Republic of Serbia

Ministry of Infrastructure and Energy

The Study for Introduction of Energy Management System in Energy Consumption Sectors in the Republic of Serbia

FINAL REPORT

June 2011

Japan International Cooperation Agency (JICA)

Tokyo Electric Power Company, Inc. (TEPCO)

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Abbreviation

AC	Air-Conditioner
AEA	Accredited Energy Auditor
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CHPP	Combined Heat and Power Plant
C/P	Counterpart
D/B	Database
DNA	Designated National Authority
EAR	European Agency for Reconstruction
EAS	Energy Agency of Serbia
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECCJ	Energy Conservation Center, Japan
EE&C	Energy Efficiency and Conservation
EIB	European Investment Bank
EM	Energy Manager
EMS	Energy Management System
EMS	Transmission System and Market Operator of Serbia
EO	Energy Officer
EPS	Energy Power Industry of Serbia
ESCO	Energy Service Company
EU	European Union
HPP	Hydro Power Plant
HQ	Headquarters
GDP	Gross Domestic Product
GIS	Geographic Information System
GJ	Giga Joule
GTZ	Gesellschaft fur Technische Zusammenarbeit
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt fur Wiederaufbau
kl	kiloliter
kWh	kilowatt-hour
LPG	Liquefied Petroleum Gas
MEMS	Municipality EMS
METI	Ministry of Economy, Trade and Industry (Japan)

MOESP	Ministry of Environmental and Spatial Planning
MOF	Ministry of Finance
MOME	Ministry of Mining and Energy * Since March 2011, the energy section has been merged into Ministry of Infrastructure and Energy (newly established)
NIS	Petroleum Industry of Serbia
O&M	Operation and Maintenance
OJT	On the Job Training
R&D	Research and Development
REEC	Regional Energy Efficiency Center
SEA	Serbian Energy Agency
SEEA	Energy Efficiency Agency of Serbia
SIEEN	Serbian Industrial Energy Efficiency Network
SME	Small and Medium Enterprise
S/W	Scope of Works
TEPCO	Tokyo Electric Power Company
TFC	Total Final Consumption
TPES	Total Primary Energy Supply
TPP	Thermal Power Plant
WB	World Bank

Chapter 1 Introduction

1.1 Background

The Republic of Serbia (hereinafter "Serbia"), outside of coal and renewable energy such as hydropower, is highly dependent on imported energy. About 79 % of their oil (2006) and 89 % of their natural gas (2006) supplies are imported from foreign countries, especially Russia. National energy security stipulates that Serbia diversify their energy sources and promote energy efficiency and conservation (hereinafter "EE&C").

In Serbia, an Energy Law enacted in 2004, led to the establishment of a framework for energy sector reform. The Energy Efficiency Agency of Serbia (hereinafter "SEEA") was established as an institution to promote efficient energy usage and was set up as a regulation institute. In the area of policy, the Energy Sector Development Strategy 2005-2015 was drawn up in May 2005 and Programs of Energy Development Strategy Implementation 2007-2012 were formulated in January 2007. These recognize the importance of promoting EE&C as a priority issue.

Current energy law imposes no duties on energy consumers and fails to promote concrete EE&C activities. Therefore, the establishment of a law to promote energy efficiency and conservation will impose duties on consumers and prioritize the introduction of the Energy Management System (EMS) as a critical issue.

The law mentioned above, which is defined as a priority issue in the Energy Sector Development Strategy, is under legislative consideration aiming for potential ratification by the end of 2009 (at the time of the request of the study). Following the law's establishment, it will be necessary to immediately introduce the Energy Management System in order to promote EE&C. It is this present situation that has led the government of Serbia to request of Japan, given the nation's superiority in the area of EE&C, to implement a development study (hereinafter "the Study").

1.2 Scope and Objective of the Study

1.2.1 Scope of the Study

The Study is based on the S/W signed in March 2009 between the Japan International Cooperation Agency (hereinafter "JICA") and the Serbian government. The Study period is from July 2009 to June 2011 and encompasses all of Serbia.

