The Secretary of Energy,
The National Commission for Energy Efficiency

Data Collection Survey on Energy Efficiency Sector in Mexico

FINAL REPORT

November 2010

JAPAN INTERNATIONAL COOPERATION AGENCY
Tokyo Electric Power Company, Inc.

IDD
JR
10-140

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Abbreviations

CFE	Comisión Federal de Electricidad
CONAE	Comisión National para el Ahorro de Energía
CONUEE	Comisión National para el Uso Eficiente de la Energía
CRE	Comisión Reguladora de Energía
DASPE	Domestic Appliance Substitution Program for Energy Saving
ESCO	Energy Service Company
FIDE	Fideicomiso para el Ahorro de Energía Eléctrica
IEA	International Energy Agency
IIE	Instituto de Investigaciones Eléctricas
IMP	Instituto Mexicano del Petróleo
ININ	Instituto Nacional de Investigaciones Nucleares
JICA	Japan International Cooperation Agency
LFC	Luz y Fuerza del Centro
METI	Ministry of Economy, Trade and Industry
PAESE	Programa de Ahorro de Energía del Sector Eléctrico
PEMEX	Petróleos Mexicanos
SENER	Secretaría de Energía

Chapter 1 Introduction

1.1 Background of the Survey

The United Mexican States (hereinafter "Mexico") officially announced "the Act for Sustainable Energy Use" at the end of November of 2008. On September 11, 2009 enforcement regulations were announced through official gazettes and put into effect from September 12th, 2009. The Act imposes a reporting obligation on large energy consumers and the regulations explicitly define the minimum energy consumption level for large energy consumers who have duties imposed on them. Furthermore, a framework for energy management including an energy efficiency certification system for products processes (industrial) and services (service sector) are required to be established.

In light of the aforementioned activities of the Mexican government and also the fact that cooperation between Japan and Mexico in the area of energy efficiency has been discussed on many occasions such as at the Toya-Lake Summit in June 2008 and at top level meetings held between Japan and Mexico in February, 2010, The gathering and analysis of information pertaining to the Act, especially the energy management system which is due to be prepared by 11 September, 2010, is essential.

1.2 Scope and Objective of the Survey

1.2.1 Scope of the Survey

Whole Mexico

1.2.2 Objective of the Survey

The objective of the Survey is to gather and analyze information regarding Mexico's energy management system and to consider cooperation possibilities in the area of energy efficiency via the introduction of Japanese methodology.

1.3 Scope of the Work

The scope of the work of the Survey is described in the following, based on the Terms of Reference provided by the Japan International Cooperation Agency (hereinafter "JICA").

A: Preparatory Work in Japan
(a) Analysis of the relevant information
(b)Discussion with JICA

(c)Writing Inception Report
(d)Collection and analysis of existing documents

B: First Local Survey
(a) Grasping Mexico's current situation and needs in the area of energy efficiency
(b) Grasping the current situation of energy efficiency promotion in Mexico including the "Energy Management System"
(c) Introduction of the Japanese "Energy Management System" (especially the energy manager system)
(d) Introduction of good practices in the area of industrial processes
(e) Introduction of good practices in the service sector (including buildings)
(f) Introduction of a Japanese organizational framework of (c)
(g) Confirming the needs of Mexico at the introduction of (c), (d), (e)

C: Work in Japan
Surveying the needs of Mexico required at the First Local Survey

D: Second Local Survey
(a) Additional introduction of the Japanese institutional system and good practices based on Mexico's request
(b) Analysis and consideration of the "Energy Management System" which is to be established in Mexico and the provision of useful information for its establishment

E: Work in Japan
Organizing the results of the local survey, writing a Draft Final Report and submitting a Final Report on the condition of JICA's confirmation

1.4 Overall Schedule

The overall schedule of the survey is shown below.

Table1-1 Overall Schedule

	6 月	7 月	8 月	9 月	10 月	11 月
Preparatory Work						
1st Local Survey						
Work in Japan						
2nd Local Survey						
Work in Japan						
Report Submission		Inception ▲		Draft Final ▲		Final ▲

1.5 Survey Team Structure

The survey team consists of two teams; a schematic design team which surveys the energy management system and an energy efficiency technology team which introduces good practices and conducts energy audits.

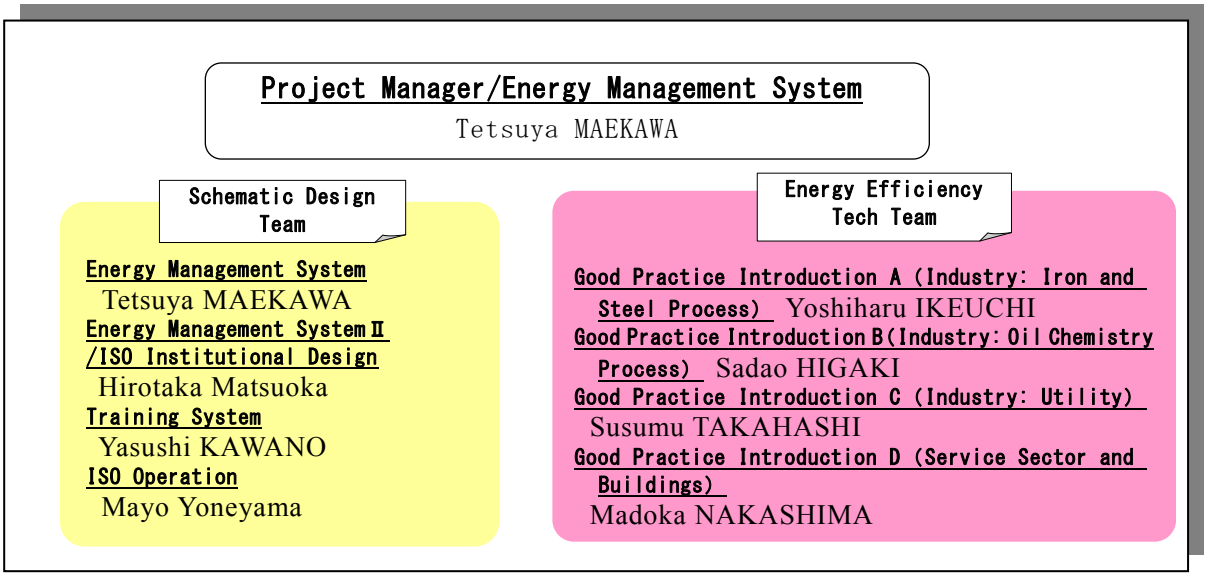


Figure 1-1 Survey Team Structure

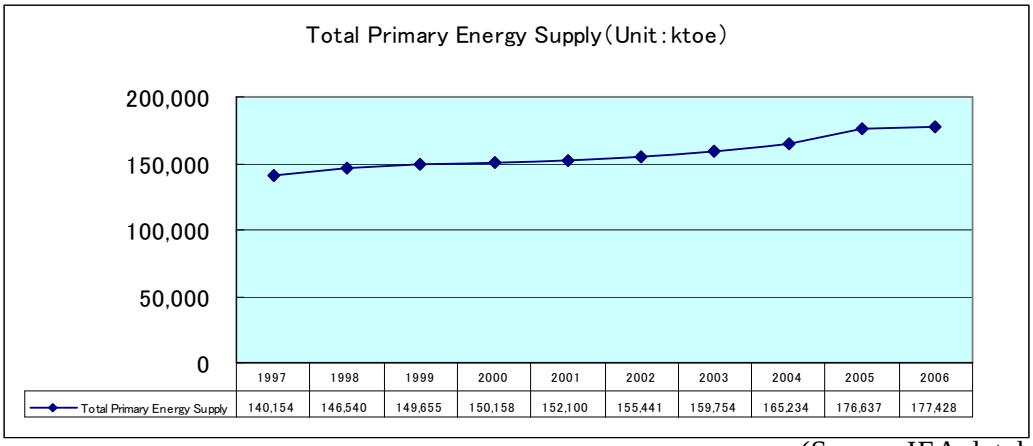
Chapter 2 Situation and Needs on Energy of Mexico

2.1 General Information about Energy

2.1.1 Primary Energy Supply

(1) Change of the Amount of Total Energy Supply

A change of total energy supply is displayed as follows. It is said that the amount of Total Energy Supply increased by 27% between 1996 and 2006.

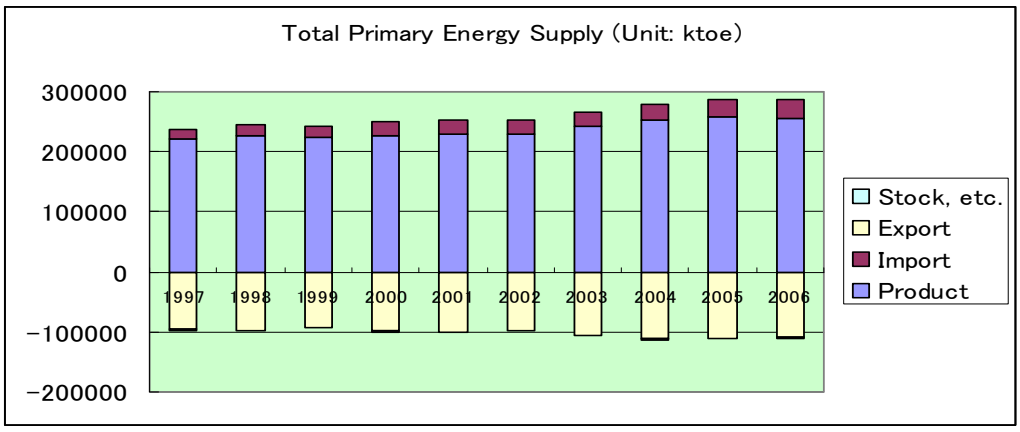


(Source:IEA database)

Figure 2-1 Change of Total Primary Energy Supply

(2) Balance of the Amount of Primary Energy Supply

The primary energy supply is represented by (Product) + (Import) - (Export) - (Stock and others). Each detail is as follows. In terms of primary energy, Mexico is a net exporting country, and there have not been any significant changes.

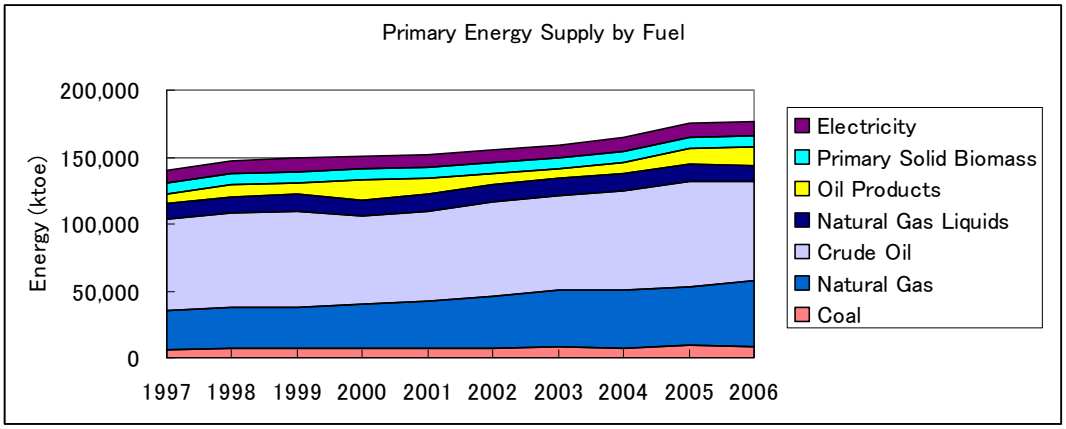


(Source: IEA database)

Figure 2-2 Details of Primary Energy Supply

(3) Amount of Primary Energy Supply by Fuel

The following is a change of the primary energy supply by fuel. It is said that crude oil, not including petroleum products, at 42% in 2006 occupied the largest portion in history. It is also said that the increase of Natural gas over the ten years (68% increase compared with 1997) is due to the expansion of consumption for power generation.



（Source: IEA database）

Figure 2-3　Amount of Primary Energy Supply

2.1.2　Final Energy Consumption

(1) Amount of Final Energy Consumption

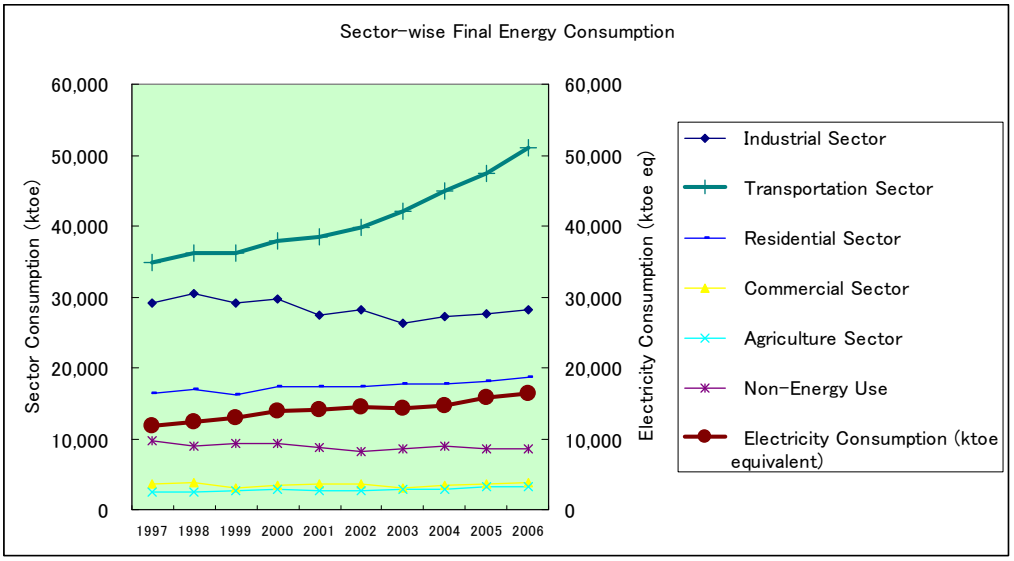
The following is the change of amount of final energy consumption. Final energy consumption is calculated by: (primary energy supply)- (loss in conversion section). In the breakdown of final energy consumption, the transportation sector is the largest at 45%, with industry at 25%, and housing at 16% (both values per 2006 data).　14% is electric power from final energy consumption (Power consumption is a number on the inside).

Table 2-1　Change of Final Energy Consumption

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Primary Energy Supply(ktoe)	**140,154**	**146,540**	**149,655**	**150,158**	**152,100**	**155,441**	**159,754**	**165,234**	**176,637**	**177,428**
Loss in Conversion sector(ktoe)	**-43,731**	**-47,465**	**-52,929**	**-49,551**	**-53,831**	**-55,834**	**-59,338**	**-59,967**	**-67,996**	**-63,996**
Electrical Conversion Loss	-24,304	-27,568	-28,356	-30,074	-30,432	-31,547	-33,675	-32,338	-37,203	-38,487
Oil Refinement	-3,578	-3,153	-3,250	-1,223	-1,536	758	-1,379	-4,692	-7,484	-5,888
Coal Processing	-150	-112	-643	-657	-507	-445	-441	-302	-366	-191
Private Consumption	-14,751	-16,208	-16,376	-16,062	-16,600	-16,488	-17,648	-16,731	-19,347	-19,682
Loss in Distribution	-2,133	-2,280	-2,375	-2,469	-2,611	-2,695	-2,882	-3,053	-3,265	-3,449
Others	1,185	1,856	-1,929	934	-2,145	-5,417	-3,313	-2,851	-331	3,701
Final Energy Supply(ktoe)	**96,423**	**99,075**	**96,726**	**100,607**	**98,269**	**99,607**	**100,416**	**105,267**	**108,641**	**113,432**
Industrial Sector	29,122	30,568	29,081	29,791	27,406	28,156	26,360	27,200	27,597	28,099
Transportation Sector	34,915	36,188	36,132	37,963	38,555	39,726	42,023	44,944	47,451	50,997
Residential Sector	16,476	16,968	16,278	17,300	17,262	17,350	17,772	17,803	18,140	18,602
Commercial Sector	3,622	3,840	3,082	3,480	3,577	3,650	2,995	3,523	3,701	3,832
Agriculture Sector	2,523	2,515	2,761	2,784	2,714	2,611	2,778	2,833	3,176	3,326
Non-Energy Use	9,765	8,997	9,392	9,289	8,756	8,114	8,487	8,965	8,575	8,576
Electricity Consumption (ktoe equival	11,845	12,347	13,039	13,943	14,033	14,389	14,360	14,619	15,837	16,412

（Source: IEA database）

Change over the 10 years from 1997 to 2006 is the 18% Final Energy Consumption increase. Especially, the transporting sector has the highest growth rate at 46%. As for electric power, this rate is also high at 39%.

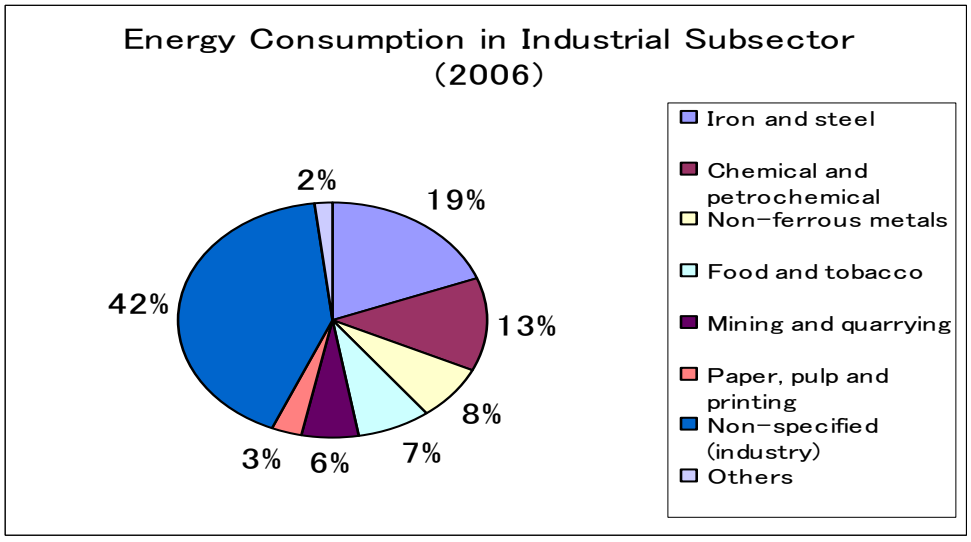


(Source: IEA database)

Figure 2-4 Sector-wise Final Energy Consumption

(2) Details in the Industrial Subsector

The breakdown of an industrial sector is as follows among the final energy consumption (figures in 2006). The ratio of steel (19%) and chemistry and petrochemical (13%) is large in their particular industries.



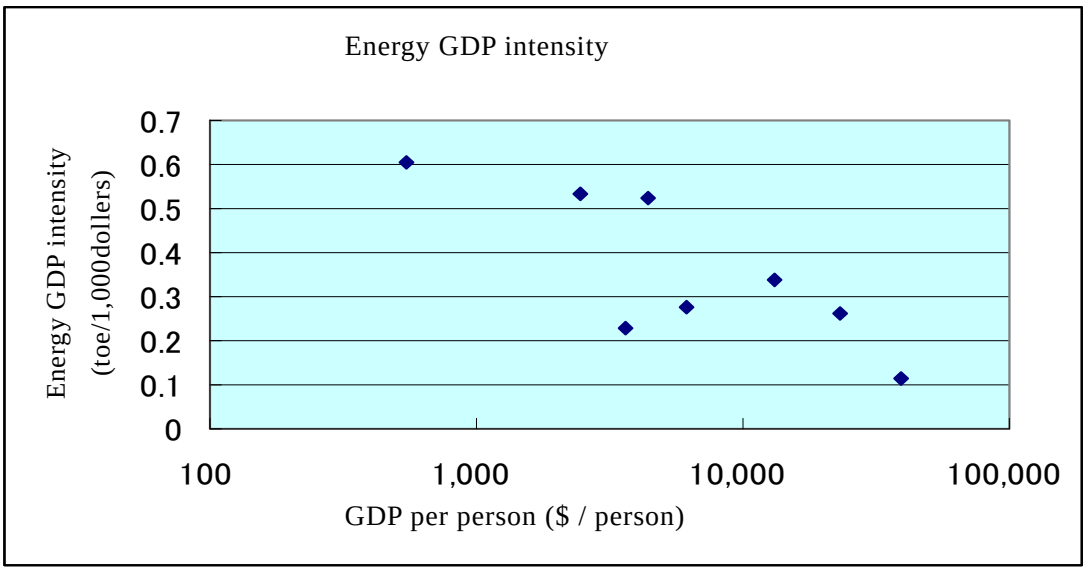
(Source: IEA database)

Figure 2-5 Energy Consumption in Industrial Subsector

2.1.3 Comparison of Countries

(1) Energy GDP intensity

The 2005 energy GDP intensity, which is the amount of primary energy supply divided by the real GDP (price in 2005), is shown as follows. Mexico's numerical value is lower than other countries (It is efficient).

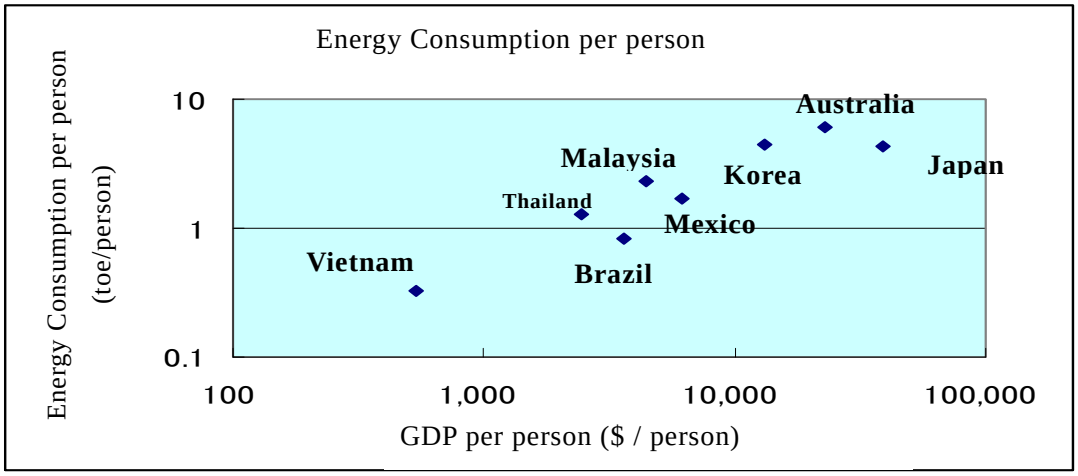


（Source: EDMC Handbook of Energy& Economic Statistics in Japan）

Figure 2-6 Energy Intensity Compared by Country

(2) Energy Consumption per Person

The energy consumption per person, which is the amount of the primary energy supply divided by the population, in 2005 is shown as follows. In general, as the GDP per person is higher (GDP per person is closer to that of developed countries), the amount of energy consumption per person is larger, and it can be said that in Mexico, energy usage is comparatively efficient.



（Source: EDMC Handbook of Energy& Economic Statistics in Japan）

Figure 2-7　Energy Consumption per person Compared by Country

2.2　General Information of Each Energy

2.2.1　Oil

(1) General Information

Mexico as an oil-producing country is sixth place in the world, and as of 2009, trails right behind the United States in the western hemisphere. In 2009, 2.6 million barrels on average per day were produced, 88% of which was crude oil (including Condensate) and 12% of which was LNG (Liquid Natural Gas). The amount of exports is 1.7 million barrel/day (2006), of which the majority of it is consumed by the United States.

In the beginning of 2009, the amount of proved reserve of crude oil is presumed to have been 10.4 billion barrels (17th place in the world, and 1% or less than 1,354.1billion barrels of the world). It is said that it cannot be produced within 10.2 years, and the urgency of finding new oil fields has intensified more than before for the purpose of securing mid/long-term security of resources. The largest oil field in Mexico of the Ku-Maloob-Zaap zone located in the Gulf of Mexico produces 800,000 barrel/day (per 2009 data).

The change in the amount of crude oil day production is shown as follows.

Table 2-2 Amount of Production Transition of crude oil per day (Unit: 1000 barrel/day)

	Total	Crude Oil				Natural Gas liquids[a]
		Total Crude	By type			
			Heavy	Light	Extralight	
2003	3,789	3,371	2,425	811	135	418
2004	3,825	3,383	2,458	790	135	442
2005	3,760	3,333	2,387	802	144	426
2006	3,683	3,256	2,244	831	180	427
2007	3,477	3,082	2,045	838	199	395
2008	3,164	2,799	1,773	815	210	366

(Source: SENER website)

(2) PEMEX (Mexican Oil Company)

The upstream section of oil (production and refinement) has governmental PEMEX (Petroleos Mexicanos). Further, it is monopolizes property and management.

PEMEX is composed of the headquarters organization and the following four sections.

- PEMEX Exploration and Production
- PRMEX Refining
- PEMEX Gas and Basic Petrochemicals
- PEMEX Petrochemical

The income of the PEMEX (consolidation) in 2009 is 1,090billion pesos with a pre-tax profit of 452 billion pesos, tax of 547billion peso. The tax ratio is exorbitant. It accounts for about 30 percent of Mexican national finance, and this is why it is said that oil taxes support state finance.

Although measures are necessary for this situation where crude oil in Mexico is in short supply, PEMEX's problem is that it runs out of self-fiscal resources because it has to pay high taxes and consequentially is not to be able to secure funds for prospective investments.

2.2.2 Natural gas

(1) General condition

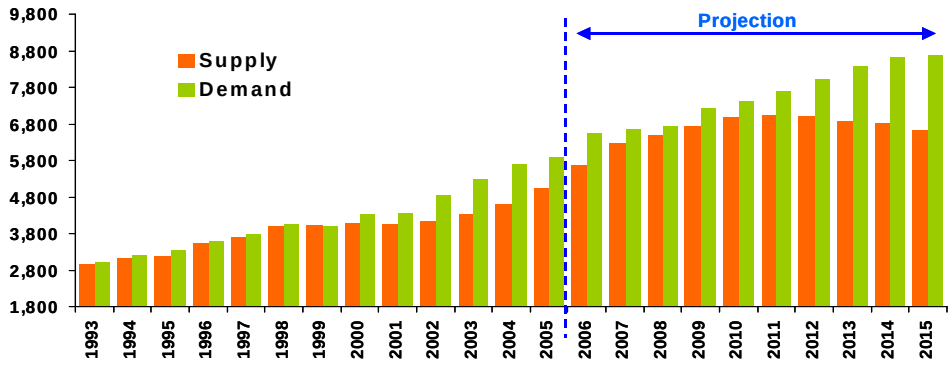
As of January 2009, the amount of proved reserves of natural gas is 13 trillion cubic feet. The consumption of the natural gas has expanded steadily, which is caused by electric power sector demand (natural gas power generation). Although northern regions are expected to have an abundance of oil reserves, a lot of reserves are now found in the south. (From the DOE/IEA website)The change in the amount of natural gas day production is shown as follows.

Table 2-3 Amount of production of natural gas per day (unit: Cubic Feet/day)

	Total	By type	
		Associated	Non associated
2003	4,498	3,119	1,379
2004	4,573	3,010	1,563
2005	4,818	2,954	1,864
2006	5,356	3,090	2,266
2007	6,058	3,445	2,613
2008	6,919	4,320	2,599

(Source: SENER website)

Next, the data of the balance amount of domestic supply and the demand for natural gas is shown below. The amount where the supply quantity does not sufficiently meet demand is covered by the imports. The imports began expanding from around the year 2000. It is expected that the expansion of demand will become larger than the quantity supplied in the future, and the import amount will increase.



(Data source: SENER presentation material)

Figure 2-8 Natural Gas Supply and Demand Balance

(2) Development actor

As with oil, although PEMEX is in a monopolistic situation, due to its expanding production of non-associated gas (taken from the gas fields), PREMEX has publicly announced that it consigned its “development service business” from 2003. This allowed foreign competition to enter this “development service” market. (Teikoku Oil in Japan also was participating in the development service business of the Cuervito mine lot and the Fronterizo mine lot).

2.2.3 Coal

The consumption in 2006 was 19.1 million tons. Out of the confirmed reserves, (1.21 billion tons: 2006), 96% can disproportionately be found in the Willa State and accounts for 85% of

the resources in the Monclova Shahinaz coal field. Present operations along with the planning and the development of the coal mine is limited to the coal from the Monclova to Shahinaz coal fields in the Coahuila state and the general coal for electricity from the Piedras Negras coal field.

2.2.4 Nuclear power

There is only one nuclear plant managed by CFE: Laguna Verde power plant (1,365MW).

2.2.5 Renewable energy

(1) Hydropower

Although, about 12% of the amount of power generation for the entire country is roughly generated from water power, there is a change every year because the annual rainfall is controlled (From the value in 2007 the SENER website: Water power is 27,000Gkw; the total amount of generation in Mexico is 231,000GWh). Moreover, the capacity of the water power equipment of the entire country was 11.3GW in 2007. The maximum hydroelectric power plant is the Manuel

Moreno Torres power plant (2,400MW) in the Chipas state that is managed by CFE

In Mexico, hydropower is defined as renewable energy regardless of the scale of energy. According to SENER, the potential of hydropower in the whole country is 53,000MW, and the small scale hydropower generation of 10MW or less is to be 3,500MW.

(2) Geothermal

Mexico's volcanoes are active, and potential geothermal activity is high. The capacity of the geothermal power generation is 980MW which is third place in the world, following the United States and the Philippines (in 2006). The maximum is 2263MW in the Adolfo Lopez Mateos power plant in the Varacruz state.

The investigation on the potential of geothermal generation is ongoing in four regions (Cerro Prieto, Los Azufes, Los Humeros, and Las Tres Virgenes). According to SENER, technical improvements are necessary economic stability. Although the whole country’s capacity is estimated to be 2,400MW.

(3) Wind

It was only at two places of the La Venta power plant (1.575MW) in the Oaxaca state where operations had begun since the Guerrero Negro (Guerrero Negro) power plant (the power generation ability 0.6MW) in the southern Baja California state that had been in operation since 1982 and 1994 before 2007.

However, because the second division (La Venta II) of the La Venta power plant began operating in January 2007(the power generation ability 83.3MW), the capacity of power generation reached a total of 85.475MW in October 2007.

It became an accessible environment where private organizations could easily enter the wind power generation market by agreeing to share a public power grid of CFE among CFE and two or more private power-generation activities in 2007 though CFE owned both of the current wind-power plants.

In the explanation from SENER, it is estimated that the force of the wind potential is 40,000MW for the entire country in 2007.

(4) Solar Power
The quantity of average solar radiation is assumed to be 5kWh/m2. The solar panel of 328 millionm2 and the photovoltaic generation panel of 115 millionm2 were set up by 2005.

(5) Biomass
A Biomass power generation of Mexico is mainly methane power generation that uses residue of the bagasse or uses the methane that goes out of from municipal solid waste.

CRE (Comisión Reguladora de Energía) authorized 2 power plants by biogas (391MW) and 44 power plants via the hybrid combustion (10.8MW) of the sugarcane bagasse and oil in August, 2002 (From No.2 in NEDO overseas report fiscal year 2003).

The Law to promote bio-fuel promotion development was announced and was enforced the next day on June 18, 2010. This provides a grant system for production, storing, transportation, and sales of the bio-fuel, and approval from the Ministry of Energy was forthcoming. Moreover, it was assumed that a notification to this ministry would suffice for import corn though prior permission from the ministry was necessary for using domestic corn. An actual grant acquisition procedure seems to have the detailed rules which are to be stated in six months, so it will take longer for an actual introduction of the bio-fuel (From JETRO news).

2.3 Energy Policy

2.3.1 National Development Plan

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(1) General Information
In Mexico, National Development Plan is provided during the president's tenure (There is no

reelection of the president for six years). This is the foundation of all development plans. Plans for 2007-2012 period is at president Calderon's tenure.
In this National Development Policy, the following five basic policies are declared.

