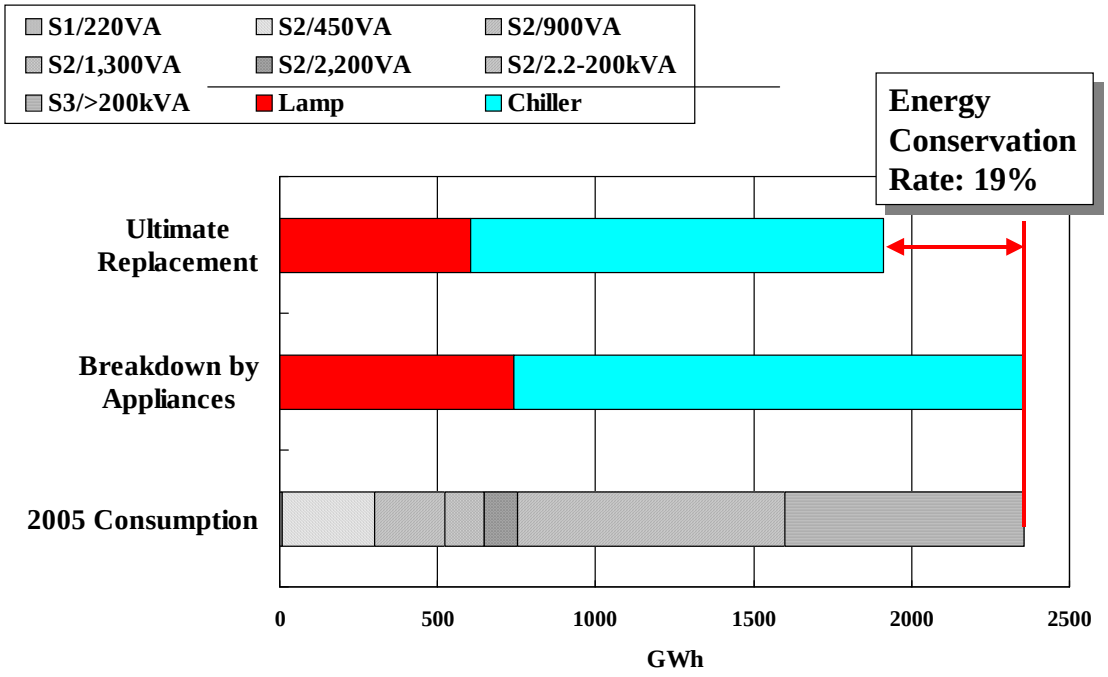


図 5-4 社会部門における省エネ貢献度

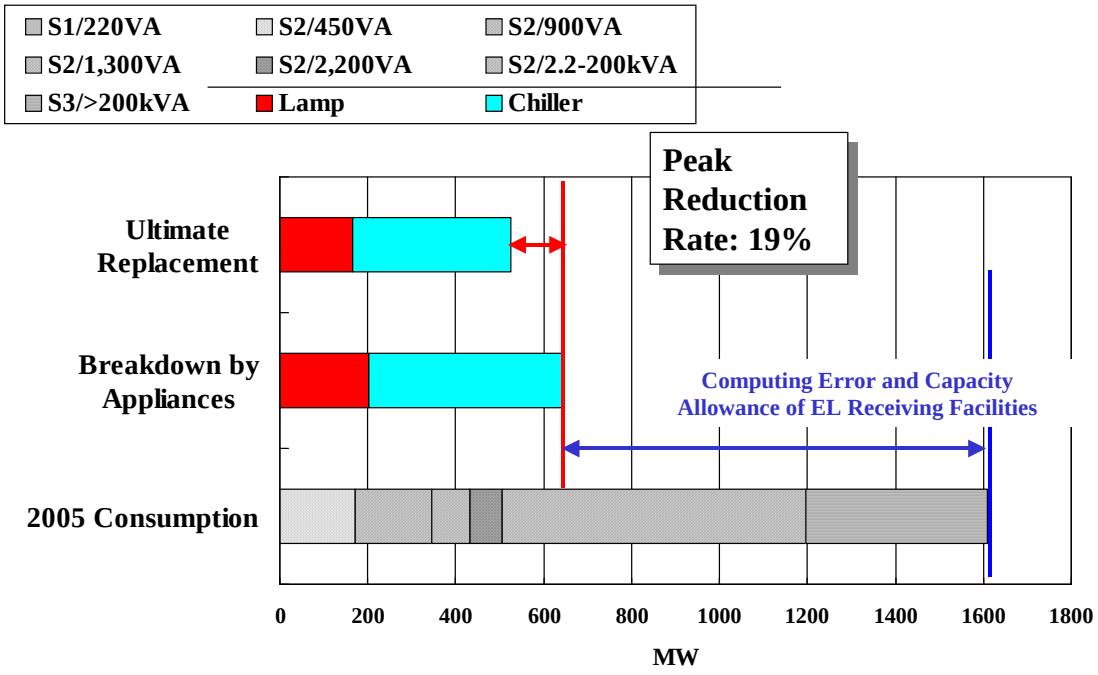


図 5-5 社会部門のおけるピーク削減貢献度

(3) 公共部門

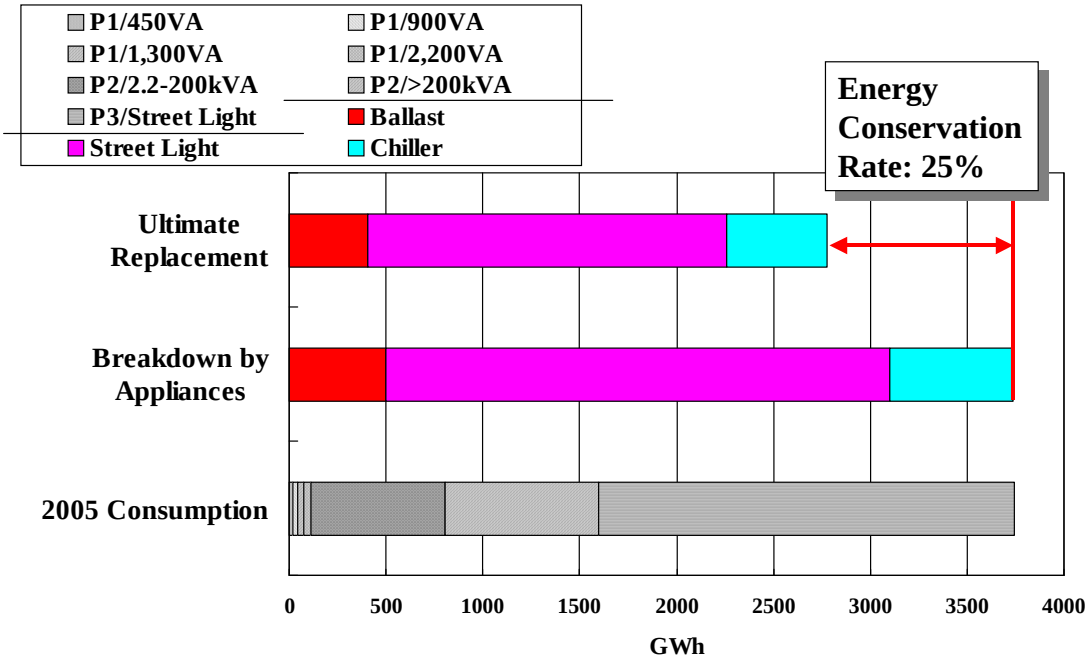


図 5-6 公共部門における省エネ貢献度

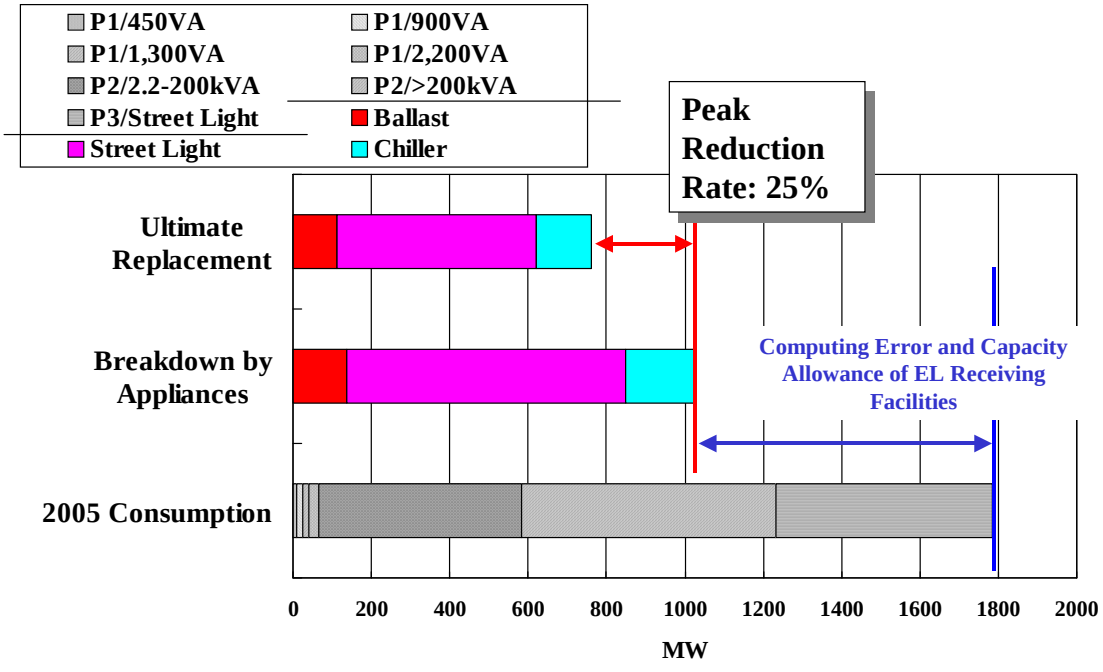


図 5-7 公共部門におけるピーク削減貢献度

(4) 業務部門

