【Materiales de la Presentación】

Energy Efficiency Policy & Measures in Japan

July, 2010

JICA Study Team

How to make the "Low-carbon Economy and Society"

"Low-carbon economy and society" = Non-fossilization of energy supply × Energy Efficiency Improvement × Economic growth

CO2 emissions = CO2 emissions / Energy supply × Energy supply / GDP × GDP

- ✓ Expansion of the introduction of new energy
- ✓ Promotion of nuclear energy
- ✓ Expanded utilization of biofuels

Others

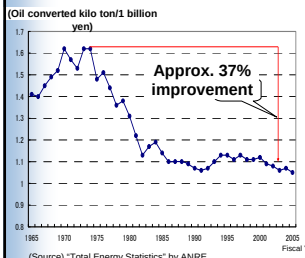
- ✓ Promotion of energy Efficiency
- ✓ Improvement of energy utilization intensity
- ✓ Improvement of fuel efficiency performance

Others

Energy Conservation Efforts of Japan after Oil Crises

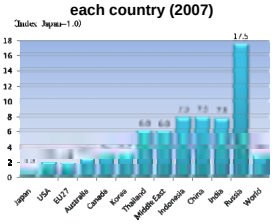
- Japan improved the energy efficiency by 37% in last 30 years after the oil crises in the 1970s, as a result of activities made by both public and private sectors.
- Japanese primary energy consumption per GDP is the lowest in the world owing to various energy conservation measures taken by the respective industrial sectors.

Energy use per real GDP of Japan



(Source) "Total Energy Statistics" by ANRE

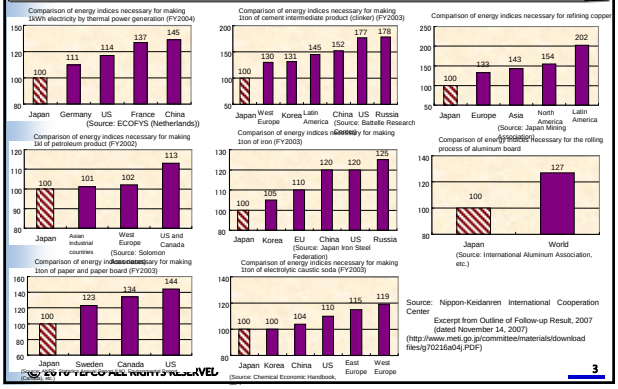
Primary energy supply per GDP unit of each country (2007)



* Calculated according to IEA Energy Balances of OECD/Non-OECD Countries(2008edition) Index of each country making Japan 1, based on the value dividing primary energy consumption by GDP.

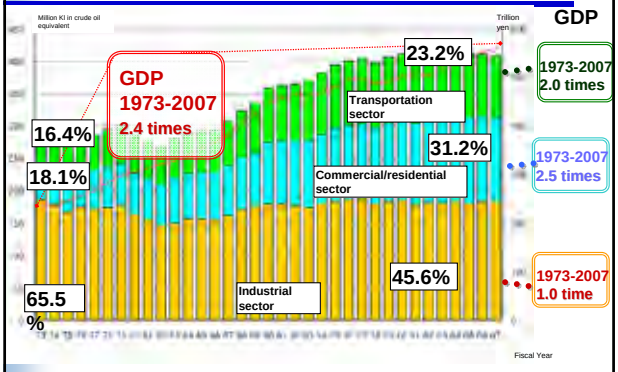
Energy Consumption Efficiency of Each Sector

- The energy consumption efficiency of Japanese manufacturers is the highest in the world.



Source: Nippon-Keidanren International Cooperation Center
Excerpt from Outline of Follow-up Result, 2007 (dated November 14, 2007)
(http://www.meti.go.jp/committee/materials/downloadfiles/g70216a04j.PDF)

Transition of Final Energy Consumption by sectors



(Source) Total Energy Statistics, Annual Report on National Economy.
(Note) It must be noted that the values after 1990 were calculated differently from those of the years before that, because the calculation method for totaling the total energy statistics was changed in that year.

Overall Picture of Energy Efficiency Policy

Energy Efficiency is promoted through both regulatory and supportive measures for each sector.

Industrial	Buildings (commercial)	Buildings (Residential)	Transport

(1)Regulations based on Energy Conservation Law

- Obligations to report energy consumption & CO2 emission annually
- Obligations (Appointment of Energy Managers etc.)
- Building Code for Energy Efficiency in building sector
- Top Runner Standard (for appliances, automobiles, etc.)

(2) Supportive measures (subsidy, taxation, policy-based financing)

- Promotion of energy-efficient equipments and lifestyle
- Development of energy conservation technologies

(1) Regulations

Major points of the Law Concerning the Rational Use of Energy. (Energy Conservation Law)

(1) Energy Management System

- **Energy Manager**
- **Periodical Report to the Government**
- **1 % Reduction Plan**
- **Management Standards for Equipments**

(2) others

- **Building Code**
- **Top-runner regulation**
- **Transportation Sector**
- **etc**

Energy Conservation Law (1)

Existing Large Factories and Buildings

Large-scale Factories	Large-scale Buildings	Midium-size Factories and Buildings
Annual energy use: 3,000kl in crude oil equivalent or larger	Annual energy use: 3,000kl in crude oil equivalent or larger	Annual energy use: 1,500kl in crude oil equivalent or larger
(1) **Appointment of Energy Manager on site** (2) Submission of Periodical Report of Energy (3) Formulation & Submission of Mid/Long- term plans to reduce energy consumption	(1) Appointment of Energy Management Staff (2) Submission of Periodical Report of Energy (3) Formulation & Submission of Mid/Long-term plans to reduce energy consumption	(1) Appointment of Energy Management Staff (2) Submission of Periodical Reports of Energy

Energy Conservation Law (2)

Construction of New Buildings & Retrofitting

Total floor space of 2,000㎡ or more

Submission of Report on Energy Saving measures upon new construction, extension or rebuilding, or extensive repair

Machines and Equipment

Passenger cars, air conditioners, televisions, etc.

Requirement to meet the Energy conservation criteria

(Top runners program)

Transportation

Specific carriers (freight, Passengers)

Over 200 cargo trucks, Over 300 railcars

(1) Obligation to submit a medium and long-term energy plan

(2) Periodic reporting on the situation of energy use

Specific cargo owners(cosigners)

Annual carrying capacity exceeds 30 million kg.

(1) Obligation to submit energy plan

(2) Periodic reporting on the situation of energy use related to consignment transport

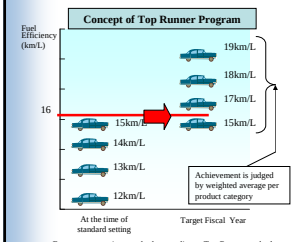
Building Codes for Energy Efficiency in Buildings

Building Envelop	Equipments
Perimeter Annual Load (PAL)	Coefficient of Energy Consumption(CEC)
Performances of Insulations, Windows are defined depending on types of buildings.	Performances of HVAC, Lighting, Hot water supply unit, Elevator are defined.

85% of the newly constructed buildings cleared these Codes in 2005.

Top Runner Program

Fuel consumption standards for vehicles and energy efficiency standards for electric appliances shall be set, after certain years, higher than the best value of each product item which is available now in the market.



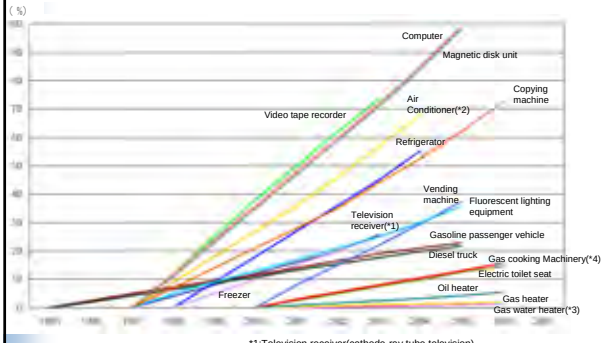
Energy conservation standards according to Top Runner method

Target products (23 products)

1. Passenger vehicles
2. Freight vehicles
3. Air-conditioners
4. TV sets
5. Video-cassette recorders
6. Fluorescent lights
7. Copiers
8. Computers
9. Magnetic disc units
10. Electric refrigerators
11. Electric freezers
12. Space heaters
13. Gas cooking appliances
14. Gas water heaters
15. Oil water heaters
16. Electric toilet seats

etc.

Energy Efficiency Improvement by Top Runner Program



*1:Television receiver(cathode-ray tube television)
*2:Air conditioner(room air conditioner)
*3:Gas water heater(instantaneous gas water heater,gas heated bath)
*4:Gas cooking machinery(cooker)

(2) Supportive Measures

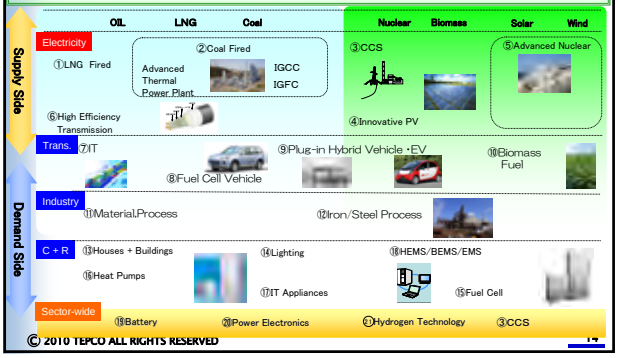
- Financial Support
  - Subsidy
  - Taxation
  - Policy-based financing
- Research & Development
  - Cool Earth – Innovative Energy Technology Plan
- Promotion of energy-efficient equipments
  - PR activities by ECCJ
  - PR activities by Utilities
  - PR activities by Retailers (stores / shops)
- Promotion of energy-efficient lifestyle
  - Cool Biz
    - 28℃ in Office in Summer
    - Business without neckties from June to September

Financial Support

Subsidy	For promotion + pilot projects + demonstration +international cooperation + R&D - 1/3 to 1/2 of the EE investments are subsidized by the Government etc.
Taxation	For 88 Energy Efficient equipments - 7% of price of EE equipments are deducted from the income tax of the company etc.
Policy-based Financing	For Equipments of 25% Energy Efficient or more - Loan from the Development Bank of Japan (DBJ) for big companies - Loan from Japan Finance Corporation (JFC) for smaller companies etc.

Cool Earth – Innovative Energy Technology Plan

■ **21 Technologies which will dramatically reduce CO2 were selected by the Government, and released in March 2008 as "Cool Earth – Innovative Energy Technology Plan" which covers both supply and demand side.**



Promotion of High-Efficiency Hot water Supply System

- Energy demand for hot-water supply dominates approximately 30% of total energy consumption in a typical Japanese household.
- A subsidy has been introduced to promote the energy efficient hot-water systems.

CO2 Refrigerant Heat-Pump Boiler (ECO CUTE)

Utilizing the principle of a heat-pump used in an air-conditioner, it can be heated with energy of approximately 3 times more than input energy. Energy saving of approximately 30% compared to a traditional combustion-type boiler is achieved.

Latent-heat Recovery Boiler (ECO JOZU)

Recovers the latent heat of exhausted gas, which is usually wasted. Energy saving of approximately 15% compared to a conventional combustion-type boiler is realized.

Gas Engine Boiler (ECO WILL)

Uses the gas-powered engine's exhaust heat and power to provide heat (main) and electricity (sub) for approximately 10% of overall energy saving for a building.

Energy Saving Label

- The Revised Law Concerning the Rational Use of Energy requires that retailers shall make efforts to provide information. A guideline including " Energy Saving Label" was formulated. .
- Televisions and air conditioners are applied by this system.

Uniform Energy Saving Label

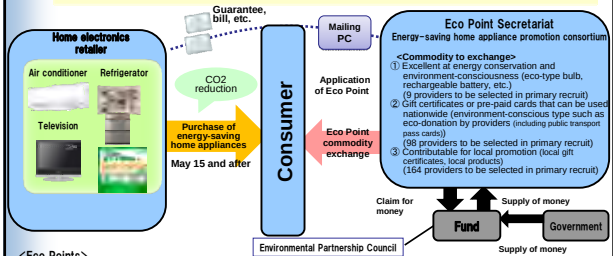
【Rating system】
- Energy-saving performance is indicated by 5 stages, from 1 to 5 stars, from low to high performance.
- In order to clarify the level with the Top Runner Standard, arrows are placed under the stars.

【Energy-saving labeling system】
- Products which achieved the Top Runner Standard carry a green "e" mark, while others carry an orange "e" mark.
- Achievement level and estimated annual electricity consumption are also indicated.

【Expected annual electricity bill】
- The expected annual electricity bill is indicated.

"Eco Point" for energy-saving home appliances

[Purpose] ① CO2 reduction, ② Economic activation, ③ Spread of ground-wave digital television



<Eco Points>

	Air conditioner	Refrigerator	Television
Purchase of product with energy-saving label equivalent to 4 stars	6,000 to 9,000 (3 steps according to cooling capacity)	3,000 to 10,000 (4 steps according to capacity)	7,000 to 36,000 (5 steps according to screen size)
Further recycling point	3,000	5,000	3,000

Provision of Information by private sectors

The Energy Conservation Law requires provision of information of energy conservation by Electric Power Companies, Gas Companies, and Retailers.

Electric Power Companies
Gas Companies

Online energy conservation navigation service by TEPCO

(1) Promotion of energy efficient equipment to consumers

(2)Provision of energy-saving information to consumers

(3) Publication of brochures

Consumer Electronics Retailers

Provision of information on energy conservation (annual consumption of power, fuel cost, etc) at stores

Thank you for your kind attention !

Introduction of Nation-wide Energy Management System (EMS)

TEPCO
Yasushi Kawano

Topics

1. Basic Concept of Energy Management System (EMS)
2. Other Countries Experience (Japan, India, Australia and European Standard)
3. Details of Japanese Energy Management System
4. Key Factors for Designing EMS
5. How to Discuss Design Options

1. Basic Concept of Energy Management System (EMS)

Background and Objective of the Scheme

Background:

- Numerical target in energy efficiency has been adopted by some countries.
- Energy efficiency in industrial and building sector is one of the important factors to achieve nation-wide numerical target.

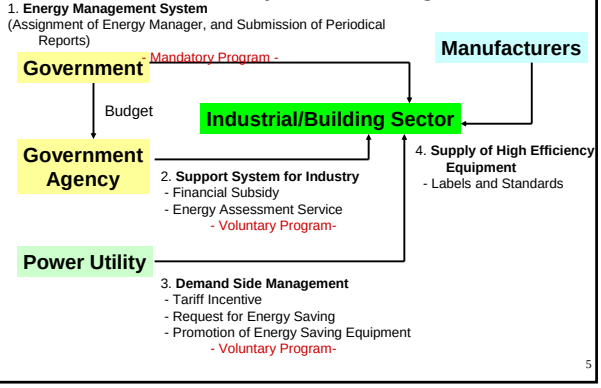
Objective:

- Periodical monitoring by the mandatory reporting system can contribute to gradual improvement of energy efficiency.
- Such monitoring system can help to link national energy database.

Methods:

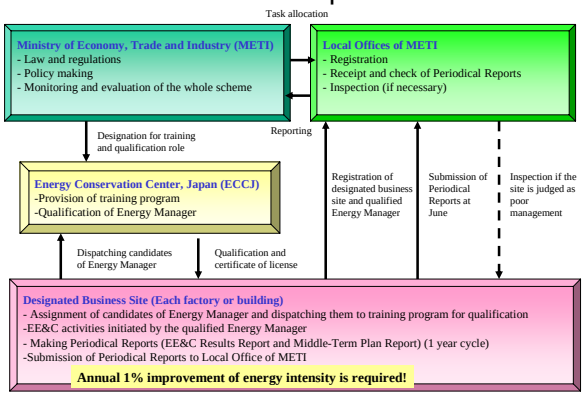
- To promote EE&C activities within a designated unit by mandatory reporting and assignment of energy manager
- Energy manager is assigned by the top of the designated unit, as a responsible person of EE&C activities. Qualified energy manager should have a high level status to strongly promote EE&C.

Overview of EE&C Scheme surrounding Industry and Building

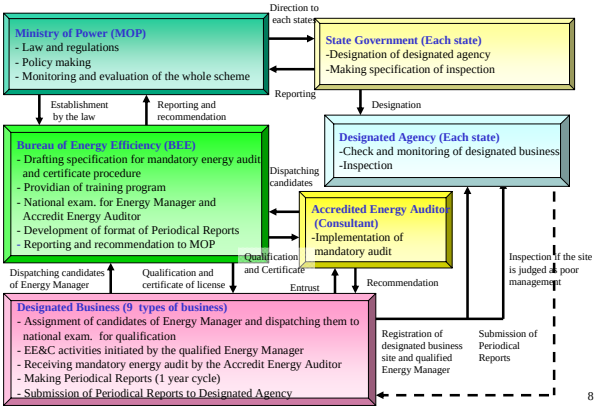


2. Other Countries Experience (Japan, India, Australia and European Standard)

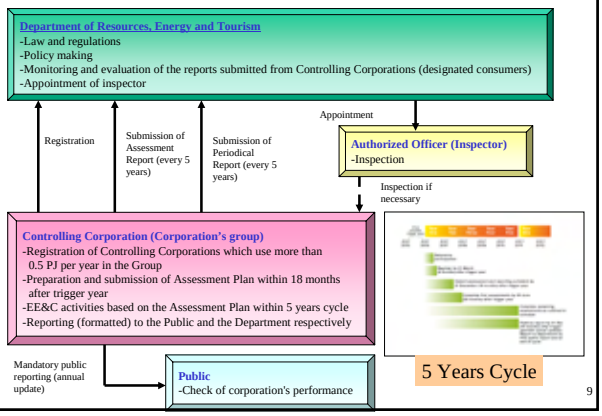
Case of Japan



Case of India



Case of Australia



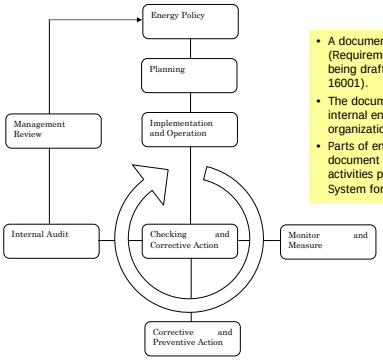
Comparison among Other Countries

	Japan	India	Australia
Target Energy	Fuel, Electricity and Heat	Fuel, Electricity and Heat	Fuel, Electricity and Heat
Unit to be Designated	Each Factory or Building	9 Type of Business (by site)	Group Corporations incl. subsidiaries, JV, etc.
Threshold	3,000 kl- crude oil equivalent/year	30,000 toe/year	0.5 PJ/year (12,900 kl-coe/year)
Responsible Person	Qualified Energy Manager	Qualified Energy Manager	Top Management
Training Provider	ECCJ	BEE	Not specified
Periodical Reports	Every 1 year	Every 1 year	Gov:Every 5 years Public: Annual update
Monitor and Evaluation of Reports	METI Local Offices	Designated agency appointed by each State Government	Department of Resources, Energy and Tourism
Inspection	METI Local Offices	Designated agency	Appointed Officer by the Department

Lessons Learned from Other Countries

1. Target energy in the sampled 3 countries was all type of fuel, electricity and heat.
2. Boundary to be monitored is by site (Japan and India), or by group corporation (Australia).
3. Consumers are designated by criteria, volume of primary energy consumption (Japan) and final energy consumption (Australia and India).
4. Responsible person in EE&C is “Energy Manager” (Japan and India) or top management (Australia).
5. Japan and India appointed an authority of training provider for Energy Manager. Australia does not specify an official training provider.
6. Periodical reports are submitted once a year in Japan and India. Australia has 5 years cycle and submit the report at the end of the cycle.
7. All 3 countries adopted an inspection system.

European Standard (Draft: prEN 16001)



- A document for “Energy Management Systems (Requirements with Guidance for Use)” is being drafted by European Standard (prEN 16001).
- The document indicates a standard way for internal energy management within an organization (like ISO 14001).
- Parts of energy management way in the document can be commonly used for EE&C activities proposed in Energy Management System for Serbia.

3. Details of Japanese Energy Management System

Key Items in Japanese EMS

1. Making Periodical Reports (formatted): Mandatory
2. Assignment of Energy Manager: Mandatory
3. Annual Schedule: General Schedule

Periodical Report (Energy Consumption Calculation Sheet)

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 sale and others	
		Quantity	Calorie GJ	Quantity	Calorie GJ	Quantity	Calorie GJ
Fuel and heat: Crude oil (excluding condensate)	kl						
Condensate included in crude oil (NGL)	kl						
Gasoline	kl						
Naphtha	kl						
Kerosene	kl						
Diesel oil	kl						
Fuel oil A	kl						
Fuel oils B/C	kl						
Asphalt	t						
Other fuels: City gas	1000m3						
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 (Equipment Operation List)

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				

- For analysis of potential of energy efficiency. Grasping equipment and operation status is very important.
- A list which shows energy consuming equipment and their operation (days and hours) are submitted.

Periodical Report (Energy Intensity)

Table 3: Production quantity y 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)	

Table 4: Unit energy consumption

	(Fiscal year)	Comparison vs. previous fiscal year (%)
Unit energy consumption: Quantity of energy used (crude oil equivalent kl) (a) — (b)+(c) / Values closely related to energy consumption such as production quantity, gross floor space or others (d)		

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 (%)						

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

- To monitor extent of energy efficiency, unit energy consumption (energy intensity) is calculated.

  Energy Intensity =

  Energy consumption calculated in the calculation sheet / Annual Production Quantity.
- Past 5 years record of the Unit energy consumption should be recorded. In Japan. 1% annual improvement is requested by the guideline.
- If efficiency target (1% improvement) is not achieved, reasons are described.

1% improvement is the target of all designated consumers regulated by the guideline.

Periodical Report (Middle-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

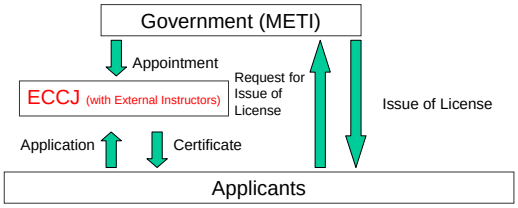
- M plan targets at 3 years in Japan.
- Planning program/project and expected effects are estimated.
- Comparison of last year's plan is also shown.

Definition of Energy Manager in Japanese Law

Article	Explanation
Article Energy Manager	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.
Article Qualified Energy Manager's License	**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. - 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
Article Duty of Energy Manager	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.

Qualification of Energy Manager

- Energy Manager is a national qualified status.
- National qualification is needed.
- Regarding qualification of Energy Manager, ECCJ (Energy Conservation Center, Japan) is entrusted by METI.
- There are 2 methods for qualification, namely national examination (1 day examination) and training program with certificate examination (6 days training program and 1 day examination).



License of Energy Manager (Case of Japan)

1. National examination

< in 2005 >

- **Once a year**
- **1 day, 4 subjects**
- **Requirement: At least 1 years experience**

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

2. Training program with certificate examination

- **Once a year**
- **6 days training & 1 day examination**
- **Requirement: At least 3 years experience**

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

ECCJ (Energy Conservation Center, Japan) is assigned to carry out the national examination and training program with certificate examination.

Annual Schedule (Japanese Case)

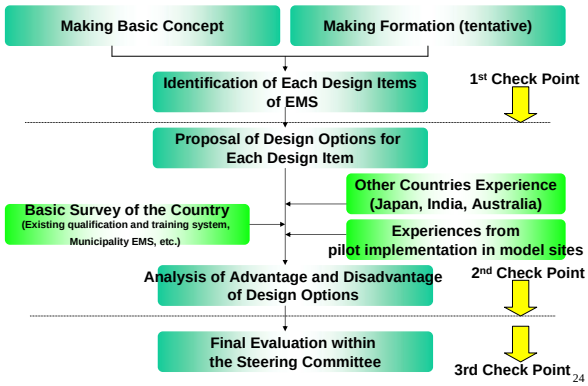
PR: Periodical Reports

	Apr	May	Jun	Jul	Aug	Sep
Control Agency		Registration		Clarification of submitted PR		Check of PR
Designated Consumers	Registration		Submission of PR	Response to the Clarification		
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Control Agency	Check of PR	Random Check on Site		Inspection (if the site is judged as poor management)		Instruction
Designated Consumers		Response to the Random Check on Site		Response to Inspection		

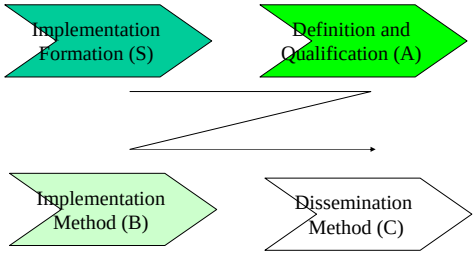
Even after instruction from Control Agency, if EE&C activities of the site is not improved, penalty (Fine 4,000 Euro and Public Announcement of the Name) is levied for the company.

4. Key Factors for Designing EMS - From the Project of Serbia -

Scheme Design Schedule



Prioritization of Design Item



Design Items to be Decided (1)

1. Designation of Energy and Consumers — Priority (A)
- Target Sector
- Target Energy
- Criteria of Designated Consumers (Threshold)
- Unit (boundary) to be Designated

2. Formation — Priority (S)
- Roles of Executing Agencies (Ministry and Agency)
- Judgment Flow of Poor Management
- Annual Schedule and Task Allocation
- Mandatory External Audit by the Accredit Energy Auditor

3. Status of Energy Manager and Accredit Energy Auditor
- Certification Methods for Energy Manager, Accredited Energy Auditor (and Inspector)
- Procedure of Issue of Energy Manager's License — Priority (A)
- Energy Manager's Duty and Status
- Energy Officer, Accredited Energy Auditor, Inspector's Duty and Status·
- Assignment of Energy Manager and Energy Officer

4. EE&C Activities within the Unit
- Evaluation Criteria (Guideline) and Management Standards

Design Items to be Decided (2)

5. Periodical Reports
- Contents of Periodical Reports
- Collection Method of Periodical Reports

6. Monitoring and Check
- Introduction of Numerical Targets (ex. 1 % annual improvement) and its Status
- Quality Management for Proper Reporting by the Monitoring Agency
- Evaluation Method for Periodical Reports
- Evaluation Method for Mandatory External Audit
- Utilization of Obtained Data (Benchmark)

7. Inspection and Penalty
- Inspection Method (Inspection Formation, Appointment of Inspector, Procedure, etc.) and Evaluation
- Penalties and Methods (Public Announcement of Company's Name, Fine, etc.)

5. How to Discuss Design Options (Sample from a JICA Study conducted by TEPCO)

Roles of Executing Agencies

Option 1

Ministry:
-Law and Regulation
-Registration of designated consumers and Energy Manager
-Check and monitoring of designated consumers
-Inspection

Agency:
-Training and Qualification Authority
-Arranging Training Program and Examination

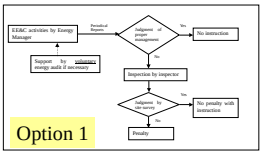
Option 2

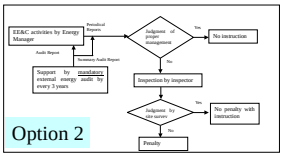
Ministry:
-Law and Regulation

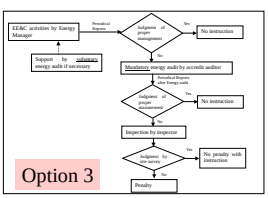
Agency:
-Registration of designated consumers and Energy Manager
-Check and monitoring of designated consumers
-Inspection
-Training and Qualification Authority
-Arranging Training Program and Examination

	Option 1	Option 2
Workload	Tasks of monitoring and qualification/training are shared to Ministry and Agency.	All tasks of EMS including training and qualification are done by Agency.
Empowerment	Ministry has a power for monitoring and inspection.	Power for monitoring and inspection is given to Agency.
Budget	Budget for EMS is shared to Ministry and Agency.	All budget for EMS is concentrated on Agency.

Judgment Flow of Poor Management







	Option 1	Option 2	Option 3
Opportunity of Inspection	Opportunity of inspection is expected more.	Opportunity of inspection is expected less because of mandatory audit.	Opportunity of inspection is expected less because of mandatory audit.
Cost borne by Designate Consumer	Cost is the least.	Cost for hiring mandatory audit (every 3 years) is taken. (EE&C fund should be considered)	Only poor management consumers judged by Periodical Reports have to hire mandatory audit.
Acceptability by Designated Consumer	Suddenly inspection after judgment of Periodical Reports might be strict.	Good consumers might have complains for mandatory audit for all consumers.	Only poor management consumers judged by Periodical Reports have to hire mandatory audit. This seems to be fair for good consumers.

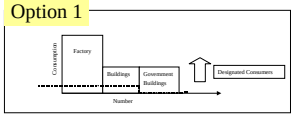
Target Sector

1. Category of Target Sector

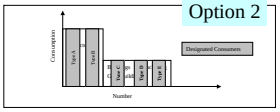
- Category A: Factories and buildings, and central Gov. buildings
- Category B: Transformation sector consisting of power utility, oil refinery, coal transformation, district heating system, etc.

2. Designation (Case of the Category A)

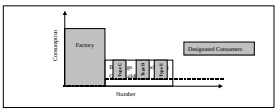
Option 1



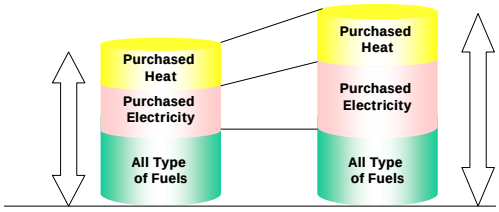
Option 2



Option 3



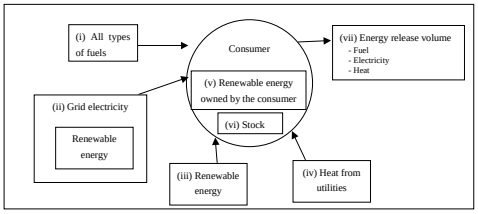
Target Energy (Final Consumption or Primary Energy)



Final Consumption Primary Energy

	Option 1 (Final Consumption)	Option 2 (Primary Energy)
Easiness	Final consumption is easy to calculate. Workload is not so much.	Conversion factor is necessary. Average conversion factor in electricity and heat supply should be reviewed periodically.
Country-wide Viewpoint	Final consumption does not represent country-wide consumption. It represents on-site consumption.	Primary energy represents "real energy consumption" from the viewpoint of the country.
EU directives	Final consumption is used.	N.A.
Electricity	Electricity is evaluated at smaller volume compared with other fuels. It might happen to shift fuels use to electricity use.	Electricity is appropriately evaluated compared with other fuels.