- Rule and public and safety by law
- Economical competitive edge and hiring increasing numbers
- Equality of opportunity
- Durability of environment
- Effective democracy and accountable diplomacy

The policy concerning the energy efficiency is included in above-mentioned "Economical competitive edge and hiring increasing numbers" and "Durability of the environment" among these

(2) Economical competitive edge and expand of hiring opportunities
17 targets are set to "Economical competitive edge and expansion of hiring opportunities", the our target No.15 "Supply of energy resource in a highly reliable, high-quality, competing price" is composed of 17 strategies further, the energy efficiency improvement is located with one of the strategies, and the strategy of the energy efficiency improvement has been described as follows.

Strategy15.13: Promote efficient use for energy by offering highly effective and energy-saving technology.
Strategy15.14: Promote renewable energy and bio-fuels, and build a legal system to promote these investments.
Strategy15.15: Strengthen the energy conservation program including the introduction promotion of cogenerations.
Strategy15.16: Give the advantage to the investigation and research activities concerning renewable energy and the efficient technologies.
Strategy15.17: Strengthen restriction organizations.

(3) Environmental Sustainability
14 targets are set to "Environmental Sustainability ", and our target No.10 such as “It is decreased the exhaust of the heat-trapping gas" is composed of four strategies in addition, and the strategy of the energy efficiency is described as follows.

Strategy 10.2:The efficient utilization of energy is promoted in home, factory, agricultural, traffic area. On the based of the policy of energy efficiency and efficient product promotion in use of energy, which is released by Fund for Energy Saving (FIDE: Fideicomiso para el Ahorro de Energía Eléctrica) and National Commission of Energy Efficiency (CONAE: Comisión Nacional

para el Ahorro de Energía and present CONUEE), promote to use energy efficient lighting, to insulate houses, and to change machines which use a large amount of energy. The standard (criteria) of efficient utilization of energy is included in the new house design. It is necessary to specify the chance of the heat-trapping gas decrease, and to press the participation of the exhaust gas decrease market in the frame to the enterprise in the frame at the business and the distance in the segment of industry. Moreover, industry such as cement, steel manufacture, and sugar refining especially has high potential in the cogeneration of energy, and can prevent the exhaust of the heat-trapping gas and the volume consumption of energy by the cogeneration. Moreover, it is necessary not to cause the fuel usage.

2.3.2 Energy Sectoral Program

(1) General Information

Energy Sectoral Program is a concrete, operational program that that Ministry of Energy (SENER) establishes based on National Development Policy. The "Energy Sectoral Program up to 2012" established in March 2008 is the latest version now.

This program declares the following nine basic policies. 1-3 are policies, 4-6 concern hydrocarbon, and policies and 7-9 concern electric power and deal with the direction energy efficiency and renewable energy will be taking.

1. Guarantee the country’s energy security on hydrocarbons
2. Encourage the operation of the hydrocarbons sector in accordance with international standards of efficiency, transparency and accountability
3. Increase exploration, production and transformation of hydrocarbons in a sustainable manner
4. Encourage tariff levels correspondent with the costs of an efficient operation of public entities of the electric sector
5. Balance the portfolio of primary sources of energy
6. Strengthen the public entities of the electricity sector in operations and standards of quality and reliability in service delivery
7. Promote the efficient use and production of energy
8. Encourage the use of renewable sources of energy and bio-fuels that are technically, economically, environmentally and socially viable
9. Mitigate the increase of Green House Gas emissions

(2) Targets pertaining to energy efficiency improvements

In the energy sectoral program until 2012, the setting and promotion of the following nine

objectives have been assumed.

- Secure Security in hydrocarbon energy resource

Index	Unit	In 2012
Recovery of reserved resources	%	51
Use of Natural Gas	Extracting rate (%)	97
Import of Gasoline	Import / demand (%)	40
Reserve own a) Gasoline b) Diesel	Days	 4.0 4.0

- Improve the operating effectiveness and the transparency of the sector related to the hydrocarbon, compared with the international average

Index	Unit	In 2012
Recovery of Hydrocarbon product	%	34.5
Use for oil refine	%	87
Accident rate in Oil sector	time／million operating time	0

- Maintain the promotion of the excavation, production, and refinement of hydrocarbon resource

Index	Unit	In 2012
Oil production	Million barrel / day	>2.5
Natural Gas production	Million m2 / day	5

- Electric rate level that reflects the public, electric entrepreneur's efficient management

Index	Unit	In 2012
CFE: Electricity sales/ operating person	GWh/ person	2.6
CFE: Electricity sales/ distribution& sales person	GWh/ person	4
LFC: Electricity sales/ distribution& sales person	GWh/ person	2.9

- Balanced use of primary energy source

Index	Unit	In 2012
Amount of Power Generation of Primary Energy Supply	%	Oil 20.1 Natural Gas 41.4 Coal 9.6

		Hydropower （equal to or more than 70MW） 16.8 Small-hydropower 3.5 Renewable 5.9 Nu-clear 2.7

- Improve public, electric entrepreneur's commodity supplied quality and reliability

Index	Unit	In 2012
Hours of Blackout（caused by supplier） 1) CFE 2) LFC	minute／year	 CFE: 78 LFC: 106
Energy Loss rate 1) CFE 2) LFC	%	 CFE: 10.5 LFC: 28

- Be more Efficient of the energy production and use

Index	Unit	In 2012
Cumulative amount of reduction of electricity use	GWh	43,416

- Promote the technically, economically, the environment, and socially use of appropriate renewable energy

Index	Unit	In 2012
Rate of Renewable energy in power generation capacity	%	26

- Control of increase of greenhouse gas emission

Index	Unit	In 2012
CO2 Emission from Power Generation	Mt CO2	28
Amount of sulfur Magna Gasoline Premium Gasoline Diesel	ppm	Average 30 Max 80 Average 30 Max 80 Max 500

2.3.3 National Infrastructure Program

(1) General Information

The national infrastructure program is setting an introduction target for all the infrastructure installations including the energy field based on the National Development Policy. The present program has been set for the 2007-2012 period.

It aims to enter the high rank of 20% in the World Economic Forum competitive edge index (World Economic Forum's Infrastructure Competitiveness Index) in 2030, and is composed of roads, railways, harbors, the airport, and each communication field, the water supply, hygiene, irrigation, the flood control, the electric power, oil, gas production, and oil and gas purification.

(2) Important fields of electric power

The policy of the power sector in the aforementioned "National infrastructure program" is as follows.

- Development maintenance of low-cost sending out of the supply of electric power equipment to meet electric energy requirements
- Diversification of the power supply and use of renewable energy
- Especially, the electrification rate improvement in the provinces
- It is assumed that the quality in power supply will improve

The following targets by 2012 are sets.

- The power generating machine is reinforced to assume a marginal supply capability of 23-25%, and the supply reliability is maintained.
- The effective power generation capacity is increased to up to 9,000MW.
- The supply capability of renewable energy becomes 25%.
- The delivery electric wire of each class is newly established at 14,000km or more.
- The electrification rate has increased up to 97.5% compared with the population at large.
- In the World Economic Forum power supply quality index, it ranks 40th.

2.4 Main Laws

2.4.1 Constitution of Mexico

The "Political Constitution of the United Mexican States of 1917" enacted in 1917 is now Mexico’s constitution. This is assumed to reflect a reactionary past history when resources and major industry were deprived at the hands of Northern America and the European nations, and the shade of the nationalism over resources and key industry nationalization is extremely strong due to events that occurred in the middle of the Mexican Revolution.

Articles 27 and 28 states that national restriction of natural resource development, oil, the acquisition of goods, and tight controls over the electric power field are permitted and monopolistic government rule is also possible with regards to the field of energy.

Although the government had exercised direct control over power supply through CFE, due to the enactment of a new electric power public service law (Ley del Servicio Publico de Energía Electrica) in 1992, non-government entities were permitted market entry into areas besides public service.

Article 27: About the development of natural resources - All natural resources belong to the property of the nation. - The nation exclusively executes power generation, power transmission, the supply of electric power, etc. to provide public service. Article 28: About the monopoly prohibition -All monopolies are prohibited. -However, the government can rule immediately, and mail, the communication, oil, the derivation goods or neither petrochemical industry nor power generation, etc. are considered to be monopoly.

（Source: Website of the Government of Mexico）

2.4.2 Law of the Public Services for Electric Power

Although this law (Ley del Servicio Pubulico de Energia Electrica) provides for a national monopoly of the electric power public service, non-government entities were enabled market entry due to the revision enacted in 1992 for power generations outside of designated public services.

The main fields allowing private corporation participation are as follows.

- Power generation of individual or corporation for captive use (private generation)
- Cogeneration (both use of heat and electricity)
- Small-scale power generation not to exceed 30MW capacity (1MW cap, in cases of decentralization and independent power supplies in farm villages or remote places)
- selling of electricity to a power company to CFE and LFC (Luz y Fuerza del Centro: Central supply of electric power public corporation) was assumed to be the main purpose of independent power-generation activities that exceed 30MW (IPP)

Moreover, it was assumed that a power company could sell electricity to CFE etc. up to 20MW without bidding. Afterwards it could sell up to half of its equipment capacity without bidding due to revised ordinance enacted in May, 2001. However, using surplus electricity in the private sector for the public sector was unconstitutional in April, 2002.

2.4.3 The energy efficiency standard as national standard

Home appliances concerning the energy consumption efficiency standard was provided dependent on the federal measurement standard law (Ley Federal Sobre Metrogia y Normalizaction) that had been enacted in July, 1992.

NOM (Normas Oficiales Mexicanas: compulsion standard) was established from the field of which each ministry agency was taking charge respectively based on this law. SENER enacted NOM such as home appliances of three kinds of products through CONAE at that time in 1995, and has increased to 18 kinds (air-conditioning, pumps, lights, fluorescent lamps, washing machines, refrigerators, freezers, motors, and heat insulators, etc.) now.

As for NOM, which is the energy consumption efficiency standard for home appliances, products sold domestically including imports are covered, and the manufacturing entrepreneur, the import entrepreneur, and the retailer are responsible for observing this regulation. Measures such as penalties and business suspensions are enforced when violated.
A label that displays the efficiency rate must be placed on about five different products (refrigerators, washing machines, water heating appliances, air-conditioning, and centrifugal force type pumps) among the other products that the energy consumption efficiency standard has been imposed on too.

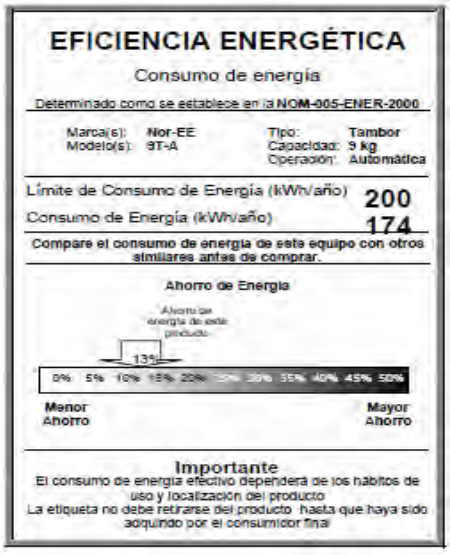


Figure 2-9 Example of Labeling

2.4.4 Energy restriction committee method

The Law concerning the restriction of electric power, natural gas, and LP gas enforced in October, 1995. As a result, independence and the autonomy of management as the

organization of CRE (Comision Reguladora de Energia: energy restriction committee) have risen. This law's main target is as follows.

Improvement of energy supply and sales productivity as a public service to the beneficiary

- Power generation that the private sector executes and encouragement of importing and exporting of electric power
- Promotion of the procurement of electric power supplied to public services
- Power transmission and the supply of electric power service among enterprises and individuals who obtain the permission of power generation and importing and exporting and are promoted between suppliers and the supplier for electric power.

2.4.5 Energy Reform Method

(1) Background

Although 30% of Mexico's national finance is dependent on the hydrocarbon tax collected from PEMEX, the fact that the confirmed amount of crude oil reserves will not last 10 years is a source of anxiety for the government. On the other hand, given this heavy tax burden, PEMEX is unable to inject a sufficient amount of funds into investments which serves as an obstacle to increasing crude oil reserves. Given this situation, the necessity of separating the management of PEMEX from state finance has been pointed out. Nevertheless, given that government coffers are highly dependent on the aforementioned tax accounting for 30% of state finances, such a feat is easier said than done. Hence, a more realistic approach to increasing crude oil reserves and enhancing oil production must be found.

One strategy presented in April 2008 by President Calderon via an energy reform bill would give management sovereignty to PEMEX, where it could manage the budget and strengthen its debt. This bill was approved in the assembly on October 28, 2008, and, as a result, PEMEX was able to introduce a private technology necessary to mine crude oil from other sources and the ocean where it is now able to invest a lot of capital in new crude oil, gas inquiries, and its production.

This energy reform method came from a package of seven laws, and two were concerning the reformation of PEMEX, three were related to SENER, CRE, and CNH (National Hydrocarbons Commission), the others were "Sustainable energy use" and "Renewable energy use promotion method".

(2) Sustainable energy use

The description items enacted as law concerning sustainable energy use (Act for the Sustainable Use of Energy) are as follows.

✧ A national program is settled on the inquiry, production, and the supply by

setting the strategy, the purpose, the target to use sustainable energy, and each action plan, etc. when processing and each acting consumption. It is assumed that the following content is contained.

- Positive adoption of the conservation of best energy practices for federal government buildings
- Decision of permanent programs for acquisition, lease, activity, and service that contributes to sustainable energy use
- Promotion of science and technology
- Educational program strengthening sustainable energy use in education such as elementary schools, junior high schools and high schools
- Spread promotion of efficient technology, equipment, and vehicles
- Decision of standard program concerning energy efficiency
- Accurate, effective provision of information of energy consumed such as various equipment and vehicles
- Strategy formulation concerning modernization of a long distance transportation system and a short distance electrification transportation system
- Decision for a substitution strategy from incandescent lamps to fluorescent lamps

✧ Strengthening of the authority and mission of CONAE that is an organization for energy efficiency (reorganization to CONUEE)

✧ Establishment of an advisory committee in CONUEE

✧ The mechanism of a regular offer of information is settled by specifying the construction of the national information system concerning the energy consumption (amount of the supply, consumption, energy efficiency index, and conservation of the energy strategy case, etc. according to the energy) and multi consumption energy users.

✧ Information to recognize the importance of energy efficiency improvement and environmental protection to the charge receipt of the specification of information concerning consumption to the energy consumption equipment and the electric power public corporation or bills collected.

✧ Construction of an execution methodology of an energy efficiency authentication system (construction of an authentication system, attestation by an external specialist concerning an energy consumption concerning process, product, and service, training program, and a regional central establishment etc. of small and medium-sized enterprise support)

(3) Act for the Use of Renewable Energy and the Financing of the Energy Transition

This law is composed of the following three contents.

✧ Establishment of a national strategy and finance tool in the power generation

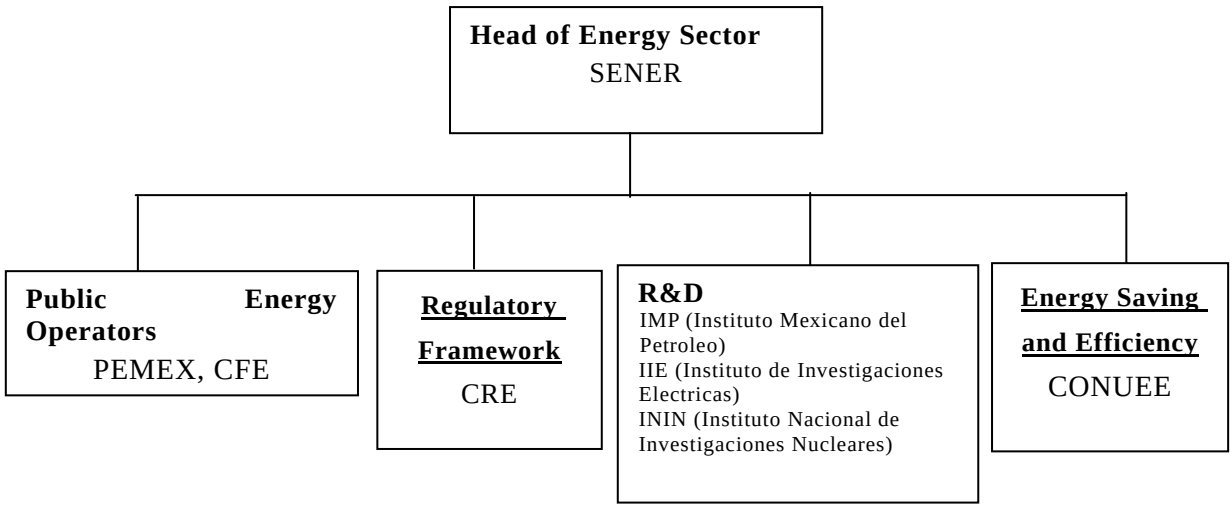
field for the promotion of the utilization of renewable energy and clean technology and energy shifting

- ✧ A rule including renewable energy use and a new authority for strategy formulation are given to the energy undersecretary and CRE.
- ✧ "Fund (Energy Transition and Sustainable Energy Use Fund) for energy shifting and sustainable energy utilization" of three billion pesos every year has been established from 2009 to 2011 aiming at energy shifting.

2.5 Implementation system for energy sector

2.5.1 Implementation system for energy sector

The energy sector in Mexico is composed of four functions as shown in the following figure, and the head organization is SENER (Ministry of Energy). Some of them are PEMEX and CFE who are public energy operators. And, CRE is a different branch from PEMEX and CFE, which restricts the electric tariffs and power-generation activities. Moreover, the organization for R&D divide into the oil system, the electric power system, the nuclear power system and others, and it has each national laboratory. As an organization to promote energy efficiency improvement in the whole of Mexico, CONUEE is located under SENER.



(Source: SENER presentation material)

Figure 2-10 Implementation System of Energy Sector

2.5.2 Outline of electric business

(1) History of electric business

The Electric business of Mexico, which private enterprises begun by 1989, has the second

oldest history in the middle-south America after that of Brazil. Although a lot of private enterprises had been managed regionally until CFE was established by the Executive Order in 1937, CFE developed rapidly at the small hydropower and the diesel electric power generation after its establishment, and came to account for about 60% of the amount of total power generation in 1960.

In the United Mexican States constitution, the power generation to perform public service, power transmission, the transformation of electrical energy, and the supply of electric power are provided for that nation that has an exclusive right and all authorities concerning electricity utilities and industries belong to the government by a government-run federal corporate method in 1960. CFE executed all new Electric Power Development after 1961, and absorption amalgamated a lot of electric power companies from the electric rate union and from 1963 to 1967 of the whole country with CFE in 1962.

Electric power (Mexlight) of a Mexican light with Mexico City in the service area had been managed independently of CFE under the name of LFC (central supply of electric power public corporation) until LFC (central supply of electric power public corporation) was dismantled in October, 2009.

It is composed of the power supply as the public service that CFE treats and the power supply by the private organization like IPP and the cogeneration and the private power generation, etc. now. It supplies it as the service area is monopolistic.

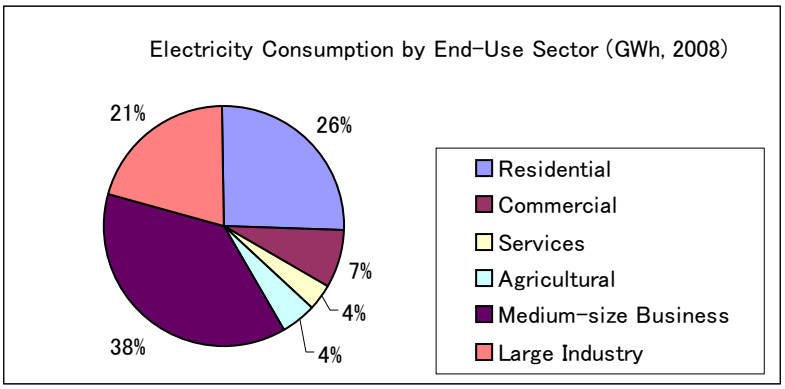
CFE has the power generating machine, and about 95% and other oil public corporations (PEMEX) have and about 3% and a private departure and IPP, etc. have about 3%.
41,178MW, and on the other hand, the total power generation capacity in 2007 is a gas combined cycle 16,846MW (33.8%), oil thermal power 12,651MW (23.4%), and water power 11,045MW (22.2%) in the fuel type when seeing. Recently, the development of wind power generation (2006: 2MW and 2007: 85MW) in addition to an increase of the gas combined cycle power generation by the entrepreneur including IPP is advanced.

(2) Trend of electricity liberalization
Because the retail division was still a monopoly supply after the law revision of the electric power public service in 1992, and the private investment to power-generation activities without the state guarantee was unattractive, etc. business entries from the private sector were limited. The electric business reform bill was submitted to the assembly to advance structural reorganization of the electricity utilities industries afterwards in the electric business reorganization idea and 2002 in 1999. It has not arrived at the enactment of legislation though this has the feature of the introduction of generating electricity, transmitting of CFE and LFC, separating the electricity producer from the power supply company, the power transmission

company, making to the national enterprise of the licensing to the power supply company of 30 years, the system operation, feeding power, and nuclear power generation (public enterprise), and the wholesale electric power market etc.

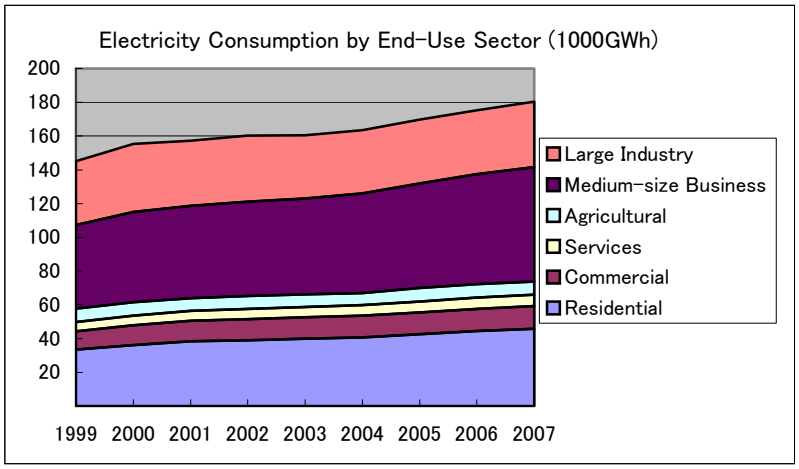
(3) Power consumption

The power consumption breakdown according to the sector and the transition are shown as follows. It serves to expand the residential sector the largest (42%), the second largest is small and medium-sized industry (40%), the third largest is services (30%), and the fourth is commerce (25%) between 1999-2008. It remains almost about large industry in 2% of the level-off.



(Source: SENER website)

Figure 2-11 Electricity Consumption Breakdown by Sector (2008)



(Source: SENER website)

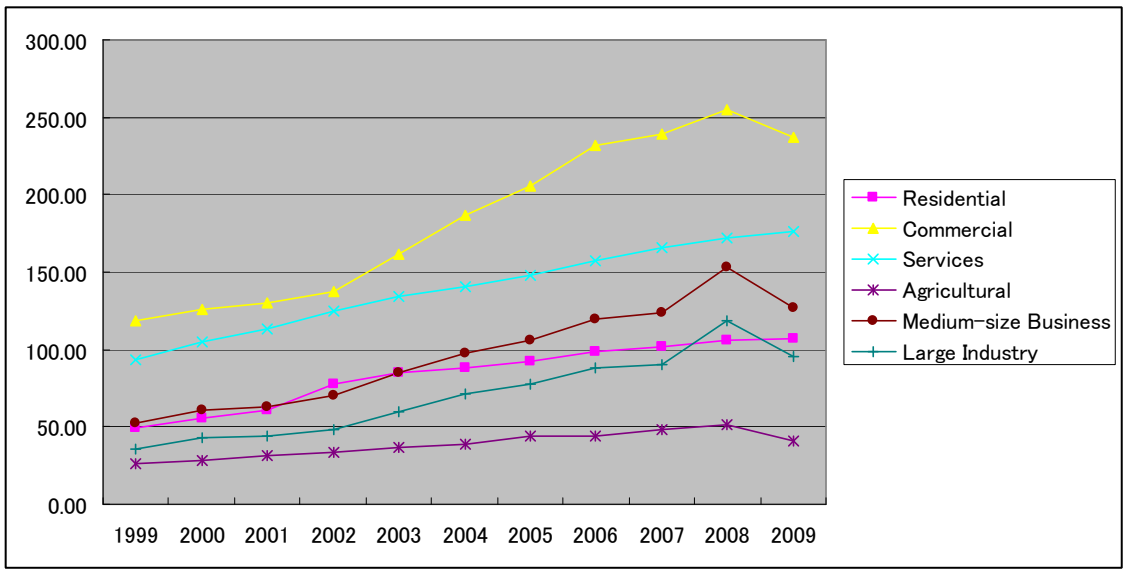
Figure 2-12 Electricity Consumption by End-Use Sector

(4) Electric rate

The electric rate is a system that is divided into the house, commerce, service, agriculture, medium-sized business, and large-scale industry, and is dependent on the region and the season.

An official price adjustment of industrial electric power was changed as one of the economic stimulus measures out of the 25 items that president Calderon announced in January 7, 2009. The decrease of the price of the power generation fuel such as natural gases was greatly reflected in the electricity cost by this change, and the charge in January, 2009 was reduced by 10~27.8% compared to December, 2008. Moreover, the fixed charge system degree of one year that had been adopted for industrial high tension power as measures of the rise of the price of the power generation fuel such as natural gases from the latter half of 2007 to the first half of 2008, and electricity costs also increased greatly since December, 2008 was adopted for inside piezo-electric power since February, 2009.

The transition of the electric rate average unit price and one example of the fee system are shown as follows. The charge is an uptrend when viewed from a general perspective.



(Source: SENER website)

Figure 2-13 Average Electricity Unit Price

2.6 Power equipment

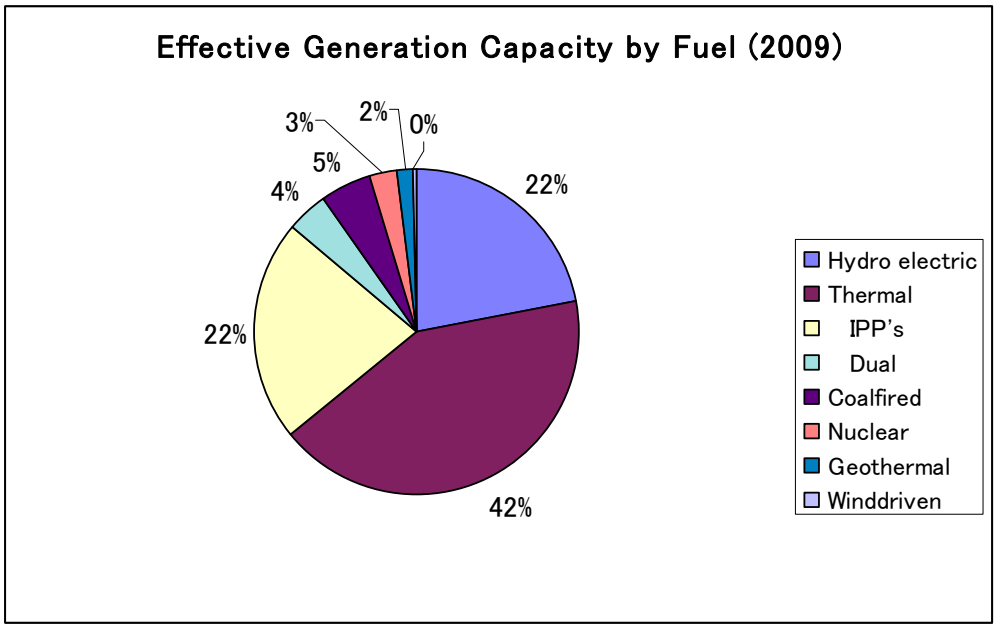
2.6.1 Power supply equipment

(1) Electric power supply and demand situation

The power demand in Mexico has increased by 191.3TWh by 4.1% every 11 years from 1995 to 2005 year on average in 2005. It was said to be primarily for industrial use, and recorded the expansion of 4.7% a year on average.

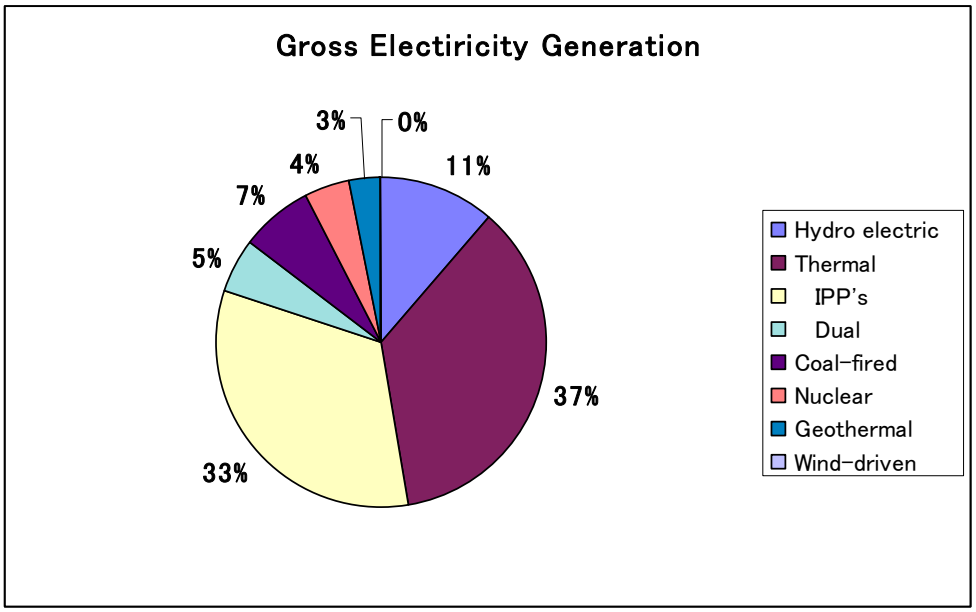
Thermal power generation that uses the fossil fuel accounts for 60 percent or more of all

power generation capacity (The private power generation trader's self-consumption is excluded) in Mexico, and the gas combined cycle power generation is increasing especially in recent years now. The gas combined cycle power generation of 1,912MW reaches about 8.8 times 16,846MW in 2007, and accounts for 33.8% of the domestic power generation capacity in 1996. Private entry into the power generation field by IPP had become possible due to the electric power public service law revised in 1992, and a lot of gas combined cycle power generations with fuel procurement advantages and the equipment efficiency side introduced.
Hereafter, the breakdown of the power generation capacity and the amount of power generation according to the fuel is shown.