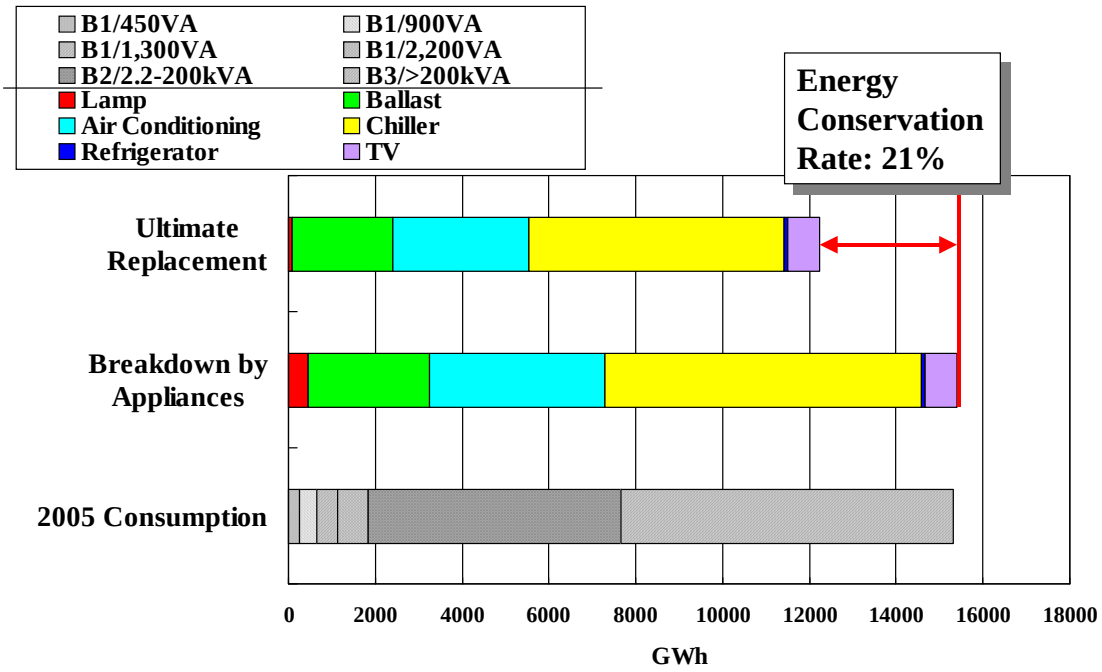


図 5-8 業務部門における省エネ貢献度

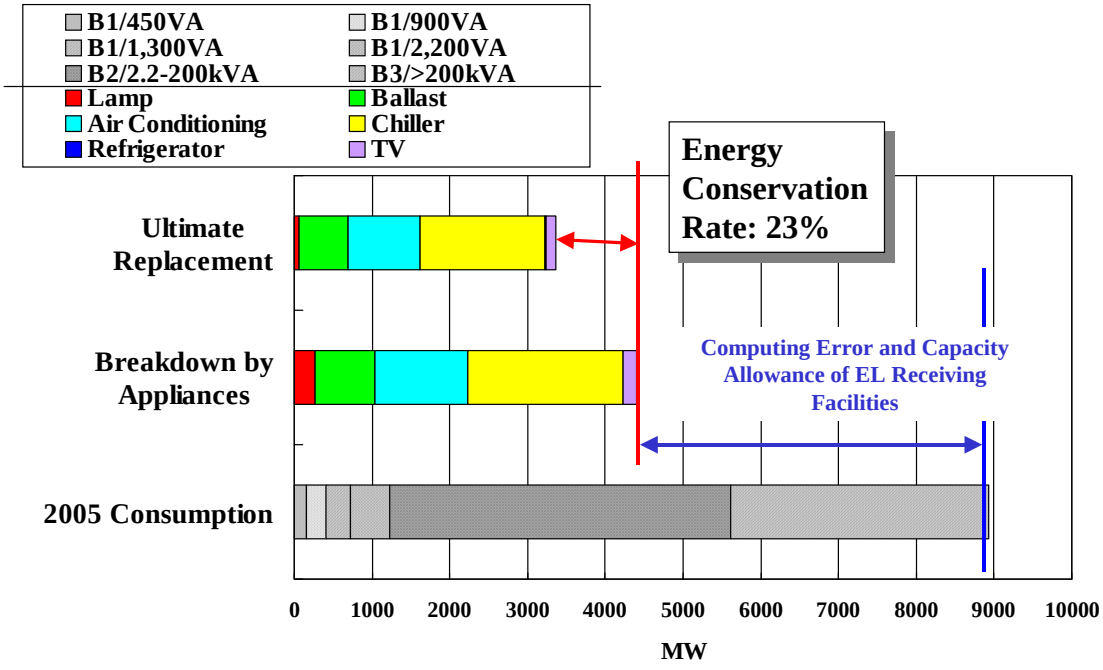


図 5-9 業務部門におけるピーク削減貢献度

(5) 産業部門

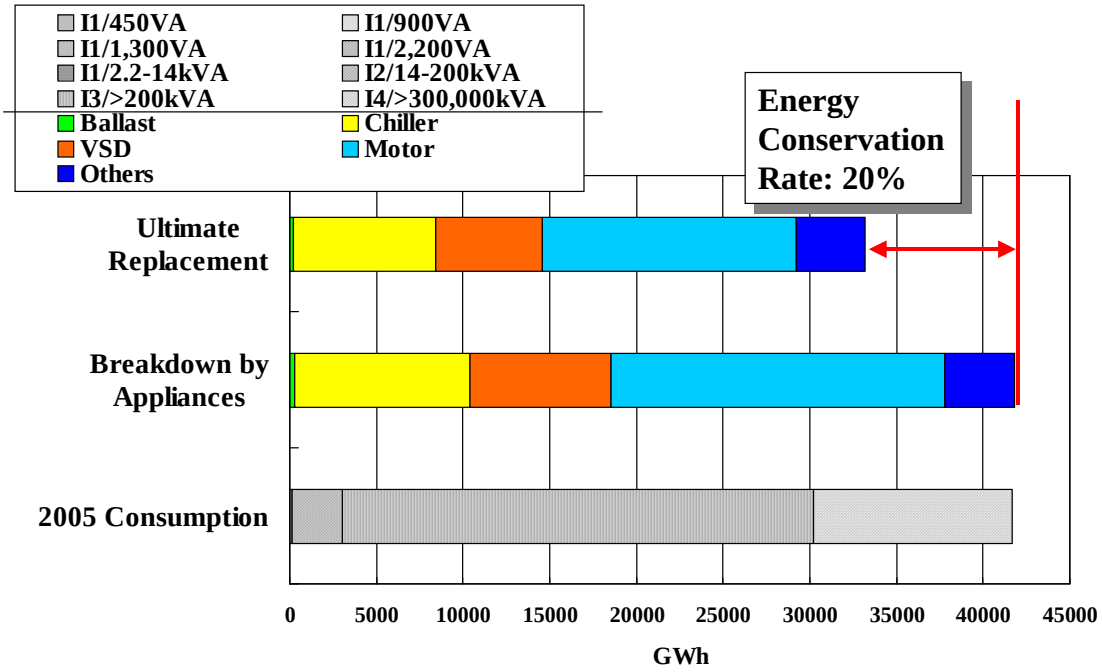


図 5-10　産業部門における省エネ貢献度

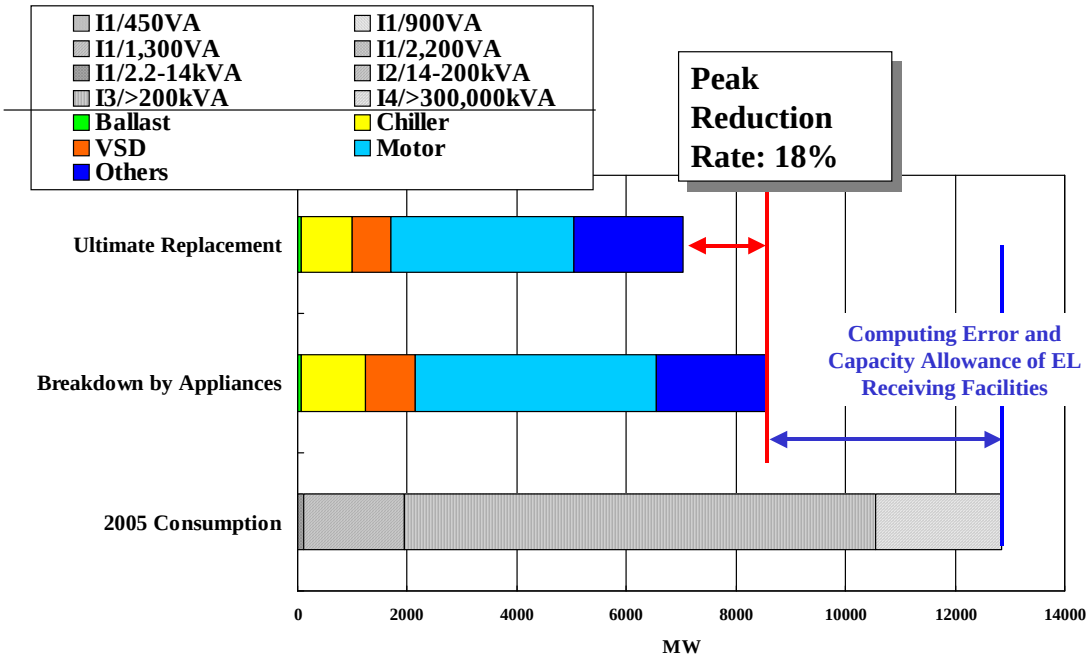


図 5-11　産業部門におけるピーク削減貢献度

(6) 「イ」国における高効率電気製品による省エネ貢献