Target Energy (Renewable Energy)



Option 1

In case that directly connected renewable energy (iii) and on-site renewable energy (v) are neglected from the target energy:

Target Energy = (i) + (ii) + (iv) – (vi) – (vii)

Option 2

In case that directly connected renewable energy (iii) and on-site renewable energy (v) counted into the target energy:

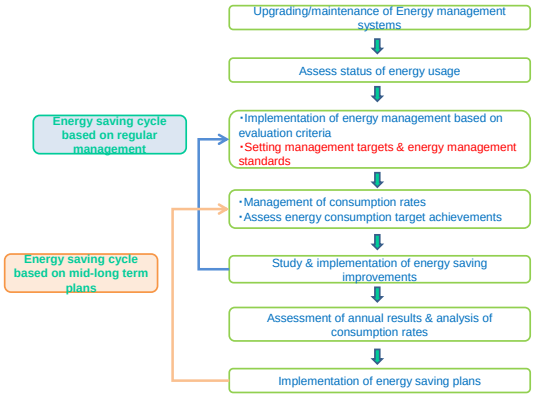
Target Energy = (i) + (ii) +(iii) + (iv) + (v) – (vi) – (vii)

Evaluation Criteria &
Utilization of Evaluation Criteria
in Random Check of Designated Consumers

Contents

1. Evaluation Criteria and Management Standards

Energy Management flow

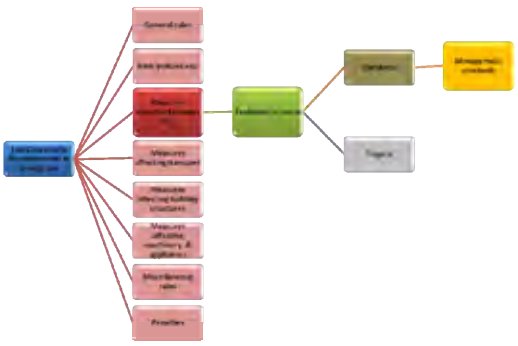


Evaluation Criteria

- Determined by the Minister of Economy, Trade & Industry
- These are the standards required to enable factories & offices to appropriately & efficiently implement increases in energy efficiency
- Comprises 2 parts – “Standards” & “Targets”

*Factory or premises with similar energy consumption

Evaluation criteria & management standards system



Evaluation criteria (standards section) items & target equipment

① Rationalisation of fuel burning
Boiler , melting furnace, heating furnace, drying furnace etc...
② Rationalisation of heat transfer associated with heating & cooling
Steam heater, absorption refrigeration machine, hot water system etc...
③ Recovery & reuse of exhaust heat
Boiler , melting furnace, heating furnace etc...
④ Rationalization of conversion to thermal heat
Generation & cogeneration equipment
⑤ Prevention of energy loss by radiation, conduction & resistance
Steam piping, chilled/hot water piping, power distribution equipment etc...
⑥ Rationalisation of electrical power conversion to heat & mechanical power
Electric motors, pumps, fans etc...

Evaluation Criteria
Sample: Rationalization of fuel burning

		Control	Metering and recording	Maintenance / Inspection	Measures to be implemented prior to new installation
1	**Reductions in combustible fuel consumption** Combustion equipment	**(1) Control of fuel combustion** ①Control of combustion air ratio for combustion equipment and type of fuel ● Control standards 1 ②Rationalization of combustion air ration for combustion equipment based on attachment 1 (A) Standards ① ③ Various systems for load regulation and total control of fuel efficiency ● Control standards 2 ④Control of fuel properties for the improvement of combustion efficiency	**(2) Fuel combustion related metering and recording** Amount of fuel supply, exhaust gas temperature, metering and recording of amount of oxygen extant in exhaust gas ● Control standards 3	**(3) Combustion equipment maintenance / inspection** Carrying out of scheduled to keep combustion equipment in good condition ● Control standards 4	**(4) Measures to be implemented prior to new installation of combustion equipment** ① Regulation of amount of fuel and combustion air ration for combustion equipment ② Ventilator arrangement for ventilation volume and combustion chamber pressure regulation

Management Standards

- In order to appropriately & efficiently implement the rationalisation of energy usage in factories, it is necessary to determine the “management standards”
- “Management standards” include:
  ① Management (Operation manual)
  ② Measurement & records
  ③ Maintenance & inspection
  to be carried out only after you have prepared and circulated your own manual to relevant personnel.

Sample: Management standards (Case of Boiler)

- It shall cover the main points of operational management that minimise use of as far as possible and important points to remember depending on the characteristics, functions etc. of each energy related system . Furthermore, the proper conditions for that equipment shall be clearly indicated.

No.	Equipment (fuel)	Control standards	
		Control items	Standard value
1	No. 8 Boiler (Black liquor)	Air ratio	< 1.3
		Exhaust gas temperature	< 200°C
		Evaporation factor	4.6~5.0 [t/pt]

2. Status of Random Check

Background

1. History
- Random check is undertaken by METI. This program has been introduced in 2001 in order to further strictly monitor Designated Factories and Buildings.
- The objective is to confirm compliance of Evaluation Criteria (Guideline) in Designated Factory and Building by site survey.

2. Objective
- The site survey reinforces information on compliance with Evaluation Criteria and grasp a real situation of activities of the Designated Consumers (not only Periodical Reports).
- The selection of site survey is made by “at random”. If the results of the site survey is evaluated as “Poor: less than 60 points”, Inspector can be dispatched to the site. The “at random” system can be an incentive to urge compliance with the Evaluation Criteria.

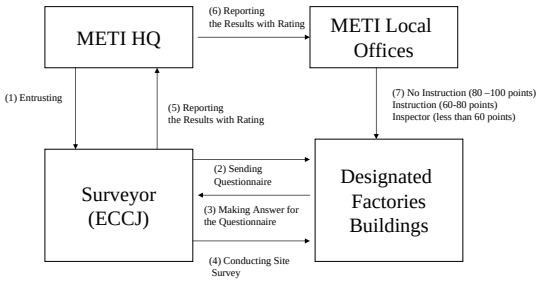
3. Methods
- 1 or 2 surveyors are dispatched to the selected site. They are entrusted by METI as an legal basis surveyor.
- Before the site survey, a questionnaire sheet is sent to the site and the site must return the sheet filled by themselves.

Basis of Law (Article 6)

Article 6 (Guidance and Advice)

- The competent minister may, when he/she finds it necessary in order to ensure the proper implementation of the rational use of Energy in Factories, provide business operators using Energy in Factories with necessary guidance and advice with regard to the implementation of the matters listed in the items of paragraph 1 of the preceding Article, by taking into consideration the standards of judgment prescribed in the same paragraph.

Players of Random Check



1. Planning and Executor: METI HQ
2. Surveyor (entrusted by METI HQ) and Rating: ECCJ
3. METI Local Offices: Instruction or Inspection (when the points are not so good)

Treatment after Evaluation

1. The Surveyor team evaluates the compliance according to the check list.
2. The evaluation is made by check list which can calculate evaluation points (Full: 100 points).
3. In case that the evaluation is less than 60 points, Inspector can be dispatched to the site later on. Inspection by Inspector has an enforcement power to the site.
4. In case that the evaluation is 60 points to less than 80 points, some instruction will be made by METI Local Offices. The organization must submit a “Rationalization Plan”.
5. In case that the evaluation is more than 80 points, no instruction is basically made. However, if energy intensity does not achieve 1 % improvement, some comments might be made.

3. Implementation and Evaluation

Selection

1. Selection
METI HQ makes a plan and select random check site.

2. Case of FY 2010
(1)Designation of Business Type
- 1/3 of Food Industry
- 30 % of Manufacturer of Transportation Equipment

(2) At Random Selection for Site
- 200 Factories or Buildings

(3) At Random Selection for HQ
- 10 HQ

Survey Methods

(1) The Surveyor (ECCJ) sends a Questionnaire Sheet with “Self-Check List for Complaisance with Evaluation Criteria”.

⇩

(2) The Designated Organization must prepare the answer to the Questionnaire Sheet with Self-Check List before the site survey. .

⇩

(3) The Surveyor visits the site and reviews the “Self-Check List” (rating by the Surveyor).

⇩

(4) The Surveyor submits the results of the rating evaluation to METI HQ and METI Local Office.

Composition of Questionnaire Sheet

Repeat of the Contents of PR

1. Basic Information of the Factory/Building and Energy Manager
2. Historical Energy Consumption and Energy Intensity Data
3. Reasons when 1 % improvement has not been achieved.

Information to Grasp Background

4. Questions for EE&C target, past EE&C projects and activities, organizational activities, etc.

Evaluation Sheet For Rating

5. Self-Check List (1): List of Energy Consuming Equipment
6. Self-Check List (2): Compliance Evaluation Sheets with Evaluation Criteria for Individual Equipment

⇩

This Self-Check List is re-evaluated by the Surveyor at the site survey.

Self-Check List

List of Energy Consuming Equipment

1. Equipment List of A Section
- Capacity, Number of Units
- Annual energy consumption

2. Equipment List of B Section
- Capacity, Number of Units
- Annual energy consumption

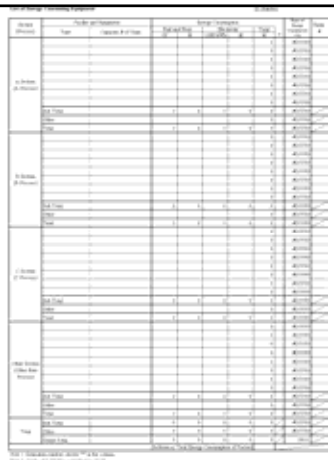
3. Equipment List of C Section
- Capacity, Number of Units
- Annual energy consumption

Compliance Evaluation Sheets for Individual Equipment

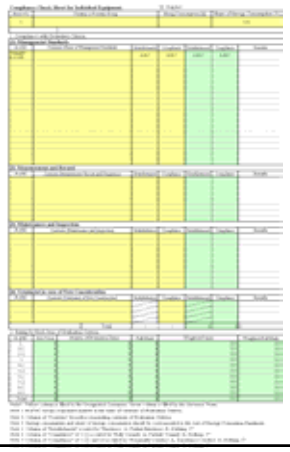
1. Check of Compliance with Evaluation Criteria
- Establishment of Management Standards and its Compliance
- Establishment of Measurement and Record Standards and its Compliance
- Establishment of Maintenance and Inspection Standards and its Compliance

2. Rating Sheet for Individual Equipment

Format (1)

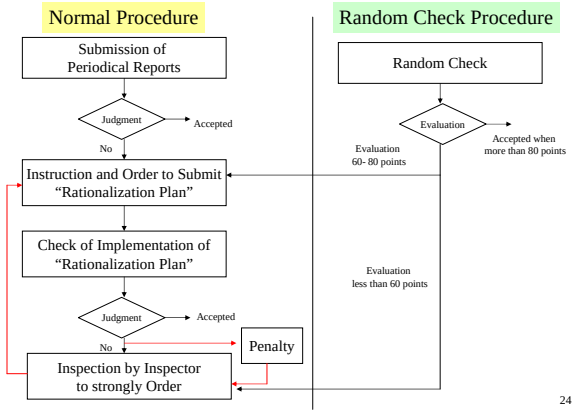


Format (2)



4. Treatment after Random Check

Instruction and Inspection



Instruction and Submission of Rationalization Plan

1. Based on the results of evaluation (60-80 points), METI Local Office gives instruction to the Designated Consumer with evidence that they do not comply with Evaluation Criteria.
2. When the Designated Consumer received the instruction to be improved, they must prepare and submit a "Plan on Rational Use of Energy" to METI LO.
3. METI LO monitors the implementation of the Plan. If METI LO judges that the Designated Consumer has not improved their performance, METI LO can dispatch Inspector to strong order implementation.

Article 16(Instructions and Orders on Rationalization Plans)
The competent minister may, when he/she finds that the status of the rational use of Energy in a Type 1 Designated Energy Management Factory is significantly insufficient in light of the standards of judgment prescribed in Article 5, paragraph 1, instruct the Type 1 Specified Business Operator pertaining to the Type 1 Designated Energy Management Factory to prepare and submit a plan on the rational use of Energy(hereinafter referred to as a "Rationalization Plan"), while presenting the grounds for his/her judgment.

Sector-wise Benchmark Approach (SBA)

August 2010
JICA Study Team
Susumu TAKAHASHI

Sector-wise Benchmark Plan of Japan

Objective

(Energy Management System)

- Japanese EMS has adopted a target "1% annual improvement of energy intensity" for all designated consumers.
- But a definition of "Energy Intensity" is decided by each designated consumer. Because the intensity is used for internal evaluation (not for external comparison).

(Domestic Issue)

- Currently, some designated consumers met a difficulty to annually improve 1%. They insisted that they had already made efforts and a fair "yardstick" should be introduced.

(World Trend)

- International framework (IEA, EU-ETS and APP) is now developing Sector-wise Benchmarking Approach (SBA).

(Objective to Introduce SBA)

- Japanese Gov. wants to introduce SBA to mitigate the above domestic issue and want to lead the world trend in the design of world benchmark framework.

Schedule of Introduction of SBA

FY	Consultation in the ISCM	Execution
2008	3 sub-sectors (power, iron&stell (3 types furnace) and cement) were selected and authorized as a first stage.	
2009	Next sub-sectors (chemical, paper&pulp, oil refinery) are under consultation.	
2010		From 2010 FY, the first 3 sub-sectors will be executed.
2011		From 2011 FY, the next 3 sub-sectors are planned to be executed.

Before execution, amendment of legal basis is necessary.

Benchmark of the Sub-Sectors

Sub-sector	Benchmark	Boundary
Iron business using blast furnace	0.531 kl/ton	BY company (summation of all factories)
Normal Steel business using electric furnace	0.143 kl/ton	BY company (summation of all factories)
Special steel business using electric furnace	0.36 kl/t	BY company (summation of all factories)
Power generation business	100.3 %	BY company (summation of all factories)
Cement business	3,891 MJ/ton	BY company (summation of all factories)

Benchmark of the Sub-Sectors

Sub-sector	Benchmark	Boundary
Paper	8,532 MJ/ton	BY company (summation of all factories)
Board Paper	4,944 Ml/ton	BY company (summation of all factories)
Oil Refinery	0.876	BY company (summation of all factories)
Oil Chemistry Product	11.9 GJ/t	BY company (summation of all factories)
Soda	3.45 GJ/ton	BY company (summation of all factories)

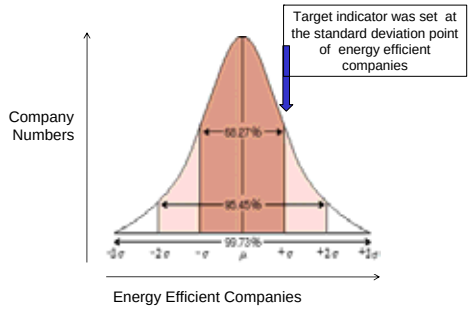
Evaluation Criteria Committee

1) Members
   26 members from various sector associations, universities and institutes

2) Discussion Points on Benchmark
   Position of benchmark on EE&C law
   Target sectors
   Target indicators of benchmark

3) Coverage
   Approximately 60% from energy consumption of industrial sectors would be covered after execution

How to set The Target Indicators of Benchmark



Indicators of Iron & Steel Sector

Iron business using blast furnace

$$\frac{\text{Total Energy Consumption}}{\text{Crude Steel Output}}$$

Normal Steel business using electric furnace

$$\frac{\text{Energy Consumption of Steel Product}}{\text{Crude Steel Output}} + \frac{\text{Energy Consumption after the Process of Rolling}}{\text{Rolling Steel Output}}$$

Special steel business using electric furnace

$$\frac{\text{Energy Consumption of Steel Product}}{\text{Crude Steel Output}} + \frac{\text{Energy Consumption after the Process of Rolling}}{\text{Product Output}}$$

Calculation of Benchmark

$$\text{Benchmark} = \frac{\text{Annual total energy consumption}}{\text{Annual total crude steel production}}$$

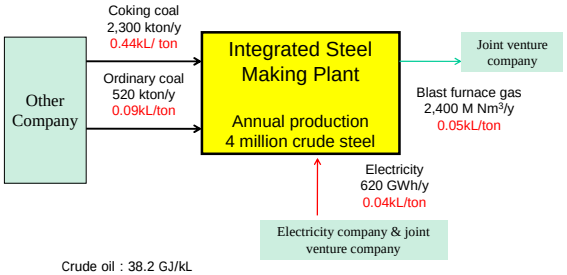
Annual total energy consumption = Purchased energy(Coking coal + Ordinary coal + Electricity – Sold energy(Blast furnace gas)

= 66,700 TJ + 13,364 TJ + 6,181 TJ –8,184TJ = 78,061 TJ

Benchmark = 78,061 TJ ÷ 4,000,000 ton = 19.5GJ/ton

= 19.5GJ/ton ÷ 38.2 GJ/kL =0.51 kL/ton

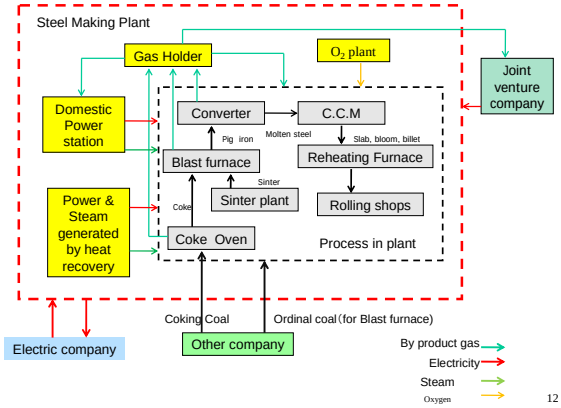
Benchmark : 0.51kL/ton



Crude oil : 38.2 GJ/kL
Coking coal : 29 GJ/ton
Ordinary coal: 25.7 GJ/ton
Electricity: 9.97 GJ/1000kWh
Blast furnace gas: 3.41 GJ/1000Nm³

Operation condition
Coke ratio in BF : 400kg/ton
Pulverized coal injection: 140kg/ton

Boundary of Steel Making Plant



Power Sector (Thermal Power Station)

Official Indicator

$$\frac{\text{Gross Thermal Efficiency (high heat value) at the Rated Output Test}}{\text{Design Thermal Efficiency}}$$

Additional Information

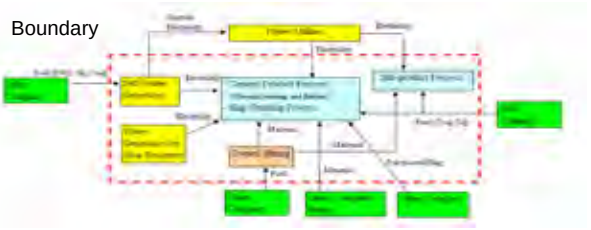
$$\frac{\text{Output}}{\text{Input}}$$

Cement Sector

Indicator

$$\frac{\text{Energy Consumption of Material Process}}{\text{Material Output (Clinker equivalent)}} + \frac{\text{Energy Consumption of Burning Firing Process}}{\text{Output of Clinker in Burning Firing}} + \frac{\text{Energy Consumption of Finisher Process}}{\text{Finished Output in Finisher Process (Portland Cement equivalent)}} + \frac{\text{Energy Consumption of Shipping Process}}{\text{Shipping Output (Various Type of Cement and Clinker)}}$$

Boundary



Bench Mark of Petroleum Refineries

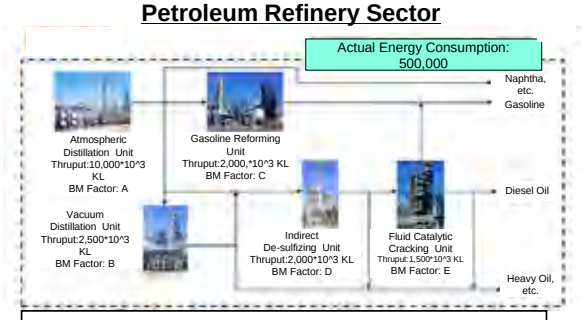
$$\text{Bench Mark(BM) of Refineries} = \frac{\text{Actual Energy Consumption}}{\text{Standard Energy Consumption}}$$

1) Equation
Standard Energy Consumption
= Σ (Throughput of Each Plant × BM Factor of Each Plant)

2) BM Factor is derived from the average of plants in the world based on **the Solomon's data** (340 refineries)

3) The target of bench mark was decided as 0.876.

Petroleum Refinery Sector

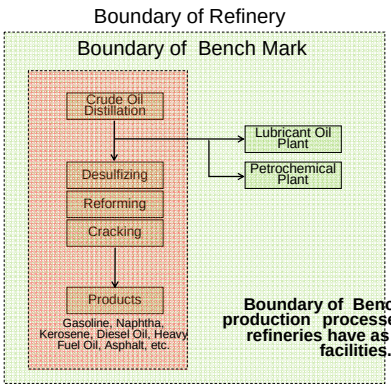


$$BM = \frac{\text{Actual Energy Consumption } 500{,}000}{10{,}000*A + 2{,}500*B + 2{,}000*C + 2{,}000*D + 1{,}500*E}$$

Standard Energy Consumption

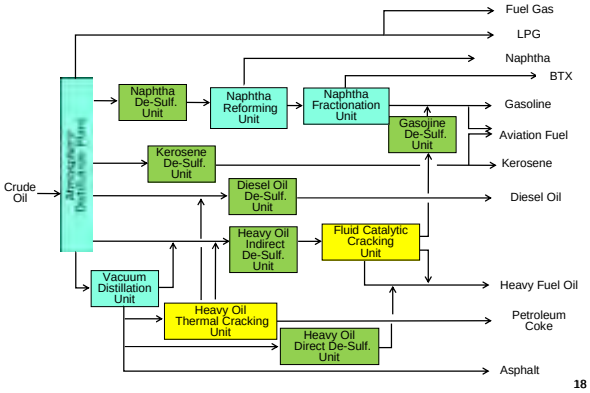
Atmospheric Distillation Unit · Vacuum Distillation Unit · Gasoline Reforming Unit · Indirect De-sulfizing · Fluid Catalytic Cracking Unit

Boundary of Bench Mark



Boundary of Bench Mark is production processes which all refineries have as common facilities.

Example of Process Configuration in Refinery



Sector-wise Benchmark Plan of EU

(still under discussion)

EU Benchmark Indicator Planning(1)

Sector	Products	Benchmark Indicator (Planning) (Unit: per product Ton)	Remarks
Iron & Steel	Cokes production/Cokes	0.090t-CO_2	
	Sinter production/Sintered ore	0.119t-CO_2	
	Blast furnace/Liquid pig iron	1.286t-CO_2	
	Electric furnace/Crude steel	0.058t-CO_2	
Chemical	Nitric acid	0.00121t-CO_2	
	Steam cracking	0.5～0.7t-CO_2	
	Ammonia	1.46t-CO_2	
	Adipic acid	5.6t-CO_2	
	Hydrogen	8.9t-CO_2	
	Sodium carbonate	0.73t-CO_2	

EU Benchmark Indicator Planning(2)

[illegible]	Product		Benchmark Indicator (Planning)	Remarks
Chemical	Aromatic compound	Aromatic solvent extraction	5.25CWT	
		Toluene	2.45CWT	
		Thiamine diphosphate/ Toluene diisocyanate	1.85CWT	
		Cyclohexane	3.00CWT	
		Xylene isomer	1.85CWT	
		Para xylene	6.40CWT	
		Ethylbenzene	1.55CWT	
		Cumene	5.00CWT	
	Carbon black		2.62t-CO_2	

EU Benchmark Indicator Planning(3)

Sector	Products	Benchmark Indicator (Planning) (Unit: per product Ton)	Remarks
Cement	Clinker	0.78t-CO_2	
Petroleum refinery	Petroleum refinery	0.03t-CO_2/CWT	
Paper Pulp	Kraft pulp	0.048t-CO_2/Air Dry MetricTon	
	Sulfite pulp/Mechanical pulp	0t-CO_2/Air Dry MetricTon	
	Recycled paper	0.0187t-CO_2/Air Dry MetricTon	
	News paper	0.318t-CO_2/Air Dry MetricTon	
	Fine paper	0.405t-CO_2/Air Dry MetricTon	
	Coated paper	0.463t-CO_2/Air Dry MetricTon	
	Facial tissue	0.343t-CO_2/Air Dry MetricTon	
	Containerboard	0.368t-CO_2/Air Dry MetricTon	
	Boardpaper	0.418t-CO_2/Air Dry MetricTon	

EU Benchmark Indicator Planning(4)

Sector	Products	Benchmark Indicator (Planning) (Unit: per product Ton)	Remarks
Glass	Sheet glass	0.606t-CO_2	
	Insulating glass	0.250t-CO_2	
	Glass wool	1.003t-CO_2	
Aluminum	Almina	0.39t-CO_2	
	pre-baked anode	0.33t-CO_2	
	Primary aluminum	1.57t-CO_2	
	Aluminum product	0.22t-CO_2	
—	—	—	

EU Benchmark Indicator Planning(5)

Sector	Products	Benchmark Indicator (Planning) (Unit: per product Ton)	Remarks
Ceramics	Mineral wool	0.664t-CO_2	
Gypsum	Dry gypsum/land plaster	0.01t-CO_2	
	Gypsum	0.05t-CO_2	
	Gypsum block/Gypsum Board/	0.08t-CO_2	
	Glass wool reinforced Gypsum board	0.18t-CO_2	
—	—	—	

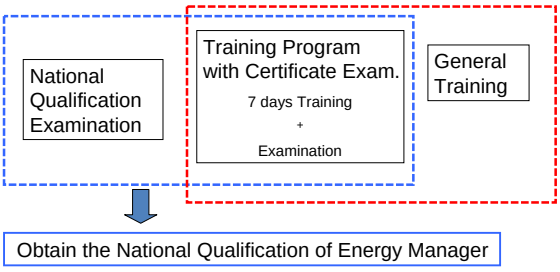
Training Programs for Energy Manager in Japan

JICA Study Team

Contents

Ⅰ. Introduction

Qualification System and Training Programs



Classification of Training Programs

Classification	Contents
Training program with certification examination for candidates of Energy Manager	●Lecture of law and regulations of the EMS ●Basic knowledge of heat and electricity ●Theory and practice of EE&C activities within a business unit ●Measurement and data collection, and analysis ●How to make Periodical Reports ●(Certification examination)
General training programs for proper implementation of the EMS	●Lecture of law and regulations of the EMS ●How to make Management Standards ●Theory and practice of EE&C activities within a business unit ●Measurement and data collection, and analysis ●Theory of heat and electricity in EE&C ●Lecture for individual technology (pump, AC, boiler, etc.)

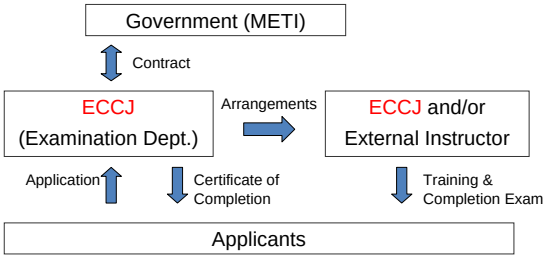
EE&C Activities and Tasks of Energy Manager (1)

	Activity	Task of Energy Manager
1	Energy-saving fundamental policies	Gives assistance when drafting the energy-saving fundamental policy. Calculates investments/costs based on the fundamental policy.
2	Energy-saving promotion framework	Develops an energy-saving promotion organization plan. Decides on the energy-saving promotion organization framework. Convenes meetings of the energy-saving promotion committee.
3	Management standards	Develops the mandatory management standards as evaluation criteria. Designates the department responsible for the management standards. Provides related departments with necessary information.
4	Identifying actual energy consumption	Investigates actual energy consumption, and makes out the basic units management chart.
5	Energy-saving plan and target setting	Designates the energy-saving tasks for the entire company and for each department once a year, and quantitatively sets out applicable targets.

EE&C Activities and Tasks of Energy Manager (2)

	Activity	Task of Energy Manager
6	Education and prize-giving for employees	Educates employees. Works with the employer to establish a prize-giving scheme.
7	Periodic internal reporting on energy-saving efforts	Reports energy-saving efforts to the employer and each department on a monthly and yearly basis by using the energy basic units management chart.
8	Improvements in energy-saving efforts	Develops an improvement plan after hearing opinions from related departments. Drafts a workplace-level improvement plan after hearing opinions from related departments.
9	Procedures/reporting scheme in accordance with Energy Conservation Law	Drafts the periodic report, and prepares a preliminary draft of the medium-to-long term plan.
10	Self-development by energy managers	Remains informed of state-of-the-art technologies and other firm's best practices.

Workflow of the National Qualification of Energy Manager



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Profile of ECCJ

Legal status: * NPO
Incorporated foundation under the supervision of METI

Establishment: * October, 1978 (just after the 2nd oil crisis)

Purpose of establishment: * Core organization responsible for promotion of energy conservation

Office location: * Tokyo Head office & 8 branches

Supporting member: * 2,719 companies (as of July 3, 2009)

Staff: * 131 persons (as of May 1, 2009)

Budget: * 4,735million yen in 2008FY (35.04million euro)
Subsidy Project (38%),
Assigned Project (27%),
State Examination (11%),
Trainings (6.1%),
Supporting Membership Fee (4.4%),
Others (13.5%)

Fields of activity: * Industrial, Residential/Commercial, Transportation and Cross sectors

Ⅱ. Qualification System of Energy Manager

10

National Qualification Examination

Course	Subjects
Electricity Course	1. Outline of energy management and Law and Regulations
	2. Basic theory in Electricity
	3. Facility and Equipment
	4. Application of Electricity
Heat Course	1. Outline of energy management and Law and Regulations
	2. Basic Theory in Heat and Fluid
	3. Fuel and Combustion
	4. Heat Utilization Facility and its Management

11

Training Program with Certificate Exam.