(Source: SENER website)

Figure 2-14 Electric power generation capacity breakdown by fuel (2009)

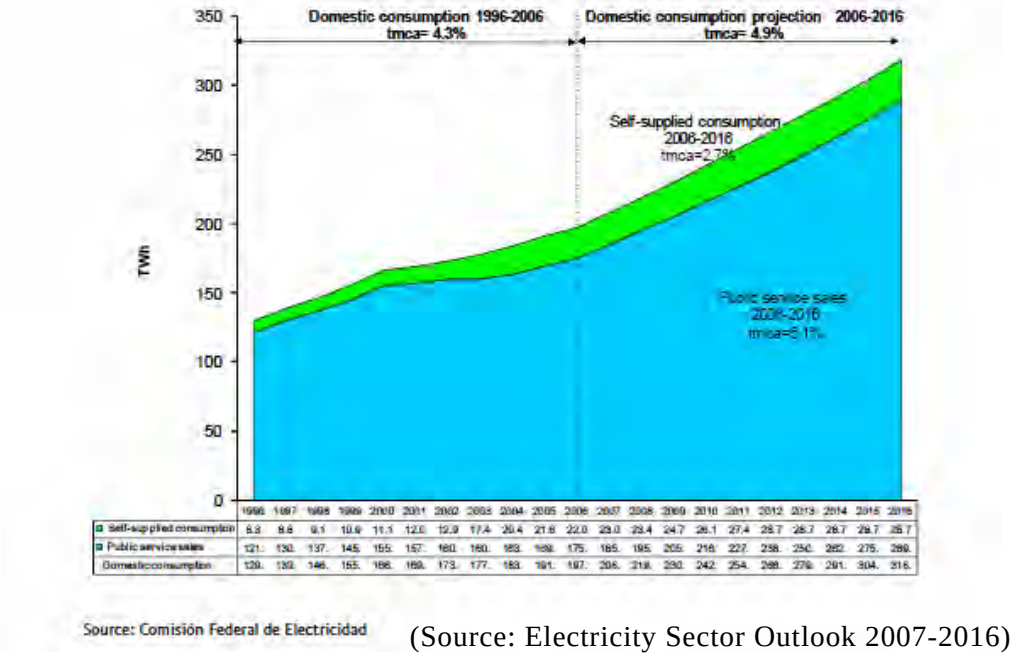


(Source: SENER website)

Figure 2-15 Power Generation Capacity by Fuel (2009)

(2) Transition and prospect of the power demand

It has been forecasted that the domestic power consumption is assumed to expand 4.6% a year on average from 2006 to 2016, and will increase from power consumption 197.4TWh in 2006 to 2016 121TWh, and reach 318.4TWh according to the electric power sector 2007-2016(Electricity Sector Outlook 2007-2016).



(Source: Electricity Sector Outlook 2007-2016)

Figure 2-16 Domestic Power Consumption Transition (1996-2006) and Forecast (2009-2016)

Economic growth and a population increase in the future are reflected, and the expansion is assumed for power consumption in recent years though the expansion of power consumption is comparatively low. The expansion of 5.2% a year on the average is concretely forecasted in the fields where the home, commerce, and the service industry were matched. It is 5.3% respectively, large-scale industry is 6.7%, and the expansion of 4.5% is forecast from the feature with a little yearly fluctuation via the average increase rate of 1.8% in an industrial field where the largest part of power consumption has occupied medium-scale industry agricultural sector including the livestock industry.

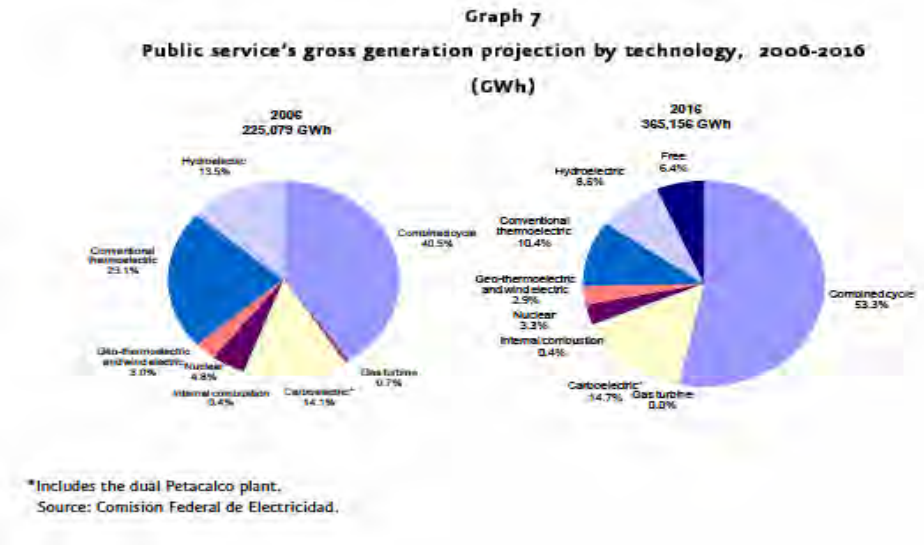
The region, about 1/4 of the amounts 175,381GWh of the domestic sale of electric power in 2006, though the metropolitan area, northeastern, and Midwest occupy of each while the expansion of the metropolitan area will remain in ten years on about 3.5% a year average in the future, the power demand in the northeastern (6.3% a year on average, especially the expansion of the Nuevo Leon state and the Tamaulipas state is large) and the southern part and southeast (6.2% a year on the average) Midwest (5.2% a year on the average) is expected to expand greatly. The expansion of

ten years will reach 6% a year on the average by the northeastern and the peninsula region about the maximum demand in each region in the future though the metropolitan area recorded 8,419MW in the maximum in 2006, and the maximum demand in 2016 is forecast to be 9,370MW in the western region and 8,259MW in the northeastern region, etc. to 7,795MW in the metropolitan area.

(3) Development Prospect of Power Supply Equipment.

1) Whole forecast

The whole forecast of the amount of the power generation of electric power in 2006 was 225,079GWh of the 2.8% increase compared with the previous year. Ten years from 2007 are assumed to be an average increase rate of 4.8%, and will reach 365,156GWh in 2016. The prospect of the fuel type that lies generated becomes 64% of natural gas, 20% of coal, and 17% of oil, etc., among the total consumption 6,427TJ of the fuel/day that lies generated in consideration of the government policy of lying the law and the energy source diversified related to the power generation efficiency, the price of the fuel, and the environment etc. in 2016. The average increase rate per year is 6.8% of natural gas, 3.9% of coal, and -2.5% of oil and -15.8% of diesel.



(Source: Electricity Sector Outlook 2007-2016)

Figure 2-17 Power Generation by Source (in 2016 and in 2006)

2) Power supply plan prospect by sector

CFE will plan to develop a new power supply of 21,737MW in 2016 for the 2007 power supply plan. The remaining 16,656MW has not been tendered yet though 5,082MW is under construction or will be at a tender stage sooner or later. On the other hand, LFC conducts the decentralized power supply project in the capital region, and there is a plan to newly establish the power supply of 416MW.

The power supply of 2,581MW is newly established in the whole country in the private departure project and other cogeneration, and 5,867MW has been abolished due to obsolete equipment.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Total	2,471	60	682	2,181	2,862	2,884	1,689	3,299	3,778	2,982	22,737
Public utility	2,471	50	562	2,029	2,852	2,562	1,569	3,299	3,778	2,982	22,153
Comisión Federal de Electricidad	2,055	50	562	2,029	2,852	2,562	1,569	3,299	3,778	2,982	21,737
Capacity in the construction or bidding phase	2,045	0	501	1,144	641	750	0	0	0	0	5,082
Additional capacity	0	0	11	700	2,036	1,812	1,569	3,299	3,778	2,982	16,187
Rehabilitations and modernizations (RM)	10	50	50	185	175						469
Luz y Fuerza del Centro	416										416
Self-supply and cogeneration	0	0	0	152	0	432					584

Source: Comisión Federal de Electricidad

Table 2-4 New Electric Power Development plan by entrepreneur (2007-2016)

(Source: Electricity Sector Outlook 2007-2016)

③ Power supply plan prospect by fuel

Recently, efficiency improvements and the development of the low capital have been achieved by making the main current of Electric Power Development a gas combined cycle power

generation from oil thermal power. Imported natural gas cannot cover all residential demand though Mexico is a natural gas production country in the pipeline from the United States, and the diversification of the power supply fuel is scheduled to be advanced in consideration of securing Electric Power Development with a change of the price of gas in the future though the combined cycle power generation will account for 51% in the novel exploitation of power supply ten years in the future. Coal, LNG, synthesis gas, and uranium, etc. are the main alternate power sources. One will be a 20% output increase of existing plants and 2015 afterwards by 2011, and one will be increased by 2025, and there is a plan that improves the ratio of nuclear power generation that occupies the amount of the power generation of electric power up to about 12%, though nuclear power has a capacity of 2 and 1,354MW in total now. The ABWR plant of the third generation is seen and the price domination is seen from the design side.

Table 2-5 Breakdown of power supply developed (2007-2016)

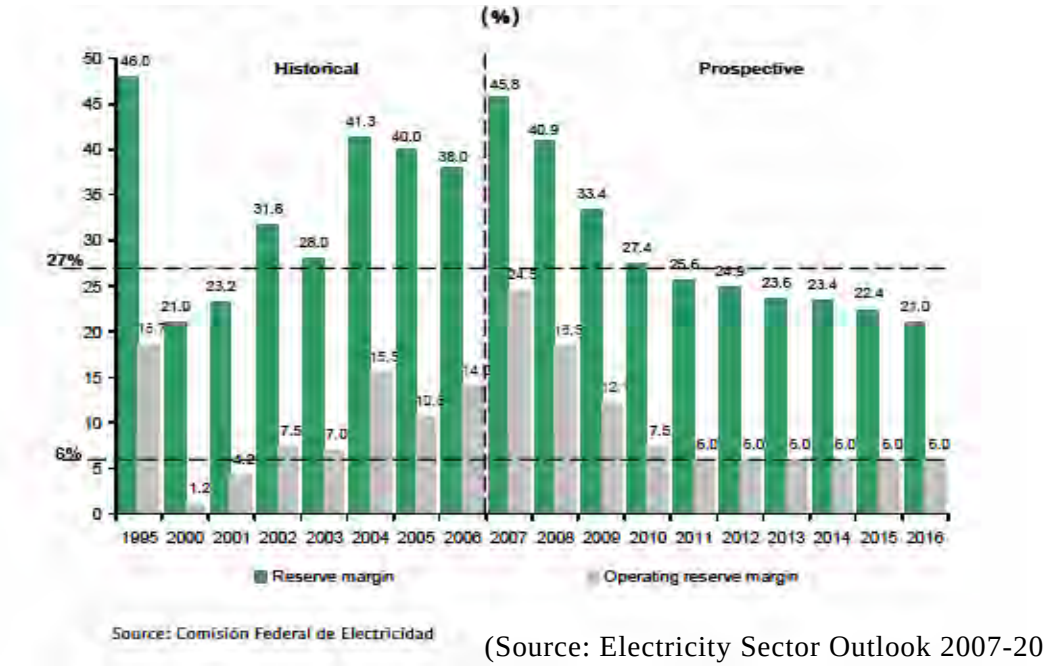
Technology	Committed (MW)	Uncommitted (MW)	Total (MW)	Percentage share
Total [2]	**5,498**	**16,187**	**21,684**	**100.0**
Combined cycle	2,677	8,385	11,062	51.0
Steam turbine	0	0	0	0.0
Hydroelectric	1,500	1,164	2,664	12.3
Fuel-oil	0	0	0	0.0
Coal	678	2,100	2,778	12.8
Geothermal	0	158	158	0.7
Nuclear	0	0	0	0.0
Gas turbine [3]	416	36	452	2.1
Internal combustion	42	112	154	0.7
Wind energy	185	406	591	2.7
Free [4]	0	3,826	3,826	17.6

(Source: Electricity Sector Outlook 2007-2016)

④Capability margin

There are two different capability margins such as the Reserve Margin that is the difference between the total capacity and the maximum dissipation of the power supply and power supplies that can be used as a preliminary rate, and such as the Operational reserve Margin that is the difference between the total capacity and the maximum dissipation of the equipment reserve rate. CFE assumed that the targeted value of the driving reserve rate in the power supply plan was set to 6% in November, 2004.

The equipment reserve rate under the nationwide system in 2006 was 38%. This is because the speed of the demand decreased in 2001, and the demand changed until about 2009. Under the Electric Power Development project, it is difficult to operate an accurate amount in the necessary amount of time, and also difficult to adjust the reserve rate in the short-term. It is said to be preferable to adjust to a low rate of use of low–rate efficient equipment and in a high rate of reserve. It is expected that changes in the reserve rate for the operation will be about 6% after 2011.



(Source: Electricity Sector Outlook 2007-2016)

Figure 2-18 Transition of power supply equipment reserve rate

2.6.2 System equipment

(1) Nationwide network

①Utility interconnection

The electric power system is almost interconnected in the whole of Mexico. The system in Baja California and the southern part of Baja California is separated. There is a plan to have the system in the Baja California system be an asynchronous interconnection with the interconnection in the California state in the U.S., though it is connected now (It is 300MW as the first stage).

In Baja California, with the interconnection to the nationwide electric power system, because there are based power generation such as geothermal power generation and the combined cycle power generation in the Baja California system, the power supply from the nationwide system during peak periods and the power supply to the nationwide system during the off-peak periods yields three effects : the efficiency on both of the utility interconnections, the improvement of security and the increase of flexible power interchanges with the electric power company in the South-west of the U.S.. In the southern part of Baja California, implementation is under discussion, though there are improvements of effective investments and the environmental aspects There is an advantage of the investment efficiency improvement and on the environmental aspect via the interconnection with the nationwide system, but implementation is still under consideration.

Regarding the Utility interconnection with the United States, the interconnection between Baja California and El Paso states with the Western Electricity Coordination Council (WECC) was held in 1967, and the interconnection at the point from Piedas Negara to Matamoros with the Electric Reliability Council of Texas(ERCOT) was held in 1970. Further, the new ones from Nuevo Laredo to Laredo Texas with 230kV and from Reynosa to Mission Tx with 138kV were added in 2007..

The increase of electric power imports are more than the exports after 1989, although the electric power export was larger in the beginning. In the 1990's, capital investment for the expansion of domestic demand was not enough and imports have increased more than exports since 1996. Afterwards, exports increased due to a supply capability increase since 2003.

(Source: SENER material)

Figure 2-19 Utility interaction with United States

(2) Plan for transmission system

The development plans of the power transmission systems, are created based on following criteria,

- Security: To maintain the amount of the content of the obstacles in a synchronous driving of the generator. During the accident of a single power generating machine or the single power transmission equipment.
- Quality: To maintain the voltage and the frequency to the regulated value.
- Reliability: To decrease the risk of trouble occurring partially in the system and the supply obstacle is generated

- Economy: To decrease the operation costs of the electric power system.

In the mid-term plan from 2007 to 2011, the power line between 69kV and 400kv has been extended to 13,168km. In addition, regarding the international utility interconnection, the new project with the United States through the Ciudad Industrial-Laredo power line and the Cumbres- Sharyland power line has been carried out, and it has become possible to contribute to correspondence in the event of an emergency and the improvement of operation reliability regarding the international system. The interconnection with Guatemala through Tapachula Potencia-Suchiate power line has not been operated yet because the priority level decreased compared with the oil refinement project though FS according to the IDB capital was completed as a part of the international project in Central America

(note) Central American Electrical Interconnection System (SIEPAC, Sistema de Interconexíon Elécrica de los Países de América Central) Project
Central America (Guatemala and Honduras, El Salvador, Nicaragua, Costa Rica, and Panama) is connected from Puebla in the southern part of Mexico with a power line, and the cooperation on a regional scale has been constructed: 80km between Mexico and Guatemala by 400kV, and 180km in Central America by 230kV. The total cost is about 30 million US dollars.

(Source: Electricity Sector Outlook 2007-2016)

Figure 2-20 Capacity (MW) of system power line between regions in 2011

(3) Transmission and Distribution equipment

President Calderon announced that on October 11th the government ordinance was proclaimed in 2009 in the official gazette to abolish and liquidate LFC, and to transfer the control on power generation and distribution in the metropolitan area to CFE though CFE and LFC had exclusively owned and had managed the electric power distribution equipment. There are two reasons: one is the low productivity that workers were defended by the non-modern, group-labor contracts, the other is to lighten the expense of the public purse by liquidating this public corporation which was harboring a huge labor debt.

There various kinds of voltage classes of distribution equipment: they are 138kV, 115kV, 85kV, 69kV, 34.5kV, 23kV, 13.8kV, 6.6kV, 4.16kV, and 2.4kV,and for the power lines are 400kV, 230kV, 161kV, and 150kV.

The distribution equipment and others of CFE and LFC are shown as follows.

Table 2-6 Distribution Equipment of CFE (km)

Voltage level (kV)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
400	12,399	13,165	13,695	14,504	15,998	17,790	18,144	19,265	19,855	20,364
230	21,224	21,598	22,645	24,060	24,773	25,687	27,148	27,745	28,164	28,093
161	456	508	508	646	470	475	475	475	547	547
150	0	0	0	0	0	0	0	0	0	0
Total	34,079	35,271	36,848	39,210	41,241	43,952	45,767	47,485	48,566	49,004

（Source: CFE website）

Table 2-7 Transmission Equipment of CFE (MVA)

Type of Substation	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Transmission	104.5	107.8	113.5	119.7	125	128.8	134	137	141.7	143.8
Distribution	29.8	31.6	33	36.2	37.7	38.7	39.7	41	42.7	43.7
Total	134.4	139.5	146.6	155.9	162.7	167.6	174.4	178	184.4	187.5

（Source: CFE website）

Table 2-8 Distribution Equipment of CFE (1,000km)

Voltage level (kV)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Subtransmission										
138	1	1	1	1	1.3	1.3	1.4	1.4	1.4	1.4
115	34.1	34.9	36.1	38	38.7	40.1	40.8	42.2	43.3	42.7
85	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
69	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2		3.1
Subtotal	**38.8**	**39.6**	**40.7**	**42.6**	**43.6**	**44.9**	**45.6**	**46.9**	**47.9**	**47.3**
Distribution										
34.5	58.9	60.3	61.7	62.7	63.6	64.7	66.3	67.4	69.3	70.4
23	23.3	23.7	24.6	25.8	26.3	27.4	27.9	28.6	29.1	29.8
13.8	233.2	239.7	246.3	251.7	257.4	264.5	269.4	273.2	278.1	286.3
6.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Low voltage	211.9	215.3	221	222.1	225.1	230.2	233	236.6	239.3	245.9
Subtotal	**528.1**	**539.7**	**554.3**	**563**	**573.2**	**587.5**	**597.1**	**606.3**	**616.3**	**633**
Total distribution lines	**566.9**	**579.3**	**595.1**	**605.7**	**616.8**	**632.4**	**642.7**	**653.2**	**664.2**	**680.3**

（Source：CFE website）

Table 2-9 Equipment of LFC (2008)

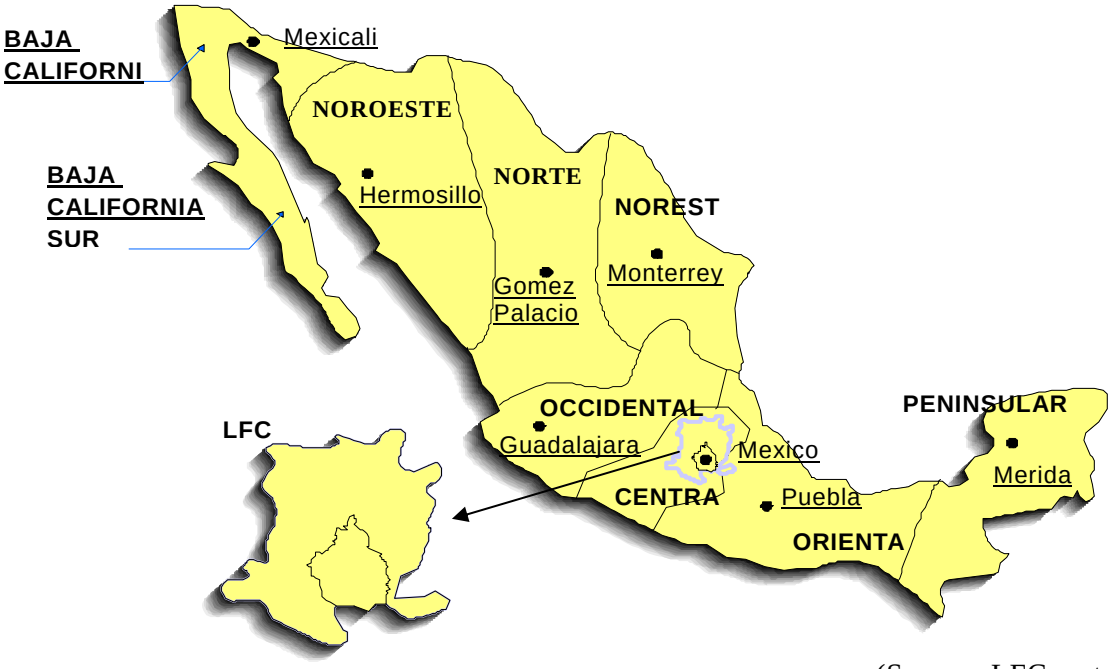
Power Generation Capacity		1,174.33MW
Transmission Capacity		30,951.223MVA
Transmission line on ground	Number of Lines	256
	Total length	3,378.637km
Transmission line underground	Number of Line	49
	Total length	162.070km
Transmission line（not including low voltage）	Number of Lines	902
	Total length	26,429km
Transmission line underground （not including low voltage）	Number of Lines	190
	Total length	4,130km

（Source：LFC）

(4) General condition of system control

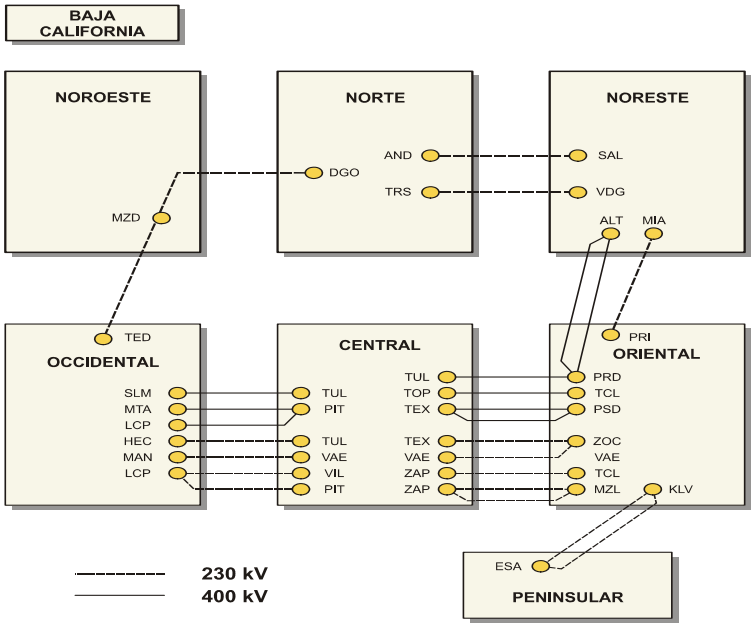
① The separation operation

The electric power system in Mexico is now interconnected with the whole of Mexico as mentioned above, but the Baja California system and the Baja California south system are operated separately Power grid system is operated within seven provinces, and the local system sections are interconnected by power lines of 400kV or 230kV.



(Source: LFC material)

Figure 2-21 Regional partition



(Source: LFC material)

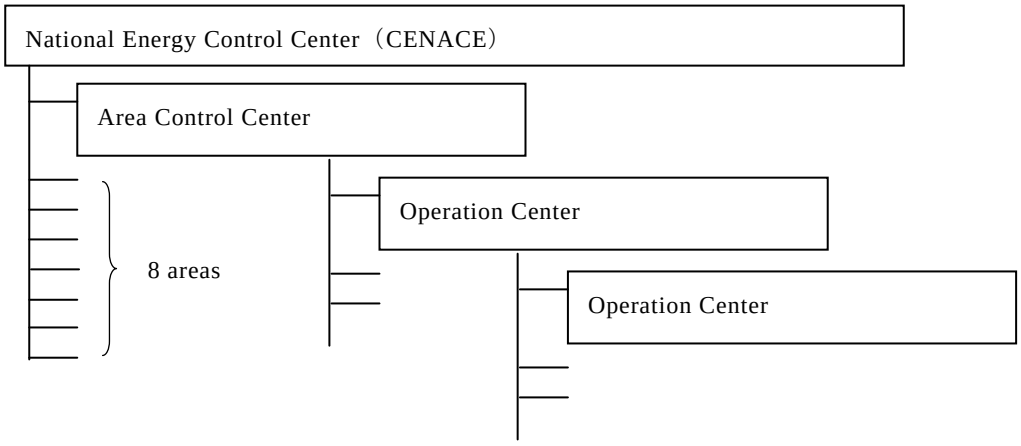
Figure 2-22 Regional partition and system ream system in whole country

② System control

The system control is combined with power generation, transmission and distribution equipment, and needs to be operated to supply enough amount of electric power by consistently.

National Center of the Control of Energy (CENACE: Centro Nacional de Control de Energía) is operated by CFE, which managed the power demand of the whole country and adjusted the supply capability. Area Control Centers are set up in eight provinces (one is Baja California, the other is the southern part of Baja California) as a function to manage the power equipment of the very high pressure of each province.

In addition, each Area Control Center has a Operations Center branch where the transmission grid is controlled regionally, and also each Operation Center has a smaller center branch where the subordinate voltage is controlled.



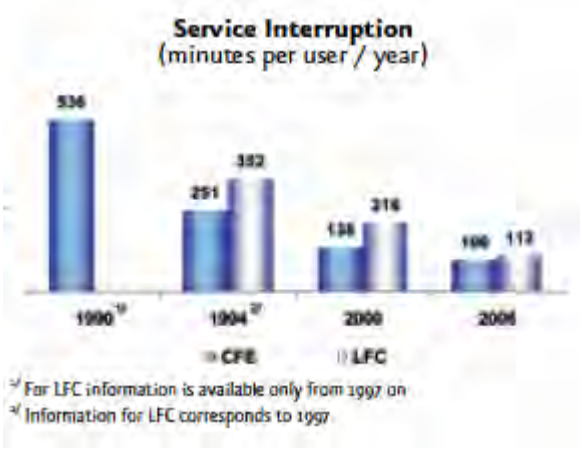
(Source: National Infrastructure Program 2007-2012)

Figure 2-23 Outline of system control hierarchy

2.6.3 Power supply quality

In the government bond index in 2006, the supply reliability (based on the interruption and the voltage change) and loss rate in the distribution of Mexico is lower than the world average/ standard. One of the utility sector policies from the "2007-2012 National Infrastructure Program" is "Quality improvement in the power supply". Further, it is necessary to improve the aforementioned index.

According to CFE, the goal of the interruption time in the energy sector program until 2012 is 78 minutes, which improved from 251 minutes to 109 minutes in 2006.



(Source: National Infrastructure Program 2007-2012v)

Figure 2-24 Transition time of interruptions for each customer

2.7 Labor Qualification Certification Regarding Energy

In Mexico, there is a National Qualification Certification Committee (CONOCER) which issues out a license of labor certification.

2.7.1 Organization of CONOCER

CONOCER is a partially state-owned entity, affiliated with the Ministry of Education and has a tripartite participation in the governance structure.

Organization of CONOCER

President: Public Education Secretariat
Substitute President: Deputy Minister of Medium High Education

Governmental Sector	Business Sector	Labor Sector
Six advisors	Three advisors	Three advisors
● Labor	● Business Coordinating Council	● Work Congress
● Economy	● Employers' Confederation of the Mexican Republic	● Revolutionary of Workers and Peasants
● Agriculture, Livestock and Fisheries	● Confederation of Industrial Chambers	● Confederation of Mexican Workers
● Tourism		
● Energy		
● Finance and Public Credit		

Figure 2-25 Organizational Structure of CONOCER

2.7.2 Procedure of Certification by CONOCER

Basic principle of CONOCER is to provide support to labors and to be in line with market requests. CONOCER consists of three sectors comprised of the governmental sector, business sector and labor sector. Further, there are three levels to promote the works.

(1) National level
The systems of acknowledgement, rule, standard, and compensation are discussed by national level workers' representatives and national level employers' representatives.

(2) Strategic Level
To establish a management sectional committee and to discuss a strategy of certification.

(3) Operative level
Formation ⟶ Evaluation ⟶ Certification
Procedure of job as follows;

1) Establish a Management Committee by Qualification (1) by representatives of high level workers and businessmen.
2) Integrate technical groups with operative staff and develop not only human resources but also qualification standards (2).
3) Register the standards (2) in the National Register of Qualification Standards CONOCER (3)
4) Define solutions for training, evaluation and certification.
5) Promote the certification of workers and their registration in the National Registration of Persons with Qualification Certification (4)

Two groups, the technical group and the expert technical group which supports the Management Committee by Qualification.

The contents of the technical group (More than 5 persons) are as follows;

1) Elaboration of the Qualification Standard and evaluation instruments which the Management Committee by Qualification requests to develop.
2) Submit to the Committee and support information of the Qualification Standard and its evaluation instrument
   Management Committee by Qualification validates the developed Qualification Standard and evaluation instrument. Further, the Committee submits it to CONOCER for its approval and registration in the Federation. CONOCER receives the Qualification Standard with the support document. In this case they are approved; they

are published in the Official Gazette of the Federation. Finally, they become standards based on Law

The contents of the expert technical group are as follows;

1) To develop a functional map up to identify the individual functions
2) To break down the individual functions to identify the elements that integrates the Qualification Standard and the Instrument of Qualification Evaluation.

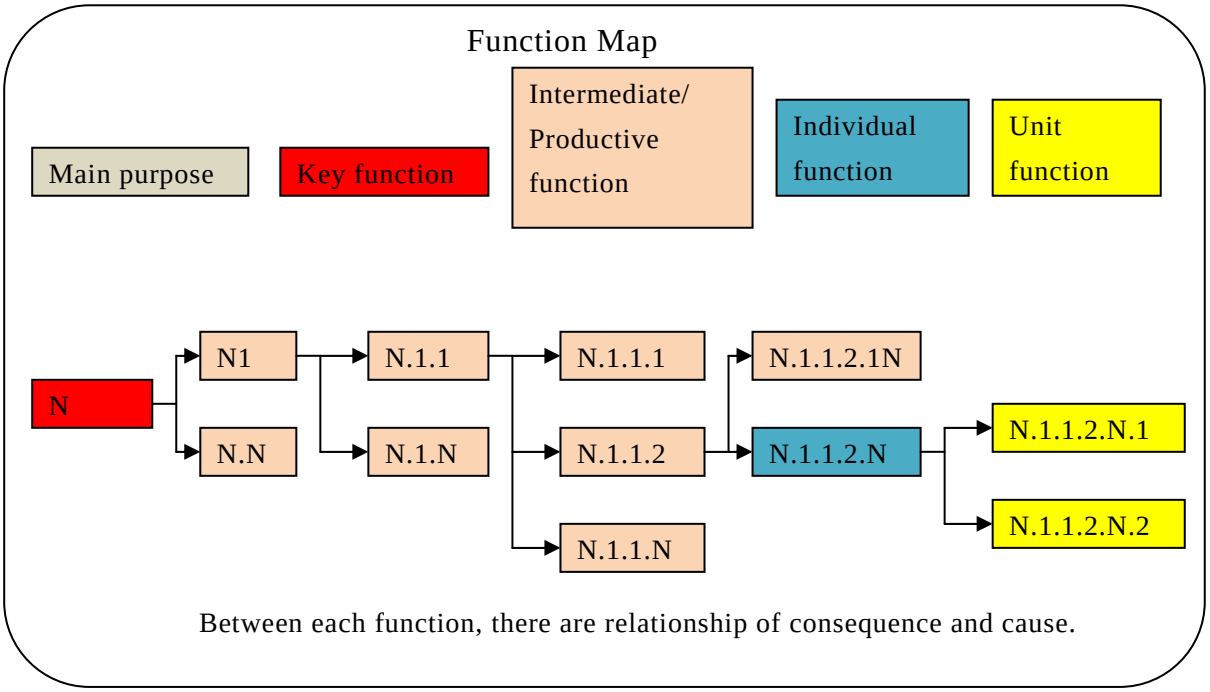


Figure 2-26 Function Map

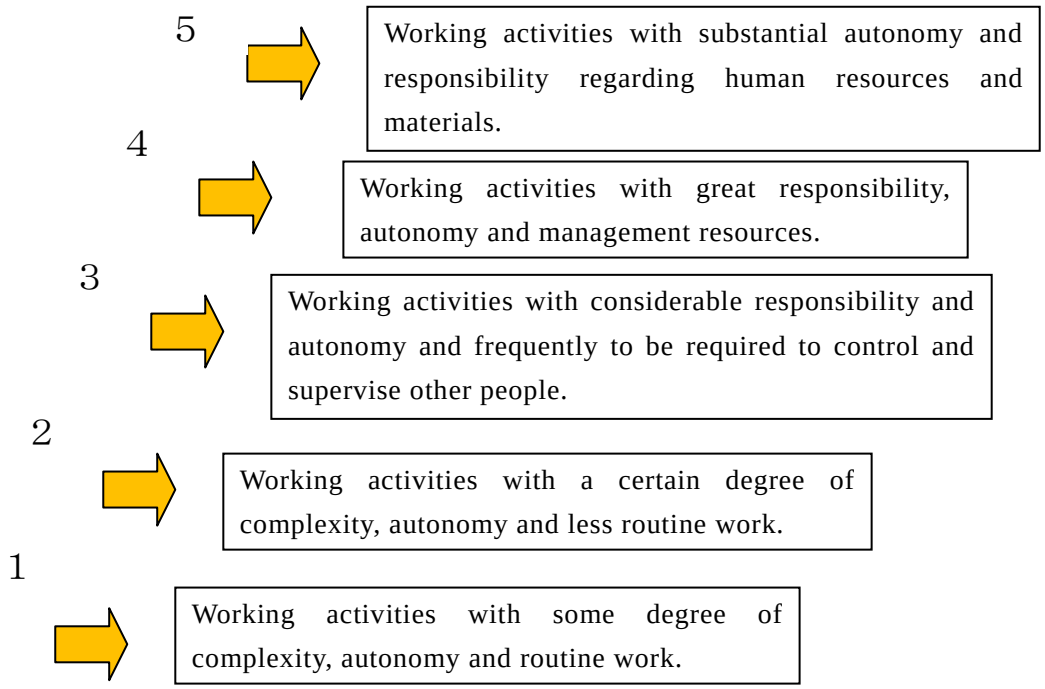
2.7.3 Qualification Areas in the Mexican System

Twelve fields are designated as follows;

1) Crops cultivation, breeding. Livestock and processing, agro-industry and forestry.
2) Mining
3) Construction
4) Technology
5) Telecommunications
6) Manufacture
7) Transportation
8) Marketing goods and services
9) Finance, management and administrative support services
10) Health and social protection
11) Social communication
12) Development and extension of knowledge

2.7.4 Skill Level

Depending on the type of occupation, skill level is defined under a five-grade system in consideration of the contents of a job, complexity and autonomy.