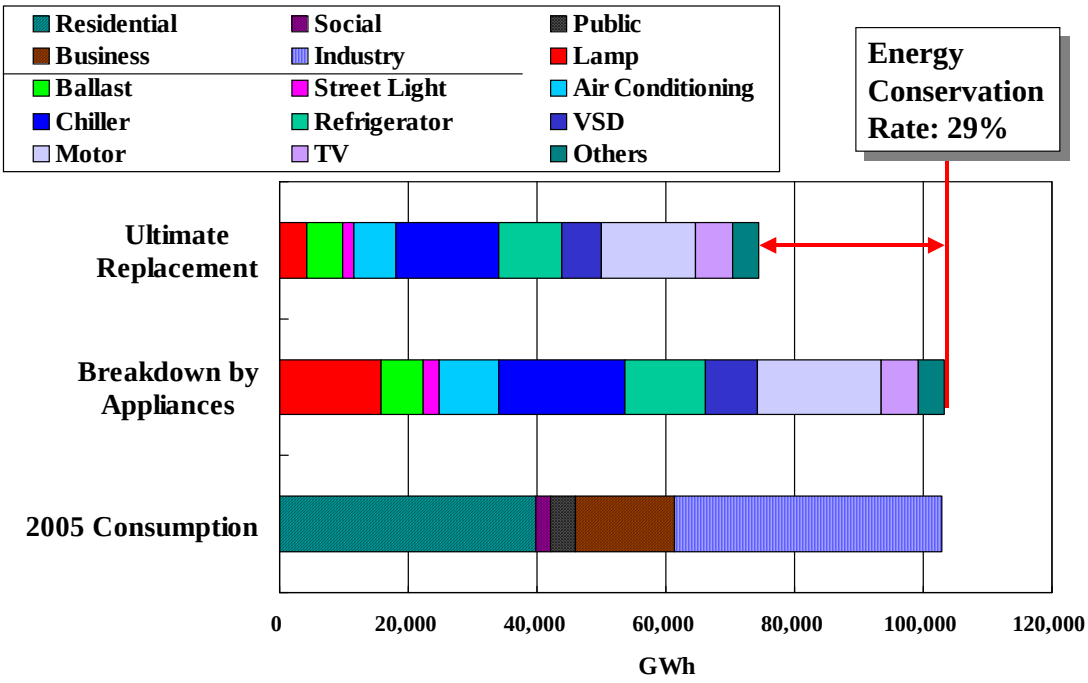


図 5-12 「イ」国における省エネ貢献

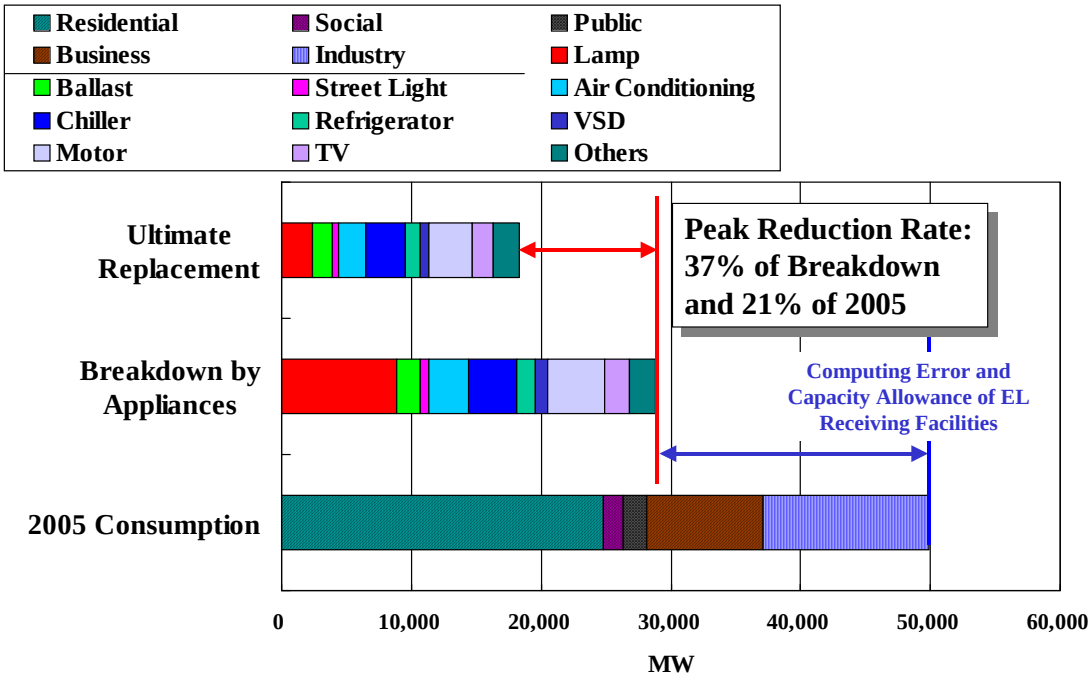


図 5-13 「イ」国におけるピーク削減貢献

6. エネルギー原単位と弾性値（国際比較を含む）

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

(1) 「イ」国のエネルギー（電気）原単位と弾性値

Fig. A6-1 shows recent trend of energy intensity of