Course	Subjects	Hrs
Electricity Course	1. Outline of Energy Management and Law and Regulations	9
	2. Basic Theory in Electricity	8
	3. Facility and Equipment	12
	4. Application of Electricity	23
		52
Heat Course	1. Outline of Energy Management and Law and Regulations	9
	2. Basic Theory in Heat and Fluid	18
	3. Fuel and Combustion	7
	4. Heat Utilization Facility and its Management	18
		52

Achievement of 2008

	Applicant	Succeeded	%
National Qualification Examination	9,980	2,954	20.6
Training Program with Certificate Exam	1,872	1,191	63.6

Ⅲ. General Training Programs

EC Technology Training Courses

Classification	Objectives	Subjects	Methodology	Duration
EC Training Program	Coverage of wide EC subjects	EC Law EC Technologies Management Electricity Heat Project finding Building etc.	Lecture Exercise Operation Measurement at site	1-2 days
Training Delivery Scheme	Customized Training	EC in factories EC in buildings etc.	Dispatch of trainer to customers	Usually 0.5 days

Training Programs of Heat Course

	Duration	Theme	Contents
First Term	2 days	EE&C Technology of Heat and Combustion Management	EE&C Technology of Heat Fuel Combustion Calculation Hands on Practice of Combustion
Second Term	2 days	Steam Management and Steam Trap	EE&C of Steam Hands on Practice of Steam
Third Term	2 days	Energy Assessment of Heat Facility	Heat Balance Calculation and Assessment Practice of Finding Potential of EE&C
Fourth Term	2 days	Good Practice of EE&C of Heat	Introduction of Good Practice of EE&C in Heat Site Visit of EE&C Technology Application

(Source: ECCJ Website)

Training Programs of Electricity Course

	Duration	Theme	Contents
First Term	2 days	EE&C of Building	EE&C of Building Measurement of Electricity Hands on Practice of Electricity Measurement
Second Term	2 days	EE&C of Compressor	EE&C of Compressor Hands on Practice of Compressor
Third Term	2 days	EE&C of Pump and Fan	EE&C of Pump and Fan Hands on Practice of Pump and Fan
Fourth Term	2 days	Good Practice of EE&C of Electricity	Introduction of Good Practice of EE&C in Electricity Site Visit of EE&C Technology Application

(Source: ECCJ Website)

Other Training Programs

Course	Duration	Theme	Contents
How to Find EE&C Potential	2 days	Practice to Find EE&C Potential in Electricity and Fuel Consuming Factory	1. Issues and countermeasure in promotion of EE&C 2. Methods to find EE&C potential and its application 3. Practice
Energy Assessment of Building	2 days	EE&C in Building Facility and Operation	1. Law and regulations 2. EE&C of lighting 3. EE&C of AC 4. EE&C of pump and fan 5. Good practice of building EE&C 6. Practice of energy assessment of building
How to Make Management Standards	2 days	Practice of Making Management Standards	1. Law and regulations 2. Practice of making Management Standards
Site Visits of Good Practice Factory and Building	2 days	Site Visits and Practice of Energy Assessment	1.Lecture ・Law and regulations ・Points of EE&C in factory and building 2.Practice

(Source: ECCJ Website)

Training Delivery Package

- Training program dedicated to a particular user and customized to its requirements
- Typical pattern:
  - In-house training;
  - Seminar organized by the government and/or public offices targeting an indefinite number of audience
- ECCJ's scope:
  - Program planning;
  - Instructor dispatch;
  - Arrangements making;
  - Training implementation.

Achievement of 2008

Classification	Course	Trainees
EC Training Program	279	6,387
Training Delivery	216	-
Total	495	6,387+

Ⅳ. Operation of Training Programs

Tasks of Training Program

Training Program for Energy Manager	General Training Program
Announcement of the Program	Announcement of the Program
Acceptance of Application (including pre-qualification)	Acceptance of Application
Collection of training fee	Collection of training fee
Arrangement of Teachers and Textbooks	Arrangement of Teachers and Textbooks
Making Certification Examination Paper	Implementation of Training Program
Implementation of Training Program and Examination with Marking	
Notice of Qualified Applicants	

Instructor

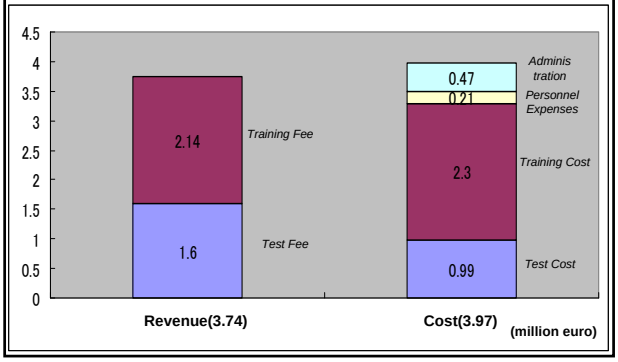
1. Sourcing:
   (1) People of academic standing
   (2) People of practical experience in EC
   (3) Expert of EC audit
   (4) Representatives of factories and/or buildings who are to make presentations on best EC practices
   (5) ECCJ officer in charge of EC related laws & regulations
2. Officials charging the completion exam: Independent of training instructors

Training Fee

1. Principle: Trainee fee basis
2. Cost Breakdown:
   (1) Training materials
   (2) Training guidebook
   (3) Compensation of instructors
   (4) Training venue
   (5) Maintenance of facilities
   (6) Other direct expenses

Classification	Fee (euro)	Applicant (In 2008)
Energy Manager Qualification Training	518	1911
General Training	148-740	6387

Examination and Training Revenue and Cost (2008)



V. Introduction of Energy Conservation Center of Japan (ECCJ)

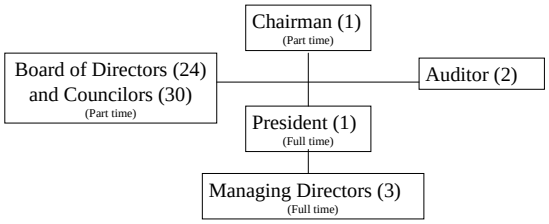
Outline of ECCJ

1. Legal status: An incorporated foundation under the supervision of Ministry of Economy, Trade and Industry (METI)
2. Establishment: 1978 (when the 2nd oil crisis hit Japan)
3. Mission: Core organization responsible for promotion of energy conservation
4. Office location: Head office in Tokyo and 8 branches in Japan
5. Supporting member: 2,719 members (as of May 2009)
6. Number of employees: Full time 131 persons (as of July 2009)
7. Annual Budget: 4375, million yen in FY2009 (48 million US$: @90¥/US$)
8. Target Sector: Industrial, Residential / Commercial and Transportation

Main Activities of ECCJ

Industrial	1) Energy conservation audits services for factories 2) Education & training on energy conservation 3) State examination for energy managers (assigned by the government) 4) Good Practice Dissemination (conference for successful cases of energy conservation activities, excellent energy conserving equipment, etc.) 5) Technological development and spillover
Commercial, Residential and Transportation	1) Energy conservation audits services for buildings 2) Ranking catalogue for energy efficient appliances (dissemination of Top Runner Program) 3) Promotion of energy labeling system 4) International Energy Star program implementation 5) Energy efficiency product retailer assessment system 6) Dissemination of energy conservation indicator "E-Co Navigator" 7) Energy education at primary and middle schools 8) ESCO research and development
Cross Sector	1) Energy conservation campaign & exhibition (ENEX) 2) Commendation (grand energy conservation prize) 3) Information & data base, publicity and publishing 4) Survey and monitoring 5) International cooperation & communications

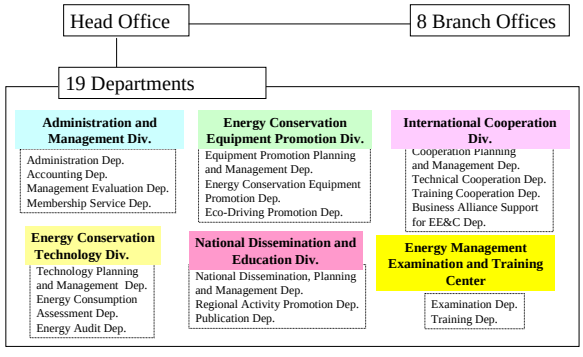
Organization (1): Governance



(Features)
- No government staff in ECCJ.
- Chairman and board members are selected from **large energy consuming companies and representatives of academy, association, etc**. (Current chairman is former president of TEPCO).
- Board meeting is held every 6 month.
- All management members are assigned every 2 years.

Organization (2): Full Time Staff

Full Time Staff: 131 as of July 2009



Membership

1. ECCJ is supported by 2,719 members (as of May 2009).
2. Members can receive the following services:
   - Distribution of a magazine “Monthly Energy Conservation”
   - Utilization for consultation regarding legal matter, technology, etc.
   - Discount of seminars, training programs, publication, etc.
   - Other energy related information
3. Membership Fee: 40,000 Yen to 100,000 Yen (400US$ to 1,000 US$) /year
4. Share of Membership Fee in Budget: 4.4 %

Membership fee is a small share in the Annual Budget.
However, the important point is participation into ECCJ membership by many companies.

Annual Budget and Expenditure

Success Key

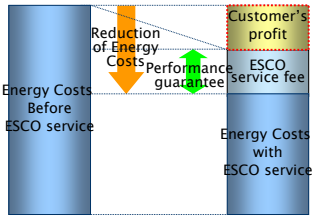
1. Many industries/companies cooperate with the activities of ECCJ.
→ Top companies (TEPCO, Toyota, Mitsubishi, Matsushita, etc.) are assigned as Chairman and Directors.
2. Many industries/companies support ECCJ activities by membership fee.
→ Fee is small. But participation consciousness is very important to maintain the activities of ECCJ.
3. Independent body from any ministries. Neutral stance is better for management of private sector.
→ Substantially Ministry of Economy, Trade and Industry (METI) can affect ECCJ operation because most of budget comes from METI. However, officially ECCJ is an independent body from government.
4. Government budget support
→ Most of activities are supported by Government budget.

Thank You Very Much

ESCO Industry in Japan

Tetsuya MAEKAWA (M.Sc)
JICA Study Team
Tokyo Electric Power Company, Inc.

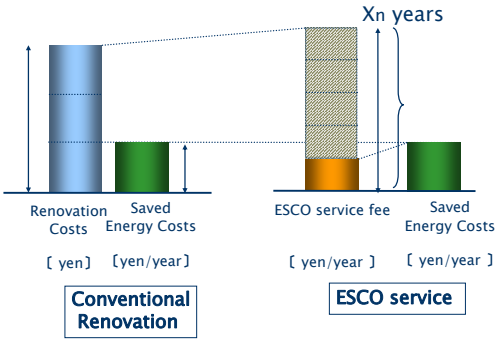
Concept of ESCO (1)



ESCO is a comprehensive service regarding Energy Efficiency, whose advantages are;

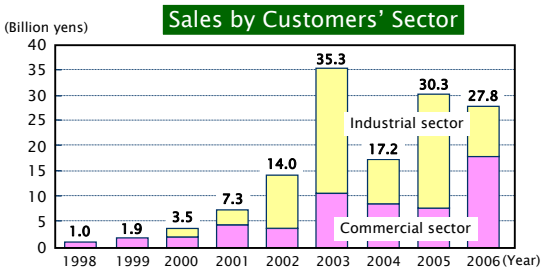
- Guaranteeing Energy Efficiency Performance
- Investment cost is provided by ESCOs and service fee is payed from the savings of Energy Cost

Concept of ESCO (2)



ESCOs in JAPAN (1)

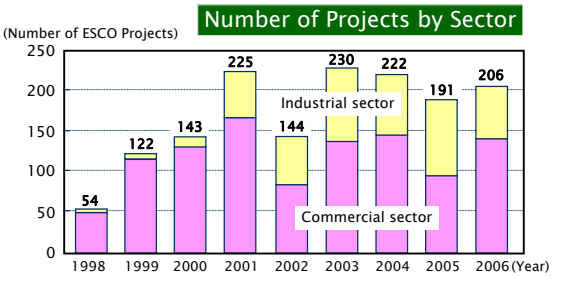
Market Size of ESCO (1)



Source: Japan Association of Energy Service Companies

ESCOs in JAPAN (2)

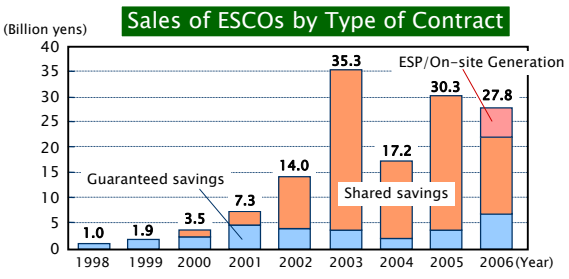
Market Size of ESCO (2)



Source: Japan Association of Energy Service Companies

ESCOs in JAPAN (3)

Market Size of ESCO (3)



Source: Japan Association of Energy Service Companies

ESCOs in JAPAN (4)

Number of Active ESCOs = 10～20 Companies

Utility-based Active ESCOs

Electricity Companies
- Japan Facility Solutions, Inc.
- Kanden Energy Solution Co.,Inc.
- C Energy Co.

Gas Companies
- Energy Advance Co.,Ltd
- Gas and Power Investment Co.,Ltd

ESCOs in JAPAN (5)

Other Active ESCOs' Background

Manufactures
- Yamatake Corp.
- Johnson Controls, Inc.
- Hitachi, Inc.

Constructors
- Sanki Engineering Co.,Ltd
- Takasago Thermal Engineering Co.,Ltd

Others
- The First ESCO, Ltd.
- Mitsubishi UFJ Lease & Finance Company

ESCOs in JAPAN (6)

JAESCO
- Japan Association of Energy Services Companies
- Established in 1999
- Number of Member Companies: 126
- Roles of JAESCO
  - Policy related lobbying activities
  - PR and marketing of the ESCO concept
  - Training the staff of member companies
  - Information exchange between members
  - International cooperation
  - Others including publishing a book of ESCO

ESCOs in JAPAN (7)

History of Japanese ESCO Industry

Background
- Deregulation of Energy Market
- Global Environmental Issue

History of ESCO Industry
- 1996 - Concept was Imported from US
- 1997 - First ESCO Co.Ltd was established
- 1999 - JAESCO was established
- 2000 - TEPCO Established JFS (TEPCO's ESCO Subsidiary)

TEPCO's ESCO Subsidiary (JFS)

Japan Facility Solutions, Inc. (JFS)
- Established : 14 Dec. 2000
- Share Holders: 4 Companies
  - TEPCO (45%)
  - Mitsubishi Corp. (35%)
  - Yamatake Corp. (10%)
  - Kandenko Co.,Ltd (10%)
- Capital Fund : 490 million yen
- Employees : 45 persons
- Turnover : 11,540 million yen (2006 FY)
- Profit : 380 million yen (2006 FY)

TEPCO's ESCO Subsidiary (JFS)

Business Line up of JFS (since 2000)
- ESCO Service : 71 projects
- Energy Audit : over 200 projects
- Energy Efficiency Renovation: 27 projects
- Sales of Equipments for All-Electric Houses
- Energy Center Project : 1 project

And so on...

Practice1: ESCO (1)

National Institute for Environmental Studies

Outline of Buildings

- Location: Tsukuba City, Ibaraki Prefecture
- Building Type: Research Center
- Number of Buildings: 54
- Total Floor Space: 78,000 m²
- Completion Year: 1974
- Energy Cost: 640 million yen/year

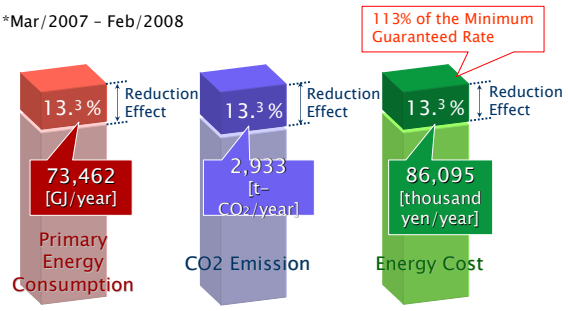
Outline of ESCO Service

- Type of Contract: Shared Savings
- Service Period: 6 years (Jul/2005-Jun/2011)

Practice1: ESCO (1)

Effect of Energy Conservation

*Mar/2007 - Feb/2008



Practice1: ESCO (2)

Chofu City Office

Outline of Buildings

- Location: Chofu City, Tokyo Metropolis

City Office
- Total Floor Space: 14,123 m²
- Number of Floors: 8
- Completion Year: 1971

Culture Center
- Total Floor Space: 31,467 m²
- Number of Floors: 13
- Completion Year: 1995

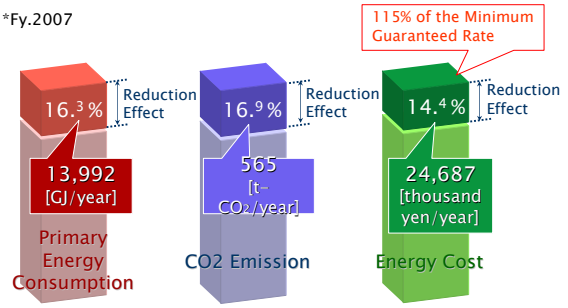
Outline of ESCO Service

- Type of Contract: Guaranteed Savings
- Service Period: 5 years (Apr/2006-Mar/2011)

Practice1: ESCO (2)

Effect of Energy Conservation

*Fy.2007



Practice1: ESCO (3)

Tokyo Metropolitan Hiroo Hospital

Outline of Building

- Location: Shibuya Ward Tokyo Metropolis
- Building Type: Hospital
- Total Floor Space: 36,511 m²
- Completion Year: 1980
- Energy Cost: 339 million yen/year

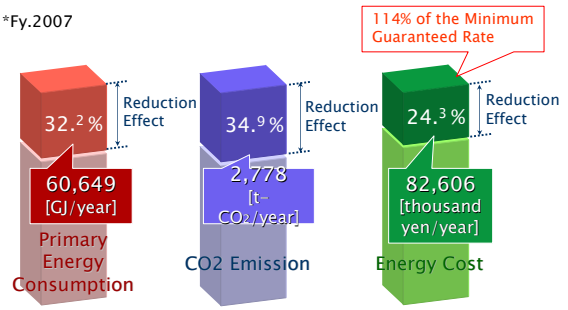
Outline of ESCO Service

- Type of Contract: Guaranteed Savings
- Service Period: 6 years (Apr/2006-Mar/2012)

Practice1: ESCO (3)

Effect of Energy Conservation

*Fy.2007



Practice1: ESCO (4)

15 Buildings in Edogawa Ward

Outline of Buildings

	Facility Name	m²
1	General Culture Center	16,496
2	Hotel Seaside Edogawa	5,564
3	Edogawa City Office	15,774
4	Sports Center	10,230
5	Sports Land	6,169
6	General Gymnasium	5,257
7	Central Library	8,452
8	Nishi-Kasai Library	2,342

	Facility Name	m²
9	Koiwa Urban Plaza	7,538
10	Edogawa Community Center	9,465
11	Komatsugawa Community Facility	5,234
12	Kasai Community Center	4,927
13	Tobu Friend Hall	6,080
14	Koiwa Community Center	3,685
15	Shinseicho Community Center	2,899
	Total	**110,112**

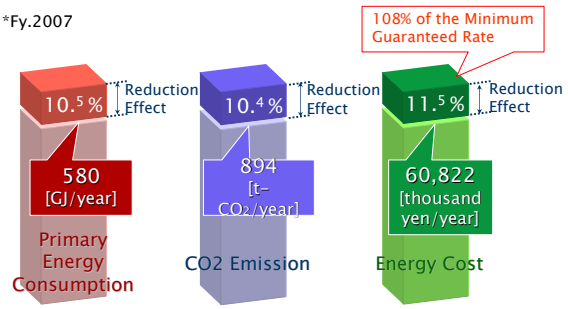
Outline of ESCO Service

- Type of Contract: Guaranteed Savings
- Service Period: 5 years (Apr/2007-Mar/2012)

Practice1: ESCO (4)

Effect of Energy Conservation

*Fy.2007



Practice1: ESCO (5)

Totsuka Regional Center

Outline of Building

- Location: Yokohama City, Kanagawa Prefecture
- Building Type: Regional Center
- Total Floor Space: 7,911 m²
- Number of Floors: 4
- Completion Year: 1978

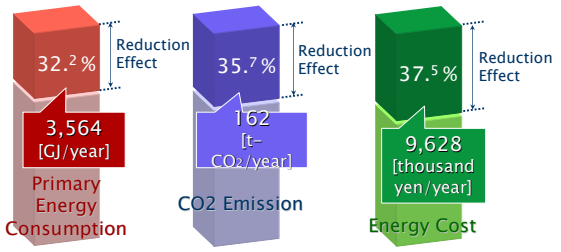
Outline of ESCO Service

- Type of Contract: Guaranteed Savings
- Service Period: 6 years (Jul/2007-Mar/2013)

Practice1: ESCO (5)

Effect of Energy Conservation

*Expectation of Energy Conservation



Thank you very much
for kind attention.

TEPCO's Strategy & Program for the Low Carbon Society

JICA Study Team
Tokyo Electric Power Company (TEPCO)

Principle for Low Carbon Society

- Both of Supply Side and Demand Side are important.
- Not a dream but practical technologies are important.

Supply Side

Low Carbon Electricity from the Grid

Nuclear Power
More Efficient thermal
Renewable Energy

×

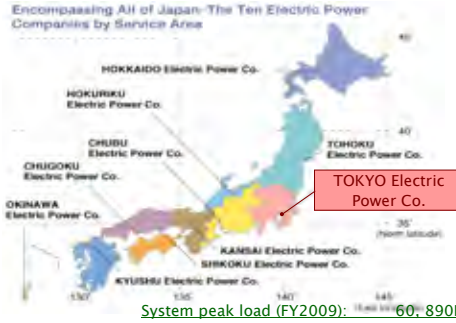
Demand Side

Promotion of Efficient Equipments & Appliances

Heat Pump, EV, IH

Low Carbon Society

Service Area of TEPCO



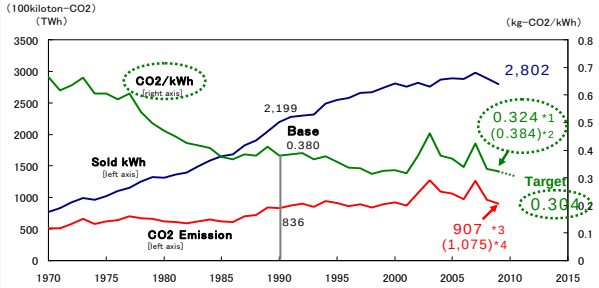
System peak load (FY2009): 60, 890MW
Electric energy sales (FY2009): 289,000GWh

Supply Side

- Diversification of Primary Energy Sources
- Efficiency Improvement in Thermal Power Plants
- Carbon Capture & Storage (CCS)
- Renewable Energy (Solar, Wind....)

Trend of Carbon Emission from TEPCO

- TEPCO will reduce 20% of unit CO2 emission by 2012.

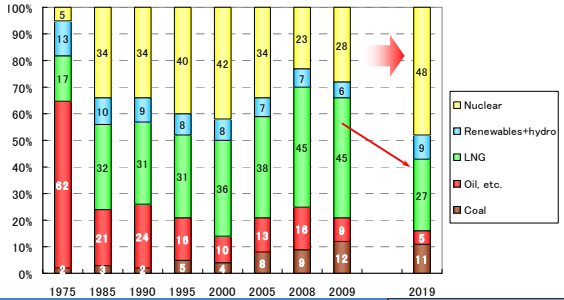


*1 & *3 : Values reflecting carbon credit
*2 & *4 : Values without carbon credit

Diversification of Primary Energy Sources

- TEPCO promotes an optimal energy source mix
- After the Oil Shock in 1970s, the effort to reduce the dependence on oil has been successful by Nuclear and LNG.
- Our target is to achieve 50% non-fossil energy ratio by FY 2020.

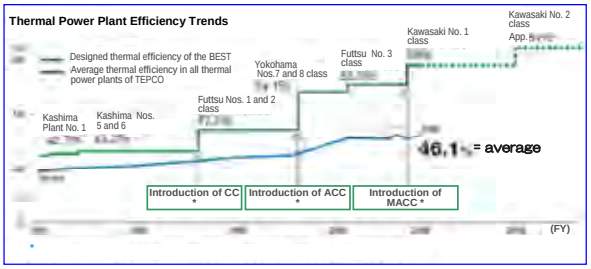
Change of Energy Sources for Electricity (TEPCO)



Efficiency Improvement in Thermal Power Plants

7

- Generation efficiency has increased mainly by the of LNG combined cycle power generation since 1980s.
  - 1,500℃ class “MACC” (with thermal efficiency of 59%) was introduced in 2007.
  - 1,600℃ class “MACC II” (with thermal efficiency of approx. 61%) will be introduced in 2016.
  - Average Efficiency is 46.1% in 2008.



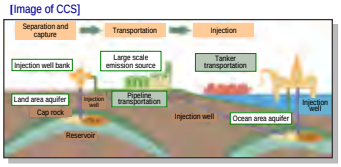
Carbon Capture & Storage (CCS)

8

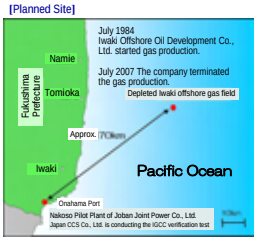
- Separate and capture CO_2 emitted from factories and power plants, and store them in the ground at a depth of approx. 1,000m and more.
- 32 companies including TEPCO along with 10 EPCos, invested in May 2008 in the new company called “Japan CCS Co., Ltd.,” which will study the feasibility of the CCS business.

◇ The company is conducting a feasibility study for storing CO_2 emitted from the IGCC of the Nakoso Pilot Plant in Fukushima Prefecture
◇ They aim to commence a large scale verification test from FY2009.
◇ They will deploy CCS to oil and coal producing countries receptive to this technology

[Image of CCS]



[Planned Site]



Mega-Solar Projects of TEPCO

9

- Generation Capacity：30MW, Estimated CO_2Reduction)：14,000 t /year
- Good cooperation with local municipalities is important.

Ukishima PV Power Station

Kawasaki City, Kanagawa Pref.

- PV Capacity 7MW
- Estimated kWh 7.4 Million kWh
- CO_2Reduction: 3,100 ton/year
- Construction starts in 2009FY
- Launch in 2011FY

Ohgishima PV Power Station

Kawasaki City, Kanagawa Pref.

- PV Capacity 13MW
- Estimated kWh 13.7 Million kWh
- CO_2Reduction: 5,800 ton/year
- Construction starts in 2009FY
- Launch in 2011FY

Yonekurayama PV Power Station

Kofu City, Yamanashi Pref.

- PV Capacity 10MW
- Estimated kWh 12.0 Million kWh
- CO_2Reduction: 5,100 ton/year
- Construction starts in 2010FY
- Launch in 2011FY

Demand Side

1. Conventional Scheme
- Tariff
- Brochure
- Backside of Bill Sheet
- Homepage
- Exhibition
- PR Facility
- Research & Development
- Demonstration

2.Promoted Systems & Equipments
- Heat Pump
- Thermal Storage HVAC
- Ice Storage HVAC
- Eco Cute (hot water supply unit)
- Electric IH Cooking
- NAS Battery

3. Energy Solution
- ESCO Service
- Energy Centre Business
- PV Support Service

Energy Efficiency by Tariff Incentive

11

Tariff Incentive in Residential Sector = 3 bracket prices (step-up price)

Tariff for Residential Sector

		Price incl. tax
Demand Charge (per month)		273.00 yen/kVA
Energy Charge	1st Step Price（～120kWh）	17.87 yen/kWh
	2nd Step Price（120～300kWh）	22.86 yen/kWh
	3rd Step Price（300kWh～）	24.13 yen/kWh

Check System for Customers Record

12

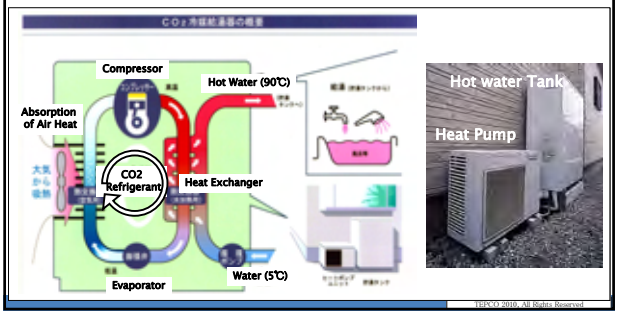
◇ Consumption Record can be obtained from Internet

● Indicate customer’s electricity consumption record and bill in the past 2 years, comparing with average of same category customers

Internet Screen

Eco-Cute (Heat Pump Hot Water Supply Unit) 13

50% of CO2 reduction will be achieved compared to conventional gas hot water unit.
- Installation in Japan: 1.7 Million as of March 2009
- National Target : 5.2 Million by 2010 (Kyoto Action Plan)



Electric Vehicle for business use 14

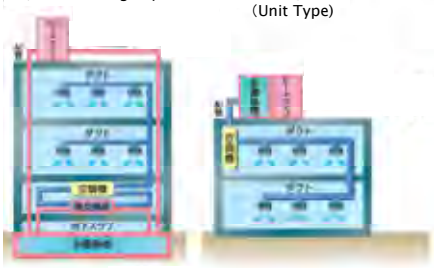
Overview: - Performance test of the lithium ion battery in size & weight per kWh, price and efficiency
- Development of lithium ion battery electric vehicles

Achievements: Utilization of the three thousand electric vehicles, instead of the use of conventional cars, contributes to reduction of 2,600 ton- CO2 per year

Thermal Storage HVAC System 15

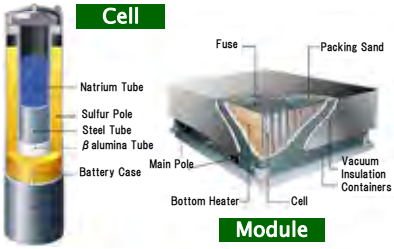
- Night-time electricity is appro.70% cheaper than that of Day-time.
- Night-time operation of refrigerators will be efficient due to the low outside temperature.

◆Ice/Water Storage System ◆Ice Storage System (Unit Type)



NAS Battery 16

Installation : 177 MW
by TEPCO at 96 sites of customers

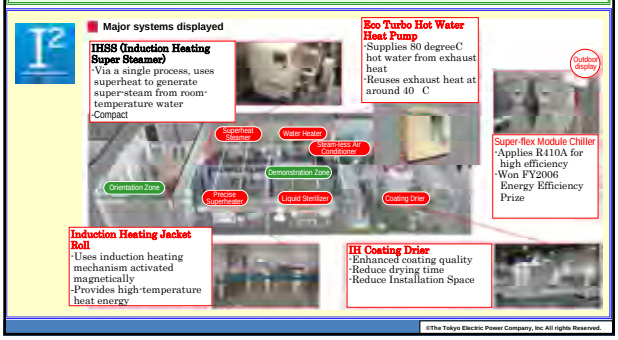


Cell Battery	
Voltage	2V
Capacity	1,220Wh
Size	D: 91mm LG: 520mm
Efficiency	Over 89%
Weight	5.5kg

50kW Module Battery	
Voltage	116V
Capacity	375kWh
Size	Width: 2.17m Depth: 1.69m Height: 0.64m
Number of cells	320 cells
Weight	3.5t

TEPCO Electric Factory " I² " (I Square) 17

- I² is an exhibition facility that supports process innovations for manufacturers by offering real experience of using electric systems.
- To streamline corporate operations and reduce CO_2 emissions with the latest heat pump and IH (Induction Heating) technologies.



To meet the Customer's Needs 18

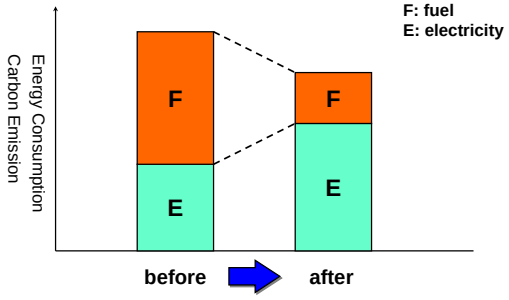
To provide "4 slim down solutions for customers" is the role of utility companies to meet customers' needs and realize low carbon society.