The fifth level is the highest. For instance, the skill level of setting the solar hot water vessel is second.
Concerned with energy managers, CONUEE wants to place them, not all of them, at the fifth level.
They are certificated at each process.

2.7.5 Other Certification System except of CONCOCER

There is a special job department in the Ministry of Education. The licenses of the special job field, such as doctor, lawyer, architect and teacher are given at this department. However, these licenses are valid in only the state where they are certificated.

Chapter 3 Mexico's Situation of Promoting Energy Efficiency including "Energy Management System"

3.1 Executed Energy Efficiency Policy

3.1.1 Execution Organization for Energy Efficiency Policy

(1) CONUEE

Energy efficiency policy planning and execution has been carried out by CONUEE, which was separated from one of the SENER departments and established as a general governmental organization for promoting energy efficiency and renewable energy. CONUEE covers industrial, commercial, residential buildings and transportation sectors and putting 3 fundamental policies for the promotion.

(a) Saving fossil fuel and effective utilization of renewable energy sources
(b) Diversification of energy port folio
(c) Environmentally harmonized economical development

(2) CFE

CFE was established by the Mexican government in 1937 as an electric power business organization in order to promote electrification for local area. Their business area is targeted from power generation, transmission to power distribution and covers nationwide.

Concerning the energy conservation activities, CFE has been executing support of energy efficiency projects, giving energy saving advice to their customers, promotion of new energy utilization, and training of their employees and so on. The followings are their execution program and foundation organization.

(a) PAESE （Programa de Ahorro de Energía del Sector Eléctrico : Program of Energy Efficiency Promotion in the Power Sector）

PAESE is composed as in-house energy efficiency promoting organization in CFE which is the largest electric power supplier in Mexico. Their main activities are improving energy efficiency for electric power supply facility of CFE and training of energy efficiency subject for the CFE employees and their customers.

(b) FIDE（Fideicomiso para el Ahorro de Energía Eléctrica : Trust Fund of Electric Energy Efficiency）

FIDE was established as non profitable organizational fund under the initiative of CFE and cooperation of LFC, Unique Union of Electric Workers of the Mexican Republic and business execution bodies in 1990.

The purpose of the fund is promoting electric power saving activities for their customers such as industry, commercial, agriculture, municipality and residential building sectors.

3.1.2 Past programs executed by CONUEE

CONUEE executed the following activities based on their fundamental policies.

(1) Mexican National Norms on Energy Efficiency

CONUEE has been planning and updating obligatory norms which are named as NOM. Currently 18 kinds of NOM are applied and CONUEE announces that 70,586GWh of electric power was saved from year 2001 by 2006 as their calculation.

(2) Daylight Saving Time

Daylight Saving Time program has been carried out since 1996 in which 1-hour time is shifted during the summer season from April to October. IIE informs that 1,000GWh power is saved by this program based on their calculation.

(3) Energy Saving Programs in the Federal Public Administration

This program is focused on power saving of the Federal Public Administration buildings since 1999. In order to promote power saving of the buildings, it is necessary to introduce installation of high efficient equipment, effective operation of the facility, monitoring and adequate control. CONUEE performed energy efficiency diagnosis activities for the facility and its operation.

(4) Program of energy efficiency assistance for industrial sector

Program of energy efficiency assistance for industrial sector is targeted for PEMEX and large corporation and give assistance for introduction of energy management index and training for company staff.

(5) Others

The following programs have been carried out.

(a) Drivers training for transportation sector energy efficiency
(b) Energy efficiency program for municipality government and small and medium sized corporations
(c) Rewarding system of energy efficiency and energy application activities
(d) Dissemination of energy efficiency and energy application
(e) Teachers training for energy efficiency lecture at elementary school
(f) Dealing with energy efficiency promotion on national level
(g) Issue of guidance booklets and manuals of energy efficiency activities

(h) Energy efficiency consulting services, workshop and training programs
(i) Study on energy efficiency potential

3.1.3 Past program of PAESE

(1) Energy efficiency program of CFE facility

PAESE completed 27 programs up to year 2008 and 106 ongoing ones. They performed energy saving improvement of air conditioning, thermal insulation and lightings for the buildings of power generation, transformation, transmission and distribution facility.

(2) Others

Training and lectures on energy efficiency for the CFE employees by outsourced consultant has been introduced and PAESE has been promoting dissemination programs for their customers such as distributing energy efficiency enlightenment booklets and goods and providing seminars.

3.1.4 Past program of FIDE

(1) Finance Program for Electric Energy Savings

FIDE gives finance fund of procurement of refrigerators, air conditioners, thermal insulation materials and CFL for the customers and collects the loan together with their electric power bill for several years.

(2) Incentives and Market Development

FIDE provides an incentive loan for the customers who plan to replace energy efficient motors, compressors, lighting equipment and so on. IDB（Inter-American Development Bank） offers financial support for the program.

(3) FIDE Label

FIDE certifies energy efficient electric products and the manufacturers can put FIDE certification label on the products. This program is voluntarily and certifies products which exceed certain energy efficient level from the NOM standard.

(4) Education Program for Rational use and Saving of Electric Energy

This program is a support program of energy efficiency for elementary schools and junior high school.

(5) Others

FIDE offers support for replacement of CFLs of residential sector and issue energy

efficiency information magazines. Concerning international activities, FIDE gives technical assistance for Latin American countries.

3.2 Law and Regulation on Energy Management

3.2.1 Act for Sustainable Energy Use

(1) Overview

The Act for Sustainable Energy Use was approved by the Mexican Congress in October 2008. The act regulates a promotion of EE&C as follows.

- The Program shall establish strategies, objectives, actions and goals to enable the optimum use of energy in all of the processes and activities for its exploitation, production, transformation, distribution and consumption.
- The CONUEE is an administrative separate organ of the Department, which has technical and operational autonomy. It has as its purpose to promote energy efficiency and to become an organ of a technical nature in matters of sustainable energy use.
- The Board is an authority of advisory nature of the CONUEE, whose purpose is to assess compliance with the objectives, strategies, actions and goals established in the Program.
- The National Information Subsystem has as its purpose to register, organize, update and spread information on the energy consumption, efficiency and indicators, etc. of Energy Consuming User.
- The equipments and devices requiring energy supply to function and which comply with the criteria set forth in the Regulations shall clearly and visibly display information on their consumption of energy.
- The CONUEE shall develop a program aimed at promoting the certification of processes, products and services.

(2) Main Descriptions in Energy Management

Main descriptions of energy management in processes and services are abstracted from the Act as follows.

(a) National Information Subsystem

Article 18

The National Information Subsystem provides information on energy consumption and efficiency in the different geographic regions of the country. The information includes the following topics.

- Consumption of energy in its main final uses
- Factors which drive the final uses
- Energy efficiency indicators describing the relationship in the final energy uses and the

factors driving them
- Energy efficiency indicators of other countries

Article 20

The offices and entities of the Federal Public Administration, as well as the users with a high-energy consumption profile shall provide the CONUEE with the following information about the use of energy, obtained in the immediately previous year.

- Production, exploitation, import and consumption of energy, by type of energy
- Energy efficiency in consumption
- Measures implemented for energy conservation
- Results of the energy conservation steps

Article 21

The Regulations shall establish the criteria to determine that a user has a high energy consumption profile, the way and periodicity in which the said users and the offices and entities of the Federal Public Administration shall deliver the information referred to in the previous article, as well as any other information that needs to be provided to CONUEE to make up and update the Subsystem.

Article 22

The offices and entities of the Federal Public Administration shall interconnect the said records with the Subsystem as provided in the guidelines issued for this purpose by the Department of Public Office.

(b) Voluntary Processes for Energy Efficiency

Article 26

Private entities shall voluntarily be able to carry out, through the certification of processes, products and services, the methodological examination of their operations regarding the extent of incorporation of energy efficiency as well as the extent of compliance with the regulations in the matter and of international and applicable engineering practices benchmarks.

CONUEE shall develop a program aiming at promoting the certification of processes, products and services and shall be able to supervise its execution. For this purposes;

- It shall prepare the terms of reference establishing the methodology to carry out the certification of processes, products and services;
- It shall make up an approval and accreditation system for experts and auditors, establishing the procedures and requirements the interested parties shall fulfill to be part of the said system;
- It shall develop training programs in matters of expert reports and audits on energy matters;

- It shall instrument an award system enabling the identification of the industries which have certified their processes, products and services;
- It shall promote the creation of regional support centers for middle and small size industries, in order to facilitate the certification of processes, products and services in the said sectors, and
- It shall agree on or arrange with individuals, corporations, public or private entities the realization of processes, products and services certifications.

(c) Penalties

Article 29

CONUEE shall penalize with a fine of one hundred to a thousand times the minimum wage all users with a high-energy consumption profile which fail to provide the information referred to in Articles 20 and 21 herein or which provide false or incomplete information.

3.2.2 Regulation for Sustainable Energy Use

(1) Overview

The Regulation for Sustainable Energy Use was approved in September 2009 as the secondary law of the Law for Sustainable Energy Use. The Regulation clarifies details of the Act and follows the composition of the Law.

(2) Main Descriptions in Energy Management

Main descriptions of energy management in processes and services are abstracted from the Regulation as follows.

(a) National Information Subsystem

Article 18

The Subsystem includes the following information.

- Documents submitted from the offices and entities of the Federal Public Administration by formats designated by CONUEE
- Documents submitted from the high-energy consuming users by formats designated by CONUEE
- Indicators designated by CONUEE

Article 19

The offices and entities of the Federal Public Administration and the high-energy consuming users shall submit the following information.

- Quantitative information on product, import and export of energy
- Final energy uses and types of energy, factors which drive the final uses, and energy efficiency

- Measures implemented for energy conservation and results of the energy conservation steps

Article 20

The following information shall be submitted in the first quarter of the fiscal year.

Article 22

Any individual or organization which exceeds the following consumption is defined as the high-energy consuming.

- 6 GWh in electricity consumption in the previous year, or
- 9,000 barells in crude oil equivalent in the previous year (excluding transportation fuel), or
- 100 times operation of transportation vehicles under the same name, company name, or business name.

(b) Certification System

Article 32

Certification is provided for individual or organization who was certified in processes and services or who achieved distinguished results in energy efficiency authorized by a preset guideline.

(3) Monitoring and Penalties

Article 33

CONUEE can monitor voluntary processes of high-energy consuming users in energy efficiency activities at random or if necessary, and inspect.

Article 34

CONUEE can penalize for high-energy consuming users who violates items described in the Law.

3.3 Overview of Energy Management Scheme of Mexico under Designing

3.3.1 Image of the Whole Scheme

The whole scheme of energy management of Mexico that is now under designing is illustrated as follows. The image is based on the contents of the Act and Regulation on Sustainable Energy Use.

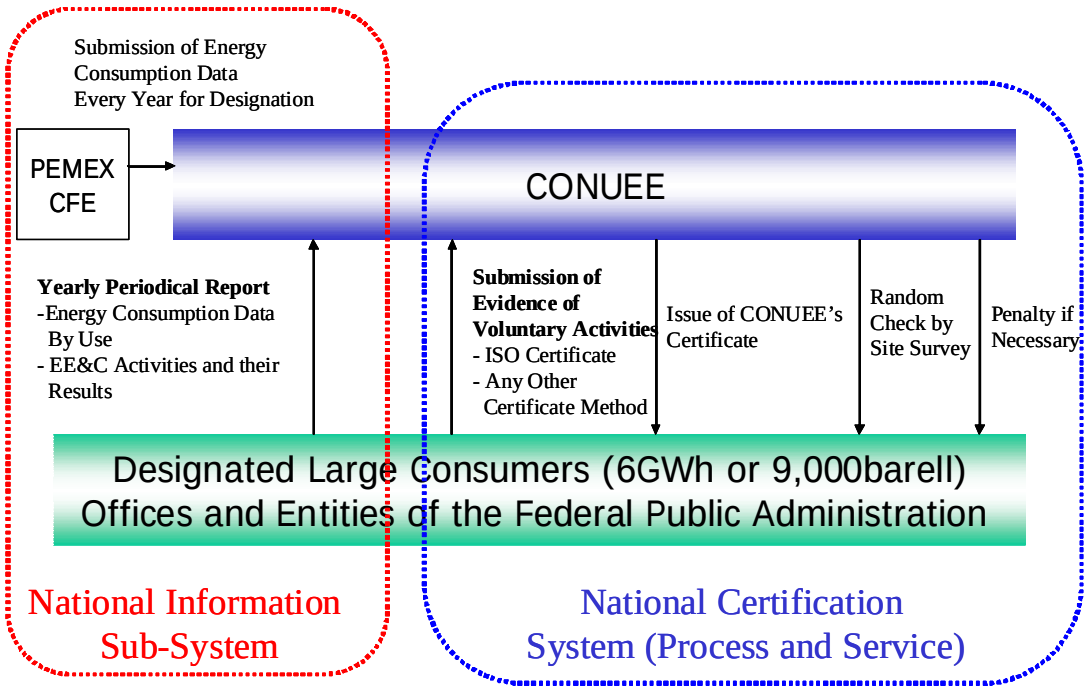


Figure 3-1 Image of the Whole Scheme

Main important points are;

- High-energy consuming user is designated by calculated energy consumption that is obtained from PEMEX and CFE.
- Periodical reports that include energy consumption, energy efficiency and energy conservation measures, etc. will be submitted annually.
- CONUEE gives a certification of process and services for voluntary activities in Designated Large Consumers ("High-energy consuming user" and "Offices and entities of the Federal Public Administration").
- CONUEE can conduct a site survey to check the performance of the Designated Large Consumers.
- CONUEE can penalize when CONUEE judges that a Designated Large Consumer is a poor energy management.

3.3.2 Study Items for Making the Scheme

For making study items of the scheme, the following contents are supposed to be formulated.

(1) Identifying necessary information on Periodical Report and making its format
(2) Making certification criteria and appraisal methodology of the certificate
(3) Establishing random check method and its evaluation methodology
(4) Formulating energy efficiency training program for voluntary activities

(5) Making implementation plan (budget, human resources, cooperation organization, implementation schedule)

Chapter 4 Information Provided to Mexico on Energy Efficiency in Japan

4.1 Japanese Energy Management System

4.1.1 Schematic Overview

(1) Schematic Overview

In Japan, the Energy Management System consists of the following four activities.

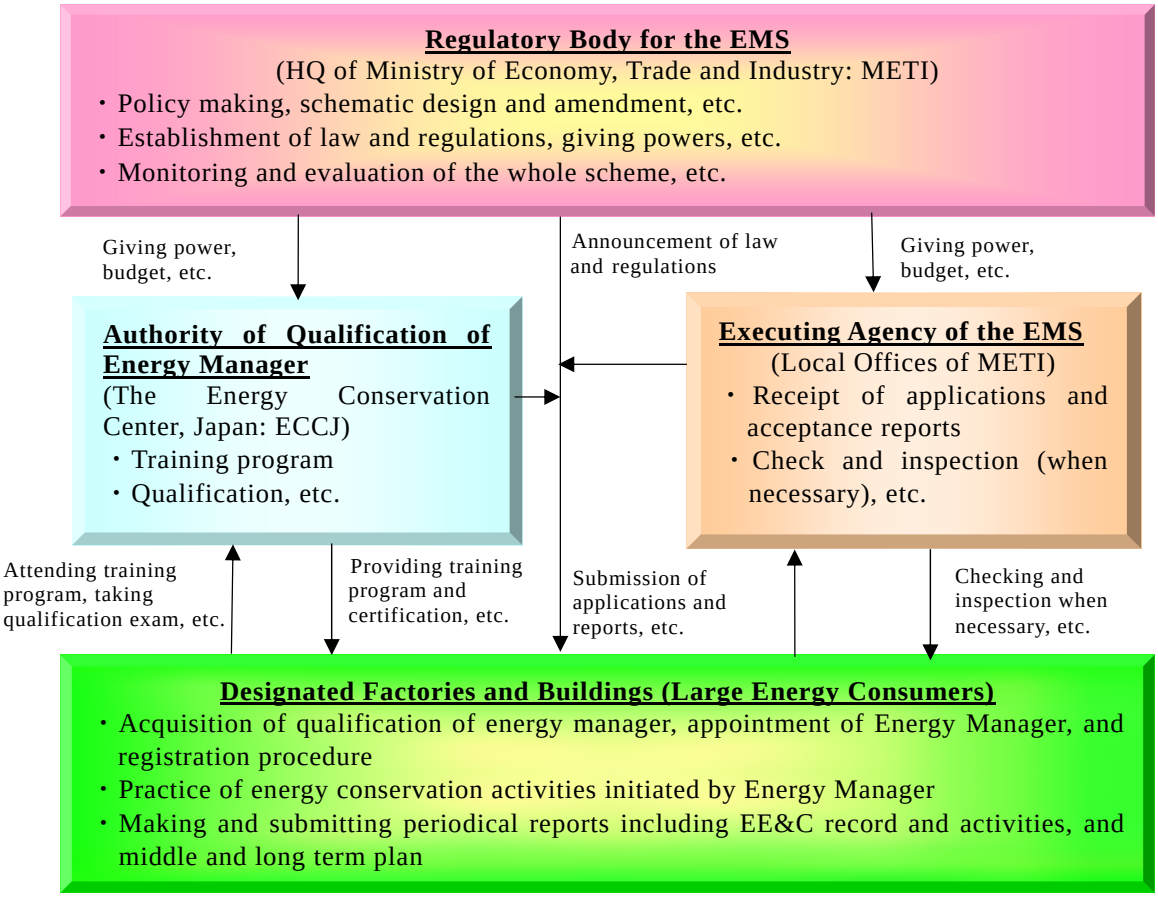


Figure 4-1 Overview of Japanese Energy Management System

The first activity is regulatory in nature consisting of policy making and establishing laws and regulations. The second activity consists of monitoring and instruction which includes overseeing EE&C activities in designated large energy consuming factories and buildings (hereinafter “Designated Organizations”) via report and inspections (or issuing penalties) when deemed necessary. The third activity deals with energy conservation and includes data collection/analysis, identification of barriers, resolution etcetera initiated by the Energy Manager in a designated organization. The fourth activity consists of examination training for the energy manager qualification, which will be required under a nationally established

system.

(2) Periodical Reports

Designated Organizations must submit periodical reports to the Executing Agency (METI Local Offices) once a year. To respond to these report submissions, the Designated Organization(s) will appoint registered Energy Manager(s) who will initiate onsite EE&C activities. On the other hand, the Executing Agency will determine whether or not certain EE&C activities are to be conducted through checking the contents of the reports and conducting inspections when necessary.

Periodical reports consisting of the EE&C Results Report and the Middle and Long Term Plan Report are to be submitted once a year. EE&C Results Report as shown below includes an energy consumption record, product output, energy intensity (=consumption / product output), compliance checklist with legally established evaluation criteria and so on.

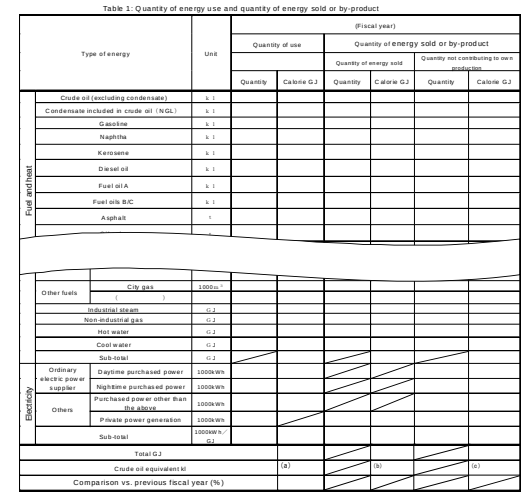


Table 1: Quantity of energy use and quantity of energy sold or by-product

Type of energy			Unit	(Fiscal year) Quantity of use		Quantity of energy sold or by-product			
						Quantity of energy sold		Quantity not contributing to own production	
				Quantity	Calorie GJ	Quantity	Calorie GJ	Quantity	Calorie GJ
Fuel and heat	Crude oil (excluding condensate)		k l						
	Condensate included in crude oil (NGL)		k l						
	Gasoline		k l						
	Naphtha		k l						
	Kerosene		k l						
	Diesel oil		k l						
	Fuel oil A		k l						
	Fuel oils B/C		k l						
	Asphalt		t						
	Other fuels	City gas ( )	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 (%)									

Calculation Sheet of Energy Consumption

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				

Table 3: Production quantity and others

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

Utilization List of Energy Consuming Equipment

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

Energy Intensity Calculation Sheet

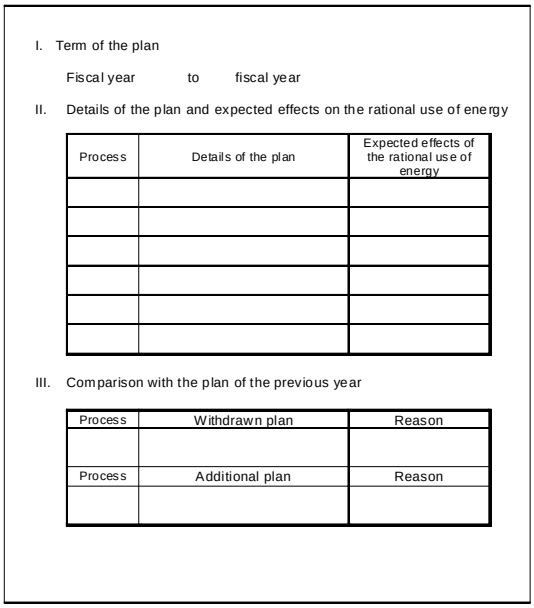
Table 7: Status of observing the standards for judgment related to rational use of energy

Target items (facilities)	Status of establishing management standards	Status of observing measurement/record	Status of observing maintenance /inspection	Status of measures taken before new installation
Rationalization of fuel combustion (Combustion facility)	Status of establishing management standards for air ratio and others □ Already established □ Being established (%) □ To be established	Status of implementing measurement/record in management standards □ Regularly done □ Done as needed □ Not done	Status of implementing maintenance/ inspection stated in management standards □ Regularly done □ Done as needed □ Not done	Status of measures taken before installation of combustion facilities □ Done □ Not done □ Not applicable
Rationalization of heating, cooling and heat transfer (Heat consumption facility)	Status of establishing management standards for heating equipment and others □ Already established □ Being established (%) □ To be established	Status of implementing measurement/record in management standards □ Regularly done □ Done as needed □ Not done	Status of implementing maintenance/ inspection stated in management standards □ Regularly done □ Done as needed □ Not done	Status of measures taken before installation for heating equipment and others □ Done □ Not done □ Not applicable
	Status of establishing management standards for air adjustment facility and hot water supply facility □ Already established □ Being established (%) □ To be established	Status of implementing measurement/record in management standards □ Regularly done □ Done as needed □ Not done	Status of implementing maintenance/ inspection stated in management standards □ Regularly done □ Done as needed □ Not done e	Status of measures taken before installation of air adjustment facility and others □ Done □ Not done □ Not applicable
Waste heat recovery and use (Waste heat recovery facility)	Status of establishing management standards for waste heat recovery facility □ Already established □ Being established (%) □ To be established	Status of implementing measurement/record in management standards □ Regularly done □ Done as needed □ Not done	Status of implementing maintenance/ inspection stated in management standards □ Regularly done □ Done as needed □ Not done	Status of measures taken before installation of waste heat recovery facility □ Done □ Not done □ Not applicable
			Status of implementing	Status of measures

Check List for Compliance with Evaluation Criteria

Figure 4-2 EE&C Results Report

The Middle and Long Term Plan Report contains an energy efficiency investment plan forecasting the next 3-5 years. A sample of the report is shown below.



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

Figure 4-3 Middle and Long Term Plan Report

(3) EE&C Activities in Designated Organization (Sample)

Within an organization, various EE&C activities are conducted and initiated by the Energy Manager. The following table shows a sampling of activities and Energy Manager tasks.

Table 4-1 EE&C Activities and Tasks of Energy Manager (Sample)(1/2)

	Activity	Tasks of Energy Manager (Sample)
1	Energy-saving fundamental policies	Gives assistance when drafting the energy-saving fundamental policy. Calculates necessary investments/costs based on the fundamental policy.
2	Energy-saving promotion framework	Develops an energy-saving promotion organization plan, and decides on the energy-saving promotion organization framework after coordination with the employer and department heads. Periodically convenes meetings of the energy-saving promotion committee, and acts as the committee's secretariat.
3	Management standards	Develops the mandatory management standards as stipulated in the legally established evaluation criteria, prepares other management standards necessary for his/her company, and also designates the department responsible for the management standards. When preparing the management standards, the energy manager should act as the coordinator and provide related departments with necessary information on the basic philosophy, the format, the responsible department and the deadline.
4	Identifying actual energy consumption	Investigates actual energy consumption, and makes out the basic units management chart.
5	Energy-saving plan and	Designates the energy-saving tasks for the entire company and

	target setting	for each department once a year, and quantitatively sets out applicable targets.

Table 4-2 EE&C Activities and Tasks of Energy Manager (Sample)(2/2)

	Activity	Tasks of Energy Manager (Sample)
6	Education and prize-giving for employees	Educates employees on an entire company basis as well as on an each department basis. Works with the employer to establish a prize-giving scheme that honors a department or worker that contributes to energy conservation.
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 (e.g., company-level energy-saving efforts and facility enhancement) 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.

(4) Evaluation Criteria and Management Standards

(a) Evaluation Criteria (Guideline)

The Japanese Energy Management System has set up "Evaluation Criteria (Guideline)" concerning the instruction of what EE&C activities are to be conducted within an organization and can also determine whether or not such activities are actually being carried out. This Criterion is based on the Act on the Rational Use of Energy (Energy Conservation Law) and regulations. The Criteria instructs on fields and methods to be managed, management standards, standard values and target improvement values

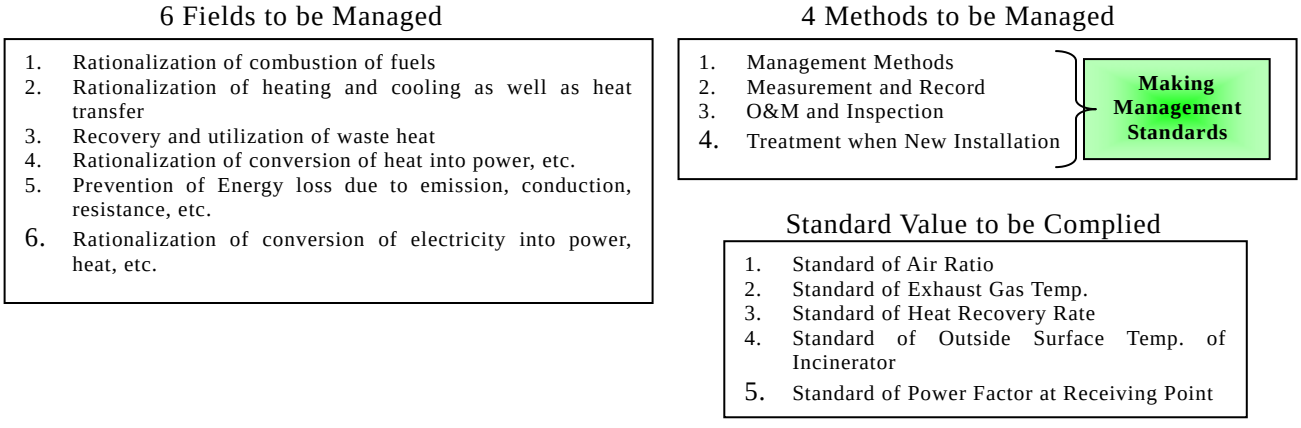


Figure 4-4 Composition of Evaluation Criteria (Guideline)

(b) Management Standards

Management Standards have set up four methods to be managed by each facility as instructed in the Evaluation Criteria. The four methods are management methods, measurement and records,

O&M and inspections, and treatments during new installation. In the Japanese Energy Management System, each user in accordance with the Evaluation Criteria sets up Management Standards. A sample (boiler case) of Management Standards is shown below.

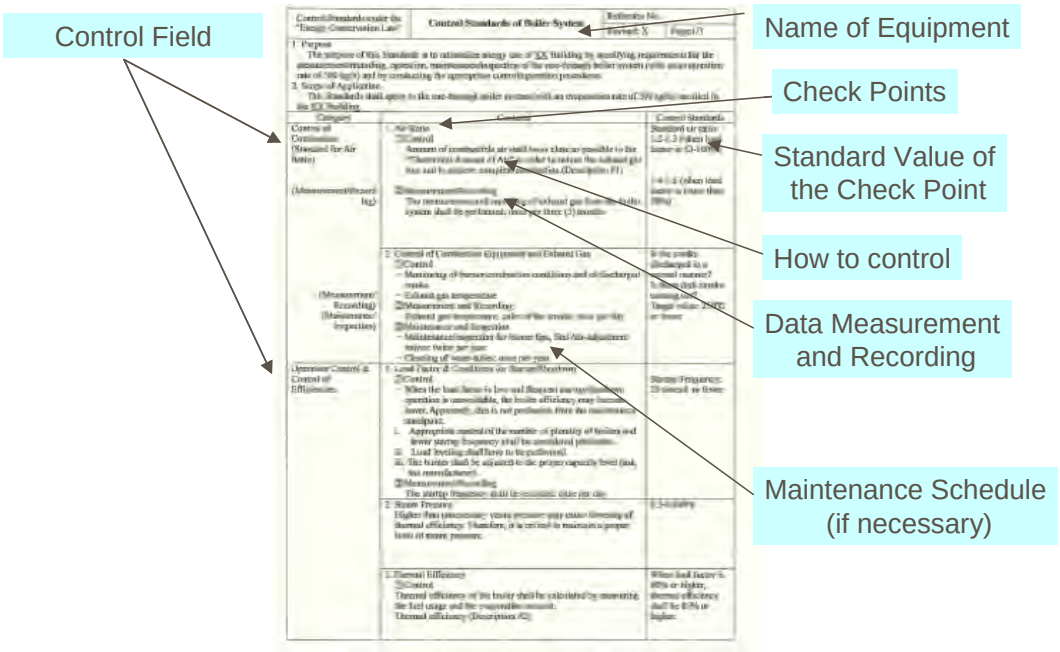


Figure 4-5 Sample of Management Standards (Boiler Case)

(5) Annual Schedule of Executing Agency and Designated Organizations

Annual schedule to be implemented by the Energy Management System is shown below. In June, designated organizations submit Periodical Reports (new and revised designated organization registers from April), and then the Executing Agency checks the contents. After that the Executing Agency visits randomly selected sites to check a site situation that is difficult to verify through Periodical Reports. Via the Periodical Report checks and the random checks, a judgment is made concerning the necessity of having an inspection.