Indonesia. Transportation sector improved very much, although other sectors are stagnant.

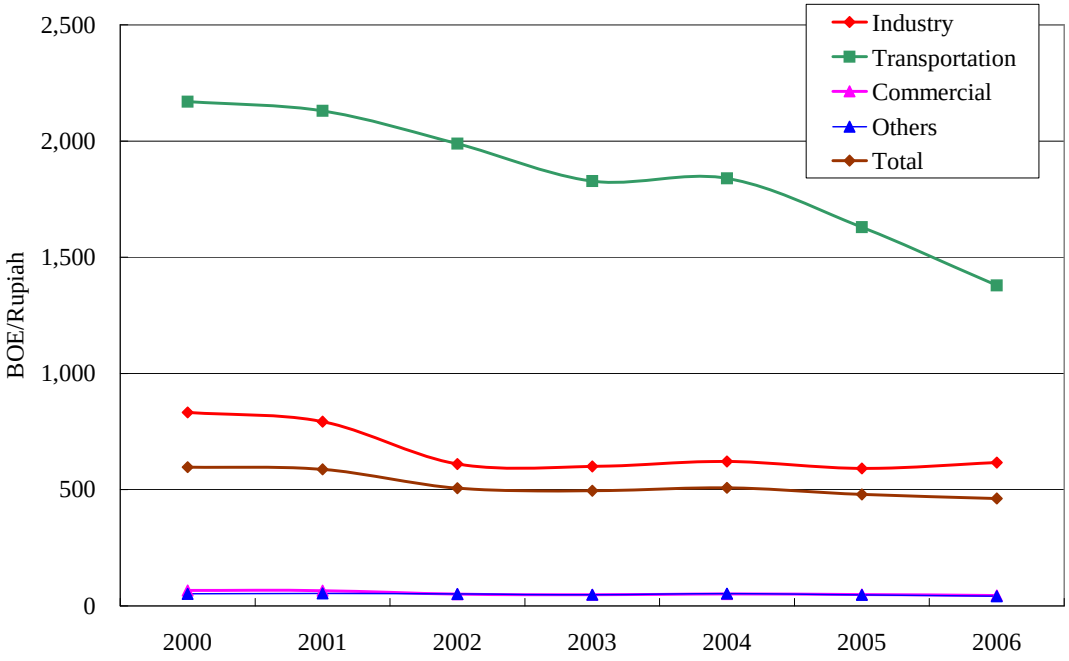


図 6-1　部門別エネルギー原単位推移（最終エネルギー消費/GDP）

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 energy conservation. 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.