1.2.2 Objective

Objectives are as follows:

- Recommendation of necessary measures and a framework in order to establish the Energy Management System which places at its core the "Energy Manager"

- Provision of necessary support and accompanying recommendations in establishing the law and relevant systems
- Via the implementation of this survey, assistance in the planning development and execution in dealing with the Ministry of Mining and Energy (hereinafter "MOME") and related organizations.

1.2.3 Expected Output

Throughout the Study, expected outputs are as follows.

1) Schematic Design of the Energy Management System

- Schematic Design (Implementation structure, roles and tasks, database, etc.)
- Energy Manager Qualification System
- Energy Manager Training System
- Required Law and Regulations

2) Action Plan for Implementation of the Energy Management System

- Overall Implementation Plan of Energy Management System
- Action Plan for Building Execution of EMS Schematics (Organization, Staffing, Budgeting, etc.)
- Action Plan for Building the Energy Manager Qualification System (Organization, Staffing, Budgeting, etc.)
- Action Plan for Building the Energy Manager Training System (Organization, Staffing, Budgeting, etc.)

3) Support Scheme for the Energy Management System

- Existing Scheme Modifications
- Needs Survey on New Scheme
- Implementation Plan (Modified Existing Scheme and Proposed New Scheme)
- Action Plan (including Donor's Assistance)

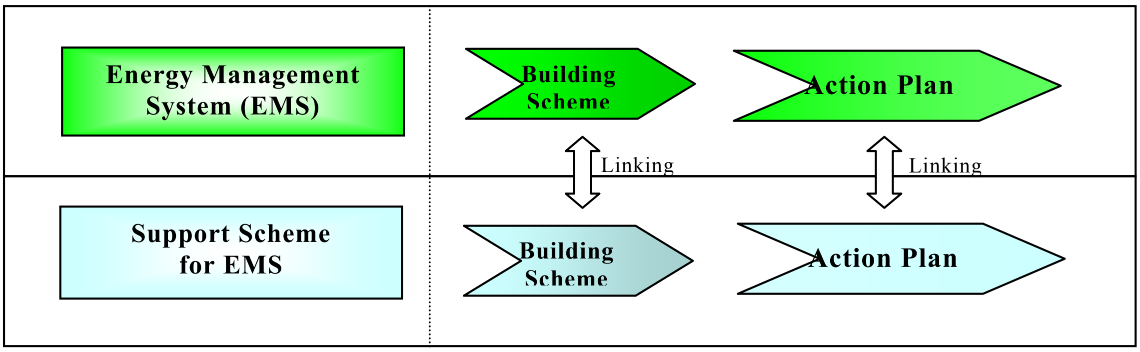


Figure 1-1 Image of Expected Outputs

1.3 Scope of Work

The Study was conducted by Tokyo Electric Power Company (TEPCO) under the name of JICA's consultant (hereinafter "the JICA Study Team"). To achieve the aforementioned outputs, the JICA Study Team undertook the scope of work shown below:

1) Current Situation Survey Analysis

- Survey on social and economic conditions, legal and policy system, energy demand and supply situation, EE&C awareness level, etc.
- Survey on the past and on-going projects
- Survey on consumer onsite EE&C activities (questionnaire and site reconnaissance)
- Survey on other countries' laws and policies with regards to EE&C
- Survey on the JICA's past EE&C projects (Poland and Turkey)
- Survey on other donor assistance

2) Drafting of the Energy Management System

- Proposal of schematic design
- Proposal of a qualification system of Energy Manager
- Proposal of an Energy Manager training program
- Finalization of the above three items
- Proposal of the legal basis and regulations concerning the Energy Management System

3) Creating an Implementation Plan for the Introduction of the Energy Management System

- Proposal of overall implementation plan
- Proposal of action plan for building scheme
- Proposal of action plan for building the Energy Manager qualification system
- Proposal of action plan for building the Energy Manager training program
- Finalization of the above 4 items

4) Proposing Support Scheme for Energy Management System

- Survey of the existing support scheme and the possibility of its utilization
- Survey regarding the possibility of a new support scheme
- Proposal for implementation framework of new and existing support schemes
- Proposal of an action plan for the implementation of such support schemes