Table 4-3 Annual Schedule to be Implemented (Japanese Fiscal Year)

	Apr	May	Jun	Jul	Aug	Sep
Executing Agency	-	Acceptance and notification	Registration of New Energy Manager	Follow up activities for clarification of submitted report or delayed submission		Checking Periodical Reports
Designated Organizations	Submission of Energy Use Report	Appointment of Energy Manager	Submission of Periodical Reports	Response if necessary		-
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Executing Agency	Checking Periodical Reports	Check by site visit (at random)		Inspection (for insufficient designated organizations in Periodical Reports or check by site visit)		Instruction to the inspected designated organization
Designated Organizations	-	Response to the site visit		Response to the inspection		Correction

Note: Blue columns are activities to be done only when there are new or revised items. Yellow columns are activities to be done for selected designated organizations (random selected or insufficient designated organizations).

(6) Law and Regulations

(a) Policy and Positioning of Energy Conservation Law

Energy policy-making in Japan is conducted under the authority of the Ministry of Economy, Trade and Industry (METI). In line with the “Basic Act on Energy Policy” (June, 2002), the “Basic Energy Plan” (March 2007) and the “New National Energy Strategy” (May, 2006) were both enacted under the “Fundamental Law on Energy Policy Measures”. The “Basic Act on Energy Policy”, promotes the following three basic objectives: “Securing of Stable Supply”, “Environmental Suitability”, and the third one, which is strongly undergirded by the first two is “Utilization of Market Mechanisms”. The “Basic Energy Plan”, formulated under the “Basic Act on Energy Policy”, was introduced as one of the important energy demand policies promoting an economy and society based on energy and natural resource conservation.

Prior to this, the “New National Energy Strategy” was announced in 2006 targeting reduced oil dependence lower than 40 % of present levels by 2030 and had presented specific programs that included an “Energy Efficiency Frontrunner Plan” which aimed for 30 % increased energy efficiency by 2030 as its target. In addition, from the perspective of promoting countermeasures to protect the earth from the potentially disastrous consequences caused by global warming, efficient energy management is required to lessen the emission of greenhouse

gases. Accordingly, the "Kyoto Protocol Target Achievement Plan" was formulated under the "Act on Promotion of Global Warming Countermeasures", resulting in concrete action plans and numeric targets being set.

The "Act on the Rational Use of Energy (Energy Conservation Law)" (enacted in 1979.6 and revised in 2008.5 respectively) contains stipulations specifying systems and regulations for carrying out the aforementioned EE&C activities. The Energy Conservation Law lies at the heart of Japan's EE&C system, and in accordance with the law, EE&C activities in Japan are being promoted.

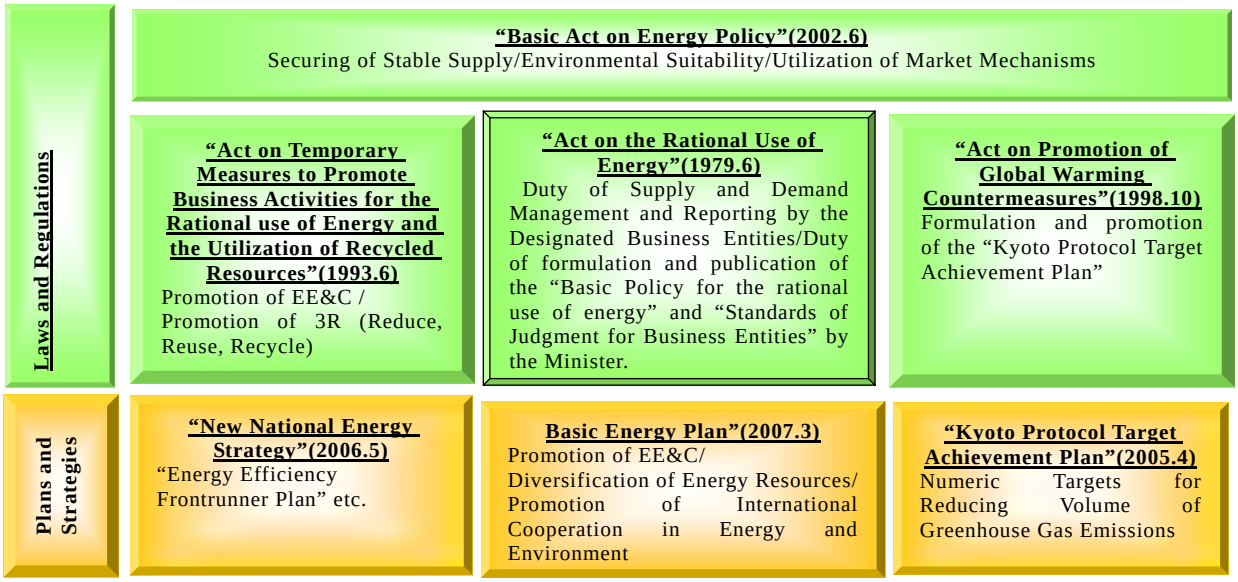


Figure 4-6 Basic Policy and Strategies Concerning EE&C

(b) History of Japanese Energy Conservation Law

The Energy Conservation Law stipulates concrete systems and regulations to be adhered to during the implementation of EC&C activities. The "Heat Management Act" (1951), which precedes this Act, has similar laws that serve as the foundation for current regulations, such as regulations designating the number of business entities to be regulated, the Heat Manager to be appointed in the designated business entities, publication of Evaluation Criteria, and Certified heat managers (predecessors of certified energy managers) etc. After the second oil crisis in 1979, the "Heat Management Act" was converted to the "Act on the Rational Use of Energy" resulting in electricity becoming the target of regulation.

The purpose of the Act is to implement rational energy usage measures required for business entities including factories and buildings, thereby contributing to the sound development of the national economy. This act also consequently gave birth to related laws and regulations, cabinet orders and ministry ordinances. Through the "Act on the Rational Use of Energy", it is the responsibility of the METI to formulate and publicize a "Basic Policy for the rational use

of energy" and "Evaluation Criteria" with accompanying measures to be implemented by energy consumers. In response to global energy volatility and increasing environmental awareness, this Act has been amended six times to improve measures concerning EE&C strategy promotion, management and the reporting system. In 2005, the act was amended to unify energy control of heat and electricity that up until then had been controlled separately. In particular, the rules were amended to define levels of designated business Entities by last year's total energy consumption (fuel, heat and electricity usage amounts were converted into their crude oil equivalent). Further, regarding Energy Managers and Energy Management Officers, a centralized system unifying the management of heat and electricity was introduced in place of the previous system, which had separated the management of heat and electricity. In addition, EE&C measures pertaining to transportation were introduced and EE&C measures pertaining to building and residence construction were strengthened.

The latest 2008 amendment introduced a system of management that in terms of measuring energy consumption treats all of the fixed assets (factories, buildings etc.) of a corporate entity as one whole unit as opposed to the old system, which evaluated each asset individually. Further, the new "Specified Chain Business Entities System" act essentially allows the same principle to be applied to franchises such as convenience stores when the total energy consumption level of all the branches as a whole exceeds a certain designated level. Substantive introduction of new regulations took place in April 2010. Therefore, this report is primarily restricted to the previous regulations before April 2010.

(c) Target and Regulatory Range of the Energy Conservation Law

The term "Energy" as defined in the Energy Conservation Law refers to "Fuel", "Heat" and "Electricity". The term "Fuel" as used in the Act refers to any oil products such as crude oil, volatile oil, heavy oil (naphtha, kerosene, diesel oil, asphalt made by oil, oil coke, and oil gas), combustible natural gas, coal, coke and other coal products (coal tar, coke-oven gas, blast furnace gas, and converter gas), all of which individually or collectively are used for combustion and /or fuel battery generation. The law's usage of the term "Heat" refers to heat (Steam, Hot Water, Cold Water, etc.) generated from any of the aforementioned "Fuels" and excludes any heat that is NOT "fuel-based" such as solar heat and geothermal heat etc.

The law's usage of the term "Electricity" refers to electricity generated from any of the aforementioned "Fuels" and excludes electricity generated from non-fossil energy sources. Non-fossil energy sources refer to photovoltaic generation, wind power generation, waste power generation, all of which have been deemed as "NON-FOSSIL Fuels".

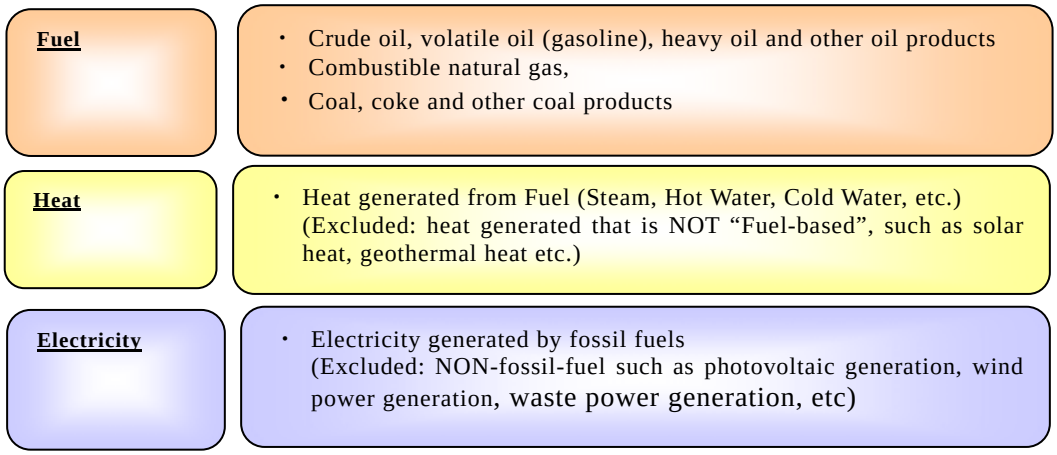


Figure 4-7 Targeted Energy under the Energy Conservation Law

The Energy Conservation Law covers four sectors, namely "Large Consuming Factories and Buildings", "Transportation", "Houses and Buildings" and "Machinery and Equipment". Fields and business entities targeted under the law are as follows. The Energy Management System of Japan is stipulated in the following "Large Energy Consuming Factories and Buildings".

Table 4-4 Fields and Business Entities Targeted under the Energy Conservation Law

Fields	Business Entities
Large Energy Consuming Factories and Buildings (Designated Organizations)	Business entities in possession of factories (manufacturing, mining, electricity supply, gas supply, heat supply) for business operations Business entities in possession of buildings (including headquarters, branches, factory business offices and buildings other than factories such as hospitals, hotels, and/or schools etc.) used to operate business
Transportation	Carriers: Business entities that operates freight or passenger transportation (including freights for personal business usage) Consigners: Business entities in possession of freight carriers to transport their freight (Includes personal business usage)
Houses and Buildings	Construction Period: Construction client(s) who intend(s) to construct buildings and/or residences Extension or Reconstruction Period: the owner of the buildings or residences
Machinery and Equipment	Manufacturers and importers of machinery and equipment that consume energy

(d) Overview of Energy Management System regulated in the Energy Conservation Law

The below table is a structural overview of the Energy Management System targeting large consuming factories and buildings, stipulated in the Energy Conservation Law.

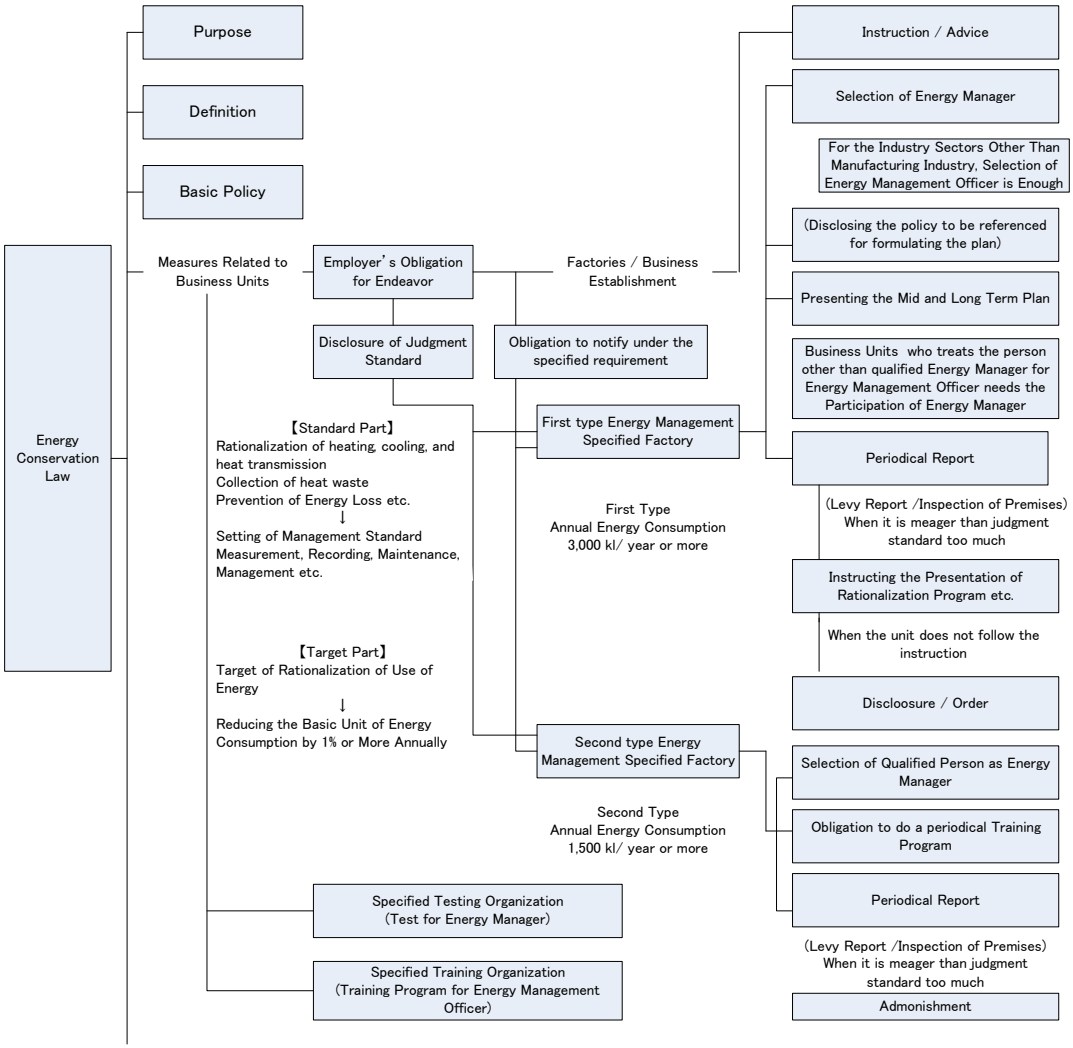


Figure 4-8 Overview of Energy Management System in the Energy Conservation Law

Each designated organization must report the individual energy consumption volume for their factories and other places of work in their respective crude oil equivalents. If the total amount exceeds the designated 3,000 kl/year or 1,500 kl/year (via crude oil conversion), a notification must be filed with the METI.

Factories and buildings are categorized as either “Type 1 Energy Management Factory” or “Type 2 Energy Management Factory” contingent on their energy consumption amount.

The below table describes the regulations for factories and building and categories of designated (for energy conservation measures) factories and business entities under the Energy Conservation Law.

Table 4-5 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 kl /year
Designated Organizations		Type 1 Energy Management Factory	Type 2 Energy Management Factory	—
Responsibilities of Business Entities	Person to be appointed	Energy Manager: (Five industries including: Manufacturing, Mining, Electricity supply, Gas Supply, Heat Supply) 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		

Japan's Energy Conservation Laws and related regulations consist of the Energy Conservation Law, as well as cabinet orders and ministry ordinances and announcements. The table below outlines regulation items.

Table 4-6 Act and Related Regulations regarding Energy Management System

	Name	Items related to Factories and Buildings
Act	**Act on the Rational Use of Energy (Energy Conservation Law)** (Act No. 49 of June 1979, Final Revision: May 2008)	・ Purpose（Article 1） ・ Definitions of Energy（Article 2） ・ Basic Policy, Role of energy Users（Article 3,4） ・ Standards of Judgment for Business Entities（Article 5） ・ Designation of Specified Business Entities（Article 7,17） ・ Appointment of Energy Managers or Energy Management Officer（Article 8, etc） ・ Duty of Energy Managers or Energy Management Officer

		（Article 11, etc） ・ Preparation of Middle and Long Term Reports（Type 1 Energy Management Factory）（Article 14） ・ Periodical Reports of Energy Consumption and Other Status of Energy Use （Article 15, etc） ・ Instructions, Orders, Advices by the Competent Minister （Article 16, etc） ・ Penal Provisions（Article 93, etc）	
Cabinet Order	**Order for Enforcement of the Act on the Rational Use of Energy** (Order No, 228 of Jun. 2005, Latest Revision: No.40, Mar. 2009)	・ Definitions of Heat and Electricity （Article 1） ・ Energy Consumption for Designation of Specified Business Entities (Article 2,6) ・ Standards of Designation of the Energy Managers and Energy Management Offices（Article 3, etc.） ・ Requirements for the Designated Business Entities (Article 4, etc.)	<Related Article in the Act> Article 2 Article 7,17 Article 8 etc. Article 8 etc
Ministry Ordinance	**Ordinance for Enforcement of the Act on the Rational Use of Energy** (METI ordinance No.44 of Mar 2006, Latest Revision No.30, May 2009)	・ Types of the Fuels（Article 2,3） ・ Calculation for Energy Equivalent （Article 4-7） ・ Time for appointing Energy Manager and Energy Management Officer, Application Format （Article 8, etc.） ・ Periodical Reports（Article 19, etc）	Article 2 Article 7,17 Article 8 etc. Article 15 etc
	Rules on Examination and License for Energy Manager (MITI ordinance No.15 of Feb.1984, Latest Revision No.82, Dec. 2008)	・ Grant of Energy Manager’s Licenses （Article 6 etc.） ・ Training Programs for Energy Managers （Article 2 etc）	Article 8 etc.
	Rules on Training Courses for Energy Management Officers (MITI ordinance No.48 Mr. 1999, Latest Revision No.16 Mar. 2006)	・ Training Programs for New Energy Management Officers（Article 2） ・ Training Programs for Upgrading for Energy Management Officers（Article 3）	Article 8 etc.

Ministerial Announcement	**Basic policy for the Rational Use of Energy** (METI Ministerial Announcement No.43 March 2006)	・Basic policies and measures for the rational use of energy with regard to factories and business buildings ・Measures for the State and Local Government （Supports）	Article 3 etc.
	Standards of Judgment for the Rational Use of Energy for Factories and Business Buildings (METI Ministerial Announcement No.65 March 2006)	・Standards of Judgment for the Rational Use of Energy (i.e. combustion of fuels, heating, cooling, electric heating, Heat Recovery) ・Targets for the Rational Use of Energy, measures to be taken systematically, and Standards of Judgment to achieve the targets	Article 5 etc.

(7) Periodical Reports

Data and information input in the Periodical Reports are as follows.

Original Data described in EE&C Results Report

1) Description Items in Cover Sheet

Address of the Companies	Describe Head Quarter address of the designated organization
Name of the Representative	Describe the president's name of the consumer
Code of the Consumer	Describe registered code of the consumer
Name of the Consumer	Describe name of the designated organization
Address of the Consumer	Describe address of the designated organization
Classification of the Sector	Describe classification code of the sectors for the designated organization
Name of Energy Manager	Describe name of the Energy Manager in the designated organization
License number of Energy Manager	Describe license number of Energy Manager of the designated organization

2) Description Items on Energy Utilization and Sub-Product Energy Sales Volume

Fuel and Heat Utilization	a. Describe oil and gas products consumed in the site as crude oil in kiloliter (kl) and Giga Joule (GJ)
	b. Describe oil and gas products sold outside as crude oil volume in kl and GJ
	c. Describe oil and gas product consumption except production line in the site, as crude oil volume in kl and GJ
Purchased Electric Power	a. Describe electric power consumed in factories and buildings in kWh and GJ separated by different power tariff
	b. Describe energy consumption except production lines in factories and buildings as crude oil volume in kl and GJ
Electric Power Consumption from Self Generation	a. Describe electric power consumption from self generation in kWh
	b. Describe electric power consumption sold outside in kWh and GJ
	c. Describe electric power consumption except production line in factories and buildings as crude oil volume in kl and GJ

3) Describe Energy Consuming Facility, Operation Load, Rebuild and Scrap

Facilities on Rationalization of Energy Use (Max 30 facilities)	a. Name of the facility
	b. Outline of the facility
	c. Operation load
	d. Status of New construction, Rebuilding and Scrap
Other Facilities (Max 30 facilities)	a. Name of the facility
	b. Outline of the facility
	c. Operation load
	d. Status of New builds, Rebuild and Scrap

Note:1. Example for facilities: Boiler, melting furnace, cogeneration, air compressor, water pumping, etc.
2. Example for outline: 6 unit high performance boilers with 10ton/hour heating capacity
3. Example for operation load: 330 days a year and 16 hours a day

4) Production Volume and Energy Intensity

Production in Factories or Floor Area in Building (Values related to energy consumption should be selected)	a. Production name and unit used
	b. Production volumes or floor area in the current year
	c. Growth rate of the above to the previous year
Energy Intensity	a. Energy intensity in the current year
	b. Growth rate of the above to the previous year

Note: Energy Intensity = (Energy Utilization – Energies sold – Energy consumption except production line) / (Production volumes or Floor area)

5) Energy Intensity Changes in the Past 5 Years

Energy Intensity (Past 5 years)	a. Energy intensity in the year of (n—2)
	b. Energy intensity in the year of (n—1)
	c. Energy intensity in the year of n
	d. Average changing rates in the term

6) Reasons when Average 1 % of Energy Intensity in the Term is not Improved

Reasons	a. Reason 1
	b. Reason 2
	n. Reason n

7) Compliance with the Evaluation Criteria

Rationalization on Fuel Combustion	a. Setting Management Standards
	b. Compliance with measurement and record standards
	c. Compliance with O&M and inspection standards
	d. Compliance with the Standards in treatment under new installation
Rationalization on Heating, Cooling and Heat Transmission	Ditto
Reuse of Wasted Heat	Ditto
Rationalization on Conversion of Heat to Motivity	Ditto

Improvement of Energy Loss of Energy Transmission and Resistance	Ditto

8) Other Undertakings on Rationalization of Energy Use (Sample)

April 2007	Established EE&C Promotion Committee
From April to July 2008	Review of Evaluation Criteria for energy consuming facilities
February 2009	Decide new Evaluation Criteria for energy consuming facilities

9) CO2 Emission

CO2 Emission from Energy Consumption	CO2 emission in the current year（t-CO2）
CO2 Emission from Power Stations and Heat Supply Facilities	CO2 emission in the current year（t-CO2）

Original Data described in Middle and Long Term Plan Report

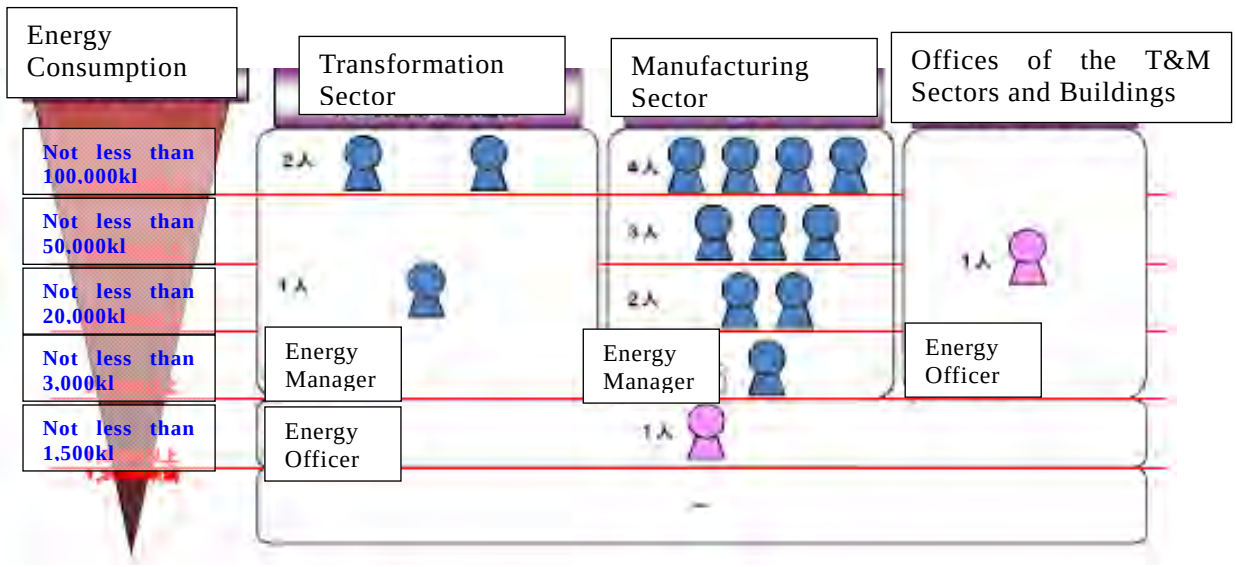
10) Middle and Long Term Plan Report

Planning Term	The term is 3 - 5 years (describe the term when the plan needs more than 5 years.)
Effects and Contents of the Rationalization of Energy Use	a. Ex. Rationalization and effects on the transportation system describe the effects as crude oil in kl
	b. Ex. Rationalization and effects on air conditioner describe the effects as crude oil with kl
	c. Ex. Rationalization and effects on lighting describe the effects as crude oil with kl
Comparison to the Previous Year	a. When some plans are deleted, describe the reasons and the titles
	b. When some plans are added, describe the reasons and the titles

4.1.2 Qualification System

(1) Obligation of Appointing Energy Manager and Energy Officer

Energy Conservation Law of Japan stipulates that Designated Organizations in the transformation sector and manufactures should appoint Energy Manager(s) respectively at each factory that consumes more than 3,000 kl (crude oil equivalent) / year. The number of Energy Manager(s) to be appointed depends upon the quantity of energy consumption (1 person to 4 persons in one site). Qualifications of an Energy Manager are restricted to those persons experienced in energy management and those who have successfully obtained the national qualification certificate.



Energy Manager: Qualification by national examination or training program with certificate examination
Energy Officer: Qualification by receiving 1-day training program

Figure 4-9 Appointing Energy Manager and Energy Officer

On the other hand, with regard to the offices of the transformation sector and manufacturers, and buildings, an Energy Officer, who becomes qualified after a 1-day training program, is appointed at the site. However, the Middle and Long Term Plan Report is authorized by an Energy Manager who can be outsourced.
Besides, consumers using more than 1,500 kl (crude oil equivalent) / year may also appoint an Energy Officer.

(2) Methods of Qualification
(a) Energy Manager
The national qualification of Energy Manager is restricted to the following qualified persons.

- One who has passed the Energy Manager examination and possessing more than 1-year experience in the energy management business. The examination is held every August.
- A successful trainee which is one who attends the training program to obtain the certificate examination for Energy Manager (7 days program) and passes the examination. Only persons possessing 3 years or more experience in the energy management business are eligible to apply for this training program. The training program is held every December.

Both the Energy Manager examination and the training program with the certificate examination for the Energy Manager are managed by the Energy Conservation Center, Japan

(hereinafter “ECCJ”) that is legally designated as the sole examination and training authority by the responsible ministry (METI). Qualified applicants who pass the examination or the training program will receive a certificate from ECCJ resulting in the Minister granting an Energy Manager license.

(b) Energy Officer

An Energy Officer can be appointed from among those who are qualified by undergoing a 1-day training program. “Training Program for Energy Management” conducted by ECCJ, or has a license of Energy Manger.

4.1.3 Training System

(1) Classification of Training Program

In Japan, the ECCJ provides various training programs regarding EE&C (1 day – several days program). These programs are categorized into the following two groups.

(i) Training program with the certification examination for Energy Manager candidates

(ii) General training programs for proper implementation of the Energy Management System (EMS)

Table 4-7 Classification of Training Program regarding EE&C

Classification	Contents
(i) 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)
(ii) 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.)

The above (i) is a training program including an examination to acquire the national Energy Manager license. So the provider of this program, the ECCJ, by law will be able to issue out valid certifications. The above (ii) are voluntary training programs targeting general engineers or technicians who will assist the Energy Manager in his/her routine tasks.

(2) Training Program with Certification Examination for Energy Manager

The training program with the certificate examination is conducted once a year and lasts seven

days. In Japan, there are two types of qualified Energy Managers designated by field, namely the Energy Manager (Heat) and Energy Manager (Electricity). The applicants for Energy Manager can select a suitable subject in light of their expertise. The training program consists of a common subject and an individual subject (the heat course or the electricity course). In order to be eligible to attend the program, one prerequisite is that an applicant has to have more than 3 years experience in energy management activities.

The certificate examination requires sufficient mastery of four subjects including a common subject. Even if an applicant does not pass all four subjects in that year, the applicant will have the opportunity to retake a class the following year.

The following table is a sample of the training program conducted in Japan.

Table 4-8 Training Program with Certification Examination (Japanese Case)

		Subjects		Contents	Lecture Time
Common		Outline of Energy Management and Law and Regulations		1 Outline of energy management 2 Energy Conservation Law and Regulations	7 hours 2 hours
Heat Field (optional)	I	Basic Theory in Heat and Fluid		1 Basic theory in thermodynamics 2 Basic theory in fluid mechanics 3 Basic theory in heat transfer mechanics	8 hours 5 hours 5 hours
	II	Fuel and Combustion		1 Fuel and combustion management 2 Calculation of combustion	4 hours 3 hours
	V	Heat Utilization Facility and its Management		1 Measurement and control 2 Boiler, steam transmission and stock facility, 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, drier facility, carbonization and gasification facility	5 hours 4 hours 3 hours 3 hours 3 hours
Electricity Field (optional)	I	Basic Theory in Electricity		1 Basic theory in electricity and electronics 2 Automatic control and information processing 3 Measurement of power	3 hours 3 hours 2 hours
	II	Facility and Equipment	Distribution in Factory	1 Planning of distribution in factory 2 Operation of distribution in factory 3 EE&C in distribution in factory	2 hours 2 hours 2 hours
			Electric Equipment	1 Outline of electric equipment 2 Rotating and stationary machine 3 EE&C in electric equipment	2 hours 2 hours 2 hours
	V	Application of Electricity	Application of Electric Power	1 Outline of application of electric power 2 Facility of application of electric power 3 EE&C in application of electric power	2 hours 3 hours 2 hours
			Electric Heating	1 Theory of electric heating and its facility 2 EE&C in electric heating	2 hours 2 hours
			Electrochemical	1 Theory of electrochemical and its facility 2 EE&C in electrochemical	2 hours 2 hours
			Lighting	1 Theory of lighting and its facility 2 EE&C in lighting	2 hours 2 hours
			Air Conditioning	1 Theory of air conditioning and its facility 2 EE&C in air conditioning	2 hours 2 hours

(Source: ECCJ Website)

(3) General Training Programs

There are various general training programs conducted by the ECCJ, such as a program for the promotion and enlightenment of the Energy Management System to facilitate its implementation and programs for basic knowledge and methods of EE&C on heat and electricity etcetera. These programs can be applied for based on each theme. Samples of the training programs are shown below.