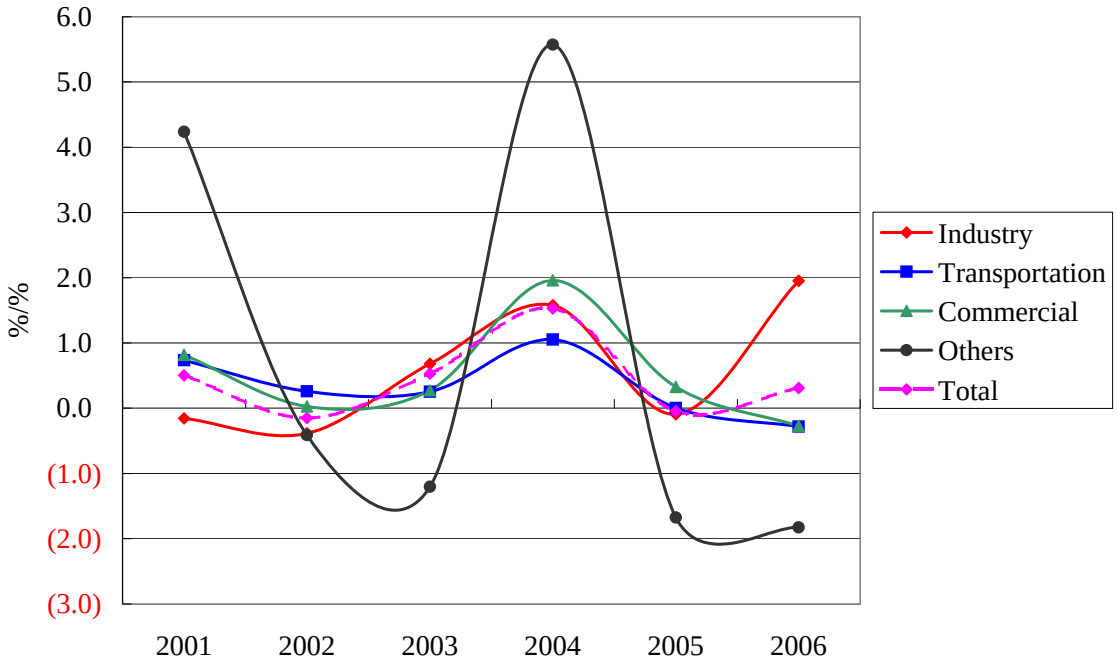


図 6-2　「イ」国の部門別エネルギー弾性値推移

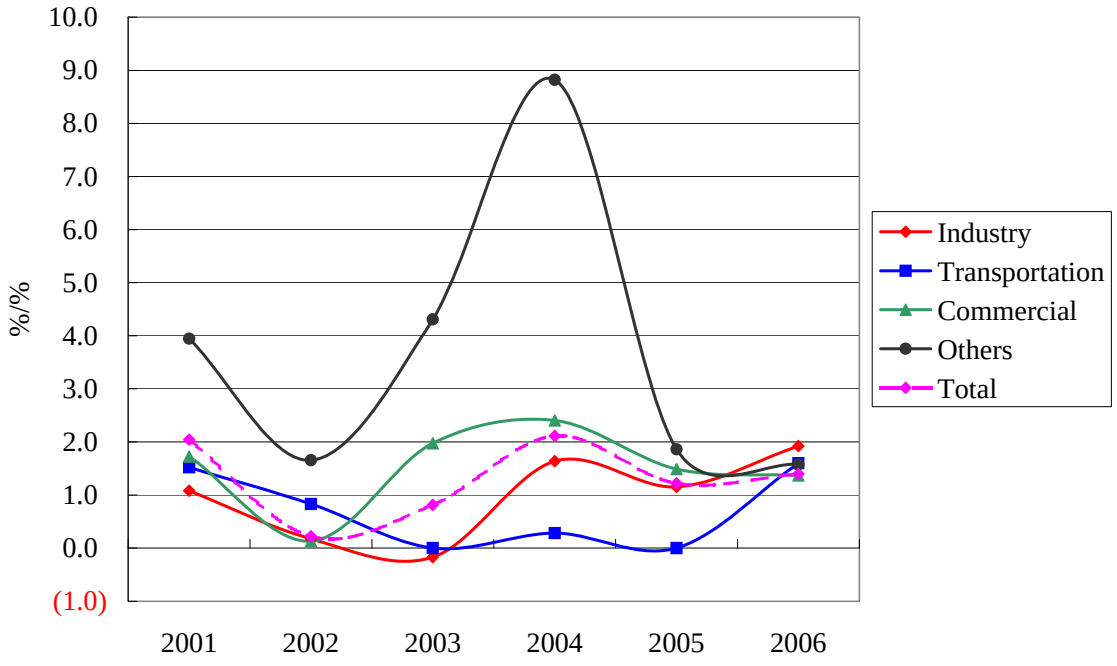


図 6-3　「イ」国の電気弾性値推移

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

表 6-1　エネルギーおよび電気の部門別弾性値（2000 ~ 2006 平均）

	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)　原単位国際比較[8]

Fig. 6-4 shows national total energy intensity of Asian countries. Almost countries show the trend of decreasing or remain unchanged.