1.4 Overall Schedule

1.4.1 Overall Schedule

Table 1-1 Overall Schedule

	2009			2010						2011
Current Situation Survey Analysis ● Survey on social and economic conditions, legal and policy system, energy demand and supply situation, EE&C awareness level, etc. ● Survey on the past and on-going projects ● Survey on consumer onsite EE&C activities (questionnaire and site reconnaissance) ● Survey on other countries' law and policy with regards to EE&C ● Survey on the past JICA's EE&C projects ● Survey on other donor assistance										
Drafting Energy Management System ● Proposal of schematic design ● Proposal of qualification system of Energy Manager ● Proposal of training program of the Energy Manager ● Finalization of the above three items ● Proposal of legal basis and regulations concerning Energy Management System										
Making implementation Plan for the Introduction of Energy Management System ● Proposal of overall implementation plan ● Proposal of action plan for building scheme ● Proposal of action plan for building energy manager qualification system ● Proposal of action plan for building Energy Manager training program ● Finalization of the above 4 items										
Proposing Support Scheme for Energy Management System ● Survey on existing support scheme and possibility of its utilization ● Survey on possibility of new support scheme ● Proposal for implementation framework of new and existing support schemes ● Proposal of action plan for implementation of such support schemes										
Local Survey Period										
Workshop										
Submission of Reports	Ic/R			Pr/R			It/R		Df/R	F/R

1.4.2 Workflow of the Study

The flowchart of the Study is shown below. As mentioned above, in the Study, in order to incorporate feedback pertaining to staff capacity and the issues of energy management in energy consuming sites to the design of the Energy Management System, a pilot implementation of energy management activities on site was planned and implemented in a factory and building respectively. The pilot implementation is positioned at the “6” of the following figure.

