

**Feedback Seminar on
Energy-Efficiency Potential in South Africa**

Energy Management System In Japan

- Japanese Case-

January 2008

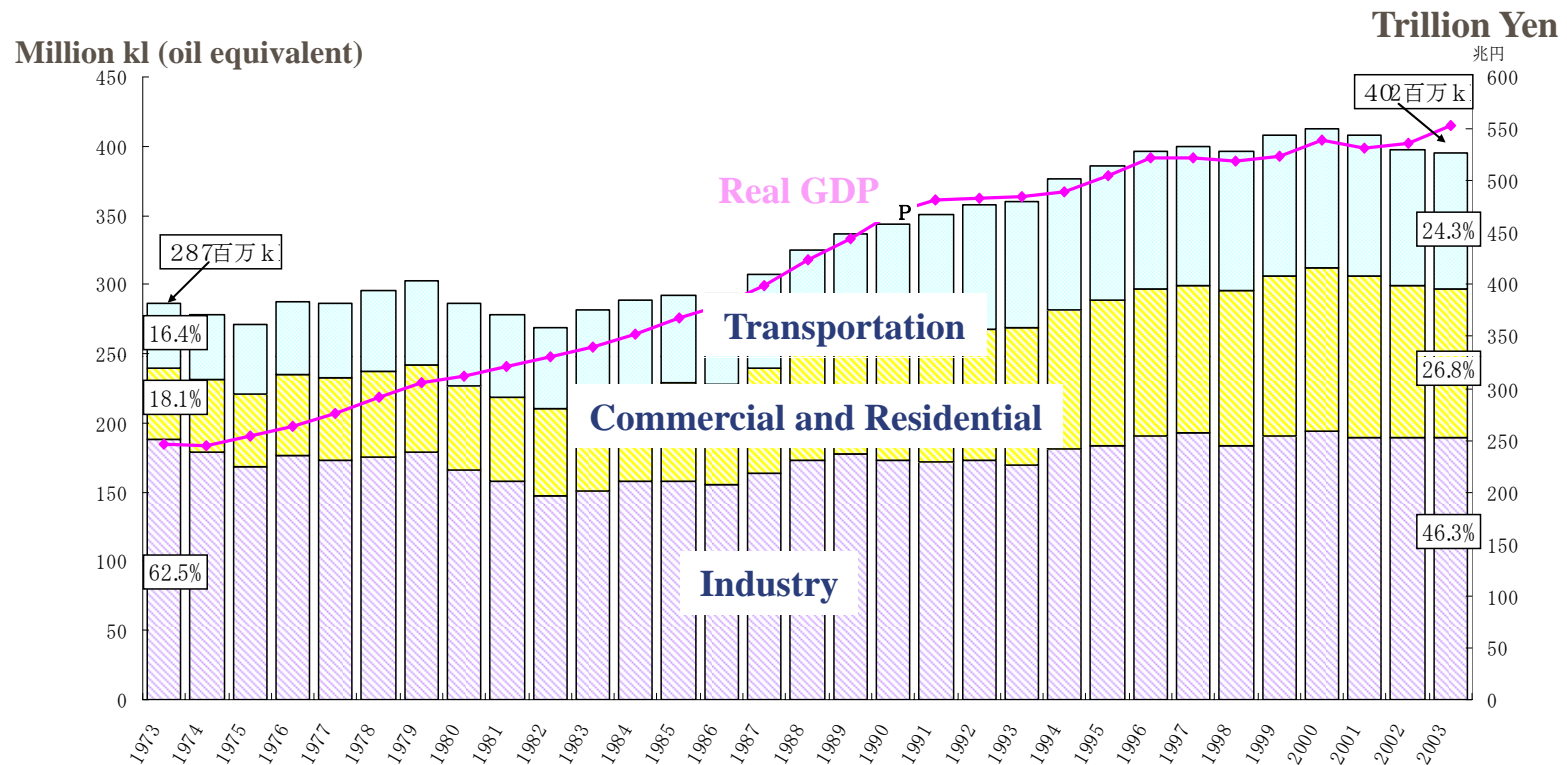
Tokyo Electric Power Company

(JICA Study Team)