Table 4-9 Training Program of Heat Course

	Duration	Theme	Contents
First Term	2 days	EE&C Technology of Heat and Combustion Management	**EE&C Technology of Heat** ● Outline of law and regulation, and energy management ● EE&C technology and its application to site ● Practical calculation method of heat **Fuel** ● Fuel **Combustion Calculation** ● Calculation method of combustion **Hands on Practice of Combustion** ● Combustion and hands on practice of explosion ● Hands on practice of combustion
Second Term	2 days	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
Third Term	2 days	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)
Fourth Term	2 days	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

(Source: ECCJ Website)

Table 4-10 Training Program of Electricity Course

	Duration	Theme	Contents
First Term	2 days	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
Second Term	2 days	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
Third Term	2 days	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
Fourth Term	2 days	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 ● Goof 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

(Source: ECCJ Website)

Other than heat and electricity training programs, there are various other programs such as a training program on how to find EE&C potential, training for building energy assessment skills, site visits to factories and buildings that engage in good practices and so on. An overview of these programs is shown below.

Table 4-11 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 ・ Resource mapping and grasping current situation ・ Selection of targeted facilities ・ How to make the Standards ・ Drafting a sample standard
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 ・ Introduction of overview of facilities

			・ Introduction of safety code ・ Site visit and practice of energy assessment ・ Best answer of the energy assessment

(Source: ECCJ Website)

(4) Operation of Training Programs

The following is a checklist of tasks the ECCJ must undergo for smooth implementation of the "Energy Manager training program with certification examination" as well as other general training programs.

Table 4-12 ECCJ's Tasks of Training Programs

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	

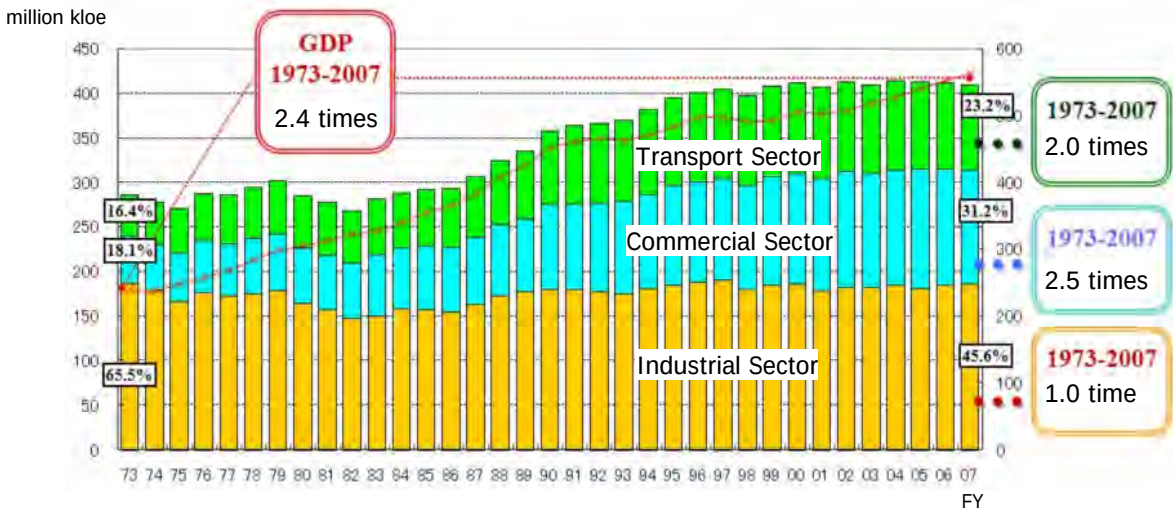
4.2 Commercial Sector

The information provided to Mexico regarding on energy efficiency in commercial sector in Japan is attached to Annex #. Thus, only the summary is shown in this section. The contents are the following 4 items;

- Energy Consumption in Commercial Sector
- Policy and Measures on Commercial Sector
- Examples of Energy Efficient Technologies
- Good Practice of Energy Efficiency

4.2.1 Energy Consumption in Commercial Sector

The next figure shows the energy consumption of Japan from 1970's to 2007. GDP (Gross Domestic Product) increased 2.4 times for 34 years during from 1973 to 2007. Although energy consumption of industrial sector remained almost the same level during the period, that of commercial sector increased about 2.5 times.

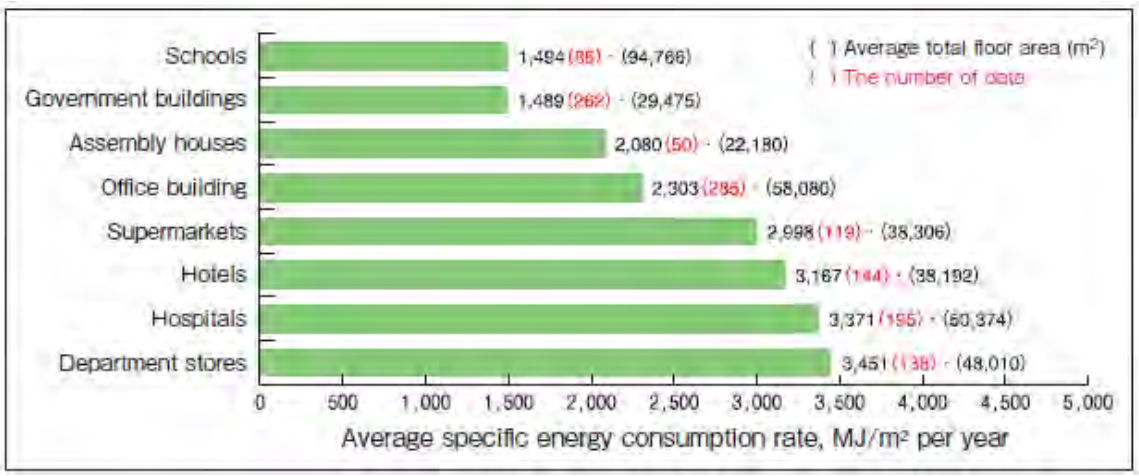


(Source: METI Comprehensive Energy Statistics 2006)

Figure 4-10 Energy Consumption of Japan (1973-2007)

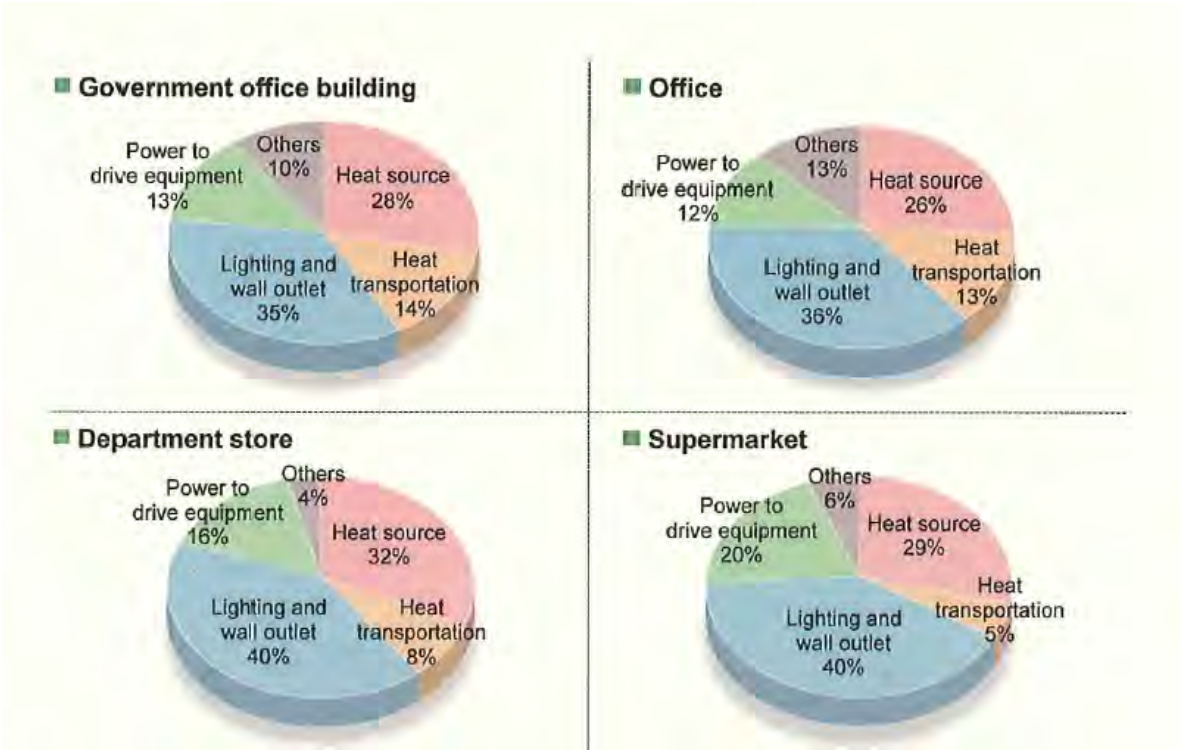
In considering the measures for energy efficiency, it is important to grasp energy intensity and energy consumption characteristics in different business. Commercial sector covers various types of business, such as offices, schools, supermarkets, hotels, hospitals, department stores and so forth and their energy intensities and energy consumption in each equipment also varies considerably. (Please refer to the following figures.)

The energy intensities of hospitals, hotel, supermarkets and department stores shows great amount about (3,500 MJ/ m^2) . On the other hand, schools show only approximately 1,500 MJ/ m^2. (Figure 4-11) Hospitals and hotels show big demand in hot water.



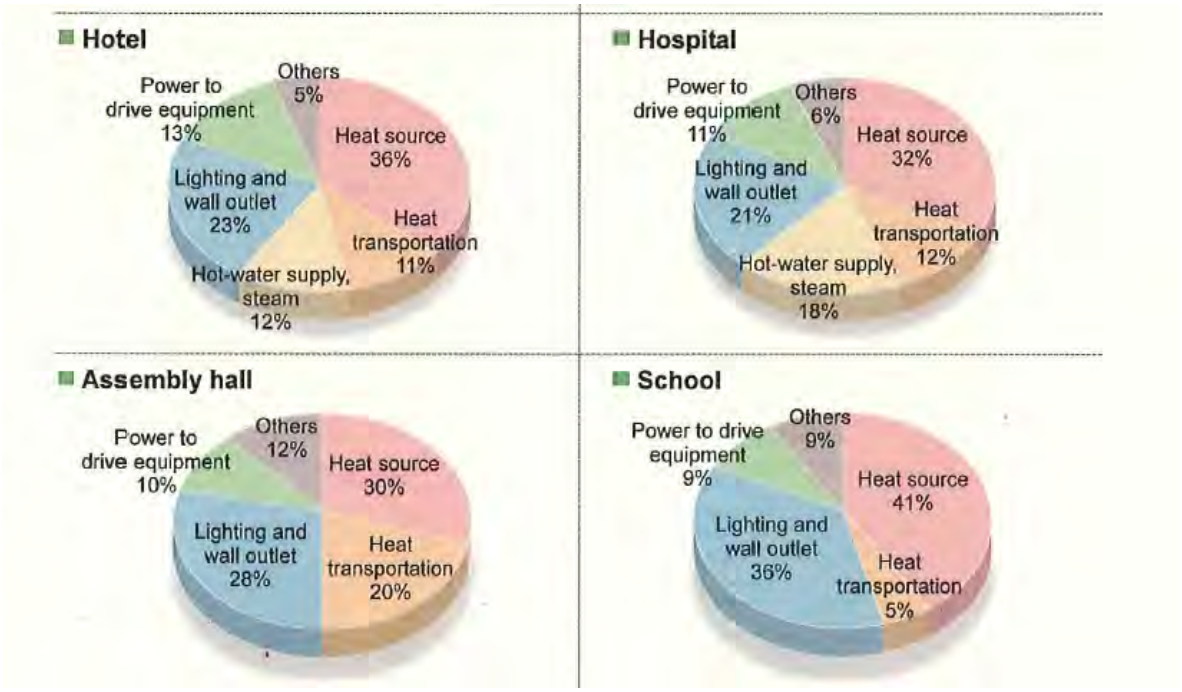
(Source: Energy Conservation Center, Japan)

Figure 4-11 Annual Energy Consumption per Floor Area



(Source: Energy Conservation Center, Japan)

Figure 4-12 Energy Consumption by Business Type (1)

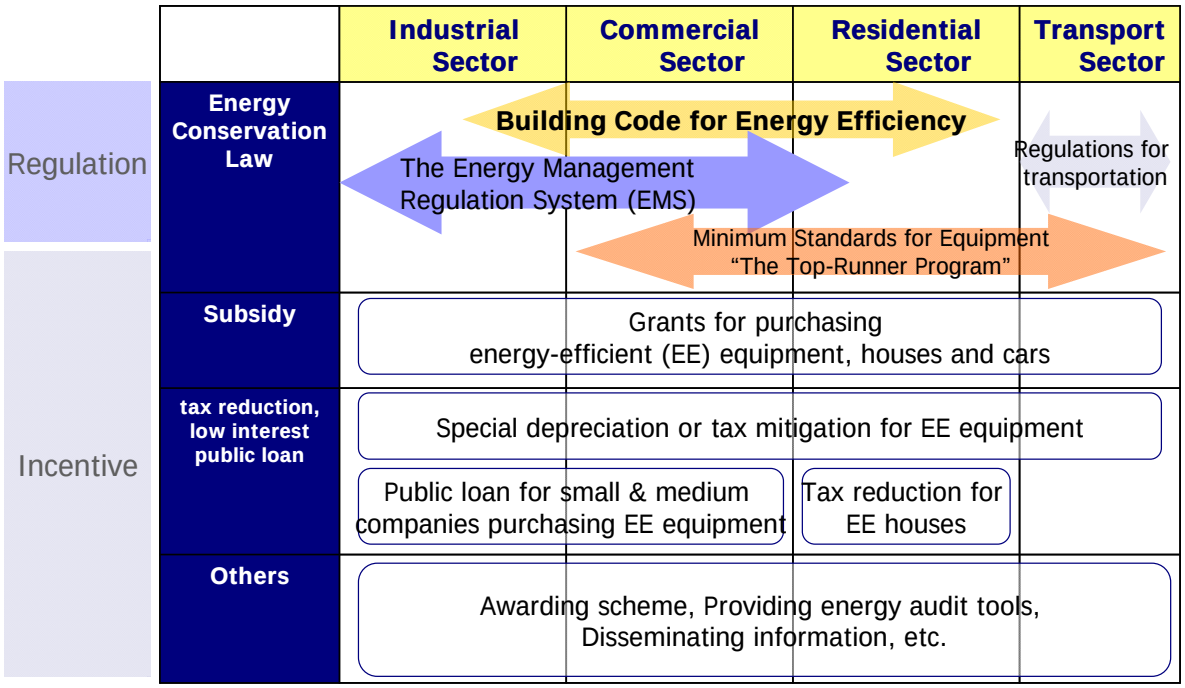


(Source: Energy Conservation Center, Japan)

Figure 4-13 Energy Consumption by Business Type (2)

4.2.2 Policy and Measures of Commercial Sector

The next figure describes a conceptual image on governmental policy and measures targeting energy consumption. It consists of two items, namely regulation by law and incentives for energy efficiency such as subsidies and low interest loan. In this survey, a focus is set on regulation. Amongst the regulation, Energy Management System is explained in section 3.2. Thus, regulation on energy performance f building is described in this section.

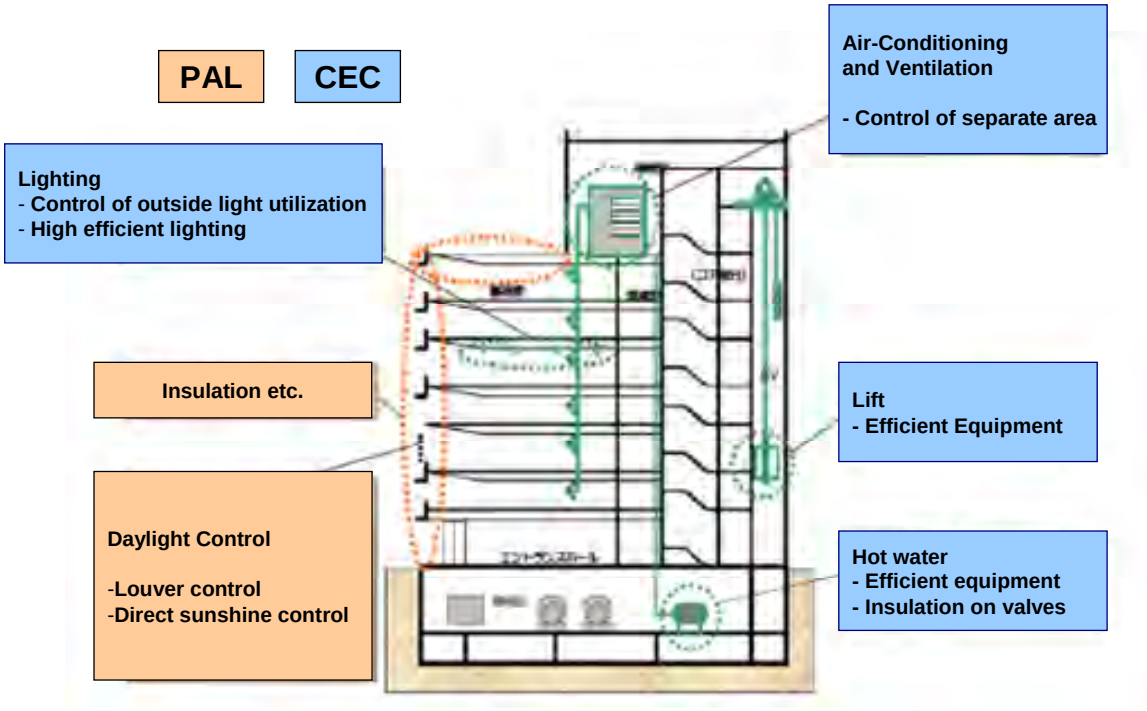


(Source: METI)

Figure 4-14 Governmental Policies and Measures in Japan

(1) Regulation on Energy Performance of Building (Building Code for Energy Efficiency)

In Japan it is mandatory to acquire construction permission under the Building Standards Act when constructing a new building or retrofitting existing building largely. In addition, a building of total floor area with more than 2,000 m^2 must submit "Energy Conservation Plan" under the Energy Conservation Law. This plan consists of two indicators, PAL (Perimeter Annual Load) and CEC (Coefficient of Consumption) which correspond to minimum standards of energy performance of building. Two indicators, PAL and CEC, have different minimum/maximum standard value for each business type, considering the situation of each business type such as hotels, hospitals, shops, offices. A concept of applying PAL and CEC is shown in the next figure.



(Source: METI)

Figure 4-15 A Concept of Applying PAL and CEC

PAL is an indicator to evaluate energy performance of building envelop, which can calculate in the following quotation. Value of PAL of each building should be equal to or less than the standard value shown in Table 4-13

PAL = Annual Thermal Load of Perimeter Zone (MJ/year) /Floor Area of Perimeter Zone (m^2)*

*Perimeter Zone: Perimeter Zone of 5 meters from the external wall. Top and bottom floor count all the floor area

CEC (Coefficient of Energy Consumption) is an indicator to evaluate system efficiency of each facility. A minimum standard value is set for each system, AC: Air-Conditioning, L: Lighting, HW: Hot Water, and EV: Elevator. A quotation is, for example, in case of air-conditioning system, defined as the numerator of annual energy consumption of air-conditioning system and the denominator of annual hypothetical air-conditioning load (refer to the following quotation). In other words, the numerator is the value of the concerned system and the denominator is the value which is calculated with assumption of a standard system. The value gained through the former being divided by the latter means the comparison to a standard system. The values are defined between 0.8-2.5.

CEC（AC）= Annual Energy Consumption of Air-Conditioning System（MJ/year）/ Annual Hypothetical Air-Conditioning Load（MJ/year）

Table 4-13 Standard Values of PAL and CEC by Business Type

	Hotel etc.	Hospital etc.	Shop etc.	Office etc	School etc	Restaurant etc.	Hall etc.	Factory etc.
PAL (MJ./ m^2)	420	340	380	300	320	550	550	-
CEC/AC	2.5	2.5	1.7	1.5	1.5	2.2	2.2	-
CEC/V	1.0	1.0	0.9	1.0	0.8	1.5	1.0	-
CEC/L	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CEC/HW	This value is decided between 1.5 – 1.9 according to the value of “hot water volume/pipe length.”							
CEC/EV	1.0	-	-	1.0	-	-	-	-

CEC/AC uses a special soft for CEC calculation, called BECS. This method is a performance standard, but in smaller buildings, specification standards might be also acceptable.

4.2.3 Examples of Energy Efficient Technologies

In this survey, common facilities in buildings, such as heat generating system, hot water system and lighting system, were chosen and introduced amongst the wide range of energy efficient technologies. (Refer to the Annex)

(1) Heat Generating System

Heat generating system when including heat transfer system consumes about 40 % and 50 % of all the energy consumption in offices and hotels respectively (Figure 4-13). Conventionally, the capacity of heat generating equipment has been stepwise and the rated efficiency has been designed to be the highest efficiency. However, responding to the fact that the thermal load appeared to be low for most of the time, a type which can control the capacity more delicately (left figure of Figure 4-16) or a type the efficiency of which is quite high during the low load, which can be much more efficient in using inverters, (right figure of Figure 4-16) have been developed.

（TOSHIBA, Super Flex Module Chiller）　（Mitsubishi Heavy Industries, Centrifugal Turbo Chiller）

Figure 4-16　Examples of Heat Generating Equipment

(2) Hot Water System

These days, highly efficient equipment which utilizes heat pump and the efficiency of which is more than one (1) even in primary energy conversion, i.e. COP is about 4, have been becoming widely spread. (Line-up examples are shown in Annex #.)

(3) Lighting System

Common lighting equipment in commercial sectors has been developed steadily to more efficient ones, from incandescent lamps to fluorescent lamps (FLR), Hf lamps, LED lamps. In parallel with high efficiency of equipment, control of lighting equipment is also an important aspect. Recently, control method utilizing the dimmer function of Hf lamps have been developed and integrated to the lighting system, such as initial luminance adjustment control (which prevents excess high luminance due to the initial allowance when newly constructed) and day-light utilization control (which maintain luminance on the desk by turning down artificial light according to the day-light amount). They are becoming easier to be used.

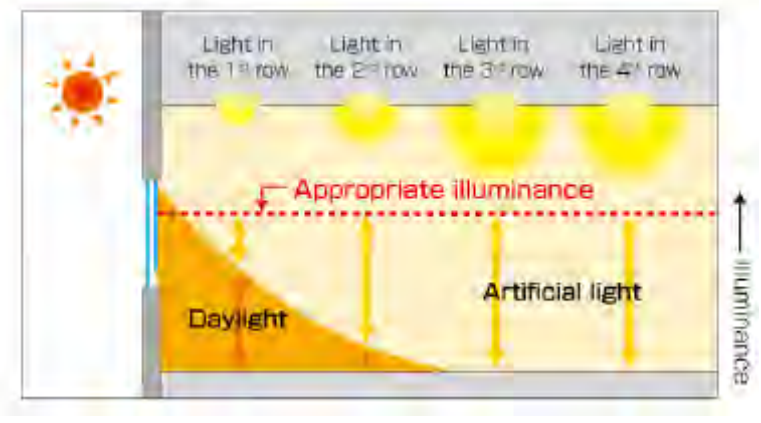


Figure 4-17　Image of Day-Light Utilization Control

4.2.4 Good Practice of Energy Efficiency

Good practices of energy efficiency, a hotel and offices were introduced. Only the summary is described in this section.

(1) Hotel

This example is a hotel of total floor area of approximately 36,000 m^2, and is one of the ESCO services of an ESCO competition of Tokyo metropolitan government. It won a gold medal of ESCO business in 2008. It achieved about 28 % and 29% reduction in energy and CO2 respectively. Simple payback period of retrofit cost is about 5.6 years, and can be decreased to 2.9 years with subsidy (next table).

Table 4-14 Reduction of Energy Consumption and CO_2 Emissions

	Primary Energy Consumption	CO_2 Emission
Reduction	28 % (61,166 GJ/年)	29 % （2,795 GJ/年）

Table 4-15 Cost for Retrofit and Reduction of Energy Expenses

Case	Cost for Retrofit	Cost Saving	Payback Period	Remarks
Without Subsidy	US$ 3,647,000	US$ 645,000	5.6 years	ESCO fee (US$ 130) is excluded from cost saving.
With Subsidy	US$ 1,887,000 (Subsidy: US$ 1,760,000)		2.9 years	

Note:
- Cost saving in the table is the guaranteed amount. Actual saving is 747,000 US$/year
- Project has not been completed yet; contract period: 2005-2011.
- Conversion from Japanese yen to US dollar is 85 yen/US$.

Adopted energy efficient technologies are as follows; (refer to Annex 2-13 for details)

- Reduction of intake air
- Replacement to efficient heat generating equipment
- Introduction of VWV (Variable Water Volume), VAV (Variable Air Volume) using inverters
- CO sensor control of parking space fan

ESCO service is a performance “guarantee” service. Thus, measures the effects of which might have big effects but might be uncertain, such as asking occupants to switch off unnecessary lighting, can not be a part of measures for guarantee. Therefore, they consist of only retrofitting.

(2) Office Building

TEPCO's activities for energy efficiency in office buildings as a whole company and an example of headquarter building were introduced in this survey. TEPCO set a companywide target of reducing 15 % energy (namely, power) consumption reduction in its office buildings by 2005 compared to that of 2000. As a result, it achieved the target by reducing 21 % (Figure 4-18). Accompanied by other similar activities such as reducing water, paper and gasoline, it received an environment minister award for global warming prevention activities in 2006.

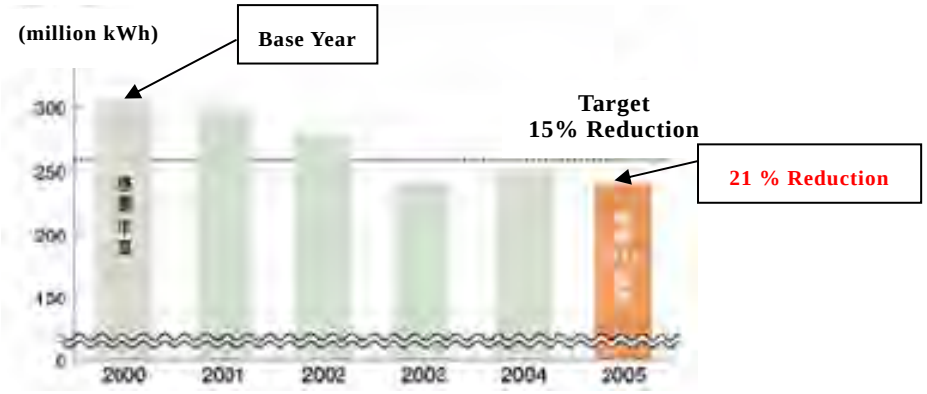


Figure 4-18 Energy (Power) Consumption of TEPCO

A headquarter building (total floor area: about 50,000 m^2) is designed to be an energy efficient building with various technologies and systems when constructed in 1972. In addition, responding to the revised energy conservation law and companywide activities, it has strengthened the energy efficiency activities. Thus, it reduced 24.5 % in energy (power) consumption in 2006 compared to that of 2000. The main measures for that are shown below.

（Operation Improvement）

- Reducing lighting hours and air-conditioning hours etc.

（Tuning of Equipment and System）

- Tuning of heat generating equipment and control of the number of the operation etc.

（Retrofit）

- Replacement of incandescent lamps to Hf lamps
- Introduction of inverters on air-conditions pumps
- Control of ventilation fan of underground parking area
- Replacement of heat generating equipment to more efficient ones
- Introduction of heat exchanger
- Introduction of all heat exchanger
- Introduction of business use Eco-Cute (hot water supply) etc.

In order to achieve energy efficiency, as usually thought in the following steps shown below, this office building also passed the same steps; firstly it improved operation and system tuning and a the same time, it considered and planed ways of system retrofit and executed them.

- Establishment of organizational structure
- Grasp of situation
- Improvement of operation
- Tuning of equipment and system
- System retrofit with investment

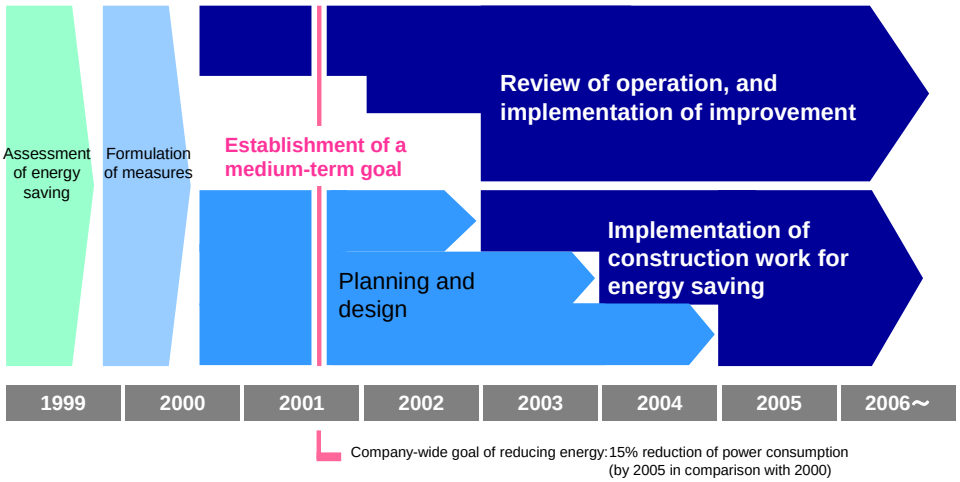


Figure 4-19 Process of Activities for Energy Efficiency

4.3 Industrial Sector

4.3.1 Information Provided about Industrial Sector

The Study Team prepared the following materials and presented them at a mini-work shop in Mexico. In addition, the information of benchmark of steel manufacturing industry and petroleum refining industry in Japan was provided as well.

In this work shop, we had lively question-and-answer and discussion, and it would be assured that the Mexican side would have sufficiently understood about the Japanese energy efficiency situations.

(1) Energy efficiency technology and measures in Japan
(a) Energy efficiency technology for steel manufacturing industry
(b) Energy efficiency technology for petroleum refining industry
(c) Energy efficiency technology for air compressor
(d) Energy efficiency technology for steam

(2) Benchmark in Japan
(a) Benchmark of steel manufacturing industry
(b) Benchmark of petroleum refining industry

4.3.2 Contents of Presentation

The details of presentation are attached to the annex. Only the outline is shown as follows.