Save Energy	Decrease energy consumption by introducing efficient devices and operating efficiently
Cut Costs	Cut energy cost by making the most use of economic energy tariffs.
Cut CO_2	Cut CO2 by using low carbon electricity which is generated with a good mixture of thermal, hydraulic, and nuclear.
Slim Down Assets	Slim down assets by utilizing various financial services. Help customers to avoid Investment.

New chances for revenue & profit = Energy Solution

Electrification will contribute Low Carbon Society

19



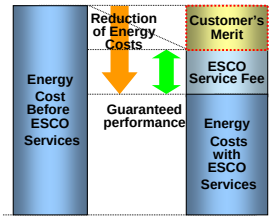
TEPCO Group's Energy Solutions

20

Service	TEPCO & Group Companies	Case
ESCO Service	TEPCO Japan Facility Solutions Inc.	(1)Tokyo Metropolitan Hiroo Hospital (2)National Institute for Environmental Studies
Thermal Energy Storage Support	TEPCO Tokyo City Service Co.	Sakakibara Heart Institute (hospital)
Fuel and Steam Supply	TEPCO TEPCO Gas Department Toden Kogyo Co.	Nippon Paper Crecia, Kaisei Mill
NAS Battery Service	TEPCO Tokyo Densetsu Service Co.	Tokyo Dome City 'LaQua'
Energy Centre Business	ISEHARA Energy service Co.	Tokai University Hospital
PV Energy Service	Toden Kogyo Co.	Haneda International Airport New Cargo Terminal

ESCO (Energy Service Company) Service

21



- TEPCO set up a subsidiary company (Japan Facility Solutions, Inc = JFS) for ESCO business in Dec.2000.
- JFS has been very successful to achieve 77 ESCO contracts and more than 200 building audits.
- Japan Association of ESCOs (JAESCO) has 130 member companies and there are approx. 10 active ESCOs in Japan.

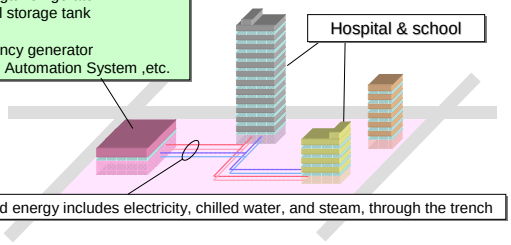
Energy Centre Business

22

ISEHARA campus of Tokai Univ.

Energy Centre
- NAS battery
- Centrifugal refrigerator
- Thermal storage tank
- Boiler
- Emergency generator
- Building Automation System ,etc.

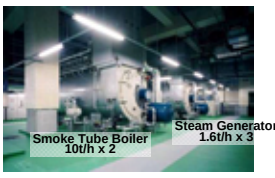
Project size : ¥ 4,000 million (26.7 million euro)



Energy Centre Business

23

Installed Facilities at ISEHARA Campus

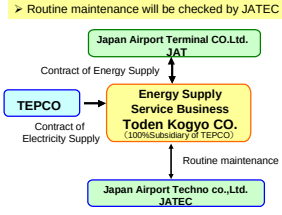


PV Energy Service by TEPCO Group

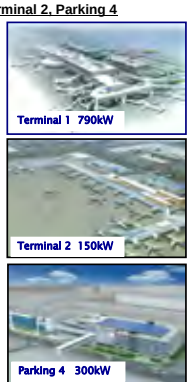
24

●Tokyo International Airport(Haneda) Terminal 1, Terminal 2, Parking 4

- TEPCO sells electricity to Toden Kogyo CO
- Toden Kogyo Co owns PV and supply electricity to JAT
- Routine maintenance will be checked by JATEC



- PV Capacity 1.2 MW(TOTAL)
- Estimated kWh 1.2 Million kWh/year
- CO_2Reduction 440 ton/year
- Construction starts in 2009FY
- Launch in 2010FY



Thank you for your kind attention.

TEPCO is providing various types of Overseas Consultancy Services.

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EE&C Activities at Refineries in Japan

July, 2010
Sadao Higaki
(JICA Study Team)

Table of Contents

1. Promotion of EE&C at Refineries in Japan

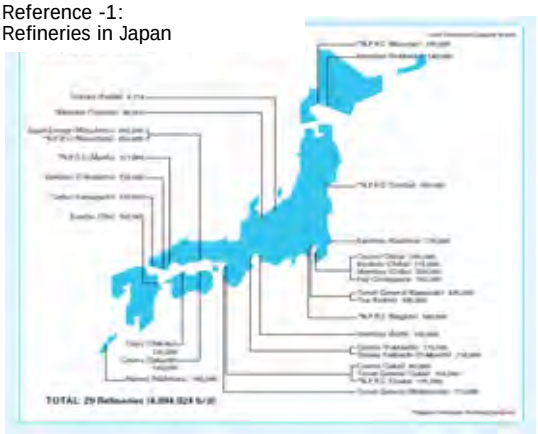
1-1. EE&C Activities

1) Organizations for promotion of EE&C
Activities in whole refinery (such as EE&C Committee in refinery)
2) EE&C activities by small groups
- Cooperation of managers, staffs and related departments
- Improvement proposal system / Quality control system / Awarding system
3) Supports from the related government offices and organizations
- Free audits by Energy Conservation Center of Japan (ECCJ)
- Subsidies on research and development, and investment
4) Publishing results of EE&C activities to inside and outside of the refinery

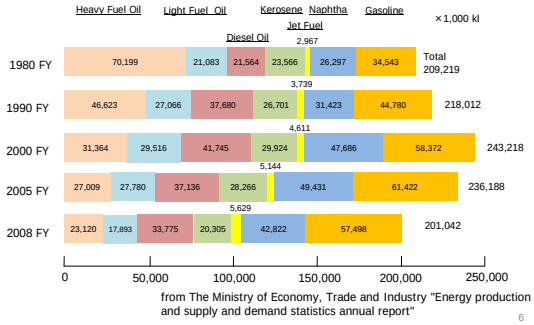
1-2. Consideration Matters on EE&C

1) Soaring of oil prices and energy costs
2) Change in demand pattern of petroleum products
3) Upgrade of oil refining facilities
4) Introducing the latest equipments and technologies for energy conservation
5) Correspondence to environmental issues

Reference -1:
Refineries in Japan

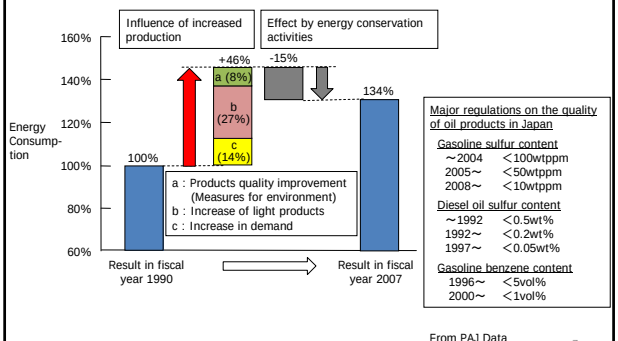


Reference-2 :
Change of demand on each petroleum product in Japan



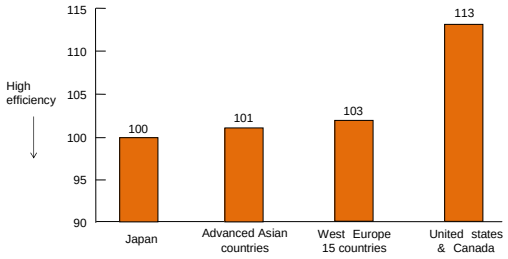
from The Ministry of Economy, Trade and Industry "Energy production and supply and demand statistics annual report"

Reference-3:
Analysis of Energy-Consumed Transition at Refineries in Japan



From PAJ Data

Reference-4:
Comparison of Energy Consumption Index at Refineries of Each Country in 2004FY



From Solomon Associates data

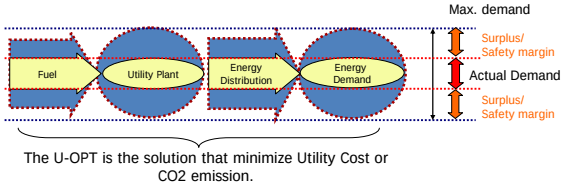
2. Examples of EE&C Measures at Refineries in Japan

Example-1 :
Introduction of Utility Optimization System

1. Merit of Utility Optimization System

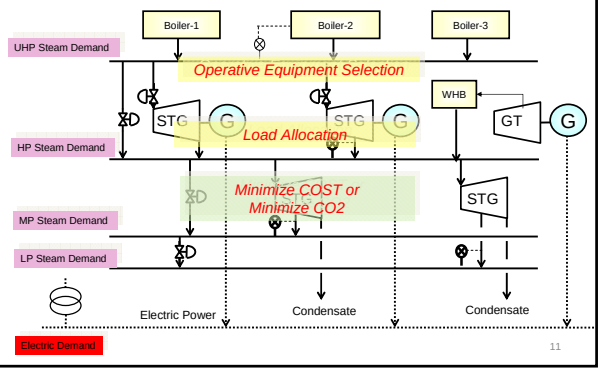
- Stable supply of utilities
- Cost saving and CO2 reduction
- Reduction for operator workload

The energy is often over supplied to accommodate the load fluctuation.

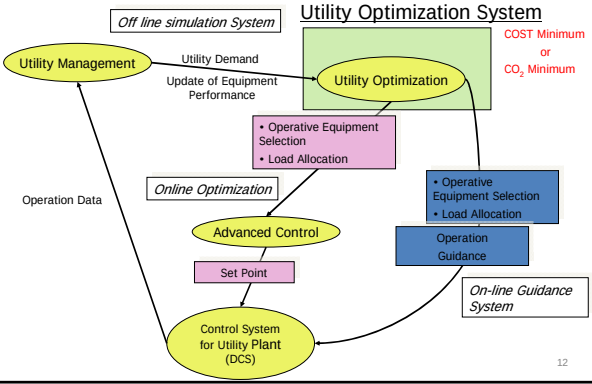


The U-OPT is the solution that minimize Utility Cost or CO2 emission.

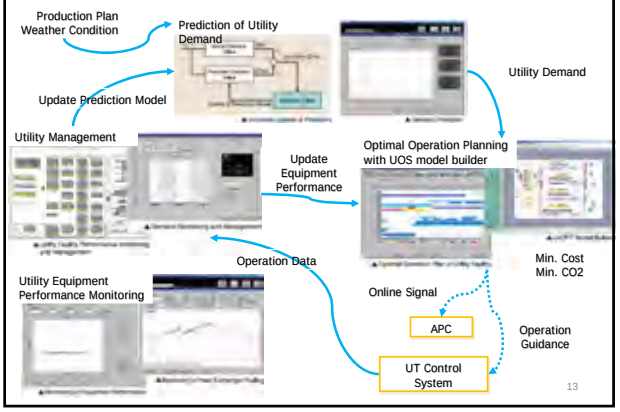
2. Concept of Utility Optimization System



3. Major Function of Utility Optimization System

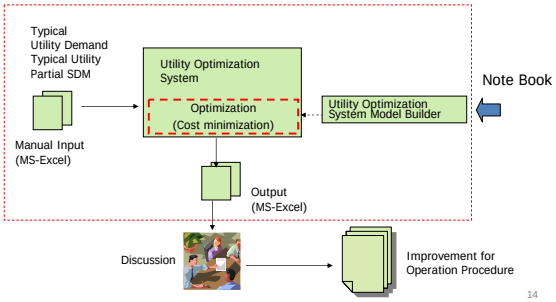


3. Outline of Utility Optimization System

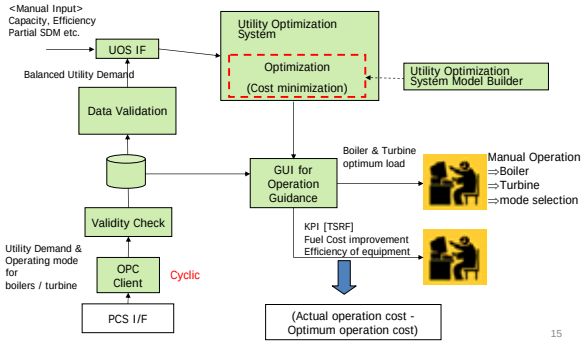


4. Off line simulation System

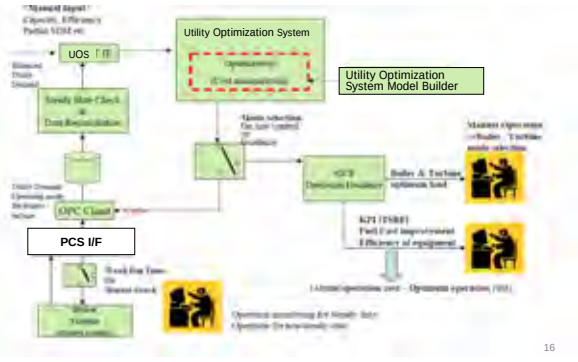
- Improvement in operation procedure
- Investment Analysis



5. On-line Operation Guidance System



6. On-line Optimization (Control)



7. Benefit Analysis for improvement current operation

Actual Operation
・Utility Cost
・CO_2 Exhaust Amount

Improvement

Optimal Operation
・Utility Cost
・CO_2 Exhaust Amount

Benefit Analysis (Cost & CO_2)

Improve Standard Operating Procedure

8. Utility Optimization by Utility Optimization System

Company	Annual Energy Cost	Annual CO_2 emission	Utility Equipment	Annual Reduction of Energy Cost	Annual Reduction of CO_2 emission
	Mill.US$	TONS		US$	TONS
A	40	200,000	Boiler, Generator, Refrigerator, Heat storage	800,000 (▲ 2 %)	7,000
B	5	60,000	Boiler, Generator, Refrigerator, Heat storage	175,000 (▲ 3.5 %)	2,400
C	10	30,000	Boiler, Generator, Refrigerator, Heat storage	300,000 (▲ 3 %)	1,200
D	2	5,000	Boiler, Generator, Refrigerator, Heat storage	96,000 (▲ 4.8 %)	200

Reduction of cost is subject to number of Utility Equipments, current operation method, constraints including geographical utility allocation and current annual primary energy cost.

Example-2 :
Utilizing of Thermo-Compressor

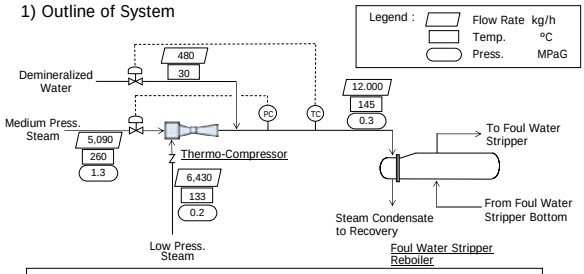
2-1. Utilizing Low Pressure Steam by Raising Pressure at Foul Water Stripper Reboiler

2-2. Flash Steam Recovery from High Temperature Steam Condensate

2-1. Utilizing Low Pressure Steam by Raising Pressure at Foul Water Stripper Reboiler

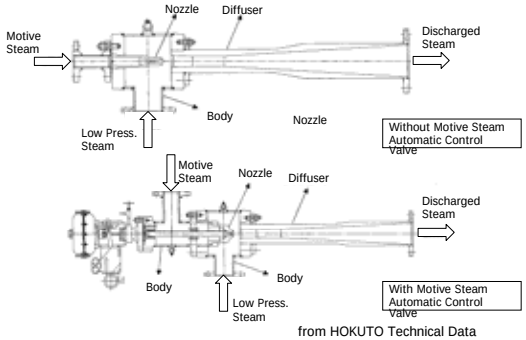
Nippon Oil
Mizushima Refinery

1) Outline of System



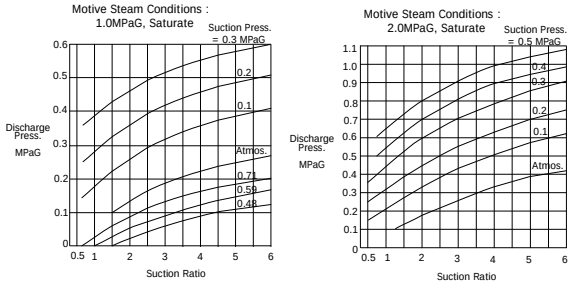
Notes :
1) Heating source for Foul Water Stripper Reboiler
Medium press. steam → Medium press. Steam + Low press. steam
2) Especially in summer season, low press. steam was released to atmosphere in large quantity because of the excessive condition.

2) Thermo-Compressor



from HOKUTO Technical Data

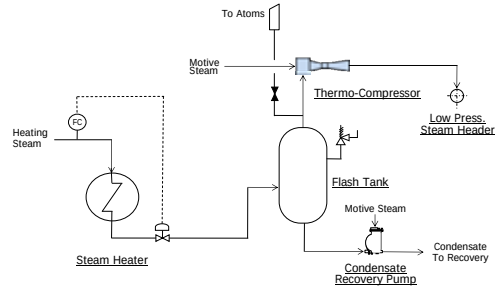
3) Typical Performance of Thermo-Compressor



$$\text{Suction Ratio} = \frac{\text{Motive Steam (kg)}}{\text{Suction Steam (kg)}}$$

from HOKUTO Technical Data

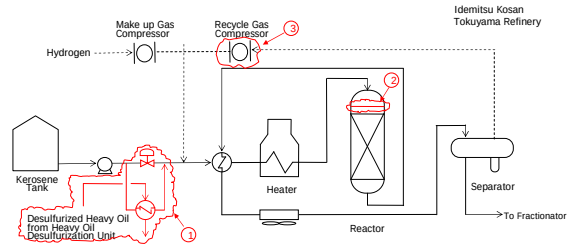
2-2. Flash Steam Recovery from High Temp. Steam Condensate



Notes : 1) Thermo-Compressor is installed for increasing recovered flash steam from hot condensate.
2) Condensate recovery pump has to be installed because of the low pressure in Flash Tank.

Example-3:
Energy Conservation by Rising Feed Oil Temperature and Lowering Reaction Temperature at Kerosene Desulfization Unit

1) Contents of Countermeasures



Countermeasures
- ① Rising feed temp. by heat recovery from Desulfurized Heavy Oil From Heavy Oil Desulfurization Unit
- ② Improving distribution in reactor by replacement of Distributor
- ③ Lowering H2/HC mol ratio

2) Total Effect

(1) Temperature change
- Feed oil temp. : 60℃ up
- Heater ΔT : 6℃ down
- Reactor inlet temp. : 15℃ down

(2) Decrement of fuel consumption at Heater

(3) Decrement in load at Recycle Gas Compressor (steam driven)
→ Decrement of total energy consumption : about 20%

Reference:
Improvement of Liquid Distribution in Reactor

Requirement for Good Distribution at Distributor
1) Narrow intervals of distributor nozzles
2) Small pressure drop
3) Small inclination of distribution tray
4) Wide turndown of liquid flow
5) Wide gas/liquid ratio
6) No clogging with scale

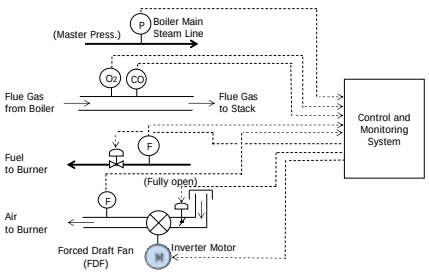
Effects of Good Distribution Tray
1) Lowering of reactor temperature
→ Decrement of fuel consumption at Reactor Charge Heater
2) Improvement of heat stability of desulfurized product

Example-4 :
Introducing O_2/CO Control System at Power Boiler

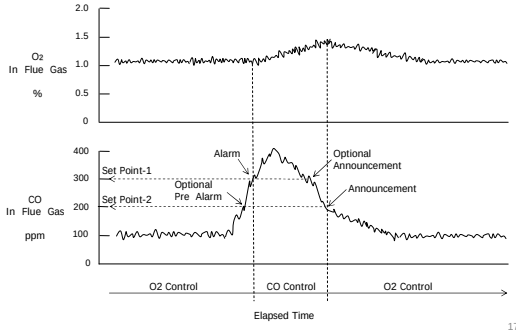
Nippon Oil
Mizushima Refinery

1) Purposes of introducing this system
(1) Lowering O2% in flue gas so as to save fuel
(2) Prevention of trouble and fuel loss by imperfect combustion

2) Outline of O2/CO Control System



3) Concept of Control Pattern at O2/CO Control System



Example-5 :
Steam Saving by Management of Steam Traps

Fuji Oil
Sodegaura Refinery

1) Reason of Choosing The Activity Theme
   (1) Increase in malfunction of steam trap of specific types
   (2) Increase of steam loss

2) Purposes
   (1) Review of selecting steam traps
   (2) Review of managing steam traps
   → Decrease of steam loss

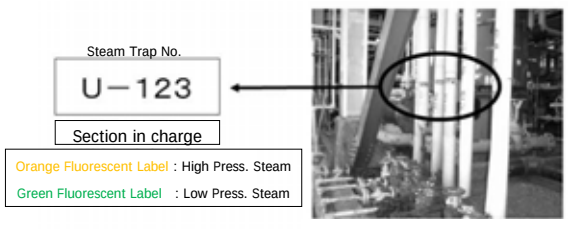
3) Confirmation of Current Status
   (1) Confirming the performance of steam traps on each type and manufacturer by actual measurements
   (2) Analysis of present conditions
   - Leaking steam quantity and the loss amount of money
   - Malfunction rate and the breakdown

4) Contents of Activities
   (1) System for Activities
   Cooperation of production section in whole refinery
   (2) Target
   - Checking all steam traps and replacing malfunctioned and inadequate steam traps
   - Reviewing previous management method of steam traps (checking intervals, criteria of replacement or repair, etc.)
   - Zero emission of loss steam

5) Contents of Countermeasures
   (1) Instruction and training about steam traps to all operators
   - Mechanics of steam traps of each type
   - Training of steam traps checking by using “steam trap checker”
   (2) Preparing “Standard” for checking and maintenance of steam traps”
   - Checking method
   - Maintenance method of malfunctioned steam traps
   - Checking interval (fundamentally every half year)
   (3) Adopting high performance steam traps (steam loss and life)
   (4) Site indications of each steam trap for easy identification

6) Effects of The Activities
   (1) Replaced numbers of steam traps in 2005
   - Total number in the refinery : 12,000
   - Replaced steam trap : 1,305 (10.9 %)
   (2) Steam saving quantity in 2005
   28,000 ton/year
   (Decrease of CO_2 emission : 6,000 ton/year)
   (3) Improvement effect and investment
   - Improvement effect (A) : about 400,000 us$ / year
   - Investment (B) : about 190,000 us$
   - Pay back period (B/A) : about 0.5 year
   (4) Another effect
   - Enhancement of the consciousness for energy conservation in the whole refinery

Reference-1 :
An Example of Site Indications of Each Steam Trap for Easy Identification



Reference-2:
Malfunction Rate of Steam Traps and Steam Loss of Malfunctioned Steam Traps

Generally, as saying

1) Malfunction Rate of Steam Traps
   In case of
   - insufficient maintenance : 15 ～ 20%
   - sufficient maintenance : under 5%

2) Steam Loss of Malfunctioned Steam Trap
   Averagely 10 ～ 15 kg/h·each

Example-6 :
Introducing IGCC (Integrated Gasification Combined Cycle)

Nippon Oil
Negishi Refinery

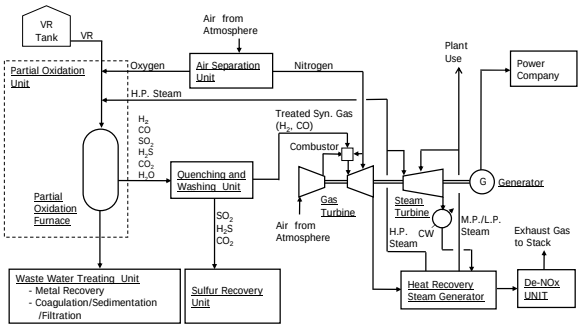
1. Reason of Introducing VR IGCC
   1) Change of demand pattern on oil products
      ⇒ Decrement of bitumen consumption
   2) Promoting IPP (Independent Power Producer) politically
   3) High power generation efficiency

   Note: VR: Vacuum Residue

2. Aspect of VR IGCC

from http://www.jgc.co.jp/

3. General Configuration of VR IGCC



4. Main Specifications of VR IGCC

Overall Power Plant	Generated Power	43.1 MW (Efficiency 46%)
	Transmitted Power	34.2 MW (Efficiency 36%)
Gasification Section Section	Gasification Method	Partial Oxidation
	Fuel	Vacuum Residue (Asphalt)
	Fuel Consumption	50,000 ton/month
Combined Cycle	Type	One Shaft Combined Cycle
Gas Turbine	Main Fuel	Synthesis Gas (Main Component : CO, H2)
	Combustion Temp.	1,350 ℃ Class
	Exhaust Gas Temp.	570 ℃
	Material for Hot Parts	Nickel Base Alloy
	Cooling Method for Hot Parts	Air Cooling
Steam Turbine	Steam Press.	High Press. 9.8 MPaG
		Medium Press. 2.9 MPaG
		Low Press. 0.7 MPaG

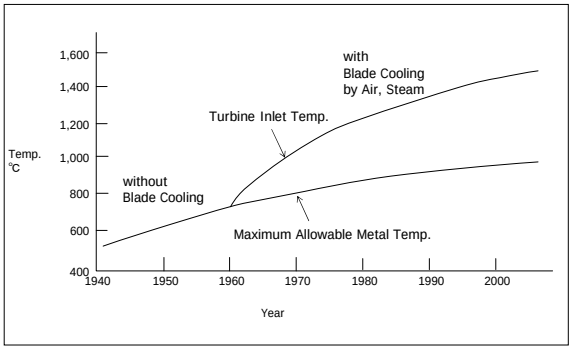
from http://www.eneos.co.jp/

5. Comparison of Thermal Efficiency and CO2 Emission between VR IGCC and BTG

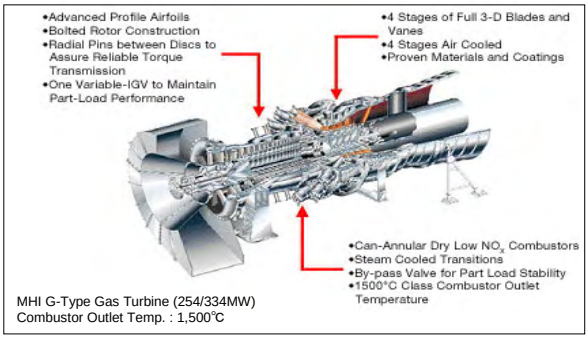
Items	VR IGCC	Boiler-Turbine Generator (Conventional)
Terminal Efficiency(LHV) %	46	39
CO_2 Emission g-CO_2/kWh	598	706

from http://www.eneos.co.jp/

Reference-1:
Progress of Inlet Gas Temperature of Gas Turbine



Reference-2:
Advanced Gas Turbine



MHI G-Type Gas Turbine (254/334MW)
Combustor Outlet Temp. : 1,500℃

Thank you very much for your attention

Steam System EE&C Technology of Japan

July 2010
JICA Study Team

Contents

Combustion Air Ratio Control

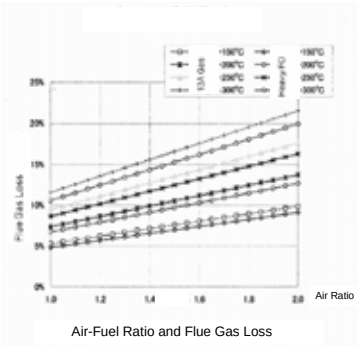
1. Excess Combustion Air Causes Energy Loss
2. Excess O_2 Reduction Saves Certain Amount of Fuel
3. Oxygen Content is the Indicator of Proper Air Ratio
4. Periodical Measurement of O_2 Concentration
5. EE&C Law of Japan regulates Adequate Air Ratio

Standard of Air Ratio at Boilers Regulated by the Law in Japan

CLASSIFICATION		Boiler Load %	Standard of Air Ratio (O2 concentration)				
			Solid Fuel		Fluid Fuel	Gas Fuel	Blast Furnace Gas and By-product Gas
			Fixed Bed	Fluid Bed			
Power Boiler		75-100	-	-	1.05-1.2 (1.0-3.8)	1.05-1.1 (1.0-2.0)	1.2 (4.0)
Others	SG > 30 t/h	50-100	1.3-1.45 (5.0-6.5)	1.2-1.45 (3.5-6.3)	1.1-1.25 (2.0-4.4)	1.1-1.2 (2.0-3.8)	1.2-1.3 (4.0-5.2)
	30t/h≧SG > 10t/h	50-100	1.3-1.45 (5.0-6.5)	1.2-1.45 (3.5-6.3)	1.15-1.3 (3.0-5.0)	1.15-1.3 (3.0-5.2)	-
	10t/h≧SG> 5t/h	50-100	-	-	1.2-1.3 (3.8-5.0)	1.2-1.3 (4.0-5.2)	-
	5t/h≧SG	50-100	-	-	1.2-1.3 (3.8-5.0)	1.2-1.3 (4.0-5.2)	-

Notes: 1) SG : Steam Generation
2) (O2 concentration) is rough values and for reference.