Yasushi KAWANO

1. General

Historical Data of Final Energy Consumption by Sector

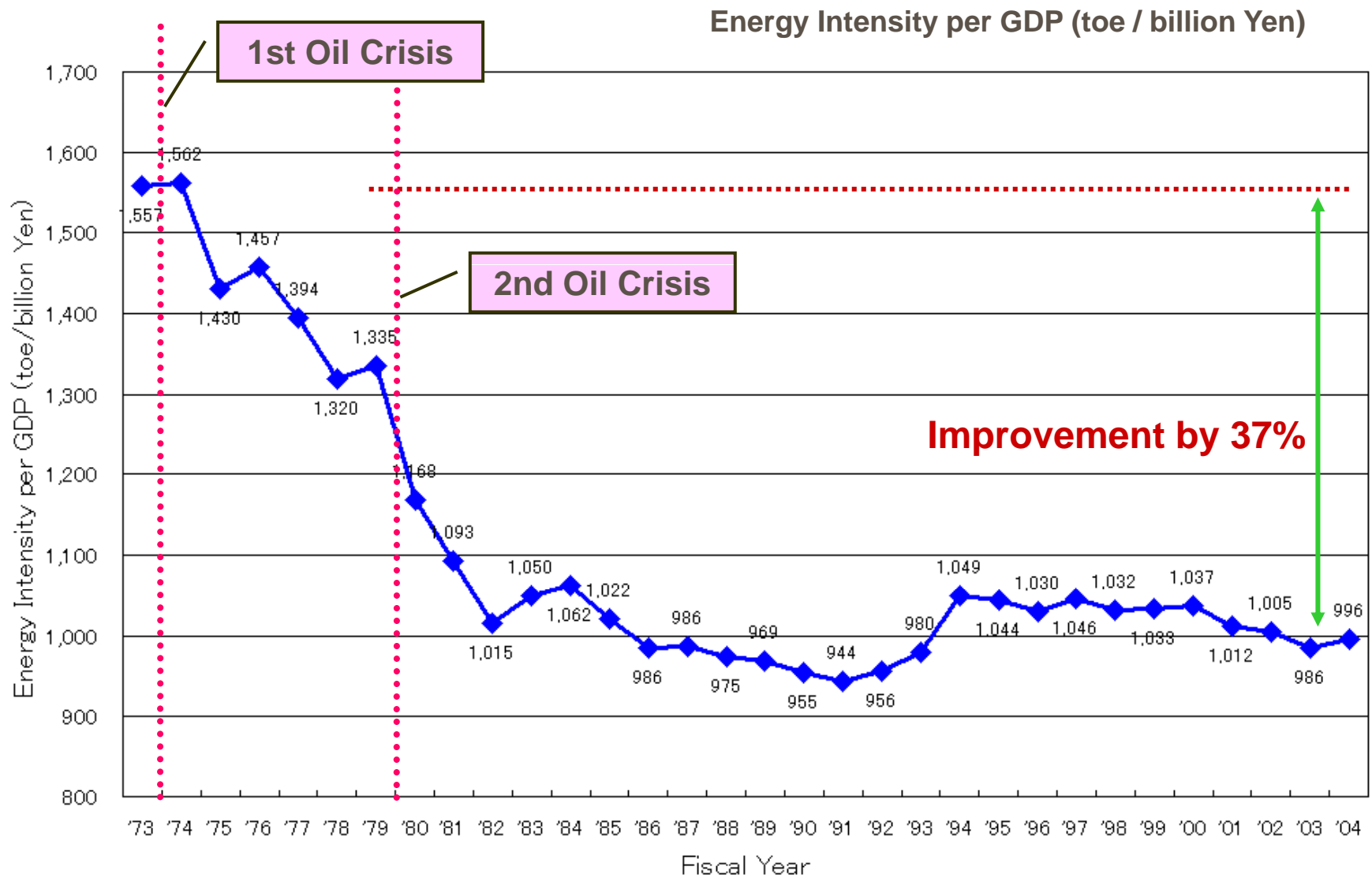


Source: METI

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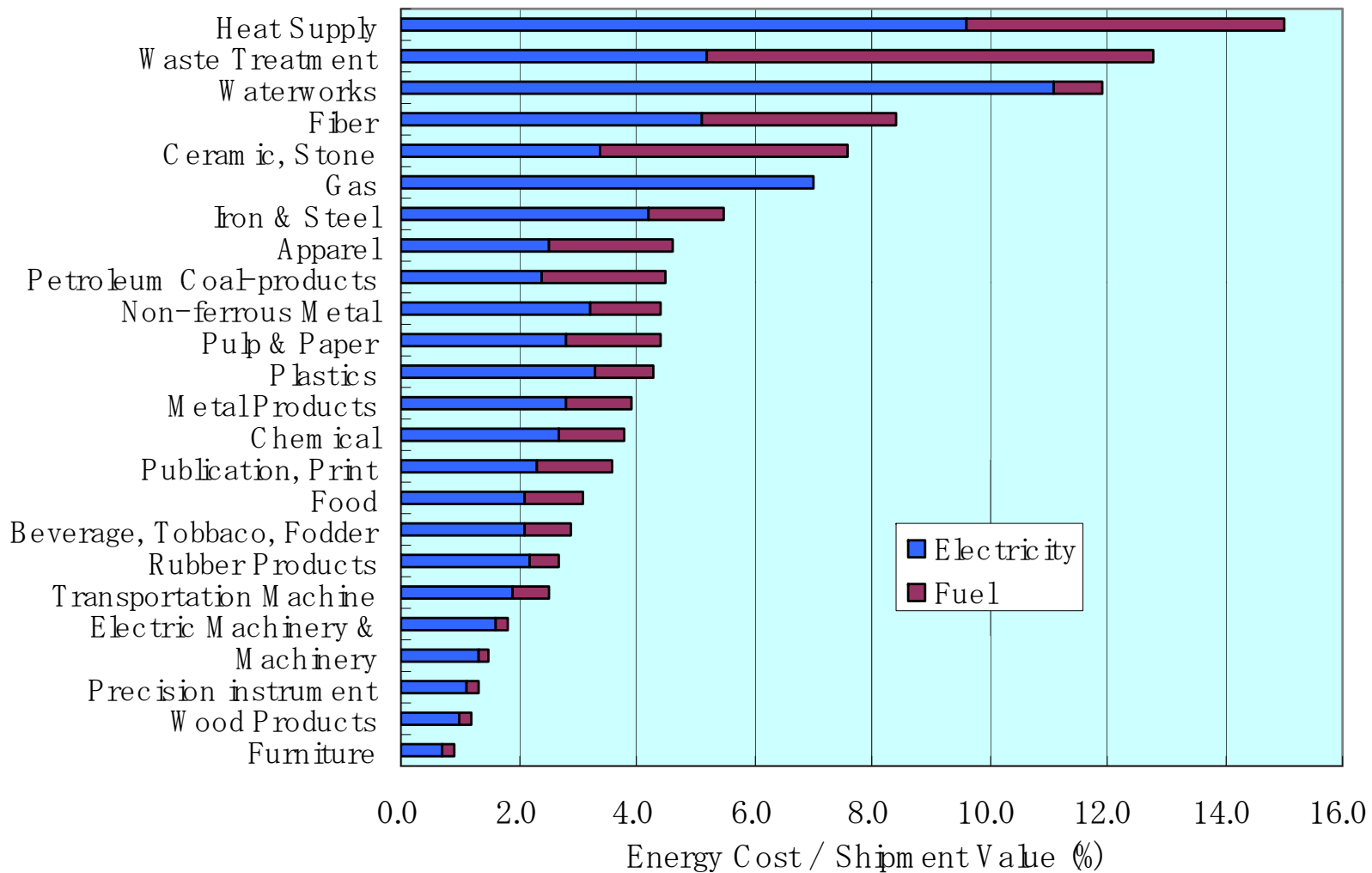
- Final energy consumption in Japan has increased since 80's (except 1998).
- Industry: C&R: Transportation has changed from 4:1:1 (in 1973 oil crisis) to 2:1:1 (in 2004).