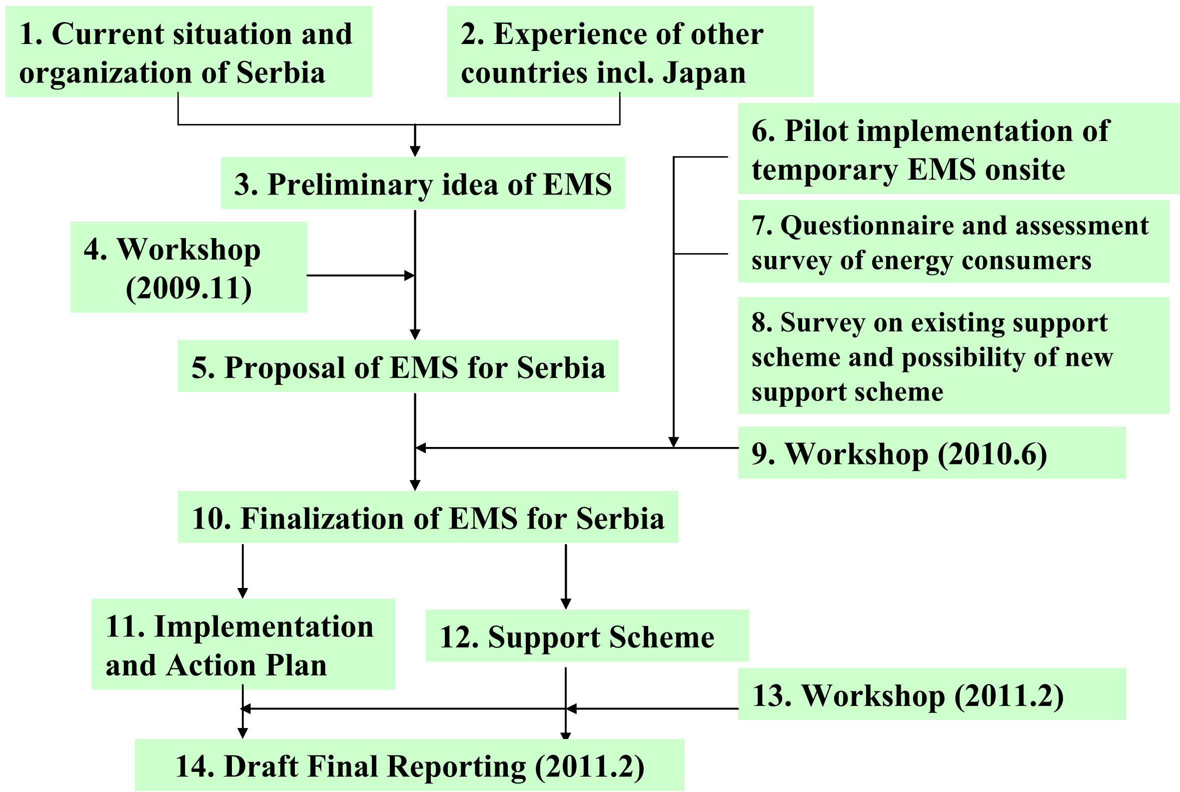


Figure 1-2 Flowchart of the Study

1.5 Study Team Structure

The JICA Study Team consists of two teams; one is the Scheme Design Team which deals with the design of Energy Management System, the other is the Energy Assessment Team which mainly deals with the site surveys to feed back the results to the scheme design. The JICA Study Team conducted the Study together with a steering committee consisting of MOME, SEEA and Ministry of Finance (MOF) of Serbia (hereinafter "Steering Committee").