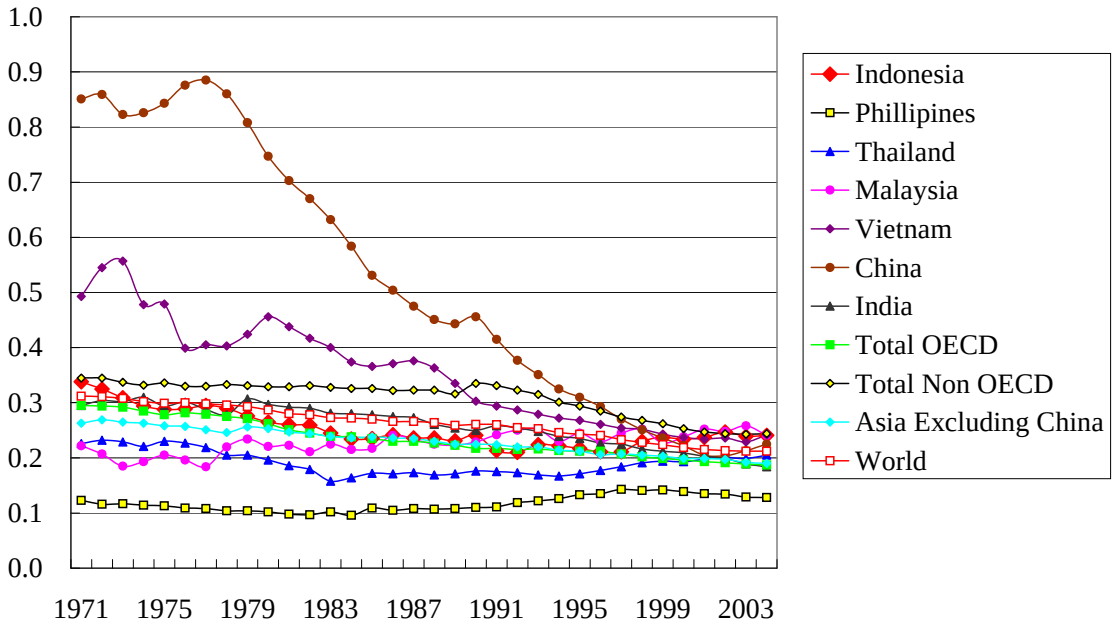


図 6-4　アジア各国のエネルギー原単位推移比較（TOE/US$ GDP 2000 年価格[9]）

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

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

[9] PPP: Purchasing Power Parties

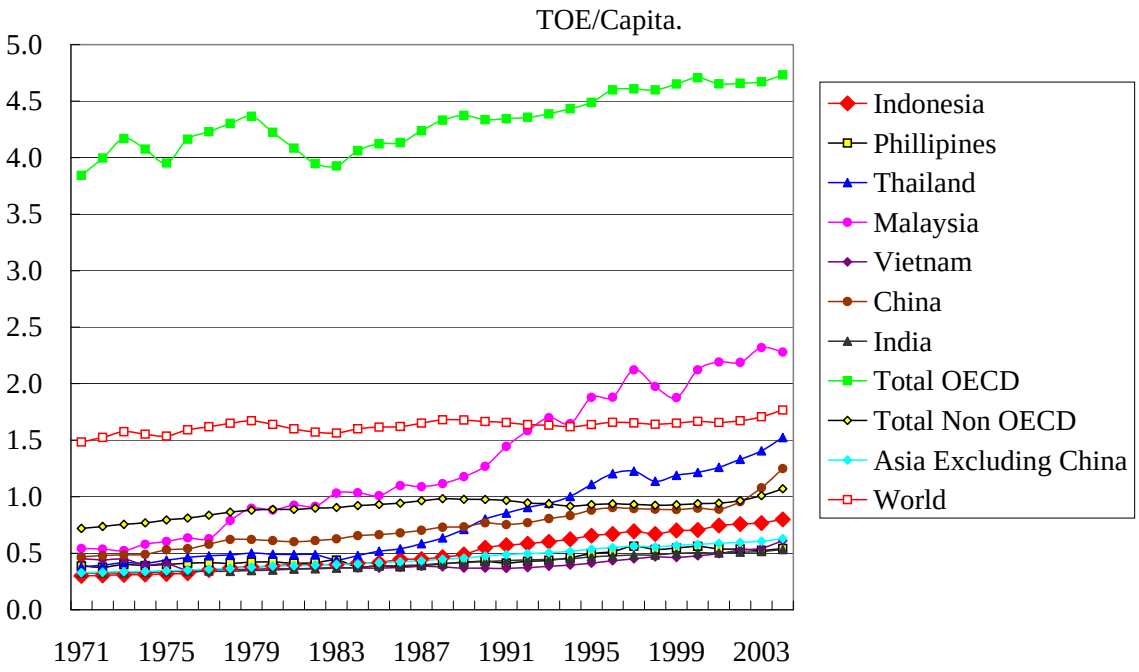


図 6-5　アジア各国の 1 人当たり TOE

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

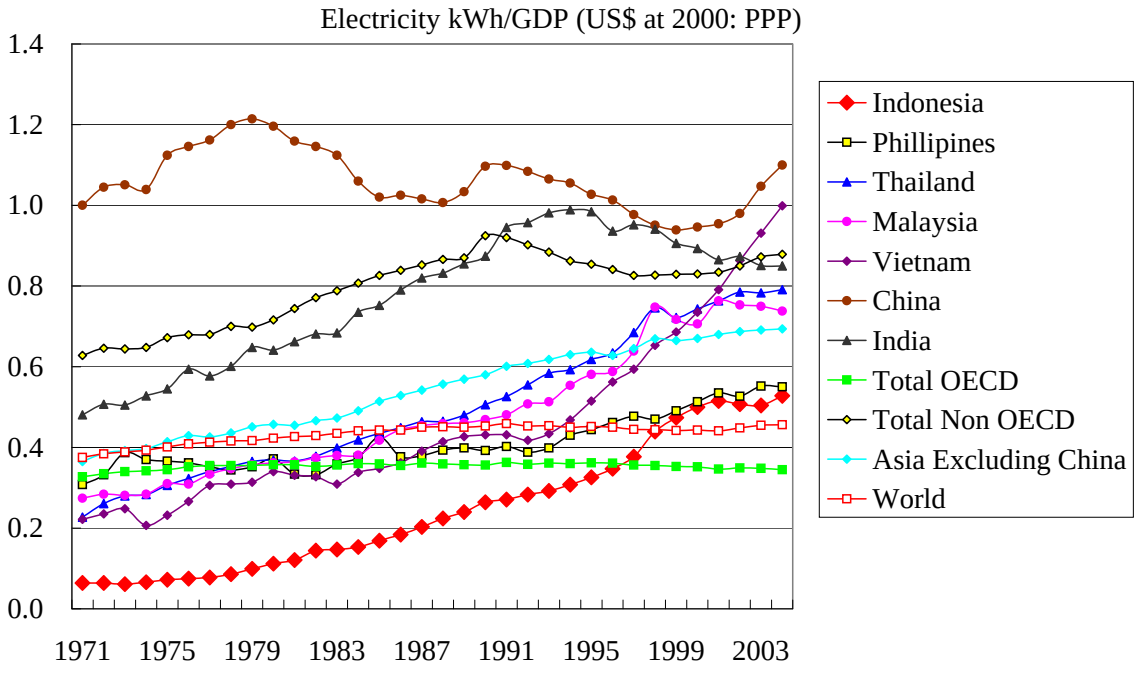


図 6-6　アジア各国の電気原単位

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.

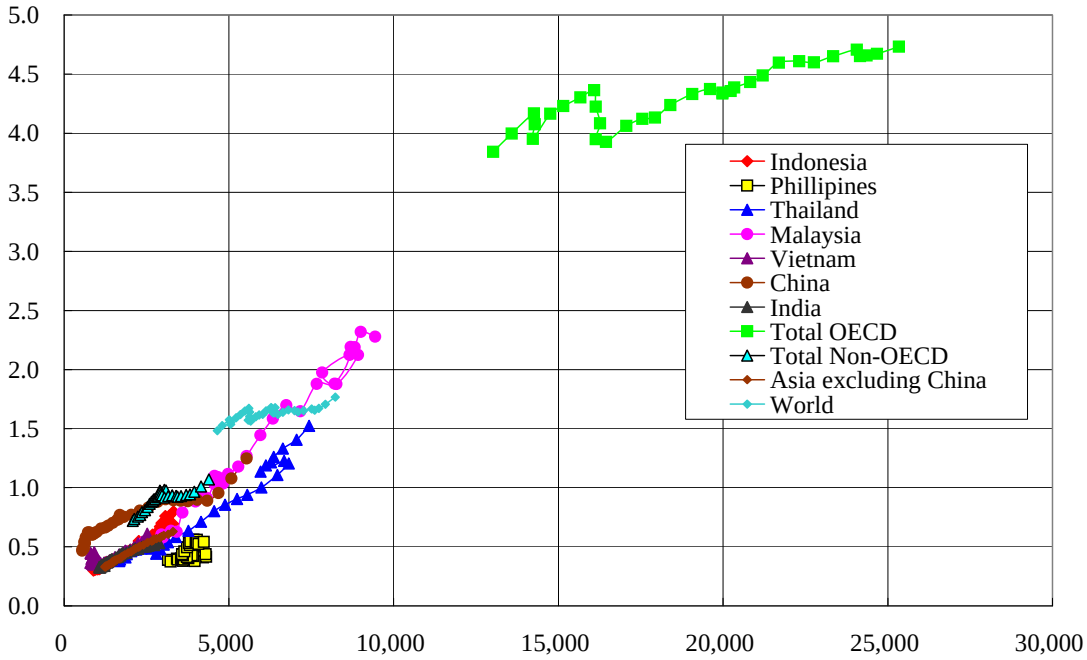


図 6-7　エネルギー原単位対 GDP（TOE/１人）/（GDP/１人)

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 energy conservation. Fig. A6-10 shows Asian version.