Change in Primary Energy Intensity per GDP in Japan



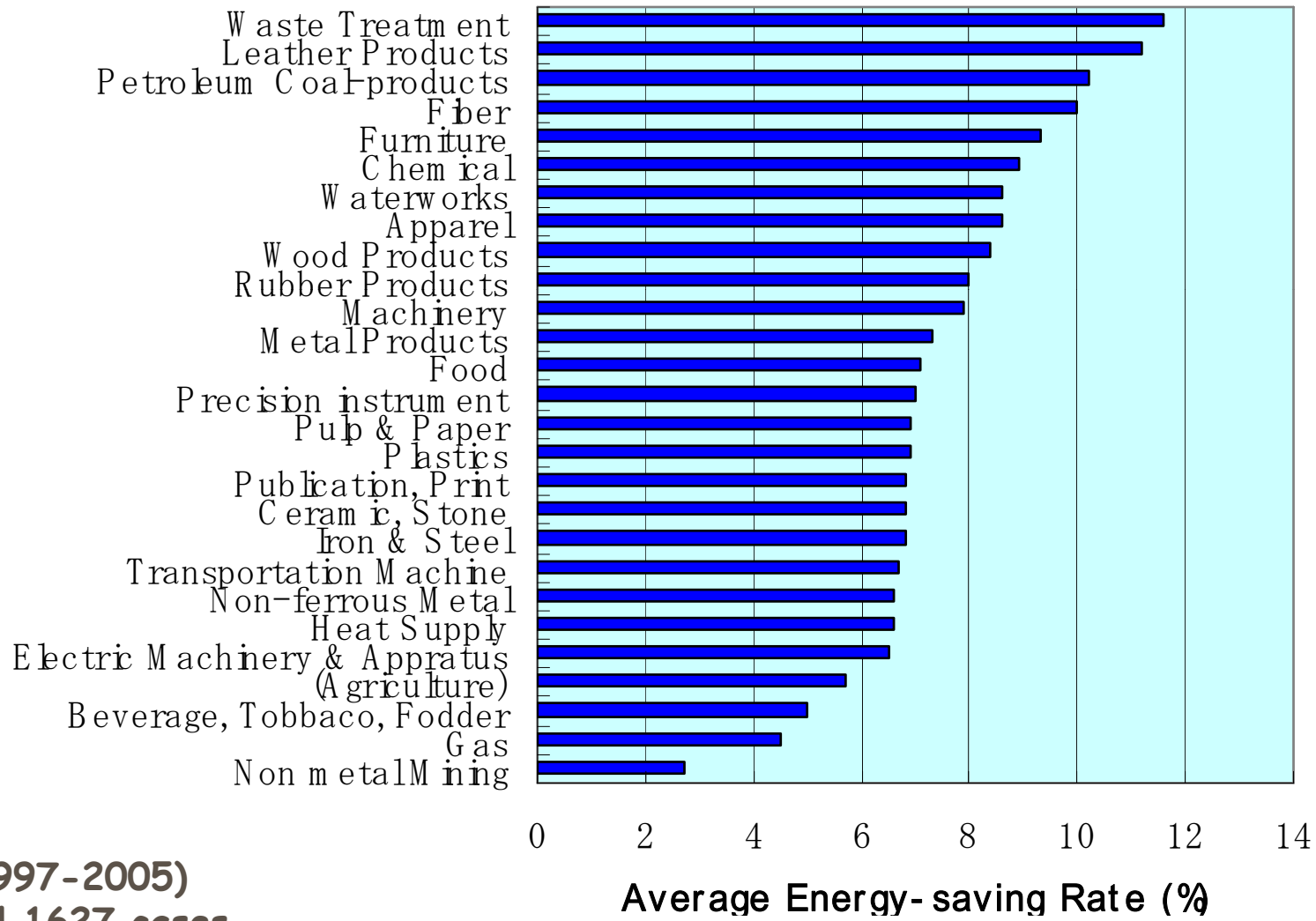
Source: General Energy Statistics (METI)

Energy Cost of Each Industry



(Source: ECCJ)

Energy Conservation Potential (estimated)



(1997-2005)
Total 1627 cases

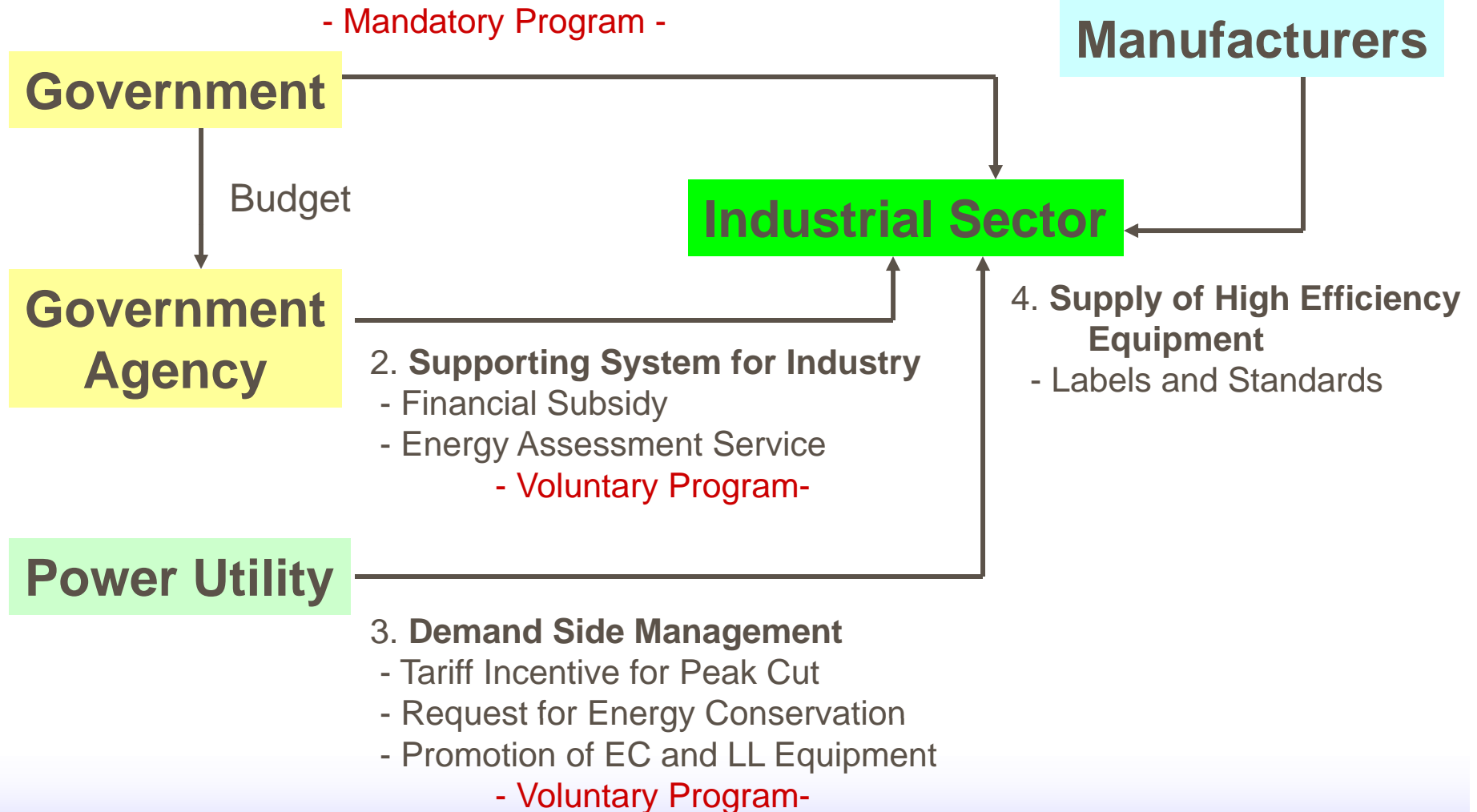
(Source: ECCJ)