(1) Energy efficiency technology and measures
(a) Steel manufacturing processes
- Crude steel production in major countries
- Energy efficiency activities in Japan
- Examples of energy efficiency measures at steel manufacturing processes
- Examples of energy efficiency measures for steel manufacturing equipment
- Energy intensity of each steel manufacturing process in Japan

(b) Petroleum refining processes
- Energy efficiency activities of petroleum refinery in Japan
- Comparison of energy consumption index between petroleum refineries of major countries
- Examples of energy efficiency measures

(c) Energy efficiency technology and measures at air compressor
- Key point of energy efficiency at air compressor
- Method for energy efficiency by using data logger
- Energy loss by compressed air leakage and method for the leak detection
- Application of inverter air compressor

(d) Energy efficiency technology and measures for steam
- Key point of energy efficiency for steam
- Examples of energy efficiency measures

(2) Benchmark
(a) Benchmark of steel manufacturing industry

An example of benchmark calculation at an imaginary iron work in Japan was introduced. (Refer to the attached sheet about the detail)

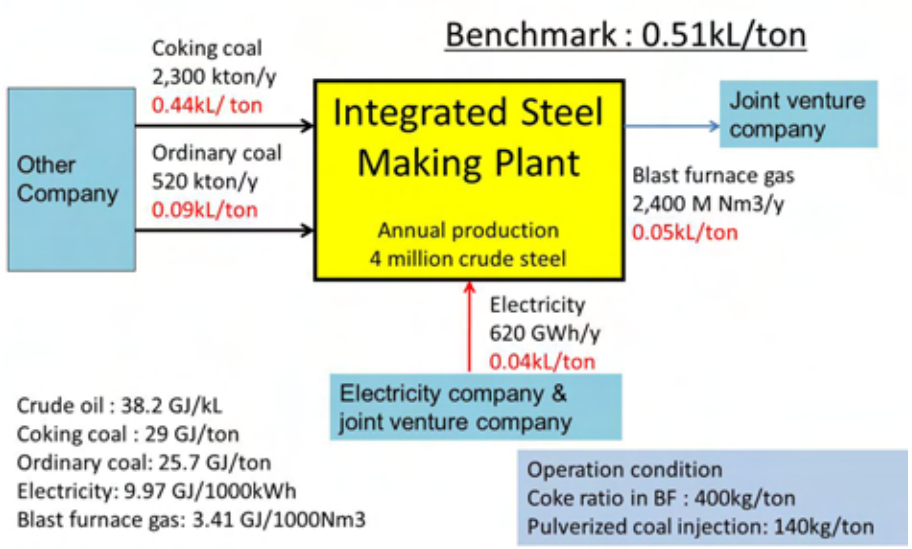
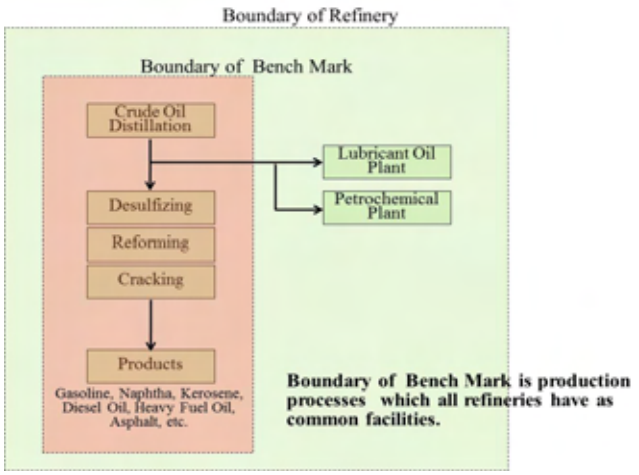


Figure 4-20 Example of benchmark calculation at imaginary iron work

(b) Benchmark of petroleum refinery

At present the benchmark is being examined in the “Subcommittee of Energy Saving Criteria of Factory and so on” in the “Energy Saving Standard Section” of the “Resources and Energy Committee”. The concept of benchmark for petroleum refinery was introduced. (Refer to the attached sheet about the detail)



Bench Mark(BM) of Refineries = Actual Energy Consumption / 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.

Figure 4-21 Concept of Benchmark of Petroleum Refinery and Targeted Value

Chapter 5 Additionally Provided Information on Japanese Schemes and Good Practices based on the request from Mexico

5.1 Sector-wise Benchmark (SWB) of Japan and EU SWB Indicator

5.1.1 Background of SWB Introduction and Implementation Methods

(1) Background of SWB Introduction

In Japan, Energy Conservation Law regulates 1% reduction of energy intensity of their products to designated energy consumers every year.

On the other hand, the law does not clearly regulate the definition of energy intensity and designated consumers voluntarily judge it and issue their periodical report to the government local office. Then the 1 % reduction only indicates the comparison of the yearly trend of the energy intensity.

Hence a consumer who actively promoted energy efficiency effort and investment does not have enough room for a 1% reduction and contrarily inattentive consumers can easily improve their energy intensity. In order to solve this unfair situation, the Japanese government launched an introduction of the SWB indication system which enables a comparison of the level of energy efficiency among companies of the same business sector.

(2) Establishment of an SWB Study Committee

Prior to the introduction of the SWB a SWB Study Committee was established and its members were organized from the representatives of the industrial sector-wise association and professor of the energy related field. The study started from May 2008 and concluded with the indicator of SWB after a one and a year and half period discussion.

5.1.2 Basic Policy of the SWB

The basic policy of the SWB is setting an indicator that enables comparison among specific business sectors where the energy is consumed in the same or similar way, and the indicator allows consumers to easily comprehend their energy efficiency level among them. At the same time, the government will be able to assess the energy efficiency effort of the consumers and press for further promotion against regretful consumers.

5.1.3 Objections against the introduction of SWB

(1) The promotion of energy consumer efforts on energy efficiency through the visualization of a relative evaluation of their past efforts

(2) Guarantee of the fairness of the Energy Conservation Law by adding an additional evaluation indicator
(3) Actual proof of SWB methodology

5.1.4 Selection of the Target Sectors

The committee focused on the large energy consuming sectors as the target sectors, because there are so many sectors in the industrial field. As a result, the steel and iron sector, the power generation sector and cement sector, whose total energy consumption reaches approximately 40% of industrial field, are selected as the target sectors of the first year. Paper sector, petroleum refining sector and petrochemical sector have been selected as the 2nd year target. Then approximately 60% of the energy consumption of the industrial field will be covered by this SWB system.

Concerning the introduction of the SWB system of the other sectors and commercial fields such as the hotel sector or office building sector, the study will launch after the evaluation of the result of the six sectors SWB system.

5.1.5 Determination of the Target Indicator

The target SWB indicator was set at a standard deviation point that is statistically analyzed from the data of the energy efficiency report of each target sector company.

From the perspective of preventing information disclosure, the government collected data from the selected companies as unsigned data and analyzed them.

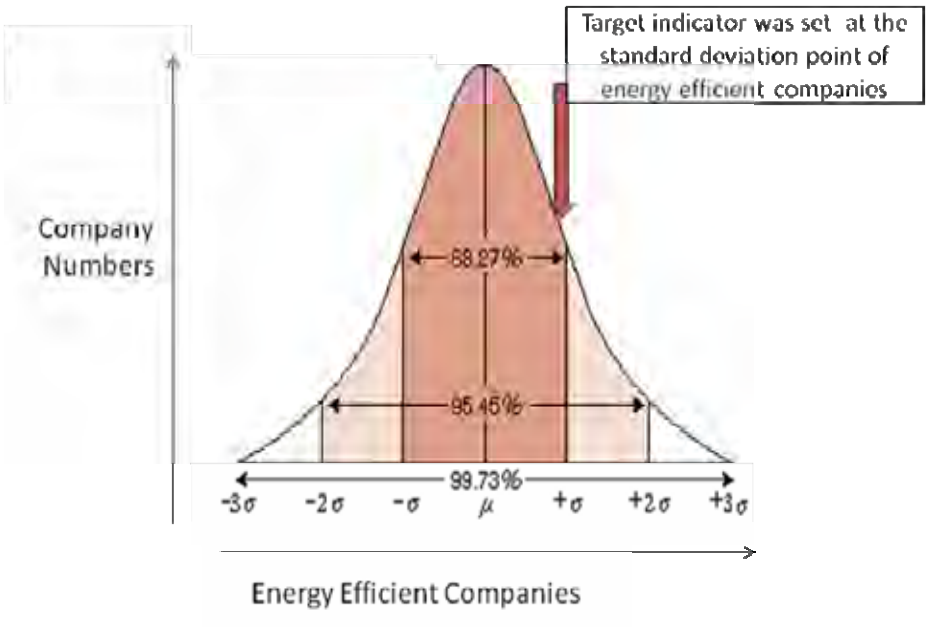


Figure 5-1 Image figure of Application of Standard Deviation Point

Concerning the power generation sector, the indicator is a ratio between the designed power generation efficiency and actual power generation efficiency on its performance operation point.
The following tables are the SWB indicators of the 6 sectors.

Table 5-1 Indicator of Iron and Steel, Power Generation and Cement

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)

Table 5-2 SWB Indicator of Paper, Petroleum Refining and Petrochemical

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)

5.1.6 Introduction of SWB Indicators of EU

Currently EU has been studying the set point of the SWB indicator. In the case of EU, the CO2 emissions volume is selected as the indicator and the following tables are the examples of the EU SWB indicators. (Please refer to the attached document)

Table 5-3 EU SWB indicator 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	

Table 5-4 EU SWB Indicator 2

Sector	Product		Benchmark Indicator (Planning) (Unit: per product Ton)	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	

Table 5-5 EU SWB Indicator 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	

Table 5-6 EU SWB Indicator 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	
—	—	—	

Table 5-7 EU SWB Indicator 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	
—	—	—	

5.2 Scheme of Radom Check on Site in Japan

5.2.1 Chief Aim of Random Check on Site

(1) To check the status of energy management (Status of energy intensity over the past five years)
(2) To check the status of energy conservation activities.
(3) To check the status of establishing “Management standards” and observing them.

5.2.2 Players of Random Check on Site

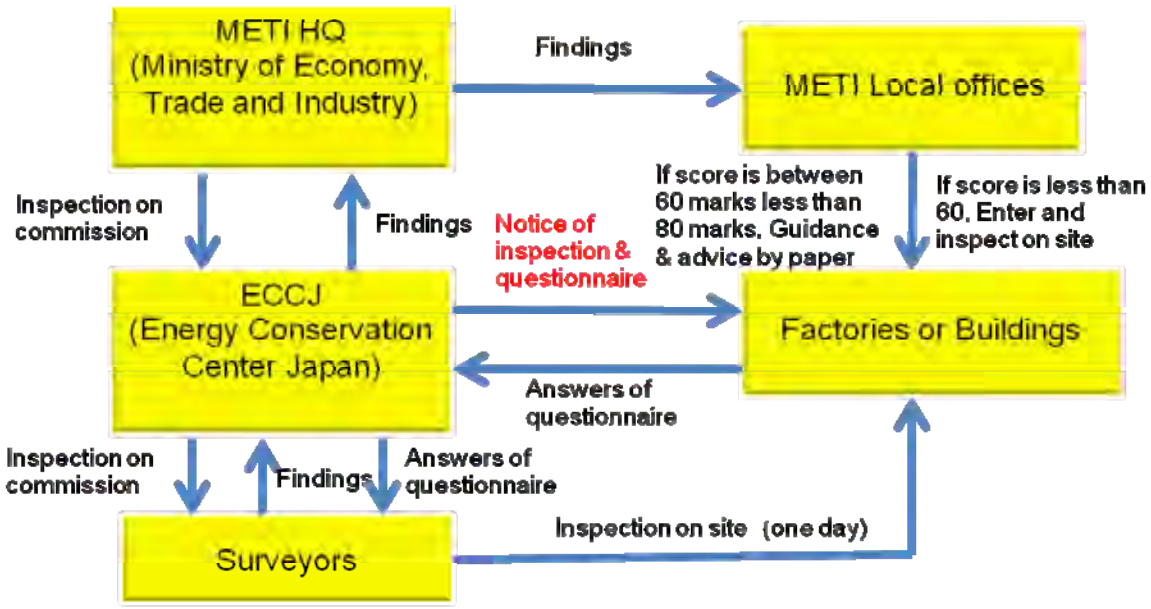


Figure 5-2 Players on Random Check on Site

5.2.3 The Number of Factories or Buildings Carried Out Random Checks On Site a Year

A random check will be carried out for 700-800 factories or buildings.

(1) Selection
METI HQ makes a plan and selects a random check site.

(2) Case of FY 2010
(a) Designation of Business Type (300-400)
- 1/3 of Food Industry
- 30 % of Manufacturer of Transportation Equipment

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

(c) At Random Selection for HQ
- 10 HQ
- The numbers of surveyors are approximately 700-800 and they are selected among experts of rational energy use who are registered at ECCJ

5.2.4 Following Factories or Buildings are Exempted from Selection

(1) Designation of business type
Factories or buildings which received the document confirming adherence to the standards of judgment issued from “Registered Investigation Bodies” in previous year

(2) At random selection for site
(a) Factories or buildings which received the document of confirming adherence to the standards of judgment issued from “Registered Investigation Bodies” in the previous year
(b) Factories or buildings selected as the designation business type in the previous year
(c) Factories or building selected as the random selection for site in the previous year
(d) Factories or buildings received the award of excellent energy management factories or buildings in the previous year

5.2.5 Contents of Questionnaire

(1) Number of licensed energy mangers

(2) Observing status for evaluation criteria concerned with the rational use of energy
(a) Transition of energy intensity over the past five years
(b) Reasons why improvement over 1% reduction of energy intensity could not be achieved
(c) Observing status for evaluation criteria concerned with the rational use of energy

- Summary of energy consumption in previous year
- Management standard（Self-Check Lists) of each equipment

(3) Energy conservation activities

(a) Programs for annual reduction target and medium and long-term activities

(b)Status of newly installed equipment, improved equipment and strengthening energy management over the past 4 – 5 years

(c) Energy management activities

Important inspection items are shown as follows;

- Status of Energy Consumption and Transition of Energy Intensity

Table 5-8 Transition of Past Five Years of Energy Intensity

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

➢ Annual energy consumption in previous year

Table 5-9 Example of Recorded Annual Energy Consumption Table

Process	Facility and equipment		Energy consumption						Consumption rate	MS
	Kind of facility	capacity & unit	Fuel and heat		Electricity		Total			
			GJ	kL	MWh	kL	kL			
A division	Air-conditioner	18	34,279	884	1,476	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	*	6.2	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	
	Subtotal		21,425	553	9,003	2,269	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	5
									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	119		**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**

Contents of energy consumption rate in each equipment

*: includes estimated value
MS：Management standard (Self-check List)

5.2.6 Energy Usage Evaluation Criteria, Management standard and Self-Checklist

(1) Evaluation Criteria of Rational Use of Energy

This is written in Article No.5 of the Law on the Rational Use of Energy, which part is the most important.

Table 5-10 Evaluation Criteria of Rational Energy Use

No	Content
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

(2) Management Standard

As written in the above table, management standards are requested to be made in every four items such as; (A sample is shown in Figure 4-5.)

1) Control method
2) Measurement and record
3) Maintenance and inspection
4) Measures to be taken for new installation of equipment

(3) Self-check List

Self-check list is based on the management standards. The self-check lists must have items such as establishing status and observing status of the four items defined in the management standard that are possible to be checked by companies or buildings themselves. The numbers of self-check lists are as necessary as many of the management standards.

Table 5-11 Self-Check List and Evaluation Method

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

(1) Management or standard

NO.	Content(Management standard)	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.	Content(Management standard, items of measurement, frequency)	Establishing status	Observing status	Evaluation of surveyors	
		○	×		

○ : More than 80% of established frequency , △ : more than 50% and less than 80%of established frequency, × : less than 50% of established frequency

NO.	standard, items of maintenance & check frequency	Establishing status	Observing status	Evaluation of surveyors	
			△		

○ : More than 80% of established frequency , △ : more than 50% and less than 80%of established frequency, × : less than 50% of established frequency

NO.	equipment in previous year)	status	Observing status	Evaluation of inspector	

- Self-check lists should be prepared to cover more than 80% of total energy consumption.

5.2.7 Method of Scoring by Surveyors

(1) Surveyors score mark all self-check lists one by one.

The example of a scored self-check list in the case of boiler is shown in Table 5-12.

Table 5-12 Self-Check List of Boiler.

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.	Content(Management standard)		Establishing status	Observing status	Evaluation of surveyors	
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

These numbers are shown in Figure 5-4 and Table 5-4

Sum of scores by surveyor is 30 marks.

In the case of boiler of Table5-5:

(a) Management or standard

There are 9 items (see the Table5-5)

4 marks is perfect for one item

(Establishing status: 2marks, Observing status: 2 marks)

In this case, 36 marks is perfect

Surveyor scores the 30 marks

○: 2 marks, △ : 1 mark , ×: 0 mark

In the same way

(b) Measurement and record

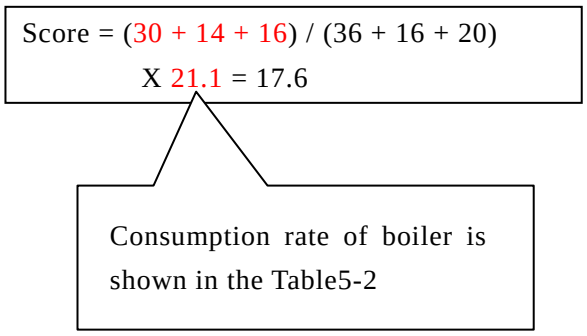
If there are 4 items

- Full mark is 16
- Surveyor scores 14 marks

(c) Maintenance and inspection

If there are 5 items

- Full marks is 20
- Surveyor scores 16 marks



(d) Boiler scores

= （30 + 14 + 16） / (36 + 16 + 20) x 21.1 = 17.6

(e) In the same way,

surveyors score marks from other self-check lists of equipment in the same way as the previous method.

And the surveyor scores the total marks from all the self-check lists.

Surveyors send the findings including total scored marks to ECCJ

5.2.8 Penalty Depending on the Evaluation Marks

(1) Penalty depending on the evaluation marks

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

(2) After getting the final results of an on- site inspection, the METI local office sends a "Guidance and Advice" by paper or do "Enter and Inspect on the Spot" within one or two weeks.

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

5.3 Award System for Excellent Energy Management Factories and Buildings

5.3.1 Purpose of Award System

(1) 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 sustainable energy resources.
(2) Awarded factories and buildings will be a good model for other ones
(3) Award system makes further improvement of energy conservation

5.3.2 Players of Award System

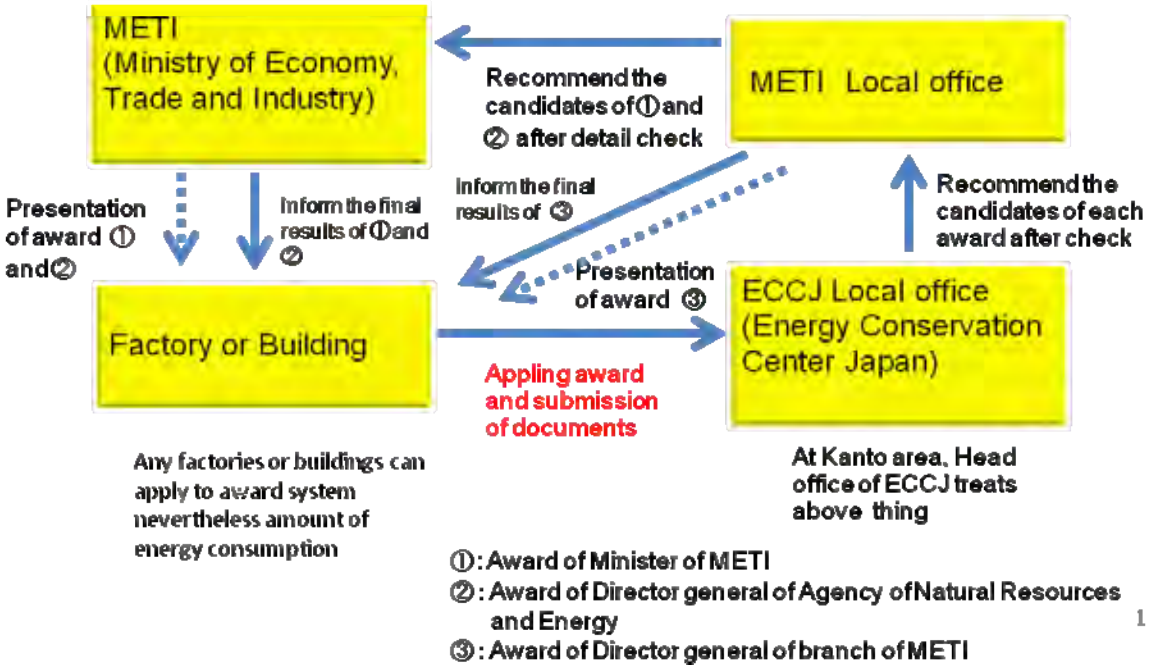


Figure 5-3 Players of Award System

5.3.3 Other type of Awards

(1) Persons
- Persons who render distinguished merit of energy conservation for long time.
- Persons who improve skill of energy conservation technology for long time.

(2) Introduction of excellent energy conservation implementation
(3) Technologies (Product / System)
(4) ESCO business

(5) Contest
- Poster
- Article
- Implementation

(6) Excellent stores of electric appliances

5.3.4 Type of award

(1) Section of award
- Fuel and heat
- Electricity

  But after 2008, the two sections were drawn together

(2) Kinds of award
- Minister of METI
- Director General of Agency of Natural Resources and Energy
- Director General of the branch offices of METI

5.3.5 Qualification for Application

(1) Does not correspond to the following three articles,
- Acting against the Energy Conservation Law (Act on the Rational Use of Energy) over the past three years
- Social problems that occur with their own responsibilities such as the pollution problem over the past three years
- Serious accidents that occur resulting in injury and death, facility accidents and disasters over the past three years

(2) Achieve distinguished results regarding the following four items
- Energy management organization and its operation status
- Energy improvement status for promoting rational energy use
- Educating and training status of energy management engineers
- Energy conservation results concerned with rational energy use

5.3.6 Procedure for Giving Award

(1) At first, all factories (or buildings) must apply for the “Award of Director General of Branch Office of METI”

(2) The above awarded from the Branch Office, factories (or buildings) can apply for the “Award of Director general of the Agency of Natural Resources and Energy” after three

years has elapsed since the previous award was given.

(3) Factories (or buildings) who have received the above award can apply "Award of Minister of METI" after two years have elapsed since receiving the previous award.

5.3.7 Contents of Submission Documents

(1) Energy management organization and its operational status

- Diagram of energy management organization
- Operation status of the holding frequency of the steering committee and discussing contents, etc
- Status of energy consumption over the past three years

(2) Educating and training status of energy management engineers

- Numbers taking the energy manager examination
- Numbers attending the training program with a certification examination for candidates of Energy Manager and general training programs for the proper implementation of EMS

(3) Extinguished results for promoting rational energy use over the past three years

(4) Enforcement of measures for rational energy use

(5) Yes or no of accidents that occur and pollution problems over the past three years

5.4 Qualification and Training for Energy Managers and its Contents

Although the qualification and training were indicated in 4.1.3, since information dissemination was demanded, this chapter shows in detail again including additional information.

(1) Employment by an administrator, and its qualification and requirements

When introducing an energy management system in Japan, the company must employ an applicable administrator. These administrators have to acquire qualifications, and they have to take a short course. Moreover, the number of the administrators onsite will depend on the amount of energy used.

1) Energy Management Supervisor

As the main roles,

(a) Maintenance of the energy management organization as the whole enterprise and promotion of energy use rationalization which were based on the managerial perspective

(b) Planning and execution of a medium-to-long term plan about energy use rationalization

(c) Decision and maintenance, and thoroughness of the plan for EE&C.

(d) Maintenance and observance of the whole enterprise managerial standards based on a

Judgment criterion, etc.

The qualification for becoming Executive Energy Supervisor is unnecessary. However, he has to be able to do company-wide energy management as a part of the business management. Therefore, he must be an officer who belongs to headquarters.

2) Energy Planning Promoter

The main roles of an energy management plan promoter are assisting the Executive Energy Supervisor on the business side with the whole energy management. Therefore, he must have taken a lecture on the course for new applicants, or have the qualification of energy management.

Moreover, the Energy Planning Promoter which took the course for new applicants must take a course to upgrade his or skills once for three years.

3) Energy Manager

The energy manager must have an energy management qualification.

4) Energy Officer

The Energy Officer must be those who took a lecture on The Course for new applicants, or those who have the energy management qualification. Moreover, the Energy Planning Promoter, which took the course for new applicants, must take a course once every three years.

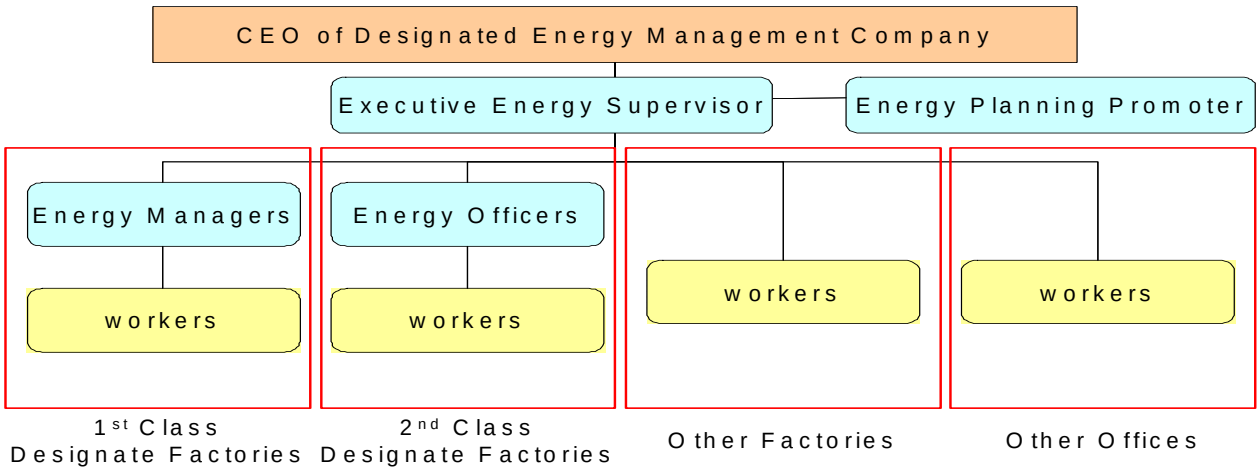


Figure 5-4 Energy Management Structure of Japan

Table 5-13 Japanese Energy Manager's Role

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

(2) Qualification Acquisition Method and its Training Outline

The qualification acquisition method in an energy management system and the outline of training are shown in Table 5-14

Table 5-14 Outline of Qualification Acquisition and Training in EMS

	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

(3) Contents of Qualification Acquisition Examination and Training

It is as the examination and training for becoming a qualified person for energy management having been shown also in 4.1.2 and 4.1.3.

1) The contents of the qualified-person-for-energy-management examination

A person has to fulfill both (a) and (b).

(a) The experience in actual business for one year or more is required for any person before and after taking an examination.

(b) Choose a Common Basic and Pick out an Optional Area of Specialty.
Refer to Table 4-8 for Common Basic and Pick out an Optional Area of Specialty.

2) The contents of energy management training

A person has to fulfill all the conditions of the following (a) - (c).

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

(b) Attend the 6-day Training before The Examination.

(c) Choose Common Basic and Pick out an Optional Area of Specialty.
Refer to Table 4-8 for a Common Basic and Pick out an Optional Area of Specialty.

3) Energy management short course (the Course for new applicants)

The Course for new applicants is the course to be Energy Officers, a Certificate will be given after attending the course. They can be Energy Planning Promoters or Energy Officers with this certificate.

(a) Lecture course

Ⅰ. Basic Knowledge for the Outline of the Energy Management and Law
1. The importance of EE&C
2. Energy Policy and Law
3. EE&C Plan

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

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

(b) Evaluation (20 minutes)

4) Energy management short course (Skills Upgrade Course)
Energy Planning Promoter or Energy Officer for some company must attend the course every three years. In addition, a lecture course and evaluation of effectiveness must be applied to a new short course correspondingly.

5) Other training
There are various general training programs conducted by the ECCJ, such as a program for the promotion and enlightenment of the Energy Management System to facilitate its implementation and programs for basic knowledge and methods of EE&C on heat and electricity etcetera. These programs can be applied based on each theme. Samples of the training programs are shown in Tables 4-9 and 4-10.

Other than the heat and electricity training programs, there are various other programs such as a training program on how to find EE&C potential, training for building energy assessment skills, site visits to factories and buildings that engage in good practices and so on. An overview of these programs is shown in Table 4-11.

5.5 Curriculum of Energy Efficiency in Japanese Universities

5.5.1 Study about Energy Efficiency

In Japan, the ECCJ does not have energy efficiency classes in any university, and universities do not have classes where people can take an energy manager examination. To become an energy manager, it is not necessary for candidates to graduate from a university. In an ECCJ Energy Manager training program, some professors give lessons, but that is separate from the university.

In Europe and America, energy engineering is a famous study field related to energy efficiency. However, there is no faculty named “Energy Engineering” in Japan. There are classes related to energy efficiency or energy management in the department of engineering or the new interdisciplinary study field.

(1) Mechanism of Energy Study in Japan

As the values of energy are changing, diversified aspects are needed to develop an energy supply and demand system. Now energy study is a fusion in which many studies are assimilated into one new field as follows.

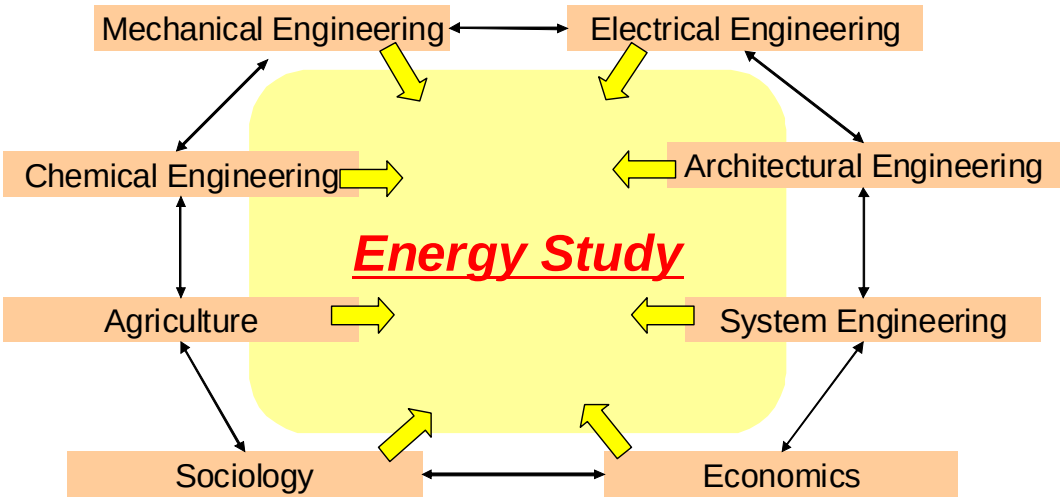


Figure 5-5 Mechanism of Energy Study

(2) Background of Energy Managers

In various faculties, there are many classes about energy, and people with any background can be an energy manager. Although there is data about energy managers' background in ECCJ, they mainly graduated from the electric engineering, mechanic engineering or building engineering departments.

In the examination of an energy manager, candidates from electrical engineering mainly choose an electric course, and those from mechanical engineering choose a heat course. As for those from building engineering, they can choose both courses, but they need to study additionally outside the building engineering field.