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

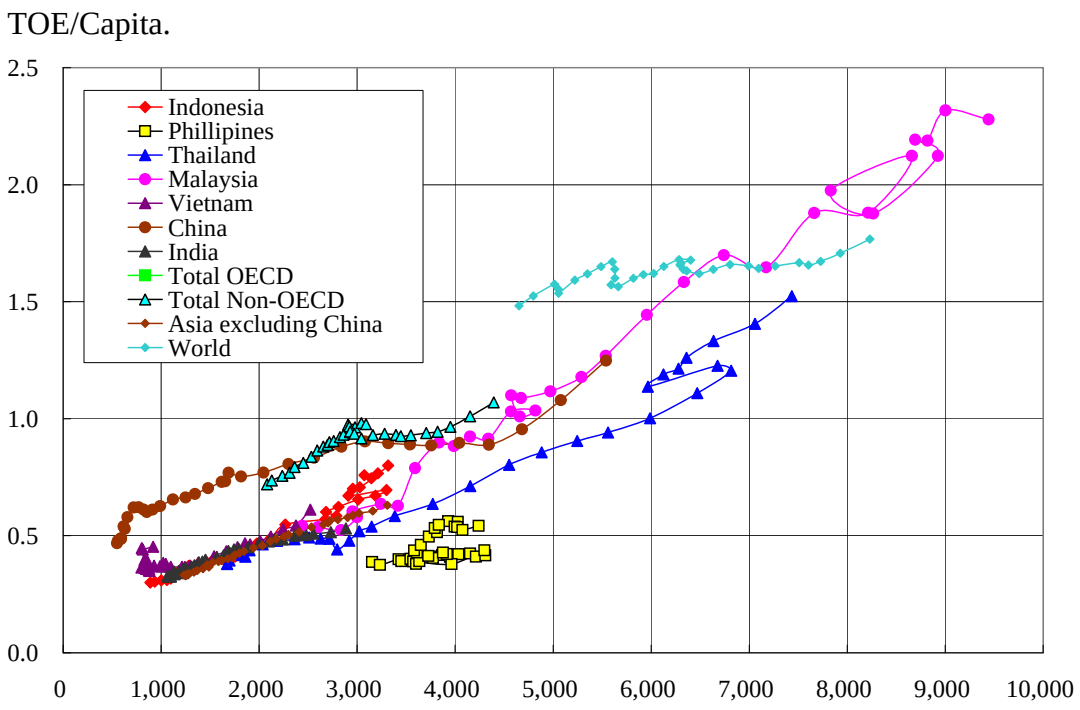


図 6-8　エネルギー原単位対 GDP（TOE/１人）/（GDP/１人）

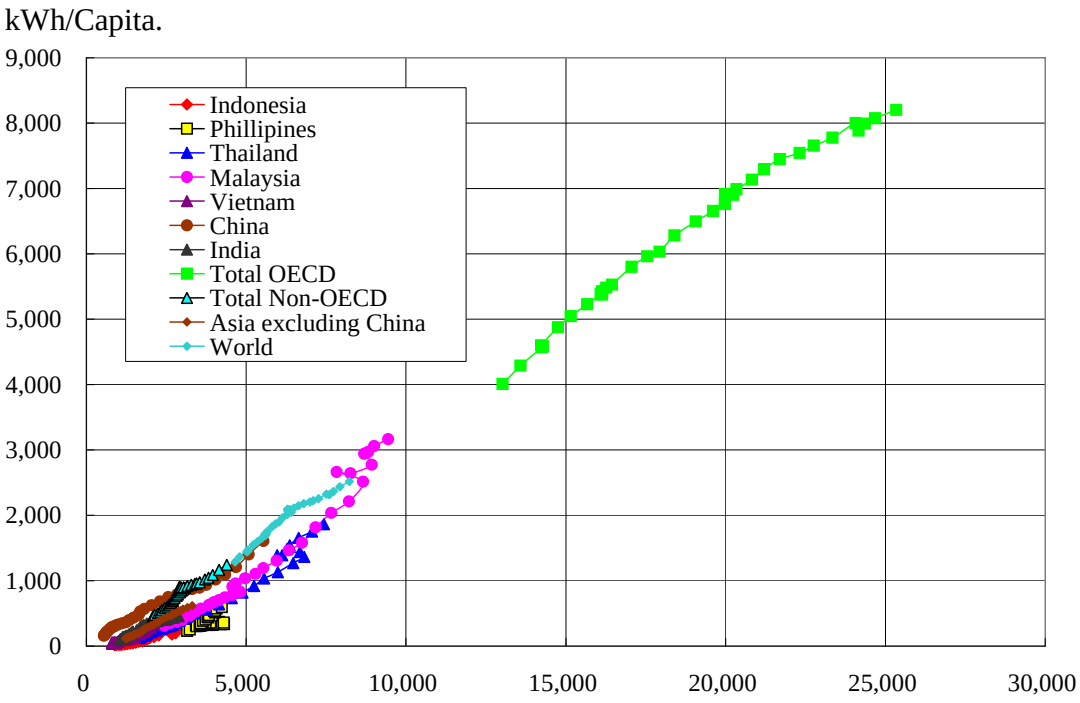


図 6-9　電気原単位対 GDP（TOE/１人）/（GDP/１人）

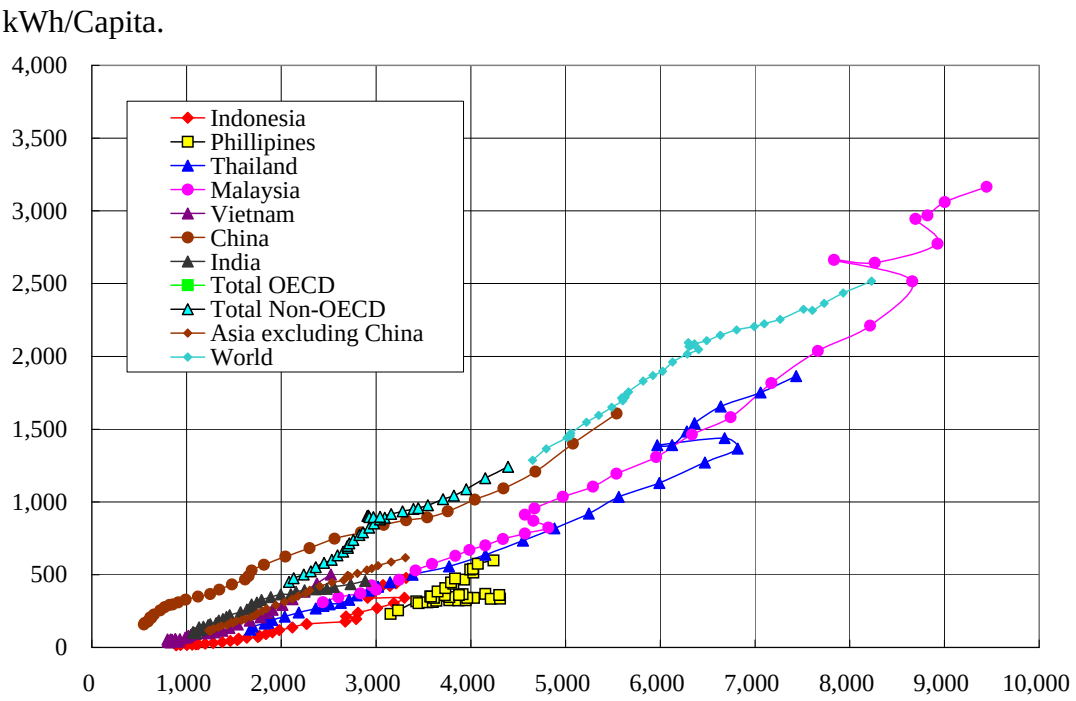


図 6-10　電気原単位対 GDP（TOE/１人）/（GDP/１人）

Supplement 8

Toward Realization of Energy Efficient Society all over the Viet Nam