Overview of Energy Management in Industry

1. Energy Management System

(Assignment of Energy Manager, and Submission of Periodical Report)

- Mandatory Program -



2. Energy Management System In Japan

Objective of the EMS

1. Executing Agency

Ministry of Economy, Trade and Industry and their Local Offices

2. Designated Factories and Buildings

Electricity and Heat (3,000 kl-oe/year, or 12 GWh/year)

(Large Consumers in Government, Industrial and Commercial Sector)

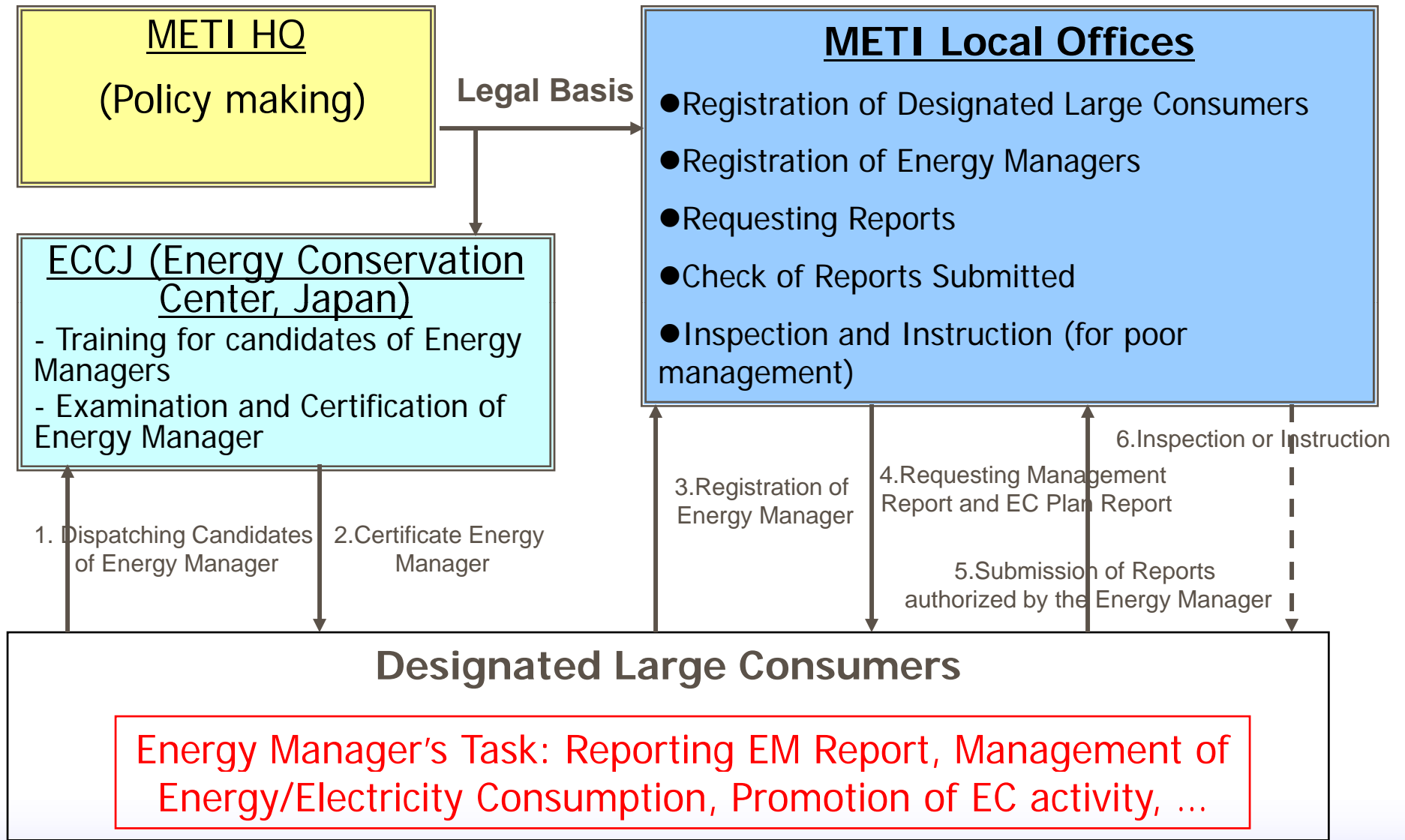
3. Objective

To promote voluntary EC practices within a business unit by mandatory reporting and assignment of energy manager

4. Contents of the Scheme

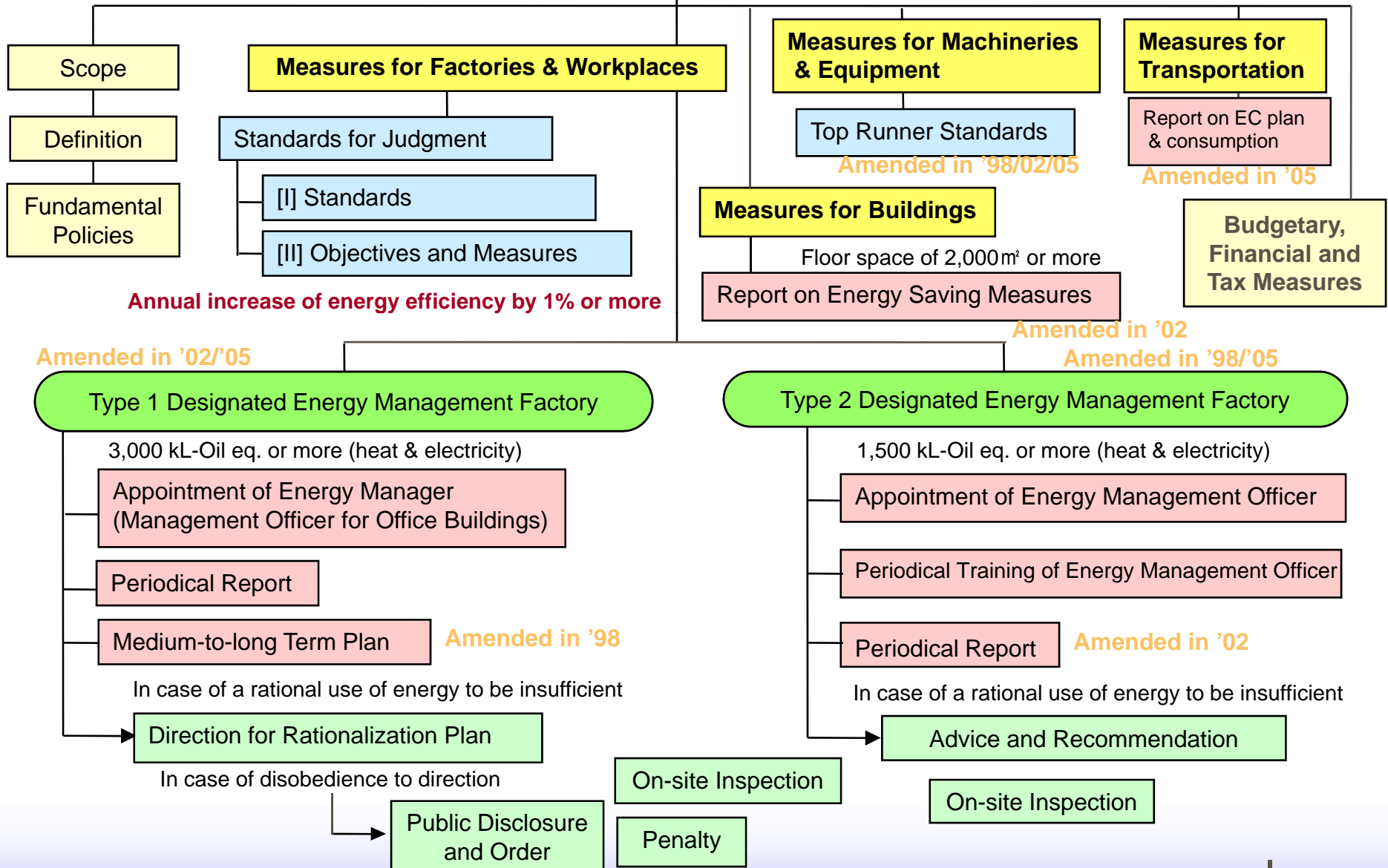
- Large consumers are designated by a criteria (3,000 kl-oe/year)
- Energy Manager is assigned by the designated consumers and submitted to METI.
- Energy Manager have to be qualified by government examination or training program.
- Large consumers have to submit annual reports (energy consumption report and middle term EC plan report), compiled by the Energy Manager, to METI Local Offices.
- Energy Manager has a responsibility for management within the business unit and instruction for workers and reporting to METI.
- METI checks the report and gives instruction in case of poor management.