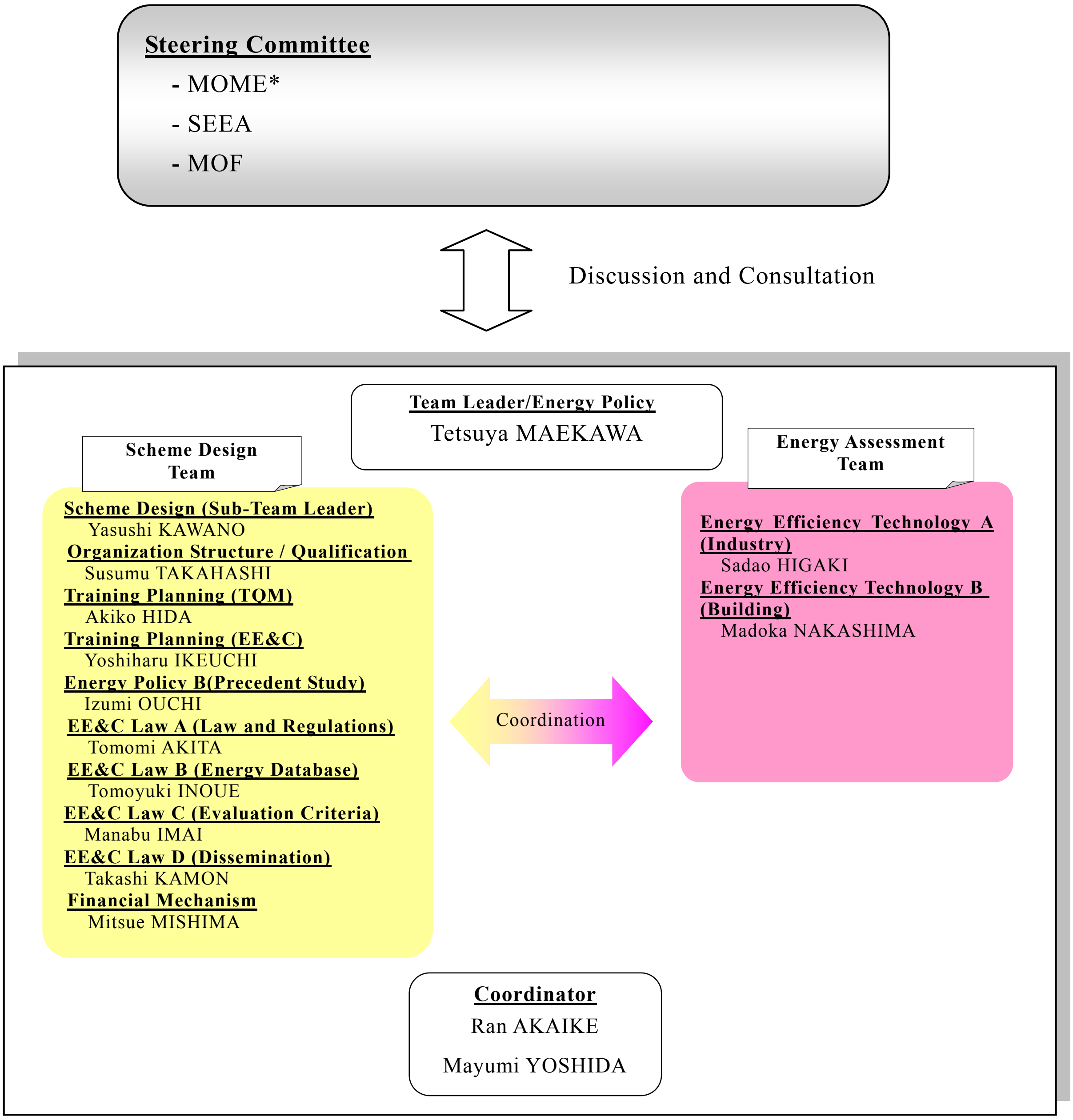


Figure 1-3 Study Team Structure

* MOME was resolved in March 2011 by the restructuring of Serbian Government and the energy section has been merged into Ministry of Infrastructure and Energy.

1.6 Re-Commission to Local Consultant

In order to effectively grasp the current situation of energy management in Serbia, the JICA Study Team re-commissioned some work over to local consultants (see the next table).

Table 1-2 Plan of Re-Commission to Local Consultants

Survey Title	Contents of Re-Commission	Local Consultant
(1) Fact finding survey on the level of sites (questionnaire and interview)	■ To grasp the local technology level of sites and confirm the availability of data to be reported	■ INNOVATION CENTER, FACULTY OF MECHANICAL ENGINEERING, Serbian Industrial Energy Efficiency Network ■ FACULTY OF MECHANICAL ENGINEERING, Regional Euro Energy Efficiency Center, University of Kargujevac
(2) Initial energy assessment	■ To identify EE&C potential in the energy consuming sectors and applicable EE&C technology regarding heat and electricity ■ To consider the implementation capacity of the Energy Management System and others	■ INNOVATION CENTER, FACULTY OF MECHANICAL ENGINEERING, Serbian Industrial Energy Efficiency Network ■ FACULTY OF MECHANICAL ENGINEERING, Regional Euro Energy Efficiency Center, University of Kargujevac
(3) Advisory work for the creation of Evaluation Criteria	■ To formulate an Advisory Committee ■ To facilitate discussion in the Advisory Committee ■ To summarize the discussion	■ ENCOTECH d.o.o.
(4) Advisory work for the creation of Audit Standards	■ To make comments on proposals from the JICA Study Team and create countermeasures if any	■ ENCOTECH d.o.o.

1.7 Others

1.7.1 Third Country Educational Tour

JICA, for the purpose of sharing their past international collaborative experience in the field of energy conservation acquired while in Poland and Turkey, is respectively paying a visit to these countries. These country's visits were conducted in 2010 to discuss with the relevant agencies. The JICA Study Team accompanied the proceedings in order to share their Japan work experiences.

Table 1-3 Visits to Two Countries

	Timing	Duration	Number of Persons (Serbia + JICA Study Team)	Destination to Visit
Turkey	2010	4 days	2 ＋ 2 persons	Electrical Power Resources Survey and Development Administration (EIE) National Energy Conservation Centre (NECC)
Poland	2010	4 days	2 ＋ 2 persons	Polish National Energy Conservation Agency (KAPE) Poland-Japan Energy Conservation Technology Centre (ECTC)

1.7.2 Pilot Project for Energy Management Activities

(1) Objective

In order to make a concrete and practical proposal of the Energy Management System in Serbia, pilot implementation of energy management has been proposed, where model sites are to be selected and a temporary energy management system is to be introduced with the objective of providing feed-back on issues and lessons to be learned. These kinds of activities such as the EE&C organizational establishment by end-users of factory/building and the participation of government people who are in positions of supervising EE&C activities in the factories in the future are expected to contribute to the technical transfer to Serbia.

(2) EE&C Activity Contents

Two model sites (one site from the factory and one site from the building) are to be selected. At the model sites, model EE&C activities are to be conducted all with an eye towards the eventual introduction of the Energy Management System. The following items are the assumed sample EE&C activities to be conducted at the model sites.