Air - Fuel Ratio and Flue Gas Loss



Air-Fuel Ratio and Flue Gas Loss

Gas Analyzer
Measurement Result of Exhaust Gas at 8t/h New Boiler

Date and Time	Temp. ° C	O2 (Dry) %	CO2 (Dry) %
Nov.3, '09 10:31	264.5	5.2	12.4
10:32	271.1	4.6	12.6
10:33	288.9	3.4	13.4
10:34	297.3	3.0	13.7
10:35	289.0	3.6	13.2
10:36	257.3	5.3	11.9
10:37	248.2	5.7	11.6
10:38	251.3	5.0	12.2
Ave.	271.0	4.48	12.6

Boiler Operation Condition
- Evaporation : 3.8 t/h
- Steam Press. : 10.5 bar
- Steam Temp. : 185.2 ° C (Saturate)

Thermal Insulation for Non-insulated Valves

1. Valves on Steam Line tends to be Non-insulated
2. Heat Loss from Non-insulated Valves is Huge
3. Application of Prefabricated Insulation Jacket

Non-insulated Valves in Steam System

- Flow Sheet of Steam System

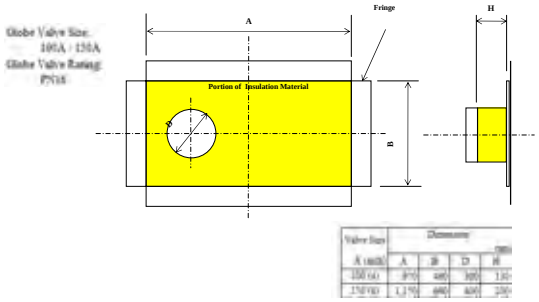
Insulation on Non-Insulated Valves

- Present Condition:
  - No insulation on steam valves, etc.
- Possible Measure for Improvement:
  - Insulation on non-insulated valves, flanges, etc.
- Premises:
  - Number of non-insulated valves : 51
  - Boiler efficiency : 85%
  - Boiler operation hours : 8,760 hours/year
- Effect:
  - Heavy Fuel Oil saving : 51ton/y, 19,200 €/y
  - Investment : 15,000 €
  - Payback period : 0.8 year

Picture of steam header

Valve insulation by insulation jacket

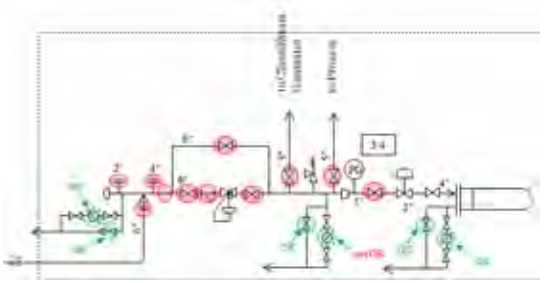
Outline of Prefabricated Insulation Jacket



Management of Steam Trap

1. Steam Condensate Drain Equipment
2. Steam Leakage from Malfunctioned Steam Traps
3. Importance of Periodical Checking and Maintenance

Steam Traps in Production line



Management of Steam Traps

- Present Condition:
  - Total steam trap number : about 40
  - No periodical checking and maintenance
  - High malfunction rate (about 30%)
- Possible Measure for Improvement:
  - Periodical checking and maintenance
  - Replacing malfunctioned ones with adequate type and capacity
- Assumption:
  - Boiler efficiency : 85%
  - Boiler operation hours : 8,760 hours/year
  - Steam loss per malfunctioned steam trap : 10 kg/h
- Effect:
  - Heavy fuel oil saving : 67 ton/year, 25,200 €/year
  - Investment : 10,000 € (1st year)
  - Payback period : 0.4 year

Reduction of Evaporation Steam Pressure

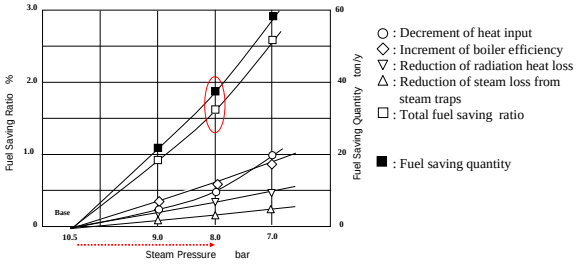
1. Energy Loss from Excessively High Steam Pressure
2. Review of Adequate Steam Pressure at Production Lines

Reduction of Evaporation Steam Pressure

- Observation:
  - Evaporation steam pressure : 10.5 bar
  - Required steam pressure at production areas : 7, 6, 3.5, 3 bar
- Possible Measure for Improvement:
  - Decreasing the steam pressure as low as possible
- Premises:
  - Pressure : 10.5 → 8 bar

    Note : The cases of 9 bar, 7 bar were calculated as well.
- Effect:
  - Heavy Fuel Oil Saving: 37 ton/y, 13,900 €/y
  - Investment : None

The lower the pressures, the better the fuel saving ratio.



Fuel Saving Ration and Fuel Saving Quantity

High Investment and High Return

1. Steam Condensate Recovery
2. Installation of Economizer at Boiler

Steam Condensate Recovery

- Present Condition:
  - No steam condensate recovery considering ingress of impurities
- Possible Measure for Improvement:
  - Condensate recovery with the required safety device
- Premises:
  - Condensate recovery rate : 50%
  - Recovered condensate temp. : 90 ° C
- Effect:
  - Heavy fuel oil saving: 118 ton/year, 44,400 €/y
  - Investment : 100,000 €
  - Payback period : 2.3 year

Installation of Economizer at 8t/h Boiler

- Present Condition:
  - No economizer
  - Exhaust gas temperature : 250 - 300 ° C
- Possible Measure for Improvement:
  - Installing economizer on the exhaust gas duct
- Premises:
  - Preheated boiler feed water temp. : 20 ° C
    >> Fuel saving ratio : 2.9%
- Effect:
  - Heavy fuel oil saving: 55 ton/year, 20,700 €/y
  - Investment : 70,000 €
  - Payback period : 3.4 year

Thank you
for your attention!

Compressed Air EE&C Technology of Japan

JICA Study Team TAKAHASHI
14, July, 2010

CONTENT

1.Compressed air system audit of a machinery manufacturing factory in Japan

2. Operation improvement and leakage improvement

3. Estimated power saving of compressed air system = 22%

Where are the EE&C potentials

High potential Energy Saving in this Factory

(1)Steam system

Heating

(2)Compressed air system

Pneumatic control and blowing

Measurement Audit of Compressed Air System

Target : Compressed Air System

1. Improvement of Air Compressor Operation
2. Reduction of Leakage Loss

Compressor Specification

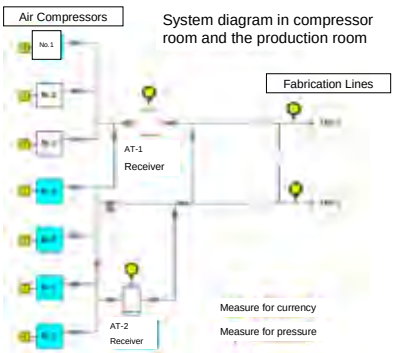
250kW 4units

Atlas Copco GA250

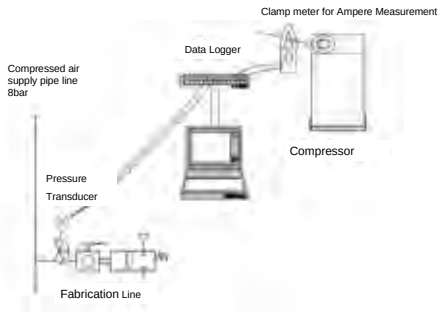
Annual Power Consumption

3 618MWh

Compressors Operation Analysis



Measurement

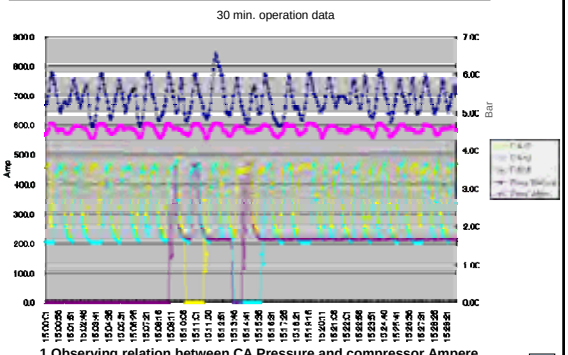


Measurement Instrument

Data Logger for Ampere and Pressure Measurement

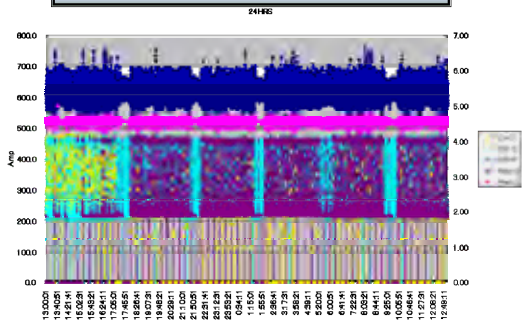
HIOKI 8430 MEMORYHILOGGER (HIOKI HP)

Operation Data of 30 minutes



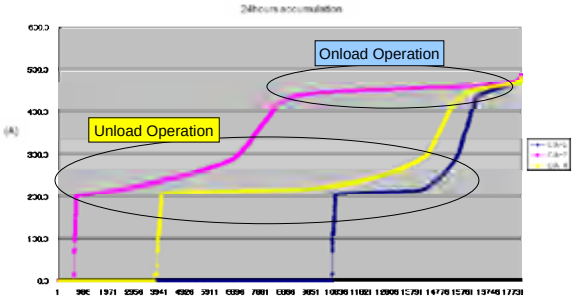
1.Observing relation between CA Pressure and compressor Ampere
2. Observing on load, unload and idling operation of 3 compressors

24hrs Measured Data



Observing 24hours operation and pressure of compressed air system

Analysis of Measured Data



Total numbers during 24hours operation

		CA-2	CA-3	CA-4	Average
Stop	Below 20A	59%	4%	21%	28%
Unload	Below 300A – 20A	27%	35%	58%	40%
Onload	300A and Above	14%	61%	21%	32%

Countermeasure for Power Saving

1. Adequate pressure setting for each air compressor

2. Application of variable speed drive compressor

Reduction of Unload Operation

Power Consumption = √3 X kV X A X PF X Running Hour

Voltage	0,38kV
Unload operation current	210 A
PF(Power factor)	70%
Unload operation hours	7 200 hr/y

$P = \sqrt{3} \times 0{,}38\ kV \times 210\ A \times 0{,}7 \times 7\ 200\ hr$

= 696 616 kWh/y

Detection of Compressed Air Leakage

1. Compressed air leaks from the CA pipe lines of the factory

2. Noise from products operation disturbs leakage detection by operator's ears

3. Ultrasonic air leakage detector helps easy detection

Ultrasonic Air Leakage Detector

Monarch VPE 1000 (Monarch HP)

Air Leakage Loss

1mm Hole 4m^3/h 0,4kWh

(Experimental leakage power loss)

80 leakage points during 1 hour survey

0,4kWh /2 x 80 x 24hrs x 300days

(Leakage prevention makes onload operation to unload operation)

= 115 200 kWh

Power Saving from Compressed Air

Original power consumption	3 618MWh
Saving from unload reduction	696MWh
Saving from leakage reduction	115MWh
Saving amount	811MWh (22%)

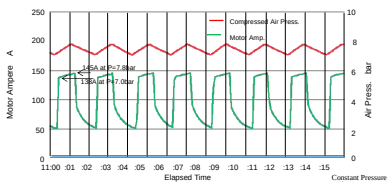
Actual countermeasure

Adequate pressure setting of Feed in and out for compressors

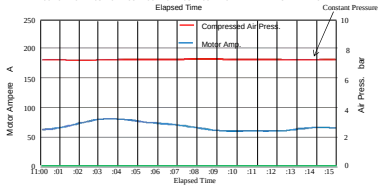
Periodical leakage detection by ultrasonic leakage detector

Application of VSD Control

Load/Unload Control



Inverter Control



EC Points of Compressed Air System

1. Elimination of unnecessary unload operation
2. Setting adequate pressure
3. Prevention of air leakage
4. Energy saving blow nozzle
5. Adequate suction air temperature
6. Utilization of exhaust heat from air cooler
7. Application of blower

Thank you for your attention

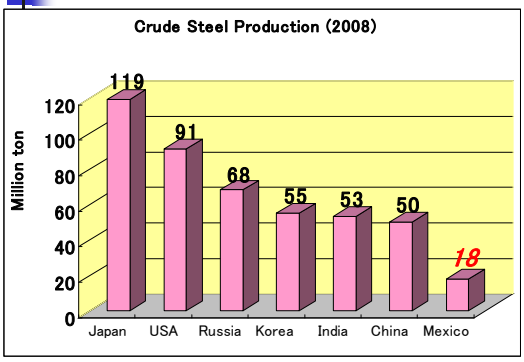
Energy Conservation Measures on Steel Making Plant

JICA Advisor

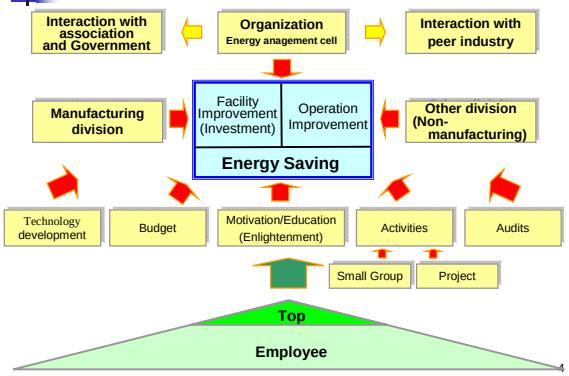
Yoshiharu IKEUCHI

Contents

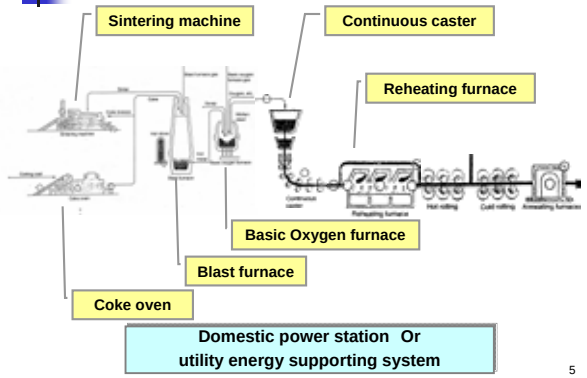
1. Crude Steel Production in Each Country



2. Energy Saving Activity

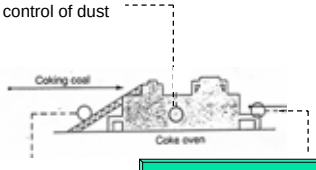


3. Process Flow on Integrated Steel Making Plant



4. Coke Oven / Energy Saving Measures

- Automatic combustion control
- Rotation speed control of dust collector fan

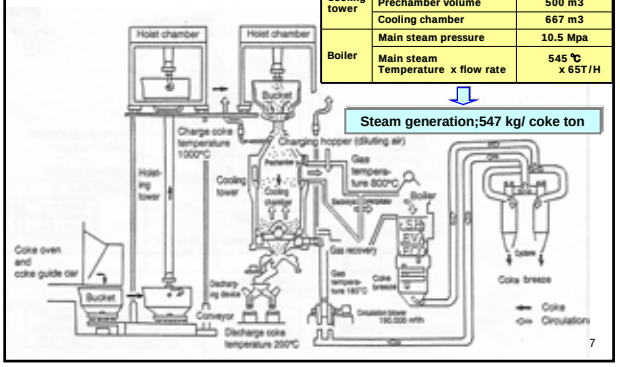


Coal moisture control

Coke dry quenching
(Steam recovery, electric power recovery)

4. Coke Oven / Coke Dry Quenching

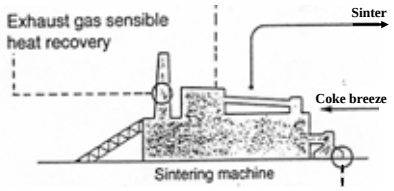
Item		Specification
Cooling tower	Coke treaty capacity	150 T/H
	Prechamber volume	500 m3
	Cooling chamber	667 m3
Boiler	Main steam pressure	10.5 Mpa
	Main steam Temperature x flow rate	545 ℃ x 65T/H



Steam generation;547 kg/ coke ton

5. Sintering Machine / Energy Saving Measures on Sintering Plant

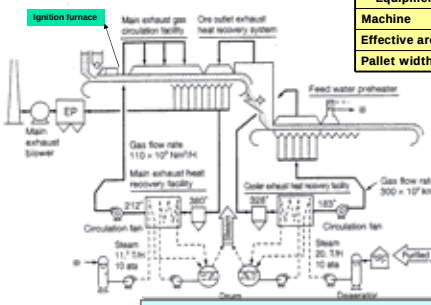
- Fuel saving measure in ignition furnace
- Rotation speed control of main exhaust fan
- Increase of layer thickness of sinter



Waste heat recovery from sinter
(Steam recovery, electric power recovery)

5. Sintering Machine / Waste Heat Recovery from Sintering Plant

Equipment	Specification
Machine	Dwight-Lloyd
Effective area	222m²
Pallet width	3,700mm

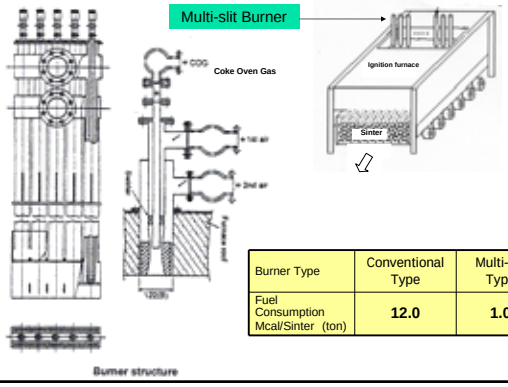


Cooler
Effective area:280m²

Recovery Steam = 8.6T/H (main Exhaust gas) + 17.2T/H(Coller)
= 25.8T/H (1Mpa,260 ℃)

5. Sintering Machine / Effective Burner on Ignition Furnace

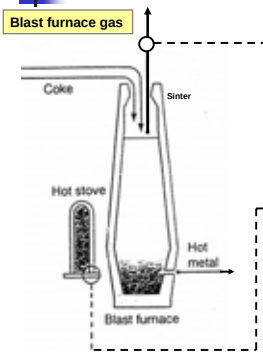
Multi-slit Burner



Burner Type	Conventional Type	Multi-slit Type
Fuel Consumption Mcal/Sinter (ton)	12.0	1.0

6. Blast Furnace / Energy Saving Measures

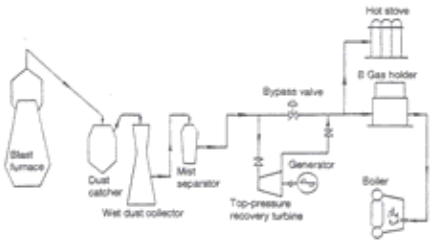
Blast furnace gas



- Pulverized coal injection to BF
- Top pressure recovery turbine
- Rotating speed control of dust collector fan

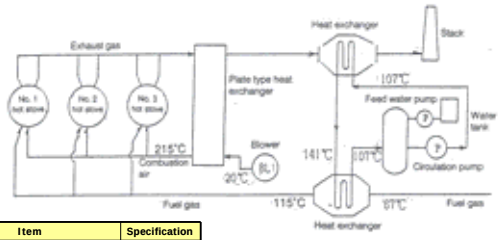
- Hot stove waste heat recovery (Combustion air preheating, Fuel preheating)
- Higher efficiency of blast furnace blower

6. Blast Furnace / Top-pressure Recovery Turbine



Item	Specification
Gas pressure	0.162 Mpa
Gas temperature	58 ℃
Generation output	7,000 kW
Turbine type	Axial flow three-stage expansion type

6. Blast Furnace / Heat Recovery from Waste Gas of Hot Stove (Preheating for combustion air & Fuel)



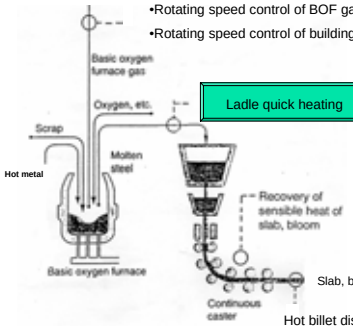
Item		Specification
Combustion Air	Air flow rate	63,200m3/H
	HE type	Plate type
	Heating area	2,131 m2
Fuel gas	Fuel gas flow rate	83,600m3/H
	HE type	Multi-tube type
	Heating area	1,575 m2

	From	To
Combustion air	20℃	215℃
Fuel gas	67℃	115℃

Recovery energy
28 x 10⁹ cal/year
9 x 10⁹ kcal/year

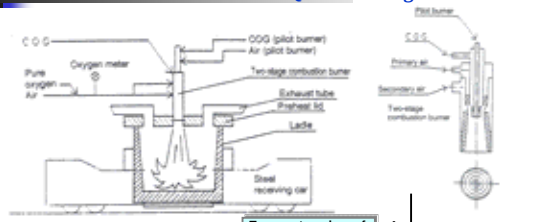
7. Basic Oxygen Furnace & Continuous Casting Machine / Energy Saving Measures on BOF & CCM

- Improvement of recovery basic oxygen furnace gas (BOF)
- Rotating speed control of BOF gas induction fan
- Rotating speed control of building dust collector fan



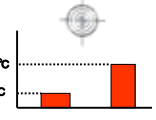
Hot billet discharging from CCM (Continuous casting machine)

7. Basic Oxygen Furnace & Continuous Casting Machine / Effective Burner for Ladle Quick Heating



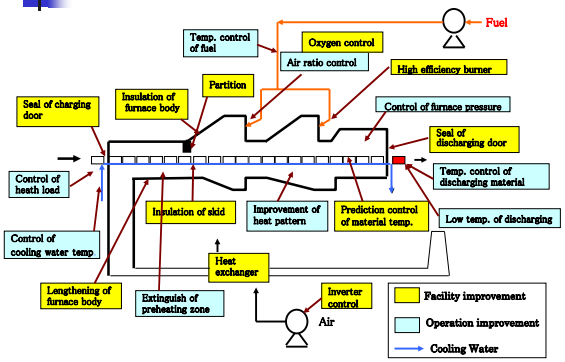
Item		Specification
Type		Ladle preheating
Heating temperature		Max:1,600 ℃
Fuel		Coke oven gas
Oxygen enrichment		21% to max. 60%
Burner	Capacity	600 x 104 kcal/h
	Type	Two-stage combustion

Temperature drop of molten steel can be suppressed by 12 ℃ in average

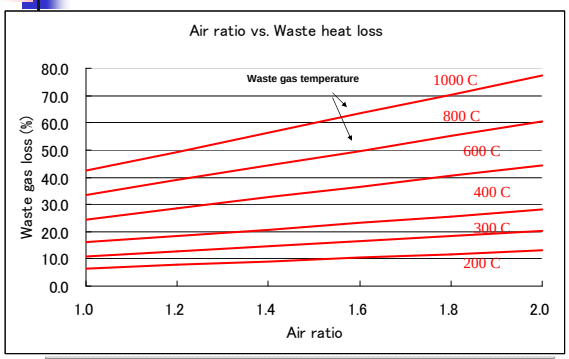


Type	Conventional	New type
COG flow rate Nm3/h)	400	1,200
O2 enrichment	21	60
Heating time (min)	15	15

8. Reheating Furnace / Energy Saving Technology on Reheating Furnace

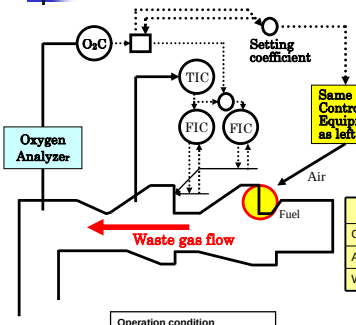


8. Reheating Furnace / Air ratio vs. Waste heat loss



Air ratio (m) = 21%/(21% - O2 %) O2% is oxygen content in waste gas

8. Reheating Furnace / Oxygen Control in Waste Gas

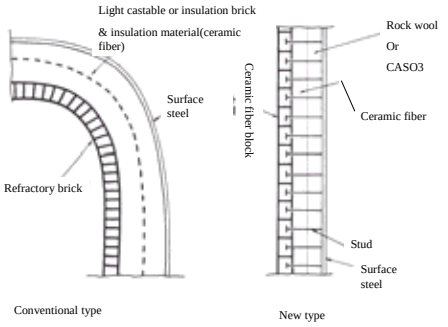


	Before	After (O2 control)
O2 content	5%	1.5%
Air ratio	1.31	1.08
Waste gas loss	42%	36%

Operation condition
Outlet waste gas temp.:800℃

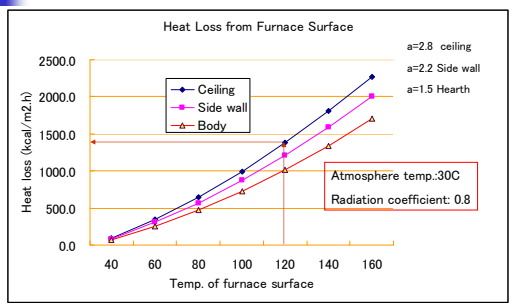
Reduction of fuel consumption: 6%

8. Reheating Furnace / Insulation of Furnace



Weight of furnace wall will be 1/10-1/20 of conventional
And heat loss from surface becomes small

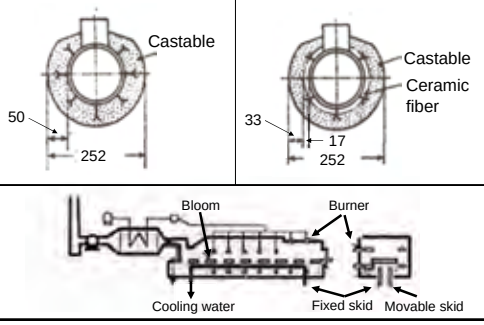
8. Reheating Furnace / Heat Loss from Furnace Surface



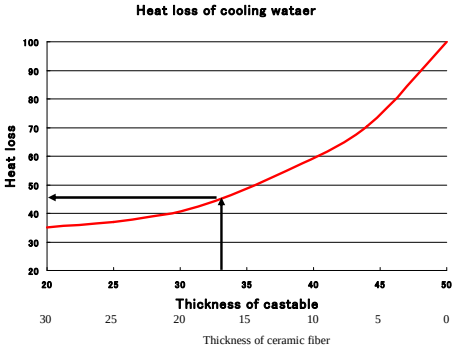
$Q=a*(t-b)^{(5/4)}+4.88*\varepsilon\,(((t+273)/100)^4-((b+273)/100)^4)$

8. Reheating Furnace / Insulation on Skid Pipe

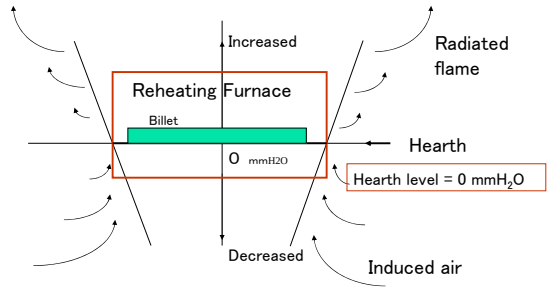
Conventional	Improvement
Size of skid pipe	Size of skid pipe



8. Reheating Furnace / Effect of Ceramic Insulation

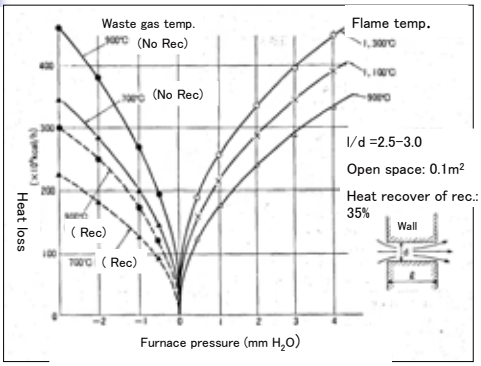


8. Reheating Furnace / Furnace pressure



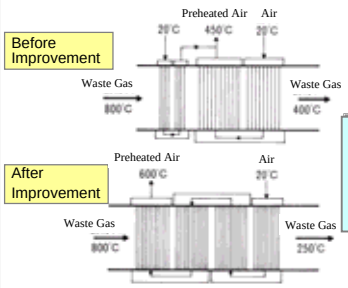
1m ≒ 1mm H_2O in reheating furnace

8. Reheating Furnace / Furnace pressure vs. Heat loss from open space



Furnace pressure vs. Heat loss of open space

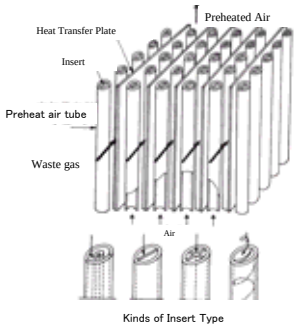
8. Reheating Furnace / Increasing Heat Transfer Area



Item	Before	After
Area of heat transfer	652 m2	1,434 m2
Dia. of pipe	61 ϕ	45 ϕ
Pieces	288 & 1,368	4,176

Specific energy consumption:
300,000kcak/t
⇩
270,000kcal/t

8. Reheating Furnace / Improvement of Heat Exchanger



Kinds of Insert Type

Q = U x A x T

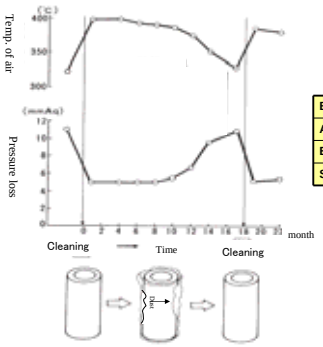
Heat Transfer = Coefficient of heat transfer x Area of heat transfer x Temperature

(kcal/h) = (kcal/m2.h.C) x (m2) x (C)

⇩

Improvement of U

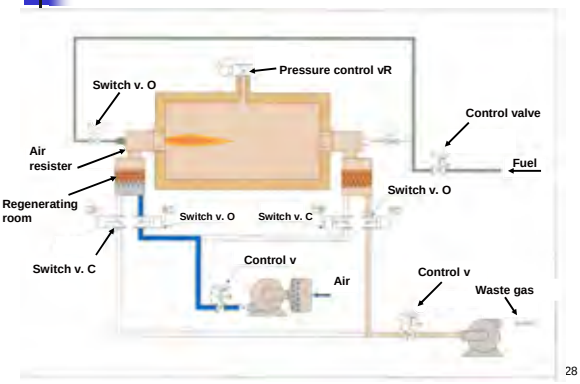
8. Reheating Furnace / Cleaning of Heat Exchanger



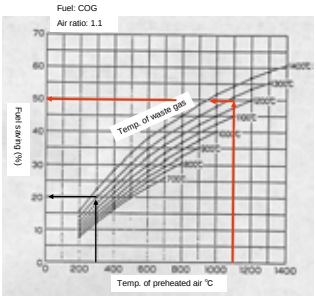
Effect of Cleaning

Before	400,000 Kcal/T
After	384,000 Kcal/T
Effect	16,000 Kcal/T
Saving rate	4 %

8. Reheating Furnace / Regenerative Burner



8. Reheating Furnace / Fuel Saving vs Waste Gas Temperature

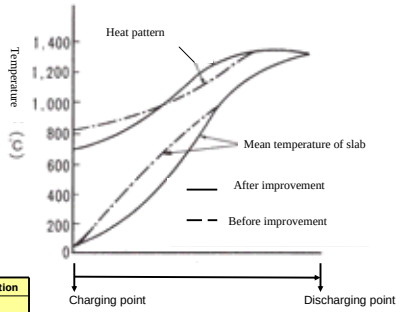


Temperature of preheated air can be raised more than 1,000 ℃

⇩

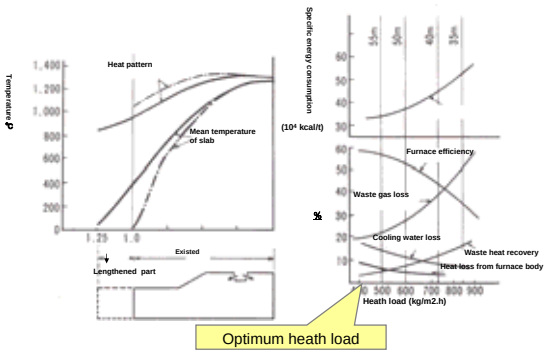
Fuel consumption can be saved more than 30%

8. Reheating Furnace / Heat pattern



Heat pattern	Fuel consumption
— · —	100%
———	93%

8. Reheating Furnace / Lengthening Furnace Body



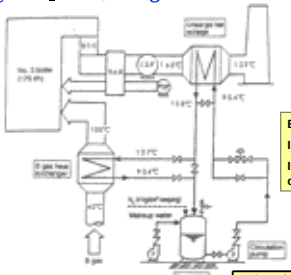
Optimum heath load

9. Domestic Power Station & Utility Energy Supplying System / Energy Saving Measures

Domestic power station and utility energy supplying system

- Rotating speed control of pump for boiler
- Preheating fuel gas
- O2 control of flue gas of boiler
- Installation of high efficiency air preheater
- Installation of cogeneration facility
- Total energy control system

9. Domestic Power Station & Utility Energy Supplying System / Preheating Fuel Gas



Effect

Increase of boiler efficiency: 1.6%

Increase of power generation output: 480kW

Exhaust gas heat exchanger		
Type : Fin tube type		
Heating area		4,290m2
Shell side	Exhaust gas	222,870 Nm3/hj
	Temperature	Inlet:160C outlet:123C
Tube side	Purified water	60 t/h
	Temperature	Inlet:90.4C Outlet: 138C

BFG gas heat exchanger		
Type: Fin tube type		
Heating area		3,411 m2
Shell side	BFG gas	142.000 Nm3/hj
	Temperature	Inlet:40C outlet:1100C
Tube side	Purified water	60 t/h
	Temperature	Inlet:137C Outlet: 190.4C

10.Excellent Specific Energy Unit on Steel Making Plants in Japan (Similar Bench mark)

	Item	Dimension	Value
Coke Oven	Steam generation	Kg/ton	600
	Energy consumption	MJ/ton	2,100
	COG generation	Nm3/ton	340
Sintering Plant	Steam generation	Kg/ton	126
	Energy consumption of ignition furnace	MJ/ton	5
Blast furnace	BFG generation	Nm3/ton	2,000
	Electricity generation by TRT	kWh/ton	47
	Energy consumption of HS	MJ/ton	1,600
Basic Oxygen Furnace	BOF gas generation	Nm3/ton	270
Energy consumption of Reheating furnace	Hot strip mill	MJ/ton	700
	Plate mill	MJ/ton	1,100
	Structure mill	MJ/ton	1,300
	Bar mill	MJ/ton	1,200
	Wire mill	MJ/ton	1,200
	Seamless pipe	MJ/ton	2,900

A

Big

Thank You !!