Annual Procedural Flow



Energy Conservation Law

【enacted in 1979, amended in 1983/1993/1998/2002/2005】



Main Articles Regarding EMS in the Law (1)

Article	Explanation
<p>Article Evaluation Criteria for Business Operators</p>	<p>Minister announces the evaluation criteria (6 fields) of rational use of energy to the designated factories and buildings.</p> <ol style="list-style-type: none"> 1. Rationalization of burning fuel 2. Rationalization of heating, cooling and heat transfer 3. Recycling heat waste 4. Rationalization of converting heat into power 5. Prevention of heat loss by emission, conduction etc and Prevention of electric loss by resistance etc 6. Rationalization of converting electricity into power, heat etc <p>Designated Business Operators have to have their own Management Standards according to the above evaluation criteria.</p>
<p>Article Designation of Designated Energy Management Factories</p>	<p>The criteria for designation is defined by the Cabinet Order. In the current Order, 3,000 kl/year (oil equivalent) is the border line for the designation. Electricity is also converted to oil-equivalent in primary energy.</p>
<p>Article Energy Manager</p>	<p>Designated Business Operator shall appoint Energy Manager for each of its Designated Energy Management Factories from among persons who have a qualified Energy manager's license, and notify to the Minister of Economy, Trade and Industry.</p>

Main Articles Regarding EMS in the Law (2)

Article	Explanation
<p>Article Qualified Energy Manager's License</p>	<p>A qualified Energy manager's license shall be granted by the Minister of Economy, Trade and Industry to persons who fall under any of the following items.</p> <ul style="list-style-type: none"> -Person who has passed an examination for qualification. -Person who has been recognized by the Minister of Economy, Trade and Industry as having equal or greater knowledge and experience than the person
<p>Article Duty of Energy Manager</p>	<p>Energy Managers shall, with regard to the rational use of Energy in Designated Energy Management Factories, manage the maintenance of Energy-consuming facilities, the improvement and supervision of methods for using Energy, and other affairs specified by an Ordinance of the Ministry of Economy, Trade and Industry.</p>
<p>Article Preparation of Medium- and Long-Term Plans</p>	<p>Designated Business Operator shall prepare each business year a medium- and long-term plan for achieving the targets for the rational use of Energy that are specified for Designated Energy Management Factories in the standards of judgment.</p> <p>Qualified Energy manager has to participate in the planning process.</p>
<p>Article Periodical Report</p>	<p>Designated Business Operator shall report to the competent minister each business year the matters specified by an Ordinance of the Ministry of Economy, Trade and Industry with regard to the Energy consumption and other status of Energy use. (Periodical Report)</p>

License of Energy Manager (Heat/Electricity)

1. National qualifying examination

- ❖ Once a year
- ❖ 1 day, 4 subjects

< in 2005 >

Applicant	8,950
Succeeded	2,290
	(22.5%)

2. Training seminar with examination

- ❖ Once a year
- ❖ 6 day training & 1 day examination
- ❖ Background : education + experience

Applicant	2,765
Succeeded	1,800
	(65.1%)

ECCJ is assigned to carry out the state exam. & training seminar by the government.

Management Standards

- Management standards (operation manual) are made for each energy consumption equipment.
- The standards are made by the business operator (in accordance with the guideline).



Report of Management Standards (sample)

1. General Provision (purpose, definition, target equipment, energy reduction target, etc.)
2. Management structure and responsibility, and annual schedule (data collection schedule, making annual reports, making monthly report of energy consumption (internal), periodical maintenance schedule, etc.)
3. Facility Data and Equipment Data List
4. Monthly Report of Energy Consumption
5. Management Standards of Each Equipment