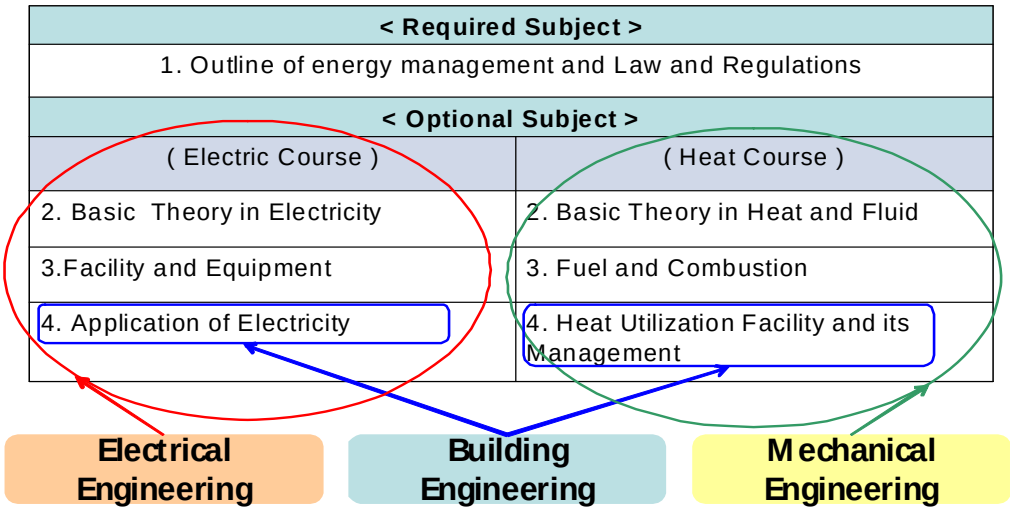


Figure 5-6 Study Field in the Examination of Energy Managers

5.5.2 Curriculum of Energy Study in Universities

In Japan's five major universities, there are no classes named "energy efficiency", but in various faculties related to energy study there are classes related to energy efficiency. The five major universities in Japan are Kyoto University, the University of Tokyo, Osaka University, Nagoya University and Waseda University.

(1) Kyoto University

In the graduate school of Energy Science, there are four departments: Socio-Environmental Science, Fundamental Energy Science, Energy Conversion Science, and Energy Science and Technology. For students of the master course, there is a special program named "Environmental Management Leader Program", which aims to foster leaders who can come up with the solution of international environmental problems including the energy problem. Energy management program does not exist in Kyoto University.

(2) the University of Tokyo

In the University of Tokyo, the graduate school of Frontier Sciences has a basic concept of the "Transdisciplinary Approach". It has four divisions: Transdisciplinary Sciences, Biosciences, Natural Environmental Studies, and Computational Biology. A course on Advanced Energy in the division of Transdisciplinary Science has some classes about energy efficiency, and the aim of this course is to foster people who will be able to solve many challenging energy problems. A course of Human and Engineered Environmental Studies in the division of Natural Environmental Studies has conducted research in the reduction of energy consumption and a future energy system for supply and consumption. Further, there is an Environment Manager Training Program, in which the skill training in environmental planning or environmental risk management is provided, which is expected of executive officials from central/local governments, the manager of private companies, etc. In this program, there is no class named Energy Management, but includes similar contents.

(3) Osaka University

The Graduate School of Engineering has a division of Sustainability and Environment. In the thirteen programs of this division, especially both the course of Environmental Management and the course of Assessing the Sustainable Environment have classes in energy management. A course of Architectural Engineering has classes about building energy efficiency.

(4) Nagoya University

In the Graduate School of Social Environmental Engineering, there are two departments: Civil Engineering and Environmental Studies. In the department of Environmental Studies, there are three courses on Earth and Environmental Science, Environmental Engineering and

Architecture, and Social and Human Environment. A course in Environmental Engineering has classes about energy efficiency. There is no class about energy management.

(5) Waseda University

In the Graduate school of Science and Engineering, there are six departments: Fundamental Science and Engineering, Creative Science and Engineering, Advanced Science and Engineering, Global Information and Telecommunication Studies, Environment and Energy Engineering, and Information and Systems. A course in Environment and Energy engineering is carrying out research into the development of an energy monitoring system for energy efficiency, and has classes about energy management. An International Environmental Leader Certification Program is to foster people who have an international vision and can work on environmental problems in a practical and specific way.

5.5.3 Comparison of Five Japanese Universities about Energy Study

In Japan, there is no faculty named “Energy Engineering”, but some schools have “Energy Science” courses. Further, there is no lecture titled” Energy Efficiency”, but some classes provide classes about energy management.

Table 5-15 Comparison of Five Japanese Universities about Energy Study

Characteristic	Kyoto	Tokyo	Osaka	Nagoya	Waseda
Energy faculty	×	×	×	×	×
Course of Energy Science	○	×	○	×	○
Special Course of Energy Management	×	○	○	×	○

5.6 About Compatibility with ISO

(1)ISO50001

ISO50001 is an international standard for energy management (abbreviated as: EnMS). U.S. and Brazil submitted a proposal to establish ISO50001in November 2007 and the study group for this standard is now working for the settlement of this series of IEO by the year of 2011.

An outline includes measures for companies to improve their energy performance (energy

efficiency and unit energy consumption, etc.), by making plans to implement, maintain and improve their industrial processes.

(2) The indicator which contributes to the new law of Mexico

1) Basic Concept

Figure5-1 shows the basic concept of the new energy management regulation which will be based on the Japanese experience as well as the ISO50000 series. This concept will be well suited to the Mexican situation. In most of the countries in the world law is composed of practical regulations and rules which should be obeyed and the secondary law shows the more detailed figures and tables. The background and the concept of the law do not generally appear on the law.

On the other hand, the ISO series is generally used for private companies or organizations to increase its corporate values by obeying the guidelines. So, the ISO series describes the concepts frequently and practical figures seldom appear. Figures are to be decided and settled by each company. We propose to create the best mixture of these two structures and achieve a common understanding concerning the goals of future cooperation.

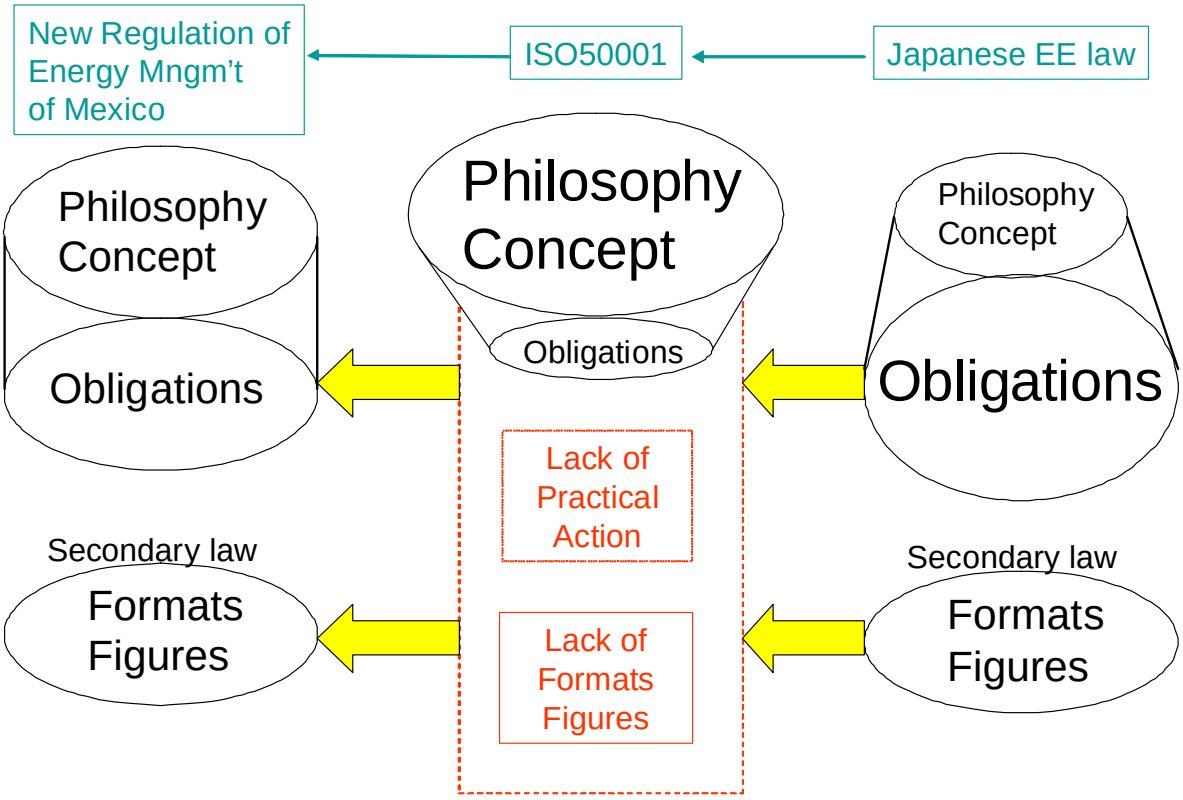


Figure 5-7 Key Map about an Energy Management Statute

2) ISO50001 and ISO14001

The ISO14001 series are now popular among many companies. The draft of the ISO 50001 has almost the same "Table of Contents" as ISO140001, and this reminds us that there are small differences in the basic part of these 2 ISOs.

Table 5-16 ISO50001 and ISO 14001

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
4.1 General requirement	requirement
4.2 Management responsibility	4.1 General requirements
4.3 Energy policy	4.2 Energy policy
4.4 Energy planning	4.3 Planning
4.5 Implementation and operation	4.4 Implementation and operation
4.6 Checking Performance	4.5 Checking
4.7 Management review	4.6 Management Review

3) Contribution by the Japanese Government for ISO50001

Through interviews, METI of Japan answers that they and the Energy Conservation Center of Japan have contributed substantially to the process of making ISO50001. This contribution is composed of 2 parts; one is for the ISO and another is for Japanese companies. As for their contribution to Japanese companies, it is to avoid overlap and the small differences between the two. As a result, Japanese companies complied with Japanese Energy Efficiency Law can easily adapt to the ISO50001, for example ISO50001 does not cover water management and cost reductions which was discussion in the beginning. However, the companies must fulfill the format of each application format in order to comply with each system, which we think is reasonable.

Table 5-17 Energy Conservation Law of Japan and Comparison of ISO50001

	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)

Table 5-18 Energy Conservation Law of Japan and Common Feature of ISO50001

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

(3) Comparison with Japanese Law for regulating EE&C by ISO50001

Japan introduced their experience and knowledge about EE&C, and, as a result, was able to have it reflected in ISO50001. Therefore, Japanese Law and the contents of ISO50001 are in principle very common. However, a private standard (=ISO50001) and the Law is different in some parts, and differences exist in the detailed portion. In this chapter, in order to aim at a further consistency of ISO50001 and energy conservation law, differences are compared.

1) The target energy and Consumers

The definition of energy : In ISO50001, they are electricity, fuel, steam, heat, compressed air, and renewable energy.
On the other hand by Japanese Law, they are heat and electricity.

In Consumers, ISO50001 which is applicable, the organization which can manage usage and the consumption situation of energy as an object, and a company, a factory, and an office are applicable. On the other hand by Japanese Law, it has been set concretely to the amount used which a company, a factory, and an office kick. (Refer to Table 4-5)

2) Implementing Organization

The organization of the ISO of Japan is JAB which belongs to the subsystem of ISO in Geneva, Switzerland. The tens of companies of certificate authority which JAB authorized exist. This certificate authority becomes a window of examination of an ISO or an audit.

On the other hand, by Japanese Law and on the other hand, as for the energy saving law, METI has managed the target customer. The organizations which are performing

the customer's office counter work are a subsystem of METI, and ECCJ. (Refer to Fig. 4-2 and Fig. 6-2.)

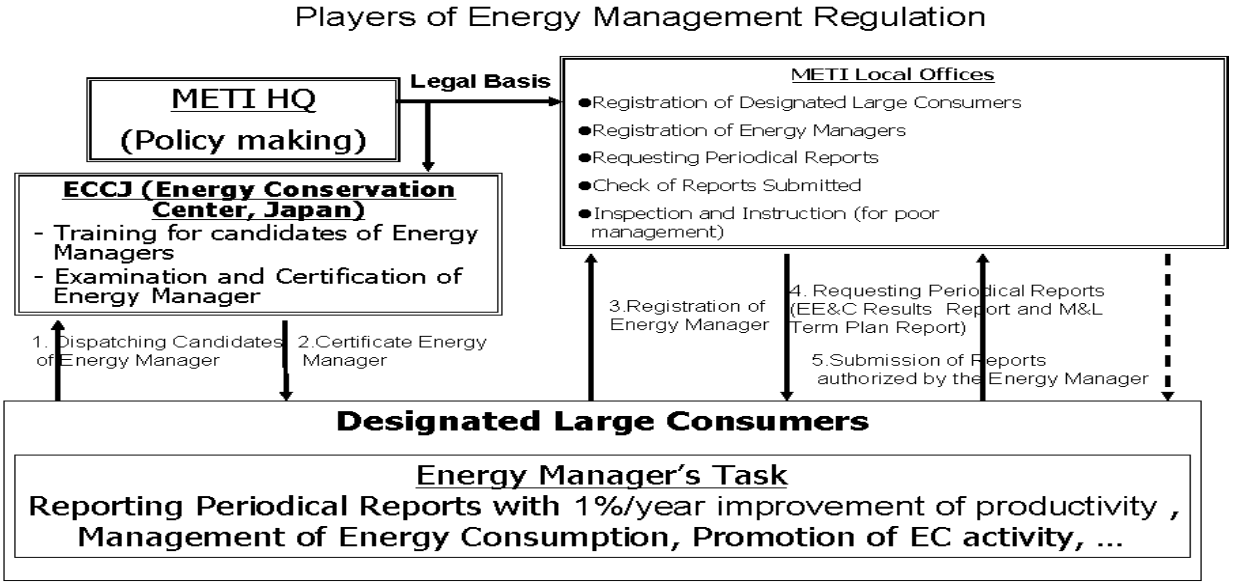


Figure 5-8 Energy management system organizational chart

3) Qualifications/Licenses of Energy Managers

About ISO50001, the zone of management must appoint a Management Representative. A qualification to become this Management Representative is unnecessary. However, the role of a zone of management or a management representative is shown clearly.

On the other hand by Japanese Law, the qualification which each administrator has to acquire is shown clearly. (Table 5-19 Reference)

Table 5-19 Role and Qualification and Requirements of Energy Managers and others

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

In the ISO50001, the standard of a management system and the standard for effective work and preservation are established. Moreover, there is no restriction on the performance standard in specific apparatus. However, you have to decide upon the criteria of control when applying.

On the other hand, by Japanese Law, the criterion of judgment is established via legal notification and, in addition to the setup of a management system and managerial standards, the numerical standard about equipment and the benchmark standard are also provided in the judgment criterion.

5) Periodical Reports to the Regulators

Since ISO is a private sector standard, the administration regulated does not exist. Therefore, although a report to administration is unnecessary, you have to keep a record of consumed target energy. On the other hand, by Japanese Law, you have to report a medium-to-long term plan, the consumption data of energy, and the numerical value of a benchmark to the METI which is a regulatory agency.

6) Investigation and management

About ISO50001, you have to turn PDCA in order to establish energy management. (Refer to Figure 6-3)

On the other hand by Japanese Law, the METI carries out audit and instructions via the periodic report submitted from each company or sites. (Refer to Fig. 6-2)

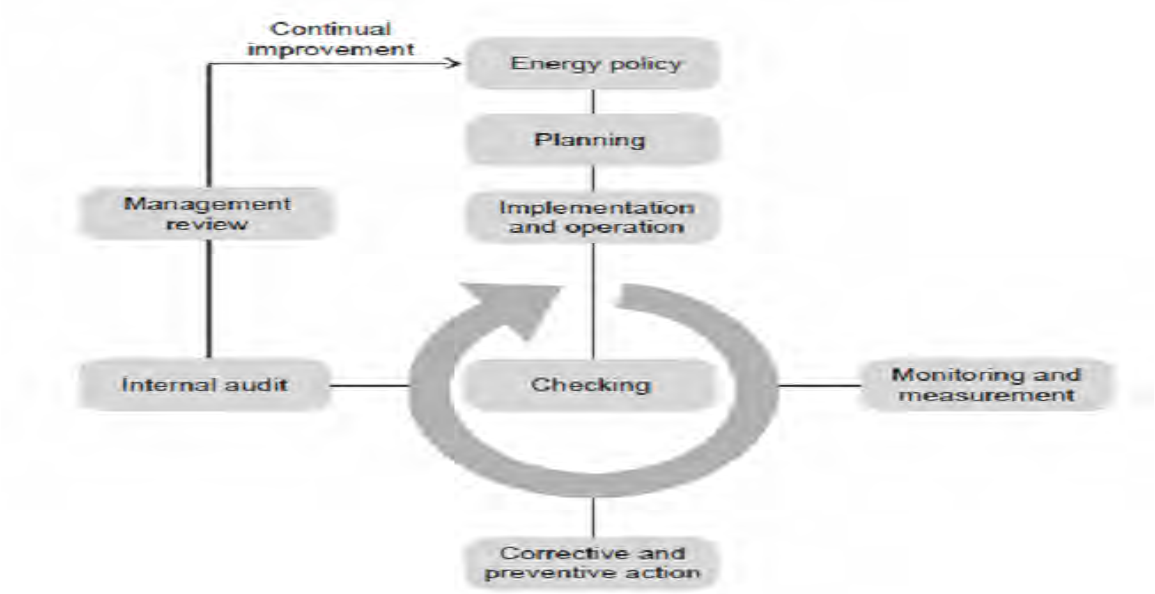


Figure 5-9 Process Flow of ISO5000

7) Inspection

About ISO50001, according to the Traditional ISO System in Japan, there are two types of reviews; regular severance (Twice a year) and Renewal Review (Once every three years). If the system has been managed well and employment is good, the number of times of a fixed examination will be reduced. Moreover, the contents will be reduced if the results of a fixed examination are good also in updating the examination. Therefore, according to the results of a fixed examination, it falls also about an examination charge. However, Renewal Review (Once every three years) is not exempted. (Refer to Table 6-5)

On the other hand by Japanese Law, it is as in Fig. 5-2 described previously.

Table 5-20 Examination of ISO

	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

8) Penalty

About ISO50001,

These are no penalties, because the ISO is a private standard.

However, when improper performance is discovered during a regular survey (twice a year) or renewal review (once every three years), the company must submit a paper of all things to improve.

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

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

On the other hand by Japanese Law, the following penalties exist.

- When wrong and no report of energy consumption, mid-and-long term plans were submitted,
  → Carry a fine of up to five hundred thousand-yen.(62,500MXD)
- When the energy manager was not appointed,
  →Carry a fine of up to a million-yen.(125,000MXD)
- When the renewal of the energy manager was not reported,
  →Carry a fine of up to two hundred thousand-yen.(25,000MXD)
- All inadequate performance,
  →announcement of company name, and carry a fine up to a million-yen.

9) Specific energy consumption

In the examination committee of ISO50001, it was said that it was not good to manage

energy by Specific energy consumption at the beginning. Then, the Japanese government continually repeated the explanation which quoted the improvement example, and performed it. Thereby, the examination committee of IS050001 admitted that a standard physical unit was to some extent an effective index.

On the other hand by Japanese Law, it was certainly managed by Specific energy consumption.

10) Energy baseline

In ISO50001, the information on initial energy determines the energy baseline. Moreover, the track record is reviewed periodically and must be compared to an energy baseline. In addition, this baseline can be changed by the method decided beforehand.

On the other hand by Japanese Law, you have to contrast the track record of the amount of the energy used with the last fiscal year. Moreover, it must be set up for the purpose of achieving a 1% incremental improvement or more.

5.7 New Energy Management System for Mexico which is suggested by the Study Team based on ISO50001 and others

The Study team suggested a new energy management system and draft ISO50001. However, this suggestion and a new program of energy efficiency did not have consistency because it was given before September 11th, 2010 when a new program of energy efficiency enacted.

1) Target energy and consumer

(a) Energy

Electricity, fuel, heat

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

(c) Category & Thresholds*

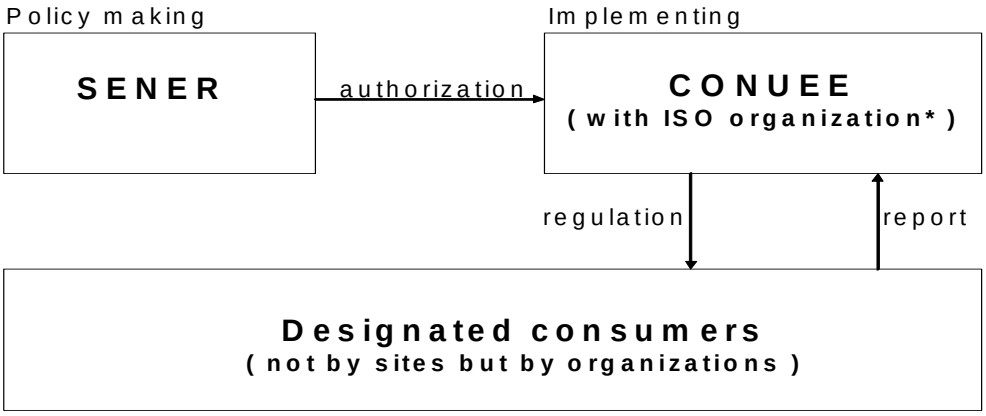
Table 5-21 Designated Consumers

	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

SENEL makes and promulgates an energy management system. SENEL authorizes CONUEE employment of this energy management system. CONUEE regulates the Designated consumers utilizing this energy management system. The Designated consumer which is the target of an energy management system conducts a periodic report to CONUEE. (Refer to the following figure).



* ISO organization : entrusted companies in ISO certification processes

Figure 5-10 A Related Design

3) Qualifications/Licenses of Energy Managers

(a) Category

Electric Engineering, and Mechanical Engineering

(b) Pathway

3 year experience + 1 week lecture

1 year experience + 1 day examination

4) A company and the contents of activity of the spot

(a) CEO places Chief Environmental Officer, and installs and creates an HQ Energy Manager at the bottom of it. This HQ Energy Manager oversees the Local Energy Manager at every place.

(b) Operation Management Manuals with numeric criteria for major Equipment

- 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: Energy consumption data with a comparison with the previous years

B: Investment plan to reduce energy consumption

C: Benchmarking figures for comparison with others

6) Monitoring and Checking

Based on the procedures of ISO50001, the PDCA cycle will be carried out for the better performance of energy efficiency. This is an internal procedure. (Refer to Fig. 2-3)

7) Inspection and Penalty

(a) ISO scheme & organizations can also be utilized for the regulation scheme with the authorization of the regulators. This will help to minimize the operation cost of the scheme.

(b) Penalties and/or fines are not the major purpose. To implement the improvements of designated consumers is most important.

Table 5-22 Inspection and Penalty

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

Chapter 6 New National Program of Energy Efficiency in Mexico

6.1 The Outline of the New National Program of Energy Efficiency

The most important law of energy efficiency policy in Mexico is LASE which is executed in November, 2008, and RLASE was enacted as the government ordinance based on LASE in November, 2009. Also, PRONASE was enacted as a national program of energy efficiency up to 2030, and a new national program based on PRONASE was enacted from CONUEE in September 11th, 2010.

The title of the new program is “National Program for Certification in Processes, Products and Services”. This will be come into effect in December, 2010.

This program has an object to establish the process to participate a certification program. The point is as follows.

1) Products

Expected results:

-Reduction of the consumption energy

-Reduction of the emissions of greenhouse gases produced inefficiently in the use of the energy

-To prompt a greater awareness-raising of the consumers so that they select and buy products of smaller energy consumption. And that these maintain their effects, capacity and comfort.

Objectives:

-Products that applies the official norm (NOM-ENER) in energy consumption standard matter (the following 19 products of the sector services, brought up to date to October of 2010):

- Vertical turbine pump
- Water heater (for commercial and domestic use)
- Pump, and pump with motor
- Washing machine for domestic use
- Pump system for deep wells
- Lighting for not residential use
- Material of wall for not-residential buildings
- Waterproof Pump (for wells)
- Air conditioner (including industrial use)
- Lighting for the outside
- Alternating current compact fluorescent
- Lamp

-Insulating thermal for the construction
-Tortilladora
- Air conditioner for room (except those of type separated)
-Cooling for commercial use
- Three-phase Motor of alternating current
*before press-released
-Air conditioning (separated type)
*before press-released
-Lamp
*before press-released

Other warnings:

- The manufacturers that put distinctive certification of energy savings in their products should show that the products surpass the value of energy efficiency with a certain proportion determined by the official norm NOM-ENER.

-The products should surpass the value of energy efficiency with a proportion determined by the official norm NOM-ENER to obtain the certification of energy savings.

-As for the electrical appliances as audiovisual, they does not apply the official norm NOM-ENER and they will not be the object of the certification until the applicable norms is determined.

-To obtain the certification of energy savings, they should present to the CONUEE the result of the exam based on the norm NOM-ENER carried out by an institute of evaluation. And then, the energy efficiency of the products will be shown.

-The certification has from 1 to 3 years of force according to the product. In this period, the manufacturers will be able to put the distinctive one of certification of energy savings in their products.

-The CONUEE can elevate the specification of minimum energy efficiency to comply for the approval of the certification when products with the distinctive certification occupy more than 50% of their market. At the same time, it is possible that CONUEE can revise the same norm NOM-ENER as basic tool.

2) Buildings

Expected results:

-Reduction of the energy consumption

-To promote the comprehension that the energy savings will contribute to the economic savings.

-Promoting the introduction of teams and energy efficient apparatuses on the part of builders and owners of buildings.

A) Not residential Buildings

(Buildings for commercial use, buildings for the public administration)

Objectives:

-Buildings that surpass the specification of energy efficiency established by the norm NOM-ENER in matter of buildings.

-Buildings that obtain 75 points in the indicator of energy efficiency that the CONUEE is going to establish in the future (where the qualification of 50 points will indicate the performance national average).

How to be certificated:

-They will pass for the processes of evaluation and the energy inspection in charge of the unit of verification accredited by the CONUEE.

-The owners of buildings should present to the CONUEE the reports of evaluation in which be shown that the buildings comply with the regulations of the density of electric power for the lighting (NOM-007-ENER-2004), of the encircling material of buildings (NOM-008-ENER-2001) and of the insulating thermal (NOM-018-ENER-1997).

-For the buildings of public administration will be needed, aside from it up mentioned, to present the result of verification of the energy in charge of an expert (the requirements for this title will be detailed further on) to certify that has been introduced in the same the technology of energy efficiency).

-The CONUEE will proceed to carry out the procedures of certification in base of the documentation presented.

-The approval will depend on if the buildings obtain more than 75 points of the scale from 1 to 100 according to the consumption of energy in the

category of buildings with the same characteristics (for example, hospitals and schools).

Other warnings:

-The force of the certification will be of 3 years and will be able to be renewed once by the same period.

-The list of commercial buildings and of the public administration with recognition will be published in the web page of the CONUEE.

B) New dwellings

Objectives:

- Housings or apartments for one or some family use that comply with the official regulation in matter of dwellings (NOM-PROY-NOM-020-ENER).

How to be certificated:

- They will pass for the following processes of evaluation in charge of the nit of verification accredited by the CONUEE:

- The owner of the building will submit to the expert the architectural project of the construction.

The necessary data to note in it are 4 things: the location where is built (city, delegation or municipality), the plan of the 4 facades and roof (to know the areas and the orientation), the materials utilized in facades and roof (thicknesses and thermal conductivity) and the characteristics of the windows (of simple or double glass).

-The expert will value the facades and inform the builder if the building complies with the requirements.

- If it is satisfactory, the expert will give the result to the builder.

- Otherwise, the expert will inform the builder, who, in turn, he will modify the architectural project of construction and he will submit to him again.

- The owner of the new dwelling will present to the CONUEE the report that show that the encircling material of the dwelling complies with the requirements of the regulatory one NOM-PROY-NOM-020-ENER.

Other warnings:

- The force of the certification will be for 3 years and will be able to be renewed once during the same period.

- The listing of the new dwellings with recognition will be published in the web page of the CONUEE.

3) Industrial Sector

Expected results:

- To improve the competitiveness of the national products as a result of a greater efficiency in the energy consumption of the industrial plants they obtain.

How to be certificated:

The participants should pass for the following processes of evaluation:

- The owner of the industrial plant will obtain the reports of verification of the index of energy consumption, emitted by an evaluation company or other companies accredited by CONUEE (engineering companies, consulting companies).

- The participant will submit data and necessary information for the energy evaluation directly to the CONUEE.

- The CONUEE will study the result of the evaluation about the energy management given by the evaluation company, and if it was complied with the standard index, it will proceed to deal with the certification. The approval will depend on if they obtain more than 75 points of the scale from 1 to 100 according to the consumption of energy in the category of industrial plants of the same dimension and characteristic.

Other warnings:

-The force of the certification will be for 3 years, and will be able to be renewed once during the same period.

-The factories with certification will bring themselves to light publicly in the web page of the CONUEE.

4) Approval of Experts and Auditors

How to be certificated as auditors:

- Participants should give CONUEE the request and resume, and take the exam. After that, they will be evaluated.
- If a participant is a person, he should take the exam and obtain more than 80 points.

- If a participant is an organization, the person who is belong to the organization should take the exam and obtain more than 80 points.

Definition of "Expert":

-It is a person or organization with the capacity to carry out expert and energy diagnoses that assesses to an organization for improve the energy management system.

Requirements:

- 5 years as a minimum of work experience as the engineer or in the projects of the sector of the energy.
- licensed or greater engineer qualification Know-how brought up to date of the sector specialized in energy (technology related to the energy, systems of energy management, services of consultancy, financial analysis, regular framework)

Definition of "Auditor":

-It is a person or an organization with the capacity to verify the energy efficiency improvement programs compliance in the industrial sectors and service sectors, in an expert in evaluation of the compliance of standards, criteria and general lines of the energy management destined to the agencies to the ones that the programs of certification are directed.

Requirements:

- 5 years as a minimum of work experience in the projects of energy management or energy efficiency to be licensed or greater qualification
- Know-how brought up to date specialized in the sector related to the energy (technology related to the energy, systems of energy management, regulations related to the energy, methodology of comparative analysis of energy management and of analysis and energy evaluation)

5) Regional Centers to support the small and medium companies

Expected results:

-Efficient use of the energy in the small and medium companies

-Sustainable Use of sources of renewable energy in the small and medium companies

- To increase the developed study and technical development on energy

management by the small and medium companies

Activities:

- Support for coordination services and technical cooperation to promote the activities directed to the efficiency in the energy management of the public sector, private enterprises, civic and academic institutes.

6.2 Next Step

The new “National Program of Energy Efficiency” which was outlined in the previous chapter of 6.1 is, in brief, the national certification program for the good energy performance of products, buildings and factories. Basic scheme has been announced on 11th of September and the following issues are to be provided in the near future including;

1) [PRODUCTS] <The figures of energy efficiency for products to be certified>

There are national standards (NOM) of energy efficiency of products in Mexico. This is the minimum standards for all the products to clear. CONUEE will announce the figures for the certification within a year. As for the products which are not regulated by NOM, they will not be targeted by this new national program of certification.

2) [BUILDINGS] <Building energy performance factors>

CONUEE will provide within 2 years the energy performance factors of non-residential buildings in Mexico including its way how to calculate the figures. In order to achieve this, CONUEE will investigate the energy consumption of various types of buildings in all parts of Mexico and will make the scheme for buildings to be evaluated by the index of energy efficiency. Average building will be marked as 50 points and 75 points will be required to be certified as energy efficient.

3) [FACTORIES] <Energy performance factors of Industrial Processes>

As for the factories, CONUEE will carry out the necessary steps as buildings. CONUEE will provide within 2 years the energy performance factors of factories in Mexico including its way how to calculate the figures. In order to achieve this, CONUEE will investigate the energy consumption of various types of factories in all parts of Mexico and will make the scheme for factories to be evaluated by the index of energy efficiency. Average factories will be marked as 50 points and 75 points will be required to be certified as energy efficient.

Chapter 7 Conclusion

This JICA project is supposed to contribute the Mexican Government by providing the requested information about the Japanese energy efficiency policies and programs to CONUEE who is preparing the new national energy efficiency program which was to be announced on 11th of September. This contribution will help better provision of new program and we, JICA Study Team, are proud of fully achieving this objective by making 21 presentations and questions and answers. But still there are some necessary steps for the practical introduction of schemes. And there are also additional schemes for energy efficiency, in addition to certification. JICA Study Team hopes further steps shall be carried out for the improvement of energy efficiency in Mexico.