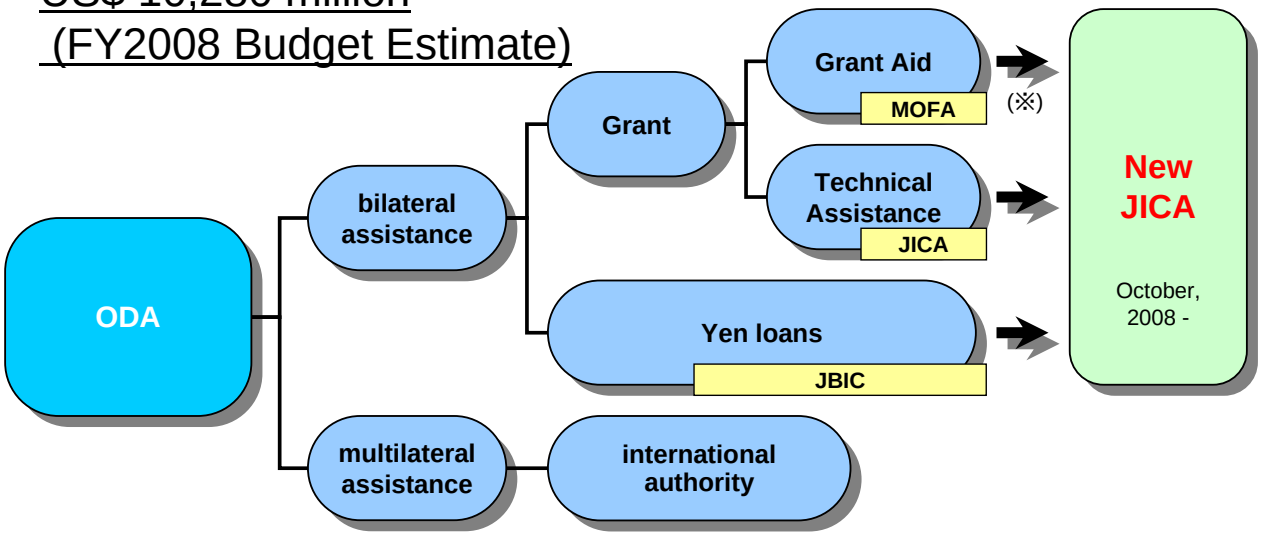
- Exclusive Cooperation by Japanese ODA – (Abstract)

Saishu MATSUDA

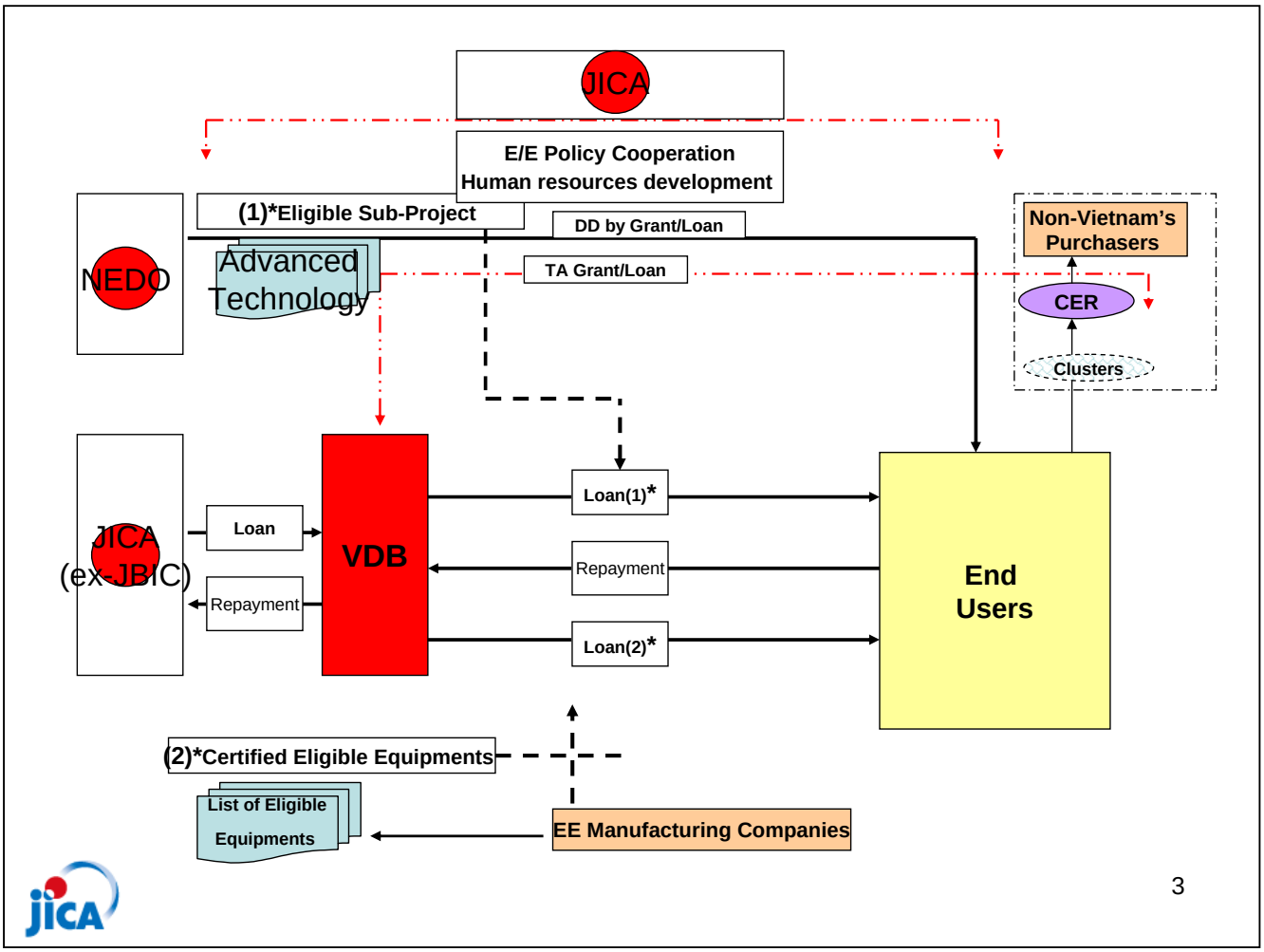
Assistant Director, Natural Resources and Energy Conservation Division
Japan International Cooperation Agency (JICA)

"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