Sample of Management Standards

Control Field

Control Standards under the "Energy Conservation Law"		Control Standards of Boiler System	Reference No. Revised: X Page: 1/3
<p>1. Purpose The purpose of this Standard is to rationalize energy use of XX Building by specifying requirements for the measurement/recording, operation, maintenance/inspection of the one-through boiler system (with an evaporation rate of 300 kg/h) and by conducting the appropriate control/operation procedures.</p> <p>2. Scope of Application This Standard shall apply to the one-through boiler system (with an evaporation rate of 300 kg/h) installed in the XX building.</p>			
Category	Control	Control Standards	
Control of Combustion (Standard for Air Ratio) (Measurement/Recording)	<p>1. Air Ratio</p> <p>①Control Amount of combustible air shall be as close as possible to the "Theoretical Amount of Air" in order to reduce the exhaust gas loss and to achieve complete combustion.(Description #1)</p> <p>②Measurement/Recording The measurement and recording of exhaust gas from the boiler system shall be performed: once per three (3) months</p>	<p>Standard air ratio: 1.2-1.3 (when load factor is 50-100%)</p> <p>1.4-1.6 (when load factor is lower than 50%)</p>	
	<p>2. Control of Combustion Equipment and Exhaust Gas</p> <p>①Control - Monitoring of burner combustion conditions and of discharged smoke - Exhaust gas temperature</p> <p>②Measurement and Recording Exhaust gas temperature, color of the smoke: once per day</p> <p>③Maintenance and Inspection - Maintenance/inspection for burner tips, fuel-air-adjustment valves: twice per year - Cleaning of water-tubes: once per year</p>	<p>Is the smoke discharged in a normal manner? Is there dark smoke coming out? Target value: 250°C or lower</p>	
Operation Control & Control of Efficiencies	<p>1. Load Factor & Conditions for Startup/Shutdown</p> <p>①Control - When the load factor is low and frequent startup/shutdown operation is unavoidable, the boiler efficiency may become lower. Apparently, this is not preferable from the maintenance standpoint.</p> <p>i. Appropriate control of the number of plurality of boilers and lower startup frequency shall be considered preferable.</p> <p>ii. Load leveling shall have to be performed.</p> <p>iii. The burner shall be adjusted to the proper capacity level (ask the manufacturer).</p> <p>②Measurement/Recording The startup frequency shall be recorded: once per day</p>	<p>Startup Frequency: 20 times/ or fewer</p>	
	<p>2. Steam Pressure Higher than unnecessary steam pressure may cause lowering of thermal efficiency. Therefore, it is critical to maintain a proper level of steam pressure.</p>	<p>0.5-0.6MPa</p>	
	<p>3. Thermal Efficiency</p> <p>①Control Thermal efficiency of the boiler shall be calculated by monitoring the fuel usage and the evaporation amount. Thermal efficiency (Description #2)</p>	<p>When load factor is 80% or higher, thermal efficiency shall be 85% or higher.</p>	

Name of Equipment

Check Points

Standard Value of the Check Point

How to control

Data Measurement and Recording

Maintenance Schedule (if necessary)

Medium and Long Term Plan

I. Term of the plan
Fiscal year to fiscal year

II. Details of the plan and expected effects on the rational use of energy

Process	Details of the plan	Expected effects of the rational use of energy

III. Comparison with the plan of the previous year

Process	Withdrawn plan	Reason

Process	Additional plan	Reason

- M&L plan targets at 3 years in Japan.
- Planning program/project and expected effects are estimated.
- Comparison of last year's plan is also shown.

Periodical Report (1)

Table 1: Quantity of energy use and quantity of energy sold or by-product

Type of energy	Unit	(Fiscal year)					
		Quantity of use		Quantity of energy sold or by-product			
				Quantity of energy sold		Quantity not contributing to own production	
		Quantity	Calorie GJ	Quantity	Calorie GJ	Quantity	Calorie GJ
Fuel and heat	Crude oil (excluding condensate)	k l					
	Condensate included in crude oil (NGL)	k l					
	Gasoline	k l					
	Naphtha	k l					
	Kerosene	k l					
	Diesel oil	k l					
	Fuel oil A	k l					
	Fuel oils B/C	k l					
	Asphalt	t					
Other fuels	City gas	1000m ³					
	()						
	Industrial steam	GJ					
	Non-industrial gas	GJ					
	Hot water	GJ					
	Cool water	GJ					
	Sub-total	GJ					
Electricity	Ordinary electric power supplier	Daytime purchased power	1000kWh				
		Nighttime purchased power	1000kWh				
	Others	Purchased power other than the above	1000kWh				
		Private power generation	1000kWh				
	Sub-total		1000kWh/ GJ				
Total GJ							
Crude oil equivalent kl			(a)		(b)		(c)
Comparison vs. previous fiscal year (%)							

- Energy consumption calculation sheet (annual) is submitted.
- Fuel consumption, purchase of heat, and purchase of electricity are converted to primary energy of crude-oil (Japanese case).

Periodical Report (2)

Table 2: Brief summary of facilities related to rational use of energy and major facilities consuming energy and situations of operation including new installation, remodeling or dismantling

	Name of facilities	Outline of facilities	Operational status	New installation, remodeling or dismantling
Facilities related to rational use of energy				
Major facilities consuming energy other than the above				

- Energy consumption facilities and their operation (days and hours) are listed.
- Annual production quantity is also filled. The data is decided by the business operator (ex. ton, units, monetary value, m2, etc.)

Table 3: Production quantity and others

	(Fiscal year)	Comparison vs. previous fiscal year (%)
Values closely related to energy consumption such as production quantity, gross floor space or others ()	(d)	

Periodical Report (3)

Table 4: Unit energy consumption

		(Fiscal year)	Comparison vs. previous fiscal year (%)
Unit energy consumption =	$\frac{\text{Quantity of energy used (crude oil equivalent kl)}}{\text{((a) - ((b)+(c)))}}$		
	Values closely related to energy consumption such as production quantity, gross floor space or others (d)		

- Unit energy consumption (energy intensity) is calculated as follows.

Energy Intensity =
 Energy consumption
 calculated in the
 calculation sheet / Annual
 Production Quantity.

Table 5: Status of change in unit energy consumption for past five years

	(Fiscal year)	(Fiscal year)	(Fiscal year)	(Fiscal year)	(Fiscal year)	Change in average unit energy consumption for past five years
Unit energy consumption						
Comparison vs. previous fiscal year (%)						

- Past 5 years record of the Unit energy consumption.
- Reasons in case that efficiency target (1% improvement) is not achieved.

Table 6: Reasons for (A) a case where unit energy consumption for past five years was not improved by 1% or more or (B) a case where unit energy consumption for past five years was not improved from the previous fiscal year

Reasons for (A) above
Reasons for (B) above

Assistance Scheme for the EMS (voluntary scheme)

Title	Executing Agency	Contents
Energy Audit Service (free of charge)	NEDO ECCJ	<ul style="list-style-type: none"> - Government agency or association provides free charge energy audit to promote EC practice. - Government supports the budget for the service.
Subsidy for EC Project and EC Equipment	NEDO ECCJ	<ul style="list-style-type: none"> - Government agency or association provides subsidy for good EC projects or EC equipment to selected applicants. - Government supports the budget for the subsidies.
Training Program for Energy Manager and Engineers	ECCJ	<ul style="list-style-type: none"> - Association (ECCJ provides training program for energy manager and engineers with fee. - Government supports a part of the cost of training program.