Energy Efficiency in Commercial Sector

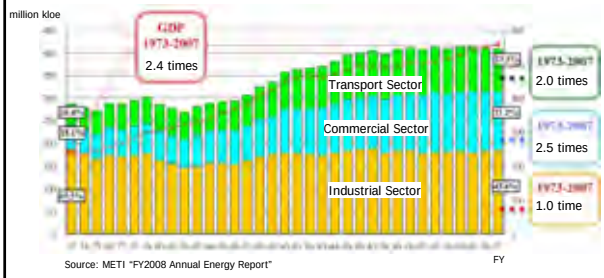
July 2010
JICA Study Team
Madoka Nakashima

Contents

1. Statistics
   - Commercial Sector
2. Measures for Energy Efficiency
   - Regulations etc.
3. Technology for Energy Efficiency

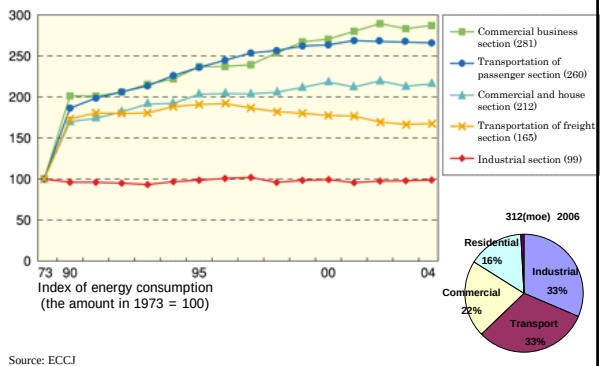
Statistics

Final Energy Consumption by Sector



Source: METI "FY2008 Annual Energy Report"

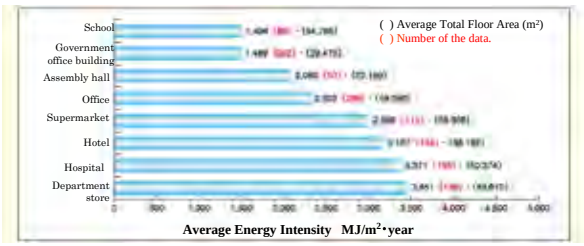
Final Energy Consumption by Sector



Source: ECCJ

Energy Intensity by Building Type of Commercial Sector

- Energy intensity = energy consumption per floor area



Source: ECCJ

Proportion of Energy Consumption by Usage (1)

Source: ECCJ

Proportion of Energy Consumption by Usage (2)

Source: ECCJ

Measures for Energy Efficiency

Overall EE&C measures in Japan

		Industrial Sector	Commercial Sector		Transport Sector
			Building Sector	Residential Sector	
Regulation	Energy Conservation Law	Building Code for Energy Efficiency / The Energy Management Regulation System (EMS) / Minimum Standards for Equipment The Top-Runner Program			Regulations for transportation
Incentive	Subsidy	Grants for purchasing energy-efficient (EE) equipment and cars			
	tax reduction, low interest public loan	Special depreciation or tax mitigation for EE equipment			
		Public loan for small & medium companies purchasing EE equipment		Tax reduction for EE houses	
	Others	Awarding scheme, Offering energy efficiency diagnoses tools, Offering information, etc.			

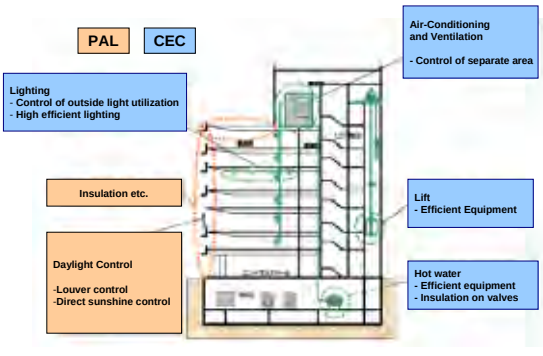
Building Code for Energy Efficiency

- Energy Efficiency Plan
  - Minimum standards of energy performance of building; Under the Energy Conservation Law
  - Mandatory submission when construction or major retrofit (over 2,000 m² (total floor area)

Two Indicators

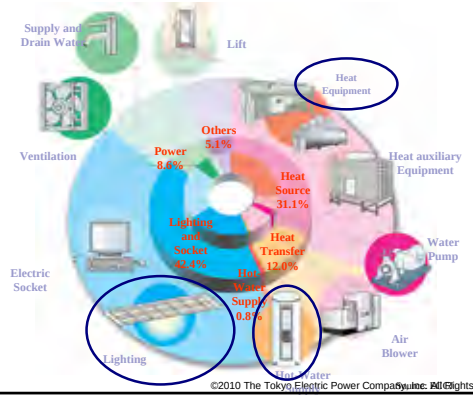
- **PAL (Perimeter Annual Load)**
  - Indicate level of heat loss through envelops (walls and windows)
  - PAL = thermal load of inside perimeter area (MJ/year) / floor area of inside perimeter area (m²)
- **CEC (Coefficient of Energy Consumption)**
  - Indicate energy efficiency of each equipment
    - AC, V, L, HW and EV
  - CEC = **Annual** Energy Consumption (MJ/year) / Annual **Standardized** Energy Consumption (MJ/year)
  - **Special software for calculation**

Building Code for Energy Efficiency



Technology for Energy Efficiency

Energy Use Structure in Office Building

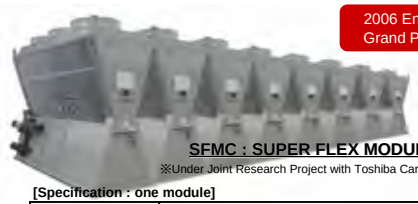


Today's Examples

- Heat Pump
  - Efficient Heat Generating Equipment (HP Chiller)
  - HP Water Heater (Eco-Cute)
- Efficient Lamp and Lighting Control System

Heat Generating Equipment

ex: Efficient Air-Cooled HP Chiller



2006 Energy Conservation Grand Prize <Gold Medal>

SFMC : SUPER FLEX MODULE CHILLER

※Under Joint Research Project with Toshiba Carrier Air Conditioning Corp.

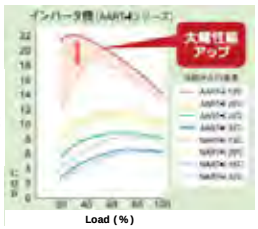
[Specification : one module]

Capacity (cooling) (heating)	95kW (high efficiency model) 90kW	85kW (standard model)
COP (cooling) (heating)	COP 4.8 (high efficiency model) COP 3.8	COP 3.6 (standard model)
Size	L3.0 × W1.0 × H2.3m	

・SFMC can combine the module from 3 to 12.
・Target floor size in office building : about 1,000 – 10,000 m²
・Flexible combination of "heat pump type (both cooling and heating)" and "cooling only type" is also possible to meet heating load.

ex: An Efficient Centrifugal Chiller

Variable Speed Drive Centrifugal Chiller
- Air conditioning for factories, IT centers, large commercial buildings etc.
- Capacity range: 230 – 4,000 USRT
- Highest **partial** load efficiency: COP 21.9!

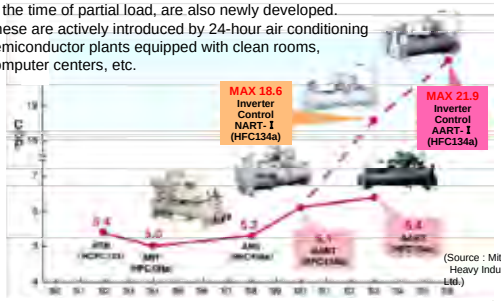


Best Energy Efficient Appliance Award (2007)

Variable Speed Drive Centrifugal Chiller
(Source: Mitsubishi Heavy Industries)

Changes in Performance of Centrifugal Chillers

- Centrifugal chillers are mainly used for air conditioning in large facilities such as buildings and factories.
- Advanced centrifugal chillers, of which the efficiency is increased to **COP=20 or higher by inverter-controlled** variable-speed operation at the time of partial load, are also newly developed.
- These are actively introduced by 24-hour air conditioning semiconductor plants equipped with clean rooms, computer centers, etc.

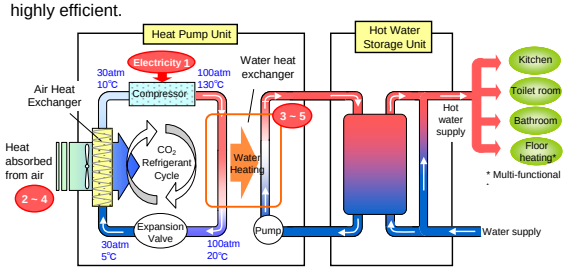


(Source : Mitsubishi Heavy Industries, Ltd.)

Heat Pump Water Heater

What is "Eco Cute" ?

The **natural refrigerant (CO_2)** heat pump water heater, **"Eco Cute",** is highly efficient.

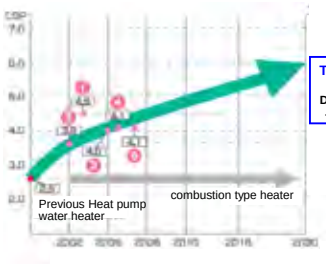


1 (Electric Energy) + **2~4** (Atomospheric Heat) = **3~5** (Available Hot Water Supply)

※"Eco Cute" is the name used by the electric power companies and water heater manufactures when they call the natural refrigerant (CO_2) heat pump water heaters.

TEPCO's Development of Heat Pump Water Heater for Business Use

- For hotels, hospitals, sports facilities, stores and restaurants



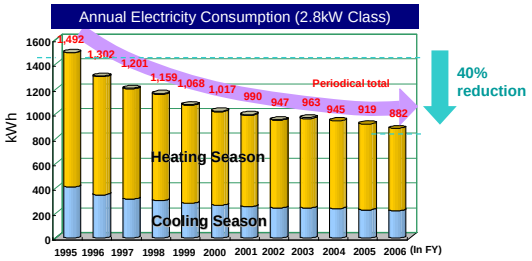
TEPCO Joint Develop-ment

1. "Hot Power Eco BIG" (Toshiba Carrier) (28kW) COP4. 5
2. "Eco Cute" (Nihon Itomic Co.) (26.3 kW) COP3.8
3. "Eco Cute" (Daikin Industries) COP4.1
4. "Eco Cute" (Hitachi Appliances) COP4.1
5. "Eco Cute" (Mitsubishi Electric Works) (40 - 320 kW) COP4.1

Efficient Air Conditioner (AC) for Home Use

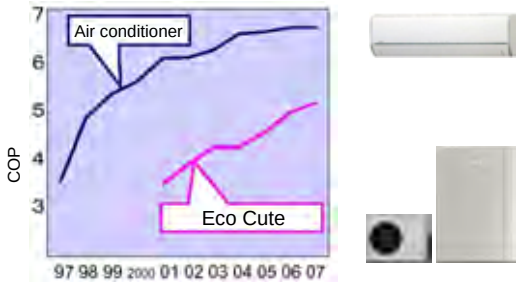
Efficiency Improvement of House AC

- The annual electricity consumption for heating and cooling decreased by about **40%** in past ten years.
- Recently, air conditioners with close to **COP 7** have made their debut.



※Cooling and heating AC, 2.8kW cooling capacity, average consumption of high class products.
※Annual electricity consumption is calculated by the standard of "Japan Refrigerator and AC Industry (JRA4046)"
Source: Association of Japan Refrigerator and Industry

Efficiency Improvement



Efficiency of air conditioners and Eco Cute increased twice as high and 50%, respectively.

Efficient Lighting System

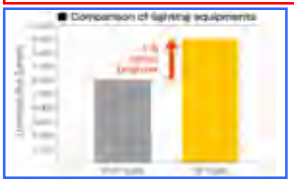
High-efficiency lamp and Lighting control system

High-efficiency lamps (HF: high frequency)

- 1.5 times brighter than conventional FLR lamps
- reduce the initial setup cost and running cost (the number of lamps)

Lighting control system

- Control artificial light to maximize daylight use
- Continuous dimming function of the HF lamps



Thank you for your kind attention!

A Case of Energy Efficiency in Hospital Japan

July 2010
JICA Study Team
Madoka Nakashima

An ESCO project at Tokyo Metropolitan Hiroo Hospital

- The first ESCO competition by Tokyo Metropolitan Government.
- JFS (Japan Facility Solutions Inc.): an ESCO, one of the TEPCO's subsidiaries
- The Golden Prize of Best ESCO Projects in Japan

Location	Shibuya ward, Tokyo
Building size	8 stories + 2 stories underground
Total floor space	36,511 m2
Construction	October 1980 (28 yrs)
Electricity demand	2,168kW
Total energy consumption	188,075 GJ/year
Expenses for utilities	2,700,000 euros/year

- A variety of medical cares including emergency/disaster medical care, cardiac medicine and cerebral vessel medicine.
- 500 beds and 800 outpatients/day.

Overview of the Results

Energy Consumption and CO2 Emission Reduction

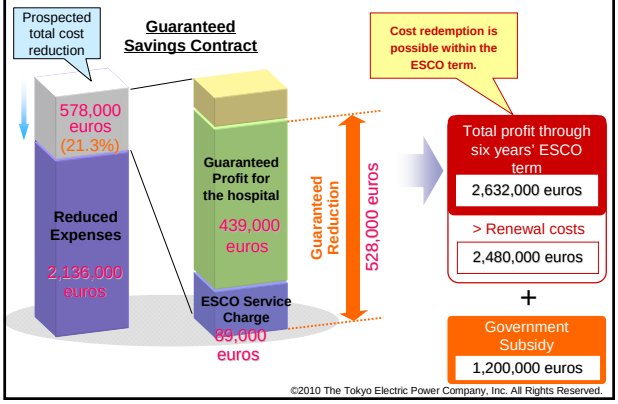
	Primary Energy	CO2 Emission
Reduction	28% (61,166 GJ/yr)	29% (2,795 t-CO2/yr)

Cost and Profits

Case	Cost for Retrofit	Cost Savings	Payback Period	Remarks
Without Subsidy	€ 2,480,000	€ 439,000/yr	5.65 yrs	ESCO fee, € 89,000, is excluded from Cost Savings
With Subsidy	€ 1,280,000 (Subsidy: 1,200,000)	€ 439,000/yr	2.9 yrs	

Notes:
- Cost savings in the table are the guaranteed amount. Actual savings is 489,000 euros/yr.
- Project hasn't been completed yet. (contract period: 2005-2011)

Cost and Profits as an ESCO Service



EE&C Measures and Effects

Applying various energy saving techniques

Reduce Heat Load Itself	1) Reduce the volume of outdoor air intake according to indoor CO2 density 2) Optimize cool and re-heat process in double coil AHUs by allowing small temperature and humidity fluctuation	6%
Produce Heat Efficiently	3) Renew refrigerators / boilers for higher efficiency (Heat generation equipment retrofit) 4) Produce chilled water only with cooling tower operation under low outdoor air temperature (Free Cooling)	12%
Heat Transport & Ventilation Efficiently	5) VWV control 6) VAV control 7) Intermittence drive of AHUs and ventilation fans	10%

Energy Saving Rate About 28%

Each EE&C Measure

A. Heat Generating Equipment/System

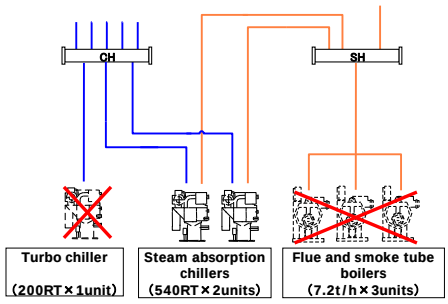
Cogeneration system (CGS) is considered to be advantageous as a heat generating equipment, especially for hospitals due to the great amount of thermal demand.

Having examined from various viewpoints such as energy consumption, CO_2 emission, overall cost including construction cost, cost, administrative and maintenance cost, etc.

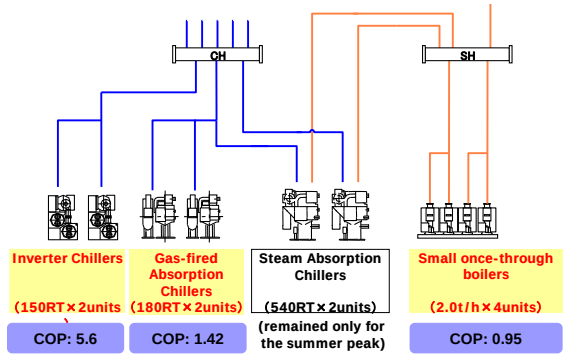
Concluded;

- Most reasonable
  - to optimize the heat generating capacity
  - to shift from fuel to electricity in actual operation
- Also important; power interruption during construction can be avoided without CGS.

Before Retrofit



After Retrofit



Heat Generating Equipment

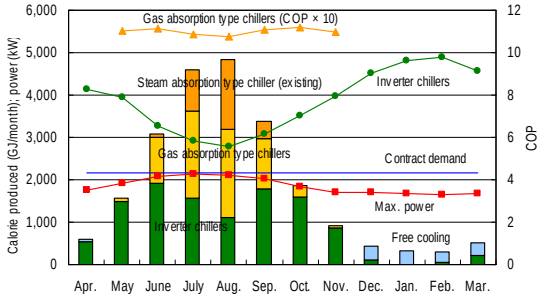
Inverter chillers
(150RT×2units)

Gas-fired absorption chillers
(180RT×2units)

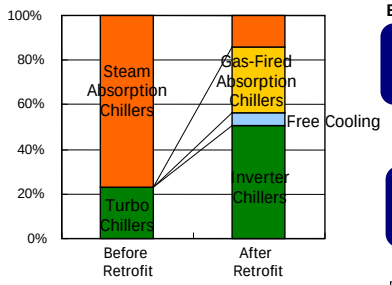
Small once-through boilers
(2.0t/h×4units)

Generated Heat for Cooling

Shift from gas to electricity, controlling the power demand



Amount of Heat Generated for Cooling



Before

About 80% by Steam Absorption Chillers.

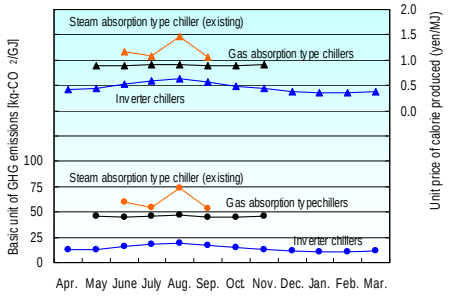
After

More than 50% by Inverter Chillers.

Parameter	
Electricity	9.83 MJ/kWh
Gas	44.064 MJ/kWh

COP improved from **0.75** to **1.45**

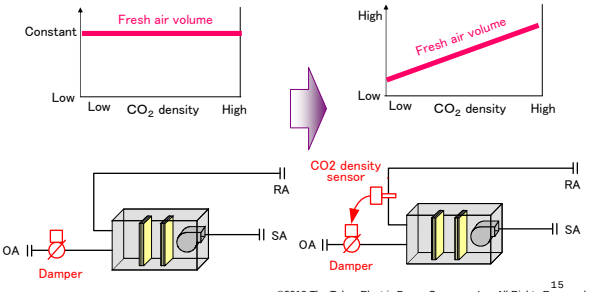
Comparison of CO2 and cost intensity



B. Optimum Control of Fresh Air

Reduce fresh air volume according to CO2 sensor

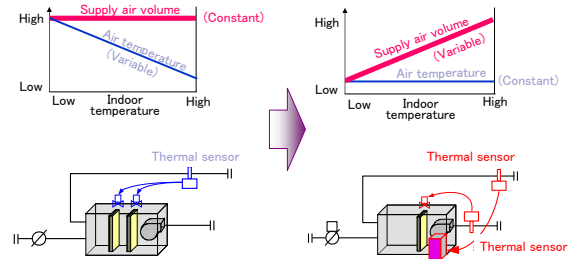
Before	After



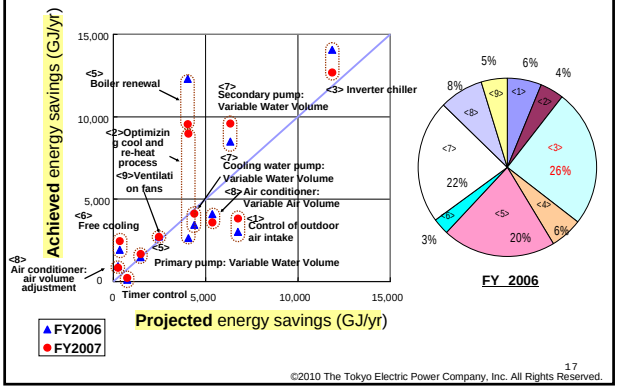
C. VAV: Variable Air Volume (AHU) Control

Control supply air volume according to indoor temperature instead of controlling supply air temperature

Before	After



Overall Results of Energy Saving



FY 2006

Thank you for your kind attention!

A Case of Office Building:

Energy Management in
Tokyo Electric Power Company
(Head Office Building)

July 2010

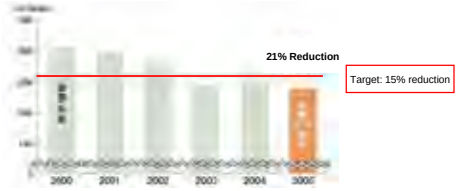
Contents

- Results as a Company
- Results of TEPCO Head Office Building
- Measures Implemented
- Energy Efficient Equipment

TEPCO as a whole

Electricity use has decreased and remained mostly level since 2003.

- Company-wide environmental goal
  The amount of electricity use for five years from 2001 to 2005 should be decreased by 15% compared to 2000.
- Results of measures
  - The reduction rate of 2005 was 20.9% compared to 2000, and the goal was reached.
  - **We received 2006's award for global warming prevention activities from the Minister of the Environment (measure and activity implementation category)** for our efforts in reducing the use of water, copy/printing paper and gasoline.



* Applicable to the head office, branch offices, power system offices, and East and West Thermal Power offices

Efforts for Energy Saving
in Tokyo Electric Power Company Head Office Building

Tokyo Electric Power Company Head Office Building:
The managerial function of TEPCO, and its central function of power supply are placed in the building.

- Total floor areas: 50,598 m2, Year of completion: 1972, Structure: SRC -

- Energy saving measures taken
  at the construction of the building
- Energy saving measures after COP3
- Response to Energy Conservation Law,
  Energy Management System

Energy saving measures taken at the construction of the building

Since 1972

■ Energy saving measures taken when constructing the building

Building completed in 1972 (38 years ago)

◆ Adoption of large air conditioners using chilled/hot water:

Highly efficient operation of heat generating equipment through rated and nighttime operation

◆ Adoption of turbo refrigerating machines and heat pumps:

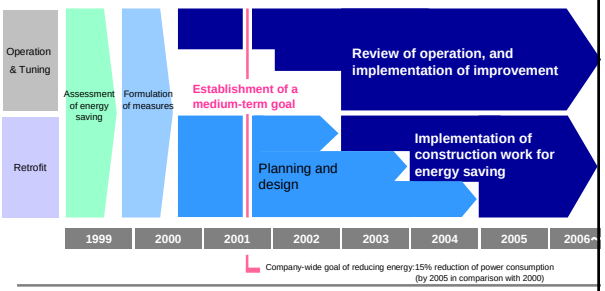
Production of heat with one third of energy using heat from the air

As a forerunner of a thermal storage type air conditioner and heat pump, the building contributed to popularizing later models of thermal storage type air conditioners and heat pumps.

Energy saving measures after COP3

Since 1997

Implementation of systematic energy saving measures



Formulation, planning, and implementation of energy saving measures based on the assessment of energy saving

Assessment of energy saving from 1999

◆ Establishment of a work group on energy

Establishment of a work group to analyze the current situation and formulate medium- and long-term plans

◆ Implementation of the assessment of energy

- Examination of drawings
- Walk-through survey
- Analysis of operational data

Formulation of medium- and long-term energy saving measures

Improved operation of heat generating equipment for AC since 2000

◆ Improved operation of a heat generating system for air conditioning

Improved operation for more efficient operation

◆ Examination of freezers in the Kitchen

Improvement of energy-consuming facilities based on data analysis

Response to the Energy Conservation Law

Since 2003

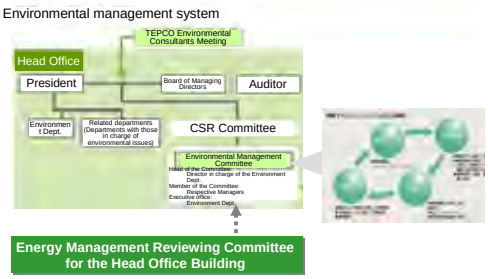
Assessment of energy saving from 1999

- Re-Establishment of Energy Management System
  - Clarification of responsibilities
  - Implementation of PDCA cycle
- Promotion
  - Management through company wide system (up-stream)
  - Promotion to building occupants (down-stream)

Response to the Energy Conservation Law

- Management through a company-wide environmental management system (upstream side)

Environmental management system



- Promotion to building users, using intranet

Further Implemented Measures

Since 2005

Further implemented Measures

Equipment

- Adoption of a floor-by-floor air conditioning system, a VAV air conditioning system, and total heat exchangers
  — Reduction: about 2.0%
- Adoption of highly efficient turbo refrigerating chillers
  — Reduction: about 1.1%
- Adoption of EcoCute for business use (water heater with a CO2 refrigerant)
  — Reduction: about 0.7%

Further Implemented Measures

Activities

- Improvement of the Energy Management Standards
  — Creation of usable standards
  in line with the actual conditions of the Head Office Building
- Stabilization of the PDCA cycle
  — Creation of a system for autonomous energy saving

Retrofit of TEPCO Head Office Building

Turbo Refrigerating Chiller

- Substantial reduction of CO_2 emissions through high efficiency

  Energy efficiency (a coefficient of performance **(COP)* = 6.4** (*catalogue value))

  Efficiency was improved by **28%** in comparison with conventional machines (10-year models of the same manufacturer) through consolidated high performance technology, and improved compressors and heat exchangers.

- Highly efficient and economic

  A reduction of approximately **40%** in electric power expenses in comparison with conventional machines (10-year models from the same manufacturer)

<Cooling tower>

<Turbo refrigerating machine>

Plate-Type Exchanger

- Mechanism

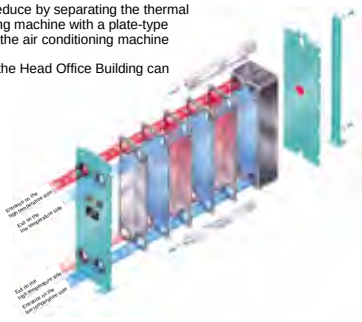
  A machine to exchange the heat of cold water (or hot water) in a thermal storage tank, and circulated water in an air conditioning machine.

- Energy saving quality

  Power for transmitting water can reduce by separating the thermal storage tank and the air conditioning machine with a plate-type exchanger, and closing circuits on the air conditioning machine side*.

  * The total power consumption of the Head Office Building can be reduced by about **5%**.

<Outer appearance of a plate-type exchanger>



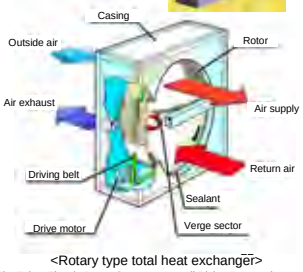
Rotary Total Heat Exchanger (Air Conditioning Machine)

- Reduction of air conditioning energy

  The thermal load of fresh outside air (intake) is reduced by recovering total heat or sensible heat from exhaust air for supply air through the rotation of a rotor*.

  * The total power consumption of the Head Office Building was reduced by about **1%**.

<Air conditioning machine>



<Rotary type total heat exchanger>

EcoCute for business use

- Environmental conservation

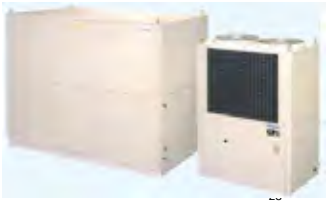
  EcoCute use a non-toxic, non-flammable, and idealistic natural refrigerant (CO2), which has an ozone layer depletion coefficient of zero, a global warming coefficient of one (about one one-thousand-seven-hundredth of a fluorocarbon refrigerant). EcoCute is excellent in terms of environmental protection.

- Highly efficient and economic

  The energy efficiency (the coefficient of performance (COP)) is high, at 3.0 or more. Furthermore, because inexpensive night-time electricity can be utilized, EcoCute can reduce running costs substantially in comparison with combustion-type water heaters.