NEDO: New Energy and Industrial Technology Development Organization
ECCJ: Energy Conservation Center of Japan

Issues and Countermeasures

	Issue	Countermeasure
1	How to standardize quality of reports submitted by business operators? (quality control)	<ul style="list-style-type: none"> - Holding seminars periodically to disseminate - Making guidelines and samples of reports - Preparing calculation sheet (excel sheet) to easily calculate energy consumption
2	How to check the report?	<ul style="list-style-type: none"> - METI local offices collect reports from business operators in June. There are so many reports submitted. - The offices make database to easily input the operators data and their reporting data.
3	How to choose an indicator of product ion unit energy consumption?	<ul style="list-style-type: none"> - For mono-product industry, ton, m2 or m3, etc. is adopted. - For multi-product industry, annual sales is possible. - For building, total floor area is used.
4	How to use the periodical reports?	<ul style="list-style-type: none"> - Basically it is used for energy management within business operator and check by METI. - In addition, it can be used for making database (specific company name should be closed)

3. Design of the EMS for South Africa

Key Design Factors (1)

Target of the Scheme

1. What energy should be targeted? (heat, electricity or both heat and electricity)
2. How to set designated consumers? (by energy consumption volume or type of business, etc.)

Implementation Structure

3. Who is an executing agency/agencies?
4. What is role of each agency? (Law/regulation, Dissemination, Collection and check of reports, Inspection, etc.)

Status of Energy Manager

5. How is the status of Energy Manager? (National qualification?)
6. How to qualify Energy Manager? (examination, training, etc.)
7. Who is responsible for examination and training for energy manager?
8. What are mandatory or voluntary tasks of energy manager?

Key Design Factors (2)

Reports

9. What data should be requested to designated operators?
10. What reports should be collected from designated operators? (energy consumption data, unit energy consumption data, M&L plan, etc.)
11. How to collect? (document, internet, etc.)
12. Is a management target set? (ex. 1%/year improvement, etc.)
13. How to evaluate reports submitted?

Inspection

14. How to choose bad operators to be inspected?
15. How to inspect?

Dissemination

16. What type of dissemination is expected? (seminar, guideline, booklet, etc.)

4. Experience of JICA Study

Energy Conservation Master Plan in the Power Sector in Saudi Arabia

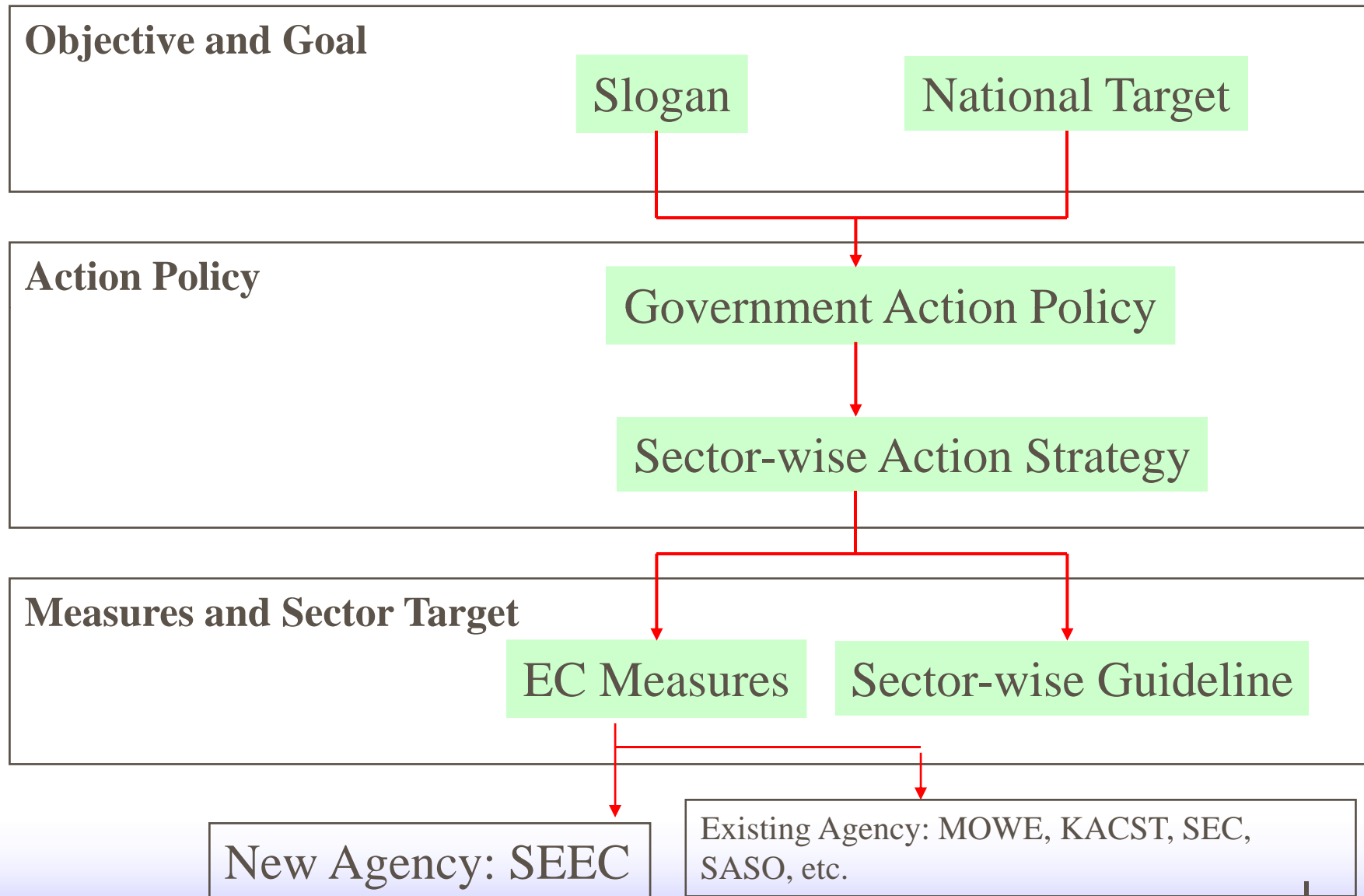
General

1. Scheme: Japan's ODA study
2. Sponsor: JICA
3. Consultant: TEPCO and IEEJ
4. Duration: 2007/2-2008/10
5. Counterpart: MOWE and the Steering Committee
6. Objective of the Study:

To make a master plan for comprehensive energy conservation by 2030 for Saudi Arabia.

- Establishment of an energy conservation target and Scenario
- Propose energy conservation measures and action plan
- Capacity Development on energy conservation in the power sector

Structure of National Basic EC Principle



Slogan and National Target

[Slogan]

- Improving energy efficiency on the demand side.
- Ensure a reliable power supply by managing peak demand while integrating efforts on the supply and demand side.
- Build an energy conscious society.

[Target]

- 30% improvement of Electricity-GDP Intensity (=Electricity consumption per GDP) in 2030 compared with 2005 level
- 50% reduction of peak demand growth rate in 2015 compared with on average in 2000 - 2005

→ To accomplish the target, the Study Team identified **13 high priority measures** and have proposed action plan.