- Hot water dispenser

  EcoCute can dispense hot water at 90 degrees centigrade through an instantaneous temperature rising process, utilizing the high thermal capability of a natural refrigerant (CO_2). Its hot water supply capability can minimize the size of a hot water storage tank.

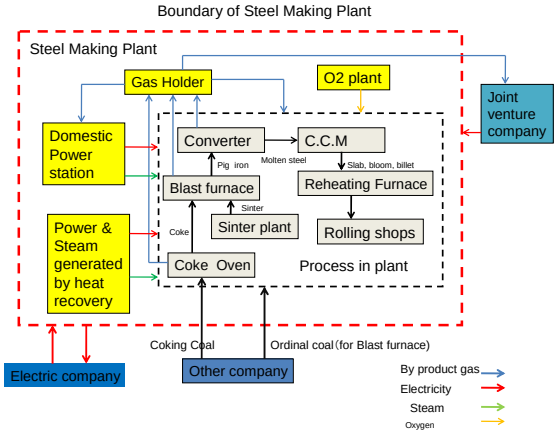


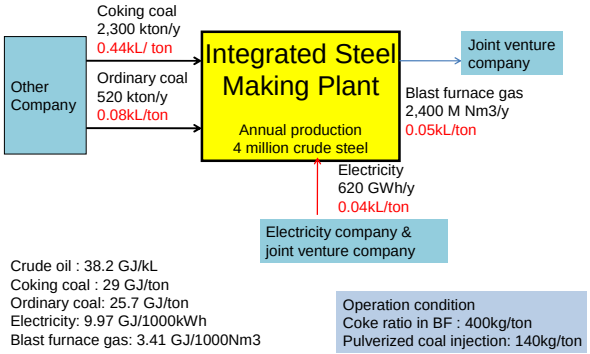
Thank you for your kind attention!

Example of Benchmark in Integrated Steel Making Plant

JICA STUDY TEAM

Yoshiharu IKEUCHI





Calculation of Benchmark

$$\text{Benchmark} = \frac{\text{Annual total energy consumption}}{\text{Annual total crude steel production}}$$

Annual total energy consumption = Purchased energy(Coking coal + Ordinary coal + Electricity – Sold energy(Blast furnace gas)
= 66,700 TJ + 13,364 TJ + 6,181 TJ –8,184TJ = 78,061 TJ

Benchmark = 78,061 TJ ÷ 4,000,000 ton = 19.5GJ/ton
= 19.5GJ/ton ÷ 38.2 GJ/kL =0.51 kL/ton

Proposal of Audit Standards

1. Identification of Contents of the this Work
   a. "Assessment Standards" for find potential and propose EE&C measures → For Consultant
   b. "Audit Standards" for evaluate performance of target consumers → For Accredited Energy Auditor
2. Utilization of the Above Standards
   a. "Assessment Standards" is for site
   b. "Audit Standards" is for both HQ and site
3. Expected Contents of the Assessment Standards
   a. Pre-questionnaire sheet
   b. Methodology
   c. Reporting format
4. Expected Contents of the Audit Standards
   a. Pre-questionnaire sheet
   b. Evaluation methodology
   c. Rating and final evaluation

Award System for Excellent Energy Management Factories and Buildings

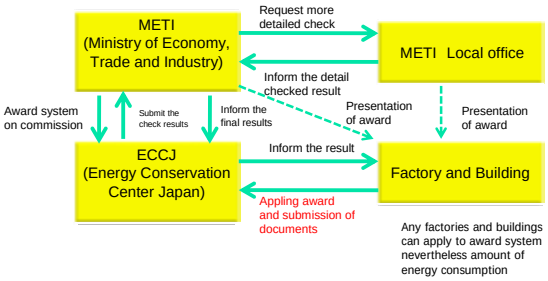
JICA Study Team
Yoshiharu Ikeuchi

Contents

1. Purpose of Award System

- To award the factories and buildings which make a great effort to improve energy conservation activities in order to develop rational energy use and to sustain the energy resources.
- Awarded factories and buildings will be a good model for other ones.
- Award system causes further improvement of energy conservation.

2. Players of Award System



3.Other Type of Awards

Excellent Activity by Employees
Introduction of Excellent EC Implementation Technologies (Product / System)
ESCO Business
Contest (Poster / Article / Implementation)
Excellent Electronics Stores

Type of Awards

Type	Main Objective	Methodology	Implementing Body	Duration	Target Layer
Excellent Activity by Organization Employees	1. Encouraging Continuous EC Activity 2. Dissemination of EC Activity	1. Application 2. Screening 3. Field Visit 4. Interview 5. Selection	1. METI 2. ECCJ 3. Local Government	Once /Year	Factory/Organization/Employees
Introduction of Excellent EC Implementation					
Technologies (Product / System)					Energy Consuming Product/System
ESCO Business					ESCO Company
Contest (Poster / Article / Implementation)					School/Pupil
Excellent Electronics Stores					Shop

4. Type of Award

- Section of award
  - Fuel and heat
  - Electricity
    But after 2008, two sections were drawn together
- Kinds of award
  - Minister of METI
  - Director general of Agency of Natural Resources and Energy
  - Director general of branch of METI

5. Qualification for application(1)

Don't correspond to under three articles,

- Acting against Energy Conservation Law (Act on Rational Use of Energy) within past three years
- Happening social problems with own responsibility such as pollution problem within past three years
- Happening serious accidents resulting in injury and death, facility accidents and disasters within past three years

5. Qualification for application(2)

Producing distinguished results regarding to following four items

- Energy management organization and its operation status
- Energy improvement status to promote rational energy use
- Educating and training status of energy management engineers
- Energy conservation results concerned with rational energy use

6. Procedure for Taking Award

Any factories (buildings) begin to apply this award

Award of Director general of branch of METI

⇩ In principal, to be selected out of awarded factories (buildings) from Director general of branch of METI.
Necessary to pass three years from previous awarded

Award of Director general of Agency of Natural Resources and Energy

⇩ In principal, to be selected out of awarded factories (buildings) from Director general of Agency of Natural Resources and Energy
Necessary to pass two years from previous awarded

Award of Minister of METI

7. Contents of Submission Documents

- Energy management organization and its operation status
  - Diagram of energy management organization
  - Operation status of holding frequency of steering committee and discussing contents, etc
  - Conditions of energy consumption for past three years
- Educating and training status of energy management engineers
  - Numbers of taking an examination of energy manager
  - Numbers of attending the training program with certification examination for candidates of Energy Manager and general training programs for proper implementation of EMS
- Extinguished results for promoting rational energy use for past three years
- Enforcement of measures for rational energy use
- Others
  - Yes or no of happening accidents and pollution problems for past three years

8. Energy Consumption and Energy Intensity for Past Three Years

		2007	2008	2009
① Consumption of fuel and heat (GJ)				
② Electricity consumption	(1000 kWh)			
	(GJ)			
③ Total	(GJ)			
④ In terms of heavy oil	(kL)			
⑤ Amount of product				
⑥ Energy intensity				
⑦ Ratio against previous year				

9. Enforcement of Measures for rational Energy Use

Target items (facilities)	Status of establishing management standards	Status of observing measurement/record	Status of observing maintenance/inspection	Status of measures to betaken on new installation
Rationalization of fuel combustion (Combustion facility)	Status of establishing management standards for air ratio and others ☐ Already established ☐ Being established (%) ☐ To be establis hed	Status of measurement/record defined in management standards ☐ Regularly done ☐ Done as needed ☐ Not done	Status of maintenance/inspection defined in management standards ☐ Regularly done ☐ Done as needed ☐ Not done	Status of measures to be taken on new installation of combustion facilities ☐ Done ☐ Not done ☐ Not applica ble
Rationalization of heating, cooling and heart transfer (Heat consumption facility)	Status of establishing management standards for heating equipment and others ☐ Already established ☐ Being established (%) ☐ To be establis hed	Status of measurement/record defined in management standards ☐ Regularly done ☐ Done as needed ☐ Not done	Status of maintenance/inspection defined in management standards ☐ Regularly done ☐ Done as needed ☐ Not done	Status of measures to be taken on new installation of heating equipment and others ☐ Done ☐ Not done ☐ Not applica ble

A
BIG
THANK YOU!!

Curriculum of Energy Efficiency in Japanese Universities

August, 2010

Mayo Yoneyama
JICA Study Team

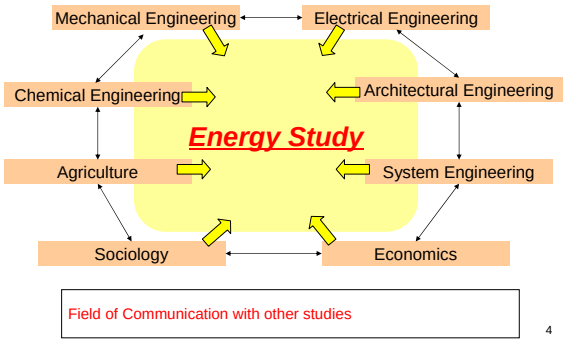
Contents

1. Any Faculty of Energy Engineering in Japan?

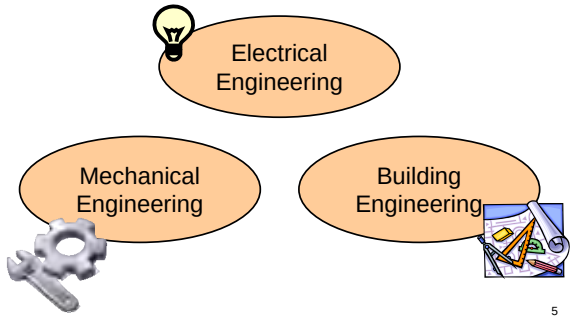
There's no faculty named "Energy Engineering".

- In Japan, Classes related to Energy are held in a variety of faculties.
- The contents depend on the university.
- Energy is taught not only in Engineering, but also in Social Science.

2. Mechanism of Energy Study in Japan



3. Academic background of Energy Managers



4. Study Fields and Subjects of National Qualification Examination for Energy Managers

< Required Subject >	
1. Outline of energy management and Law and Regulations	
< Optional Subject >	
(Electric Course)	(Heat Course)
2. Basic Theory in Electricity	2. Basic Theory in Heat and Fluid
3.Facility and Equipment	3. Fuel and Combustion
4. Application of Electricity	4. Heat Utilization Facility and its Management

Electrical Engineering **Building Engineering** **Mechanical Engineering**

5. Curriculum of Energy Study in Graduate Schools of Universities

5.1 Kyoto University
5.2 The University of Tokyo
5.3 Osaka University
5.4 Nagoya University
5.5 Waseda University

5.1 Kyoto University

[Kyoto University]
Graduate School of Energy Science

<The Aim of Lecture>
To develop a sustainable energy society by establishing theories in energy science , an interdisciplinary field that incorporates a humanistic perspective into science and technology, for fostering people who contribute to the harmonious coexistence of a global society, have an international perspective, and high-level abilities in various specialties.

	< Department >	**< Course >**
Energy Science	Socio-Environmental Science	Energy Social Environmental
	Fundamental Energy Science	Chemical energy course Physical energy course
	Energy Conversion Science	Combustion and engine system Material and system integrity Fusion and nuclear power
	Energy Science and Technology	Electricity and electronics Materials Resources Energy science and technology

[Kyoto University]
Curriculum of Socio-Environmental Energy Science

<The Aim of Lecture>
Searching for environmentally-friendly energy and social systems

*Advanced Study on Socio-Environmental Energy Science	*Energy and Environment Environmental Harmony
*Socio-Environmental Energy Science	*Societal Education for Energy
*Social Engineering of Energy	*Energy Policy
*Advanced Study on Sustainable Society with an Environmentally-sound Material Cycle	*Energy Communication
*Energy Economics	*Environmental Economics
*Economic Analysis	*Energy Politics
*Energy Ecosystems	*International Energy
*Recycling Systems in Earth Ecology	*Field Research Project on Socio-Environmental Energy Science
*Human Interface	*Special Fundamental Study
*System Safety	*Industrial Ethics

[Kyoto University]
Curriculum of Fundamental Energy Science

<The Aim of Lecture>
New fundamental science for researching energy

*Advanced Study on Fundamental Energy Science	*Catalytic Functional Chemistry
*Fundamental Energy Science	*Biological Energy
*Physical Chemistry for Energy Science	*Fundamentals of Fusion Plasma
*Energy Electrochemistry	*High-Temperature Plasma Physics
*X-ray Crystallography	*Plasma Heating
*Introduction to Functional and Solid-State Chemistry	*Energy Transport
*Solid-State Electrochemistry	*Neutron Mediated Systems
*Magnetohydrodynamics	*Introduction to Experiments Nuclear Reactor
*Fundamental Plasma Simulation	*Advanced Energy Creation
*Applied Numerical Physics	*Physics of Superconductivity
*Plasma Physical Kinetics	*Technology for Advanced Energy
*Physics of Non-neutral Plasmas	*Field Research Project on Fundamental Energy Science
*Photo-Related Chemistry	*Special Fundamental Study 1,2
*Sustainable Energy System	*Industrial Ethics
*Molecular Science of Fluids	

[Kyoto University]
Curriculum of Energy Conversion Science

<The Aim of Lecture>
Future energy conversion systems and functional design

*Energy Conversion Fundamentals	*Advanced Energy System Technology
*Rate Processes	*Particle Energy Conversion
*Heat Engines	*Electromagnetic Energy Conversion
*Thermal Energy System Design	*Functional Energy Conversion
*Combustion Science and Engineering	*Materials for Energy Conversion
*Pollutant Treatment in Energy Conversion System	*Advanced Energy Conversion Science
*Fracture Mechanics for Energy Systems	*Advanced Numerical Simulation
*Science for System Integrity	*Waste Biomass Utilization
*Theory of Plasticity	*Bio-Energy Waves
*Mechanics of Advanced Materials	*Theory of Elastic Waves
*Continuum Thermodynamics	*Materials Science and Engineering Based on Energy Processing
*Fundamentals of Fusion Energy System	*Field Research Project on Energy Conversion

[The University of Kyoto]

Curriculum of Energy Science and Technology

<Aim at the Lecture>

*** Striving to develop environmentally-friendly processes**

*** Establish energy science and technology supporting these processes for the sustainable development of humanity**

*Advanced Study on Energy Science and Technology	*Ocean Resources and Energy Technology
*Introduction to Energy Science and Technology	*Numerical Approach to Working Processes
*Lecture on Advanced Integrated Circuits	*Computational Physics
*Thin Film Nanodevices	*Advanced Physical Chemistry
*Effective Utilization Engineering in Electrical Energy System	*Physics of Energy Conversion Materials
*Materials Processing	*Photon and Quantum Energy
*Functional Materials Processing	*Electromagnetic Energy
*Thermochemistry	*Effective Utilization of Energy
*Thermodynamic Strategy for Environmental-Friendly Processes	*Energy Development
*Resource and Energy System	*Field of Research Project on Energy Science and Technology
	*Special Fundamental Study
	*Industrial Ethics

5.2 The University of Tokyo

[The University of Tokyo]

Graduate School of Frontier Sciences

- Division of Transdisciplinary Sciences
- Division of Biosciences
- Division of Natural Environmental Studies
  - Course
    - Natural Environmental Studies
    - Ocean Technology, Policy, and Environment
    - Environment Systems
    - Human and Engineered Environmental Studies
    - Socio-Cultural Environmental Studies
    - International Studies
  - Program
    - Health Science
    - Environmental Design
    - Environmental Management
    - Sustainability Science
    - Environmental Engineer Training
    - Environmental Manager Training
- Department of Computational Biology

[The University of Tokyo]

Education Program-(1) Sustainability Science

Program	Curriculum
Sustainability Science	***Sustainability perspectives in environmental issues** ***Environmental Economics** ***Fundamentals of Natural Environmental Studies** ***Environmental Information Science** ***Environmental Sustainability** ***Environmental Challenges and Leadership in Asia** ***Biosphere Function** ***Marine Resource and Environment** ***Sustainable Health and Environment** ***Structural Safety of Built Environment** ***Agricultural Development, Introduction to Formal Analysis of Conflict and Cooperation**

[The University of Tokyo]

Education Program- (2)Environmental Management

Program	Curriculum
Environmental Management	Sustainability of Ecosystem Sustainable Energy Society Sustainable Development Life Assessment Environmental Audit Environmental Energy Study Intellectual Property Right Energy Tax System Resources and Energy Kyoto Mechanism Environmental Finance

5.3 Osaka University

[Osaka University]

Graduate School of Engineering

Division of Sustainable and Environmental Engineering

<Aim at the Lecture>
*Achieve synergy by uniting the academic fields on "Environment" and "Energy."

- Environmental Management
- Sustainable Environmental Design
- Circulatory Material and Resources
- Sustainable Energy
- Quantum Energy

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[Osaka University]

Curriculum of Environmental Management Program

<Aim in the Lecture >
* Technology for conservation of the environment and resources
* The social systems for their application, diffusion and management

- Environmental Management for Sustainable Energy and Industrial Systems
- Engineering and Risk
- Environmental Dynamics Adv.
- Environmental Modeling Adv.
- Bio-Environmental Conservation Engineering
- Thermal Environment System Adv.

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[Osaka University]

Curriculum of Sustainable Environmental Design Program

<Aim in the Lecture >
* A Relationship between human beings and environment
* Seek the modality of sustainable cities and living environment

- Principles of Urban Symbiosis
- Design Techniques for Symbiotic Environment
- Spatial Design for Symbiotic Environment
- Information, Media and Communication
- Environmental Communication and Risk Communication
- Engineering System Design for Sustainability

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[Osaka University]

Curriculum of Circulatory Material and Resources Program

<Aim in the Lecture >
*Material development for zero-waste materials and waste reclamation.
*Environmentally-friendly processes including bio-process, biomaterials, diagnosis and remedy of body tissue, and medical and rehabilitation technologies

- Advanced Environmental Materials and Circulatory Utilizing System of Resources, Adv.
- Quantum Beam Bio-engineering
- Advanced Medical Engineering
- Rehabilitation Engineering
- Bio Resource Engineering
- Green Chemistry
- Nanoscience and Nanotechnology

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[Osaka University]

Curriculum of Sustainable Energy Program

<Aim in the Lecture >
*Technologies and design of energy conversion system such as nuclear power generation, new energy materials, application of renewable energy saving system

- Energy Conversion Material
- Energy and Fluid Engineering
- Energy System Design Engineering
- Applied Plasma Engineering
- Demand-Side Energy System Engineering
- Global Metabolism and Cycles
- Environmental Planning and Management in Global Society

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[Osaka University]

Curriculum of Quantum Energy Program

<Aim in the Lecture >
*Basic Science such as reactor physics , thermal dynamics, fluid dynamics and computing science
*Energy development and application such as safety, renovation reactor, fusion, quantum beam, medical and bio technologies

- Reactor Physics
- Nuclear Reactor Control
- Nuclear Fuel and Materials
- Advanced Safety Engineering for Nuclear Reactor
- Nuclear Reactor Fusion Reactor Engineering
- Quantum Beam Chemistry
- Laser Energetics

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5.4 Nagoya University

[Nagoya University]

School of Engineering

- **Faculty of Engineering**
  - Chemical and Biological Engineering
  - Physical Engineering
  - Electrical and Communication Engineering
  - Mechanical and Aeronautical Engineering
  - Social Environmental Engineering

[Nagoya University]

Department of Social Environmental Engineering

- Undergraduate
  - Civil Engineering Course
  - Architecture Course
- Graduate
  - Civil Engineering
  - Environmental Studies
    - Earth and Environmental Science
    - **Environmental Engineering and Architecture**
    - Social and Human Environment

5.5 Waseda University

[Waseda University]

Faculty of Science and Engineering

Fundamental Science and Engineering	**Creative Science and Engineering**	**Advanced Science and Engineering**
Mathematics	Architecture	Advanced Science and Engineering
Applied Mathematics	Modern Mechanical Engineering	Physics
Computer Science and Engineering	Industry and Management Systems Engineering	Applied Physics
Applied Mechanics And Aerospace Engineering	Civil and Environmental Engineering	Chemistry and Biochemistry
Electric and Photonic System	Resources and Environmental Engineering	Applied Chemistry
Intermedia Art Science		Life Science and Medical Bioscience
		Electrical Engineering and Bioscience

[Waseda University]

Faculty of Science and Engineering

Department for Undergraduate & Graduate School	Department only for Graduate School
<Aim at the Lecture> Education and research emphasizing cooperation among the five departments Nurturing individuals to the creation of a more affluent society	< Aim at the Lecture> Training scientists and engineers who offer the advanced knowledge and broad perspectives required to solve society's problems
Fundamental Science and Engineering Creative Science and Engineering Advanced Science and Engineering	+ Global Information and Telecommunication Studies Environment and Energy Engineering Information and Systems

[Waseda University]

Curriculum of Architecture

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
General, Drawings, Exercises in Architectural Design	Environmental Aspects of Buildings and Cities Architecture and Society Architectural Design and History Architecture and Building Engineering Building Laws Principles of Architectural Planning Mathematics for Engineering Mechanics A Creative Science and Technological Literacy		Structural Design and Planning Exercises for Architecture Building Environment and Services Design Drawings Structural Design Drawings Experiments in Building Materials A-D Architecture and Information		Graduate Seminar (Pratice/survey research)	
		Practical Training in Architectural Design Exercise of Architectural History Exercise in City Planning Exercise of Architectural Environment Structural Design Exercises Practice of Construction Process				
Architectural Art	<Architectural Planning> <Architectural History> <City Planning>					
Building Engineering	<Building Production> <Structural Design> <Engineering for Building Environment>					

* Data Source from Waseda Uni. Official HP

[Waseda Univerisity]

Curriculum of Resources and Environmental Engineering

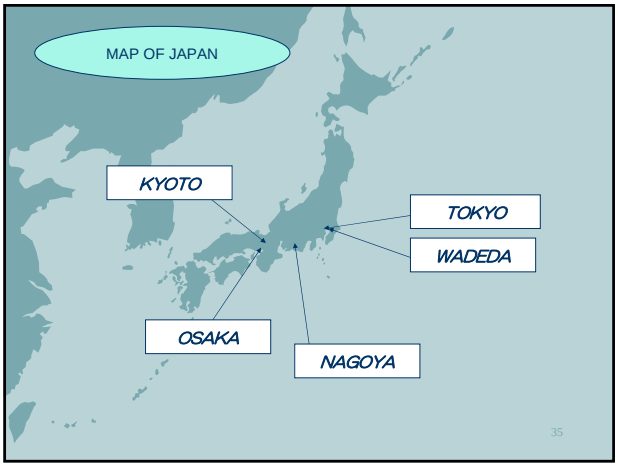
Graduate	Environment and Safety Engineering Environment Study of Ecological System Advanced Aquatic Chemistry Resources Recycling Resources Separation Technology Materials Processing Engineering Formation Fluid and Environmental Engineering Advanced Numerical Production Engineering Applied Geophysics	Geosphere Environmental Engineering Geochemistry of Mineral Resources Advanced Raw-Materials Science Physics and Chemistry of Minerals Thermodynamics in Petrology Isotope Isotope Geochemistry Structural Petrology Advanced Paleontology
Undergraduate	Resource and Environmental Engineering Laboratory Applied Physical Chemistry and Exercise Applied Mathematics and Exercise Applied Physical Chemistry and Exercise B Crust Information Engineering and Exercise Atmospheric Environment and Engineering Working Environment Engineering Environmental Geochemistry Water Environment Engineering Environmental Risk Analysis Particle Control Technology Resource Separation Engineering Solid-Liquid Separation Resource Recycling Introduction to Chemical Industry Metals Production Engineering Geophysical Engineering Overview of Resource and Environmental Engineering Earth Science A, B Computer Literacy Environmental Instrumental Analysis on Cutting-Edge Technology of Mineral Resources Fundamentals of Geoexploration Engineering on Cutting-Edge Technology of Oil and Gas Development	Rock Mechanics Numerical Rock Mechanics Fundamentals of Reservoir Engineering Reservoir Simulation Environmental Geology Computational Methods for Underground Flow Economics of Resources and Environment Mathematics Electromagnetics Chemical Thermodynamics Strength of Materials Inorganic Chemical Analysis Laboratory Mineralogy and Petrology Introductory C Programming Introduction to Environment and Safety Engineering Introduction to Resource Processing and Recycling Introduction to GeoexplorationEngineeringIntroduction to Development and Environmental Engineering Materials Processing Engineering Principles Creative Science and Engineering Literacy

6. Examples: Energy Programs of 5 Japanese universities

Characteristic	Kyoto	Tokyo	Osaka	Nagoya	Waseda
Energy faculty	×	×	×	×	×
Course of Energy Science	O	×	O	×	O
Special Course of Energy Management	×	O	O	×	O
Lately Reorganized	O April, 2010	×	O April, 2006	×	O April, 2010

7. Conclusion

- In Japan, Energy Engineering programs are provided at many universities, even in under-graduate school.
- But, there is no faculty named “Energy Engineering”.
- There is no lecture titled “Energy Efficiency”.
- In graduate schools, there are programs named “Energy + something”.
- Today we introduced 5 major universities as examples. In those universities, Energy Engineering Study is taught on three department :Electrical Engineering, Mechanical Engineering and Building Engineering.



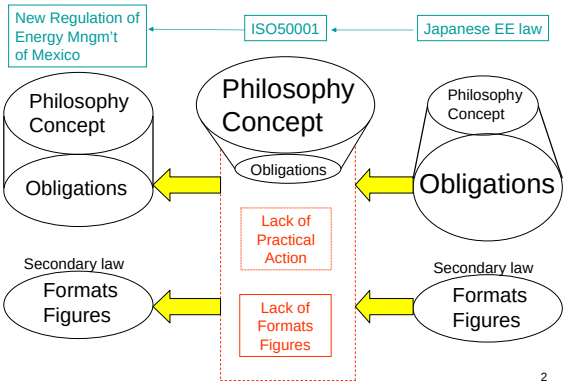
Thank you for your attention!

ISO50001
&
Energy Management Regulation

August, 2010

JICA Study team
TEPCO

Roadmap for the new Regulation in Mexico



ISO50001 vs ISO14001

1. Environmental management is achieved by Energy management.
2. So, many companies which was qualified by ISO140001 is well suited for ISO50001.
3. In addition, "Table of Contents" is almost the same in ISO14001 & ISO50001.

ISO50001	ISO14001
1.Scope	1.Scope
2.Normative references	2.Normative references
3.Terms and definitions	3.Terms and definitions
4.Energy management system requirements	4.Environmental management system requirement
4.1 General requirement	4.1 General requirements
4.2 Management responsibility	4.2 Energy policy
4.3 Energy policy	4.3 Planning
4.4 Energy planning	4.4 Implementation and operation
4.5 Implementation and operation	4.5 Checking
4.6 Checking Performance	4.6 Management Review
4.7 Management review	

Contribution by the Japanese Government for ISO50001

1. Purpose
   - To input Japanese experience for the process
   - To avoid the overlap in both procedures

2.contribution of Japanese opinion
   - the objective of ISO50001 is Energy Efficiency, not cost reduction nor water saving

3. result
   - Japanese companies must obey the Japanese law for energy efficiency, then it is easy for them to get the certificate of ISO50001 with little additional procedures.

   - This means that proposed ISO50001 fit to Japanese law for energy efficiency.

Comparison of ISO with Japanese EE Law

	ISO50001	Japanese EE Law
Basic Concept	Support for Independent Activity	Mandatory rules with numeric standards in secondary law
Sites	All applicants	Over threshold
Report	Record internally	Report to the Government
Target	Reduction target individually	1% reduction
Action plan	Necessary to make a plan internally	Long and medium term plan to be submit to the Government.
Operation management	Standard to keep an effective operation and maintenance	Evaluation criteria for operation, measurement, maintenance
Internal inspection	Necessary	Not necessary
Inspection	Non-governmental org.	METI
Necessity of qualified person	No	Energy Manager
Evaluation criteria	Not specified	Specified in detail by secondary low
Evaluation of performance	Observation of significant energy consumption and availability of action plan	Report (energy consumption, specific energy consumption rate, concrete technical index)

Same points of ISO50001 & Japanese EE law

item	contents
goal	To make the best effort of energy management and operation
Target figure	necessary
Improvement by PDCA	necessary
Baseline	To be set
Involvement of the Top management	Board member should be involved in the scheme

Main Discussion Points about EMS
In order to make the ISO50001 be a National Regulation

- **1. Designation of Energy and Consumers**
- **2. Implementing Organization**
- **3. Qualifications/Licenses of Energy Managers**
- **4. EE&C Activities within the Site**
- **5. Periodical Reports to the Regulators**
- **6. Monitoring and Checking**
- **7. Inspection and Penalty**
- **8. others**

1.Designation of Consumers (ISO50001)

All Organization（Open-ended）

1.Designation of Consumers (Japanese Law)

Designated Organization and Category of Business Entities

Annual Energy Consumption (kl /year of crude oil equivalent)		3,000 kl/year and above	1,500 kl/year – 3,000 kl/year	Less than 1,500 kll /year
Designated Organizations		Type 1 Energy Management Factory	Type 2 Energy Management Factory	–
Responsibilities of Business Entities	Person to be appointed	Energy Manager Energy Management Officer	Energy Management Officer	–
	Report to be submitted	EE&C Results Report	EE&C Results Report	–
		Middle and Long Term Plan Report	–	–
	Responsibility	Responsibility of Evaluation Criteria （Establishment of Management Standards, Implement of measures for EE&C）		
Target number		1 %/year improvement of unit energy consumption in the long and medium term		
Check by government authorities		Guidance and Advice/ collection of the reports of energy consumption		
		Investigation of factories and buildings Investigation of the situation and Observation of Evaluation Criteria		

2. Implementing Organization (ISO50001)

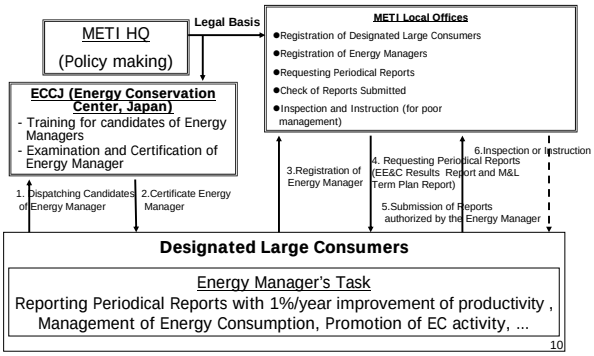
International Organization for Standardization (ISO)

<Certifying Organization>:
The Japan Accreditation for Conformity Assessment (JAB)

<Certified Company>
(1) Moody International Certification LTD.
(2) Bureau Veritas (Japan Branch)
(3) ISOQAR Japan Co.,Ltd.
(4) Management System Assessment Center.
(5) Japan Quality Assurance Organization etc.

2. Implementing Organization (Japanese Law)

Players of Energy Management Regulation



3. Qualifications/Licenses of Energy Managers (ISO50001)

The License is Unnecessary.

The Business Affairs must put into work by a Management Representative appointed The Administration.

3. Qualifications/Licenses of Energy Managers (Japanese Law)

Function of energy manager

item	Executive Energy Supervisor	Energy Planning Promoter	Energy Manager	Energy Officer
function	(HQ) ・Impulsion management standpoint ・Make of Mid-and-Long Term Plan ・Practical control	(HQ) ・Assist a Energy supervisor	(One of factory) ・Stationed at Type 1 Energy Management Factory (One of Building) ・can be outsourced	(Type 1 Building) ・To be stationed (Type 2 Factory +Building) ・To be stationed
qualification	（Board member）	Person who finish One day training course	Energy Manager with national license	Person who finish One day training course
quantity of qualified person	————	————	54,154 persons	42,325 person

4. EE&C Activities within the Site (ISO50001)

(1) Establish the management framework

(2) Provide effective operation and maintenance

(3) Provide the management standard of equipments

4. EE&C Activities within the Site (Japanese Law)

(1) Establish the management framework

(2) Provide the management standard for equipments

5. Periodical Reports to the Regulators (ISO50001)

ISO is the private standard ,so no report is required to the Government.

Consumption record should be kept internally.

5. Periodical Reports to the Regulators (Japanese Law)

Periodical Reports to METI must include mid-and-long term plan, energy consumption data and benchmarking figures.

6. Monitoring and Checking (ISO50001)

6. Monitoring and Checking (Japanese Law)

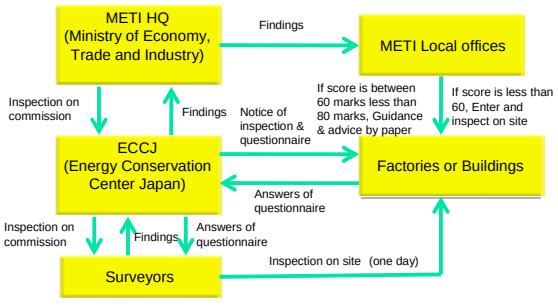
Periodical Reports which were submitted from companies are checked within METI.

7. Inspection and Penalty (ISO50001)

According to Traditional ISO System in Japan , there are two types of review; regular surveillance (Twice a year) and renewal surveillance (Once every three years).

	Regular Surveillance (Twice a year)	Renewal Surveillance (Once every three years)
Method	Random check	All ISO system check
Check Point	Performance of ISO system	Will of the management level of the company
Purpose	Correction of wrong performance	Go out of mannerism

7. Inspection and Penalty (Japanese Law)



7. Inspection and Penalty (ISO50001)

These is no penalty , because ISO is the private standard.

But, when the wrong performance is found in regular survey (twice a year) or renewal review (once every three years) , the company have to submit paper of all thing to improve.

And then, the company should implement according to the submitted paper. They have to check the result by internal audit.

After internal audit, they have to be checked by certification organization as a whole.

7. Inspection and Penalty (Japanese Law)

1. When wrong and no report of energy consumption, mid-and-long term plan were submitted,

→ Carry a fine up to five hundred thousand-yen.(62,500MXD)

2. When energy manager were not appointed,

→ Carry a fine up to a million-yen.(125,000MXD)

3. When the renewal of energy manager were not reported,

→ Carry a fine up to two hundred thousand-yen.(25,000MXD)

4. All inadequate performance,

→ announcement of company name, and carry a fine up to a million-yen.

8. Others (ISO50001)

1.Energy definition

Electricity , Fuel , Steam , Heat , Compressed air , Renewable

2. Target item of management

To be decided by the organization.

3. Specific energy consumption

Not determined

4. Energy base line

can be decided by the organization.

8. Others (Japanese law) No.1

1.Energy definition

Electricity , Fuel , Heat

2. Target item of management

Building and factory

3. Specific energy consumption

Divide annual use of energy by anything to get specific energy consumption.

4. Energy base line

(1) previous year and this year.

(2) average of 1% reduction of specific energy consumption per year is required.

8. Others (Japanese law) No.2

(3) Benchmark standard regulation was started this April.

Schedule of Introduction of SBA

FY	Consultation in the ISCM	Execution
2008	3 sub-sectors (power, iron & still (3 types furnace) and cement) were selected and authorized as a first stage.	
2009	Next sub-sectors (chemical, paper&pulp, oil refinery) are under consultation.	
2010		From 2010 FY, the first 3 sub-sectors will be executed.
2011		From 2011 FY, the next 3 sub-sectors are planned to be executed.

Draft Proposal for

the New Mexican Energy Management Regulation

based on the ISO50001

Materials for discussion

1. Designation of Energy and Consumers

(1) Energy

Electricity	Fuel	Heat

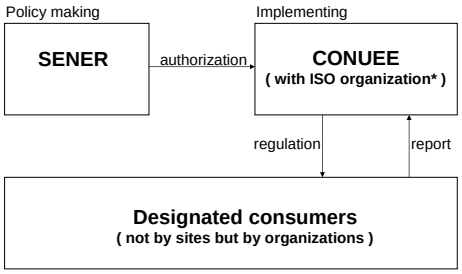
(2) Management should be carried out not by sites but by organizations

(3) Category & Thresholds*

	1st Class	2nd Class
Manufacturers	●●toe/y or more	●●toe/y or more
Non-manufacturers	●●toe/y or more	●●toe/y or more
Central Government	●●toe/y or more	●●toe/y or more
Local governments	●●toe/y or more	●●toe/y or more

* **Thresholds can be in CO2 emission.**

2. Implementing Organization



* **ISO organization : entrusted companies in ISO certification processes**

3. Qualifications/Licenses of Energy Managers

(1) category

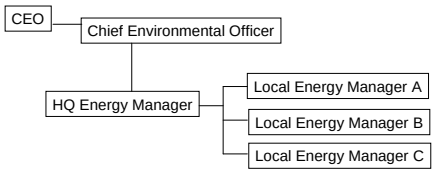
Electric Engineering	Mechanical Engineering

(2) pathway

A	3 year experience + 1 week lecture
B	1 year experience + 1 day examination

4. Activities within the companies and the sites

(1) Involvement of the Board Members



(2) Operation Management Manuals with numeric criteria for major Equipments

- operators can check the operation data for better performance

5. Periodical Reports to the Regulators

3 kinds of report shall be submitted once a year.

A	B	C
Energy consumption data with comparison with the previous years	Investment plan to reduce energy consumption	Benchmarking figures for comparison with others

6. Monitoring and Checking

Based on the procedures of ISO50001, PDCA cycle will be carried out for the better performance of energy efficiency. This is internal procedure.

7. Inspection and Penalty

1. ISO scheme & organizations can be utilized for regulation scheme with the authorization by the regulators. This will help to minimize the operation cost of the scheme.

2. Penalties and/or fines are not the major purpose. To achieve the improvements of designated consumers is most important.

frequency	Twice a year	Once in 3 years
Contents	- Random check - Check the failure of management mechanism	- Interview with board members - Check the figures - Formal fine with penny

Thank you for your attention.

Let's discuss in details.

System of Random check on Site in Japan

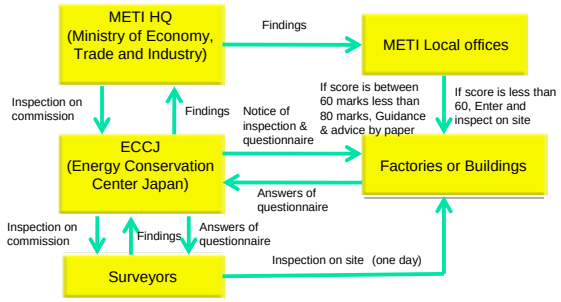
JICA Study Team
Yoshiharu Ikeuchi

Contents

1. Chief Aim of Random Check on Site

- To check the status of energy management (Status of energy intensity for past five years)
- To check the status of energy conservation activities
- **To check the status of establishing " Management standard" and observing them**

2. Players of Random Check on Site



3. Number of Factories or Buildings Carried Out Random Checks On Site a Year

1. Selection
METI HQ makes a plan and select random check site.
2. Case of FY 2010
(1) Designation of Business Type (300-400)
- 1/3 of Food Industry
- 30 % of Manufacturer of Transportation Equipment

(2) At Random Selection for Site
- 200 Factories or Buildings (Type-1:100, Type-2:100)

(3) At Random Selection for HQ
- 10 HQ

Number of Surveyors

Surveyors	Approximately 80 persons through 8 blocks in Japan and they are selected among experts of rational energy use in ECCJ

4.Following factories or buildings are excepted from selection in this year

(1) Designation of business type
- Factories or buildings which received the document of conforming to the standards of judgment issued from "Registered Investigation Bodies" in previous year

(2) At random selection for site
- Factories or buildings which received the document of conforming to the standards of judgment issued from "Registered Investigation Bodies" in previous year
- Factories or buildings selected as the designation business type in previous year
- Factories or building selected as the random selection for site in previous year
- Factories or buildings got the award of excellent energy management factories or buildings in previous year

5. Contents of Questionnaire

1. Number of licensed energy mangers
2. Observing status for evaluation criteria concerned with rational use of energy
   - ➢ Transition of energy intensity for past five years
   - ➢ Reasons why couldn't improve 1% reduction of energy intensity, if not achieved
   - ➢ Observing status for evaluation criteria concerned with rational use of energy
     - ● Summary of energy consumption in previous year
     - ● Management standard of each equipment
3. Energy conservation activities
   - ➢ Programs for annual reduction target and medium and long-term activities
   - ➢ Status of new installed equipment, improved equipment and strengthening energy management for past 4 – 5 years
   - ➢ Energy management activities

6. Status of Energy Consumption and Transition of Energy Intensity

		2005	2006	2007	2008	2009
① Consumption of fuel and heat (GJ)						
② Electricity consumption	(1000 kWh)					
	(GJ)					
③ Total	(GJ)					
④ In terms of heavy oil	(kL)					
⑤ Amount of product						
⑥ Energy intensity						
⑦ Rate against previous year						

7. Annual Energy Consumption Table (1)

Process	Facility and equipment Kind	Capacity & unit	Energy consumption Fuel and heat GJ	Fuel and heat kL	Electricity MWh	Electricity kL	Total kL		Consumption rate	MS
A division	Air-conditioner	18	34,275	884	1,475	372	1,256	●	10.3	4
	Absorption chiller	4	47,558	1,227	111	28	1,255	●	10.3	3
	Lighting				3,528	889	889	●	7.3	1
							0		0.0	
	Subtotal		81,837	2,111	5,115	1,289	3,400		27.9	
	Others		0	0	469	118	118		1.0	
	Total		81,837	2,111	5,584	1,407	3,518		28.8	
B division	Air-conditioner	16	29,994	774	1,290	325	1,099	●	9.0	4
	Lighting		0	0	437	110	110	●	0.9	1
							0		0.0	
	Subtotal		29,994	774	4,314	1,087	1,861		15.3	
	Others		0	0	437	110	110		0.9	
	Total		29,994	774	4,751	1,197	1,971		16.2	
Manufacturing division	Arc furnace	10 ton x2			4,800	1,210	1,210		9.9	6
	Compressor	10kWx4			254	64	64	●	0.5	8
	Air-conditioner	11	21,425	553	925	233	786	●	6.4	4
	Lighting				3,024	762	762		6.2	1
							0		0.0	
	Subtotal		21,425	553	9,003	2,268	2,822		23.1	
	Others		0	0	131	33	33		0.3	
	Total		21,425	553	9,134	2,302	2,855		23.4	
Power service division	Steam boiler	3	97,984	2,528	187	47	2,575		21.1	2
	Co-generation	480kW x2	26,124	674	58	15	689	●	5.6	9
	incinerator.	50t/day x1	9,457	244	65	16	260	●	2.1	7
	Lighting				885	223	223	●	1.8	1
	Transformer&power supply				369	93	93	●	0.8	8
									0.0	
	Subtotal		133,565	3,446	1,564	394	3,840		31.5	
	Others		0	0	75	19	19		0.2	
	Total		133,565	3,446	1,639	413	3,859		31.6	
Total	Subtotal		266,821	6,884	19,996	5,039	11[illegible]		97.2	
	Others		0	0	1,112	280	280		2.3	
	Full total		266,821	6,884	21,108	5,319	12,203		100.0	

MS: Number of management standard

7. Annual Energy Consumption Table (2)

Process	Facility and equipment Name	capacity& unit	Energy consumption Fuel and heat GJ	Fuel and heat kL	Electricity MWh	Electricity kL	Total kL		Energy Consumption rate	MS
Power service division	Steam boiler	3	97,984	2,528	187	47	2,575		21.1	2
	Co-generation	480kW x2	26,124	674	58	15	689	●	5.6	9
	incinerator.	50t/day x1	9,457	244	65	16	260	●	2.1	7
	Lighting				885	223	223	●	1.8	1
	Transformer& power supply				369	93	93	●	0.8	8
									0.0	
	Subtotal		133,565	3,446	1,564	394	3,840		31.5	
	Others		0	0	75	19	19		0.2	
	Total		133,565	3,446	1,639	413	3,859		31.6	

∗ Including estimated value

MS: A number of management standard

8. Evaluation Criteria, Management Standard and Self-Check List

Evaluation criteria of rational energy use (6 items)

↓

4 items to be managed in each facility (equipment) such as (1) Management method

(2) Measurement & Record

(3) Maintenance & Inspection

(4) Measures for new facilities installation

↓

Management Standards

↓

Self-check list with establishing and observing status related with above 4 items

8. Evaluation criteria of rational energy use (2)

NO	Contents
1.	Rationalization of combustion of Fuels
2. 2-1 2-2	Rationalization of heating and cooling as well as heat transfer. ●Heating units, etc ●Air-conditioning equipment and hot water supply system, etc.
3.	Recovery and utilization of waste heat.
4. 4-1 4-2	Rationalization of conversion of heat into power, etc. ●Exclusive generation system ●Cogeneration system
5. 5-1 5-2	Prevention of Energy loss due to emission, conduction, resistance, etc ●Prevention of heat loss due to radiation and conduction, etc ●Prevention of electricity loss due to resistance, etc
6. 6-1 6-2	Rationalization of conversion of electricity into power, heat, etc. ●Electric motor appliances and electric heating appliances, etc ●Lighting system, elevating machines, office appliances and consumer equipment

8. Details of Evaluation Criteria (3)

1.Rationalization of combustion of Fuel

(1)Control of Fuel Combustion

① Air ratio shall be controlled according to the type of the combustion equipment and fuel used therein. **"Management Standard"**

② For combustion equipment, the air ratio shall be lowered based on the value of the Attachment No.1(A). **"Criteria"**

③ In a case of multiple equipment use, overall thermal efficiency shall be controlled by the load adjustment. **"Management Standard"**

④ For the purpose of enhancing combustion efficiency, fuel properties shall be controlled.

(2) Measurement and record pertaining to Fuel Combustion

The fuel amount supplied, temperature of an exhaust gas amount of oxygen in an exhaust gas, etc. shall be measured and recorded. **"Management Standard"**

(3) Maintenance and Inspection of Combustion System

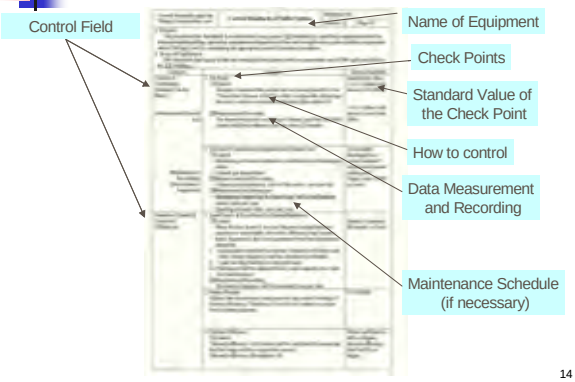
For the combustion system, periodic maintenance and inspection shall be performed to keep the good condition. **"Management Standard"**

(4) Measures to be Taken for the New Installation of Combustion Equipment

① Combustion equipment shall be introduced which is capable of adjusting the fuel supply and the air ratio to a proper level according to load fluctuations.

② A ventilation system shall be introduced after regulating the air flow rate and the combustion chamber pressure.

8. Sample of Management Standard (4)



8. Sample of Self-Check List and Marking Method (5)

No of MS	Name of equipment	Energy consumption	Energy consumption rate
2	Steam boiler	2,575 kL	21.10%

(1) Control or criteria

NO.	Contents(Management standard items of control or criteria)	Establishing status	Observing status	Evaluation of inspector	
	○: Items of evaluation criteria are reflected to management standards , △: partially reflected, ×: not reflected	○	△		
	○:Facility management is are done based on Control or Standard, △: partially done, ×: not done				

(2) Measurement and record

NO.	Contents(Management standard, items of measurement and record, frequency)	Establishing status	Observing status	Evaluation of inspector	
	○:More than 80% of established frequency , △:more than 50% and less than 80%of established frequency, ×:less than 50% of established frequency			○	△

(3) Maintenance and inspection

NO.	Contents(Management standard, items of maintenance & check, frequency)	Establishing status	Observing status	Evaluation of inspector	
	○:More than 80% of established frequency , △:more than 50% and less than 80%of established frequency, ×:less than 50% of established frequency				

(4) Measures for new installation of equipment

NO.	Content(New installation of equipment in previous year)	Establishing status	Observing status	Evaluation of inspector	

8. Sample of Recorded Self-Check List (5)

No of MS	Name of equipment	Energy consumption	Energy consumption rate	
2	Steam boiler (3t/h x2, 6t/hx1)	2,575 kL	21.10%	

(1) Control or criteria

NO.	Contents(Control or criteria)	Establishing status	Observing status	Evaluation of inspector	
1.(1)①	Air ratio <1.3	○	△	○	△
1.(1)③	Control of load	○	×	○	×
2-2(1)②	Control of steam pressure, temp, volume	○	○	○	△
2-2.(1)③	Setting the operation units	○	○	○	○
3.(1)①	Flue gas temp. <250 C	○	○	○	○
3.(1)③	Volume of recovery drain >80%	○	○	○	○
6-1.(1)①	Stop unit when no necessary	○	○	○	○
6-1.(1)②	Control of operation units	○	○	○	△
6.1.(1)③	Rated currency and voltage	○	○	○	△
				18	12

30 marks

Contents of NO. are connected with evaluation criteria

9. Necessity Numbers of of Self-Check Lists

Self-check lists of equipment which cover over 80% out of total energy consumption should be prepared and sent to METI

Surveyor checks the establishing status and observing status for each Self-check List. And score marks.

10. How to Score Marks (1)

In case of Self-Check List of boiler

(1) Management or standard

- There are 9 items (see the previous sheet)
- 4 marks is perfect for one item (Establishing status: 2marks, Observing status: 2 marks)
- ○: 2 marks, △:1 mark , ×: 0 mark
- In this case, 36 marks is perfect
- Surveyor score the 30 marks

In the same way

(2) Measurement and record

- If there are 4 items
- Full mark is 16
- Surveyor scores 14 marks

(3) Maintenance and inspection

- If there are 5 items
- Full marks is 20
- Surveyor scores 16 marks

Score = (30 + 14 + 16)/(36 + 16 + 20) X 0.211 = 17.6

Consumption rate

10. How to Score Marks (2)

In the same way,
Surveyor score marks from another self-check lists of equipment as same way as previous sheet.

Surveyor scores total marks from all self-check lists.

Finding including total scored marks made by surveyor is sent to ECCJ

11. Penalty depending on evaluation marks

Score marks ≧ 80 marks out of 100 : Success
80 marks > Score marks ≧ 60 marks
: Guidance and advice by paper
Score marks < 60 marks : Enter and inspect on the spot

After getting final results of on site inspection, METI local office sends “Guidance and Advice” by paper or “ Enter and Inspect on the Spot” within one or two weeks.

METI instructs to make the improvement plan based on above guidance and advice. Announce the name of company, if not followed.

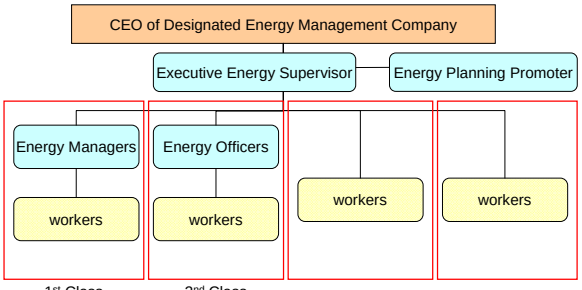
A
Big
Thank You!!

Details of Training Programs for Energy Managers in Japan

August, 2010

Hirotaka Matsuoka
JICA Study Team

1.Designates Energy Management Company



2.Function of energy manager

item	Executive Energy Supervisor	Energy Planning Promoter	Energy Manager	Energy Officer
function	(HQ) ・Impulsion management standpoint ・Make of Mid-and-Long Term Plan ・Practical control	(HQ) ・Assist a Energy supervisor	(One of factory) ・Stationed at Type 1 Energy Management Factory (One of Building) ・can be outsourced	(Type 1 Building) ・To be stationed (Type 2 Factory +Building) ・To be stationed
qualification	（Board member）	Person who finish One day training course	Energy Manager with national license	Person who finish One day training course
quantity of qualified person	————	————	54,154 persons	42,325 person

3.Examination and Training of Energy Management

	Energy Manager		Energy Officer		Not eligibility requirements
	Energy Manager Examination	Energy Management Training	**Energy Management Course**		EE&C Practice Course
			The Course for new applicants	**The Course Improving quality of them**	
timing of implemen-tation	Annually (August)	Annually (December)	Twice a year	Once a year or more	Many times a year
method	Examination	Training of 6 day and Examination on the last day	Attending a course	Attending a course	Attending a course
applicants per a year ('09)	12,034	1,907	13,925	3,557	4,060
examination pass rate	20～30%	60～70%	All who finished	All who finished	————
Started	1979	1979	1998	1998	1978
see	P5～P7	P8～P11	P12～P13	P14	P15～P25

4. Examination Subjects of Energy Management (No.1)

Possessing more than 1-year experience in the energy management business.

Common Basic and Pick out Optional Area of Specialty

Common Basic

1. Outline of Energy Management and Law and Regulations
   (1) Energy Conservation Law and Regulations
   (2) Energy Situation, Policy and General Statement
   (3) Basic of Energy Management Technology

4. Examination Subjects of Energy Management (No.2)

Heat Field (optional)

2. Basic Theory in Heat and Fluid
   (1) Basic theory in thermodynamics
   (2) Basic theory in fluid mechanics
   (3) Basic theory in heat transfer mechanics

3. Fuel and Combustion
   (1) Fuel and combustion management
   (2) Calculation of combustion

4. Heat Utilization Facility and its Management
   (1)Measurement and control
   (2) Heat utilization facility

4. Examination Subjects of Energy Management (No.3)

Electricity Field (optional)

2. Basic Theory in Electricity
   (1) Basic theory in electricity and electronics
   (2) Automatic control and information processing
   (3) Measurement of power

3. Facility and Equipment
   (1) Distribution in Factory
   (2) Electric Equipment

4. Application of Electricity
   (1) Application of Electric Power
   (2) Electric Heating
   (3) Electrochemical
   (4) Lighting
   (5) Air Conditioning

5. Energy Management Training (No.1)

Only persons possessing 3 years or more experience in the energy management business.

Attend The Training of 6 day before The Examination

Common Basic

1. Outline of Energy Management and Law and Regulations
   (1) Outline of Energy Management
   (2) Energy Conservation Law and Regulations

5. Energy Management Training (No.2)

Heat Field (optional)

2. Basic Theory in Heat and Fluid
   (1) Basic theory in thermodynamics
   (2) Basic theory in fluid mechanics
   (3) Basic theory in heat transfer mechanics

3. Fuel and Combustion
   (1) Fuel and combustion management
   (2) Calculation of combustion

4. Heat Utilization Facility and its Management
   (1) Measurement and control
   (2) Boiler, steam transmission and accumulator, steam mover, internal combustion engine, gas turbine
   (3) Heat exchanger, heat recovery, chiller, air conditioner
   (4) Incinerator, material of heat facility
   (5) Distillation/boiling/condenser facility, drying facility, carbonization and gasification facility

5. Energy Management Training (No.3)

Electricity Field (optional)

2. Basic Theory in Electricity
   (1) Basic theory in electricity and electronics
   (2) Automatic control and information processing
   (3) Measurement of power

3. Facility and Equipment
   (1) Distribution in Factory (Planning / Operation / EE&C)
   (2) Electric Equipment (Outline of electric equipment / Rotating and stationary machine / EE&C in electric equipment)

5. Energy Management Training (No.4)

Electricity Field (optional)

4. Utilization of Electricity
   (1) Utilization of Electricity (Outline of utilization of electric power / Facility of utilization of electric power / EE&C in utilization of electric power)
   (2) Electric Heating (Theory of electric heating and its facility / EE&C in electric heating)
   (3) Electrochemical (Theory of electrochemical and its facility / EE&C in electrochemical)
   (4) Lighting (Theory of lighting and its facility / EE&C in lighting)
   (5) Air Conditioning and Heating (Theory of air conditioning and its facility / EE&C in air conditioning and heating)

6.Energy Management Course (The course for new applicants)

Energy Management Course is the course to be Energy Officers, Certificate will be given after attending the course.

They can be Energy Planning Promoters or Energy Officers with this certificate.

Ⅰ. Lecture

1.Basic Knowledge for Outline of Energy Management and Law

   (1)The importance of EE&C
   (2)Energy Policy and Law
   (3)EE&C Plan

6.Energy Management Course
(The course for new applicants)

2. Energy Management Method
   (1) Basic of Energy Management
   (2) Basic of Heat
   (3) Basic of Electrical Energy
   (4) Air Conditioning and Lighting

3. Practical Business of Energy Management
   (1) Evaluation Criteria and Management Standard
   (2) Notification and Report to regulators
   (3) Evaluation Criteria in factories and buildings

Ⅱ. Examination

6.Energy Management Course
(The Course Improving quality of them)

Energy Planning Assistant or Energy Officer for some company must attend the course every three years.

Ⅰ. Lecture

Same as the course for new applicants

Ⅱ. **Examination**

Same as the course for new applicants

7.EE&C Practice Course

・This course has nothing to do with qualification and license. These are training programs conducted by the ECCJ for improving the capacity of the operators.

・These programs can be applied depending on each request.

7.EE&C Practice Course

Training Program of Electricity Course (1)

First Term (EE&C of Building)

- **EE&C of Building**
  - Outline of law and regulation, and energy management
  - Outline of EE&C of building
  - EE&C of lighting
  - EE&C of AC
  - EE&C of transformer
  - Cogeneration
- **Measurement of Electricity**
  - Measurement of voltage and current
  - Measurement of electric power
  - Measurement of pressure, flow volume and temperature
  - Measurement method of each facility
- **Hands on Practice of Electricity Measurement**
  - Practice of measurement of pump
  - Practice of measurement of fan
  - Practice of measurement of lighting
  - Practice of measurement of high efficiency transformer
  - Practice of measurement of AC
  - Data arrangement and observation

7.EE&C Practice Course

Training Program of Electricity Course(2)

Second Term (EE&C of Compressor)

EE&C of Compressor

Type of compressors and their characteristics
Axis power of compressor
Protection of leakage and its effect
Pressure loss of pipe
Measurement tool and how to use
EE&C of compressor equipment
EE&C by control method
EE&C of compressor

Hands on Practice of Compressor

Hands on practice of compressor
Data arrangement

7.EE&C Practice Course

Training Program of Electricity Course (3)

Third Term (EE&C of Pump and Fan)

EE&C of Pump and Fan

Type of pumps
Characteristics of pump
Operation and control of pump
EE&C of pump
Consideration points on installation and maintenance
Type of fans and blowers
Performance of fan
Parallel operation and series operation
EE&C of fan
Diagnosis of faults

Hands on Practice of Pump and Fan

Measurement of performance of pump
Measurement of performance of fan
Data arrangement

7.EE&C Practice Course

Training Program of Electricity Course (4)

Fourth Term (Good Practice of EE&C of Electricity)

Introduction of Good Practice of EE&C in Electricity
- Good practice of AC
- Good practice of lighting
- Good practice of compressor
- Good practice of pump and fan
- Good practice of transformer

Site Visit of EE&C Technology Application
- Site visit
- Introduction of EE&C sample in building
- Q&A

7.EE&C Practice Course

Training Program of Heat Course (1)

First Term (EE&C Technology of Heat and Combustion Management)

EE&C Technology of Heat
1. Outline of law and regulation, and energy management
2. EE&C technology and its application to site
3. Practical calculation method of heat

Fuel
- Fuel

Combustion Calculation
- Calculation method of combustion

Hands on Practice of Combustion
1. Combustion and hands on practice of explosion
2. Hands on practice of combustion

7.EE&C Practice Course

Training Program of Heat Course (2)

Second Term (Steam Management and Steam Trap)

EE&C of Steam
- Necessity of EE&C
- Improvement of stream system in Energy Conservation Law
- EE&C by utilization of steam
- EE&C measures in steam utilization field

Hands on Practice of Steam
- Measure of drain recovery
- Practice of engineering software

7.EE&C Practice Course

Training Program of Heat Course (3)

Third Term (Energy Assessment of Heat Facility)

Heat Balance Calculation and Assessment
- Introduction of heat balance calculation
- Practical assessment method
- Cast study of heat balance calculation
- Answer of heat balance calculation

Practice of Finding Potential of EE&C
- Introduction of good practice factory
- Finding potential of EE&C (group discussion)

7.EE&C Practice Course

Training Program of Heat Course (4)

Fourth Term (Good Practice of EE&C of Heat)

Introduction of Good Practice of EE&C in Heat
- Improvement of combustion
- Improvement of heat transmission
- Improvement of heat radiation
- Improvement of heat recovery

Site Visit of EE&C Technology Application
- Site visit
- Introduction of EE&C sample in building
- Q&A

7.EE&C Practice Course

Other Training Programs

(1) How to Find EE&C Potential in factories (Practice to Find EE&C Potential in Electricity and Fuel Consumption)
1. Issues and countermeasures for promoting EE&C
2. Methods to find EE&C potential and its application
3. Practice

(2) Energy Audit of Buildings (EE&C in Building Facility and Operation)
1. Law and regulations
2. EE&C of lighting
3. EE&C of AC
4. EE&C of pump and fan
5. Good practice of building EE&C
6. Practice of energy audit of buildings

7.EE&C Practice Course

Other Training Programs

(3) How to Make Management Standards
- 1.Law and regulations
- 2.Practice of making Management Standards
  - (1)Resource mapping and grasping current situation
  - (2)Selection of targeted equipments
  - (3)How to make the standards
  - (4)Drafting a sample standard

(4) Site Visits of Good Practice Factory and Building
- 1.Lecture
  - (1)Law and regulations
  - (2)Points of EE&C in factory and building
- 2.Practice
  - (1)Introduction of overview of facilities
  - (2)Introduction of safety code
  - (3)Site visit and practice of energy assessment
  - (4)Presentation of the energy assessment by trainees

Thank you for your attention!