Sector-wise Guideline

	Government	Industrial	Commercial	Residential
Annual Improvement Rate	1.5 %	1.5 %	1.5 %	1.0 %
Indicator	Electricity Consumption per Area (kWh/m ²) (= Electricity Consumption / Total Floor Area)	Productivity (kWh / production or sales) (= Electricity Consumption / Product Output or Sales)	Electricity Consumption per Area (kWh/m ²) (= Electricity Consumption / Total Floor Area)	Electricity Consumption per Household (kWh/household) (= Electricity Consumption / household)

Thank you!

Reference

Energy Audit Service

Outline of the Scheme

1. Objective

To promote energy conservation of industry and commercial building.
To support capacity building of the staff in charge of energy management

2. Target Sector

Industrial sectors by NEDO
Industrial and building sectors (ECCJ)

3. Contents of the Service

Detailed survey including measurement in a factory (NEDO)
Basic survey in a factory or building (ECCJ)

4. Budget (supported by Government)

FY2006: 147 million yen (NEDO) (about 40-50 sites)
FY 2007: 220 million yen (ECCJ) (about 700 sites)

5. Consultant

Consultant is hired by NEDO and dispatched to the factory. (NEDO)
Expert is dispatched to the factory or building. (ECCJ)

Subsidy for EC Project and EC Equipment

Outline of the Scheme

1. Objective

Category 1: Promotion of good EC project for Industry

Category 2: Demonstration of good practice for Buildings

Category 3: Promotion of high efficiency equipment for Buildings and Houses

2. Executing Agency

NEDO (supported by METI)

3. Feature

Category 1: 1/3 of total project cost (limit: 500 million Yen/year)

Category 2: 1/2 of total project cost (limit: 100 million Yen) for EC project

Category 3: 1/3 of total system cost (limit: 27 million Yen) for high efficiency system

Training Program for Energy Manager and Engineers

Outline of the Scheme

1. Objective

Training for candidate of energy manager

Capacity building for energy manager and management staff (engineers, technicians)

2. Executing Agency

ECCJ (supported by METI)

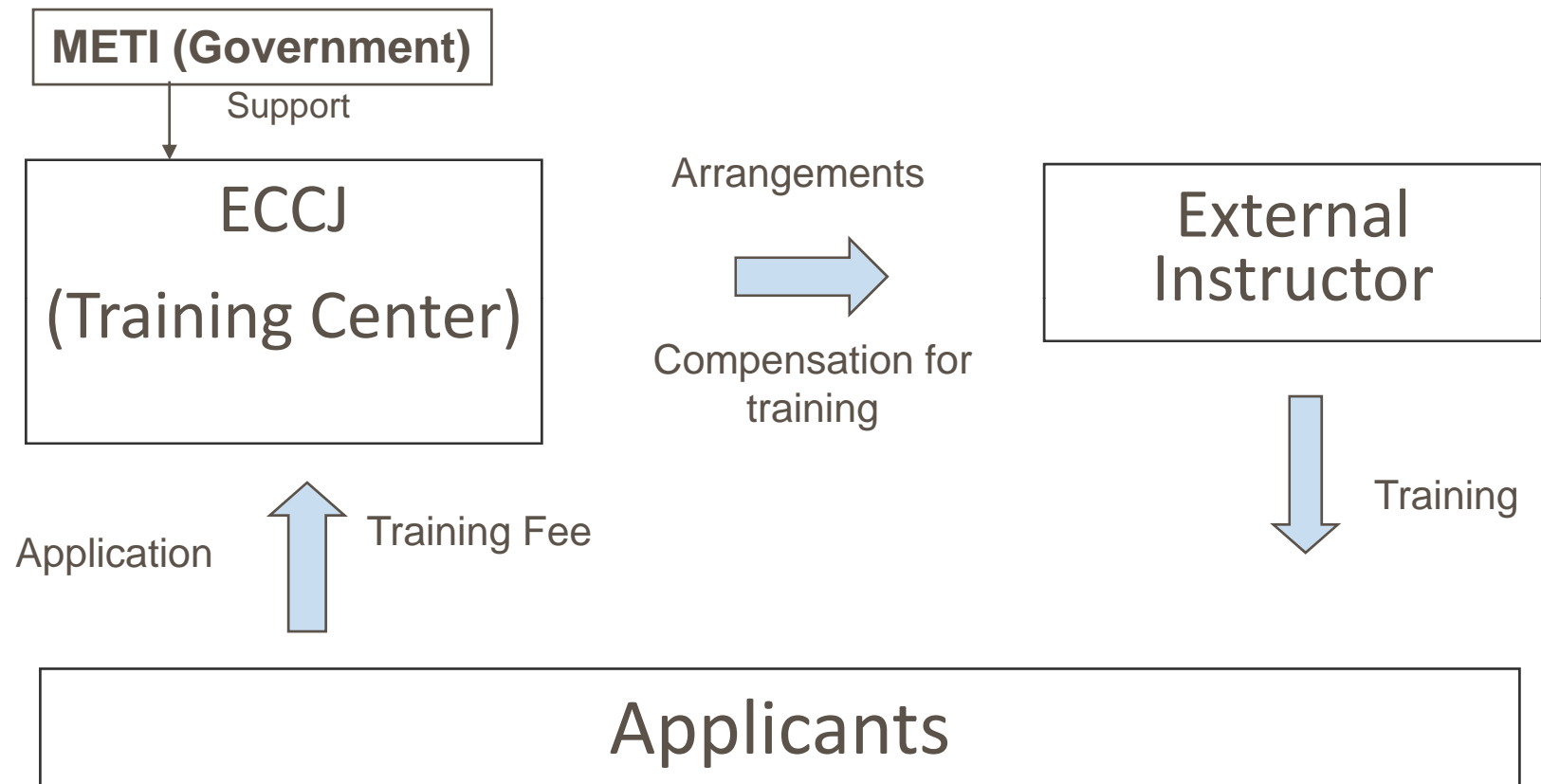
3. Feature

Training fee

Desk training and field training (Experience of audit way)



Workflow



Menu of the Training Program of ECCJ

Training Course	Contents	Duration
Training for Energy Manager	Introduction of Energy Management System Task of Energy Manager Fundamentals of Heat and Electricity	7 days
Training for Heat Energy Conservation	Theory Management of Steam and Trap Calculation of Heat and Measurement Introduction of Good Practice	2 days
Training for Electricity Conservation	Theory Compressor, and Pump & Fan Introduction of Good Practice	2 days
Training for Factory Energy Conservation	Theory Compressor, Pump & Fan Training of Audit Way in Factory	2 days
Training for Building Energy Conservation	Theory Compressor, Pump & Fan Training of Audit Way in Building	2 days