- Total Quality Management (TQM: Total Quality Management*1) training program targeting site staff
- EE&C assessment including measurements and discussions concerning countermeasures to be taken based on the results of the assessment
- Trial of making Periodical Report reflecting the results of the assessment
- Standardization of O&M (when some countermeasures are identified)

*1: Total Quality Management is a quality management method for a whole organization. The management method is developed to be linked with individual work or business principle.

Chapter 2 Energy Efficiency Policy in Other Countries

This chapter introduces other countries' experience in energy efficiency policy that can be references for introduction of Energy Management System and relating support scheme for Serbian. Japan and EU experience are described below. From Europe, UK and German are selected as advanced environmental policy country as well as advanced EE&C policy country. In addition, India, Thailand and Australia that have introduced their Energy Management System are also selected to be introduced.

2.1 Japan

2.1.1 Energy Policy

(1) Overview of the Policy

Energy policy-making in Japan is conducted under the authority of the Ministry of Economy, Trade and Industry (METI). The "Basic Energy Plan" (March 2007) and the "New National Energy Strategy" (May 2006) were both enacted under the "Basic Act on Energy Policy" (June 2002). The Basic Act 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.

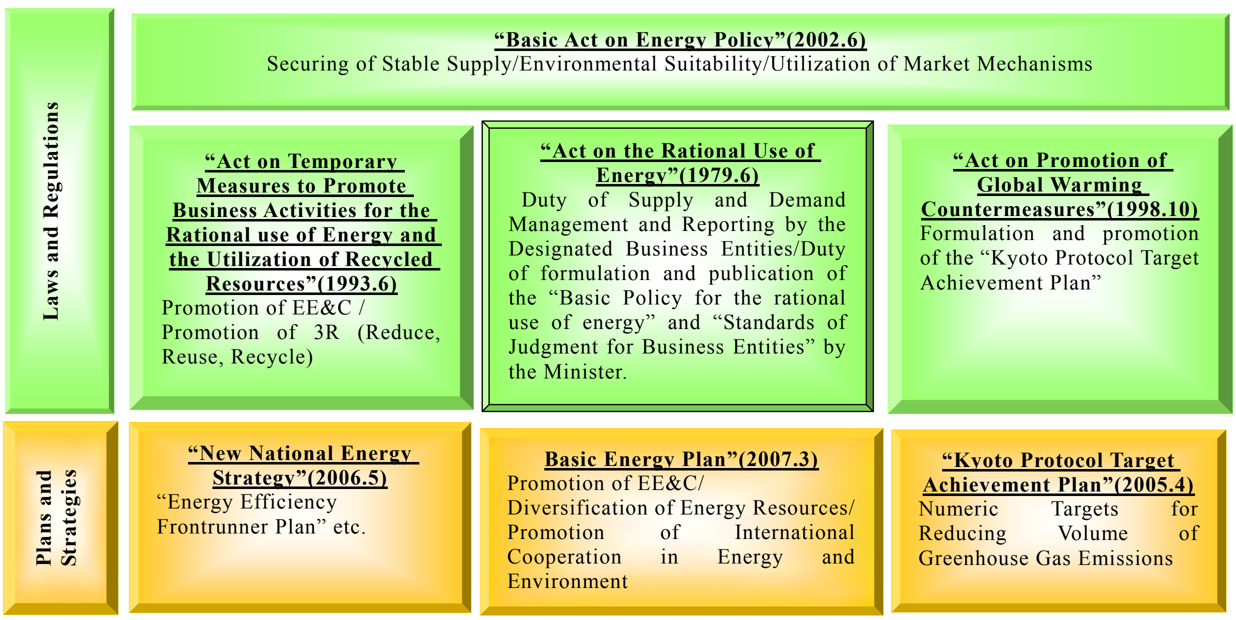


Figure 2-1 Basic Policy and Strategies Concerning EE&C

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.

(2) Energy Conservation Law

(a) History

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 August 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 amendment of the Energy Conservation Law was put into effect on May, 2008 and it introduced new regulations such as the requirement to efficiently promote EE&C activities per management discretion and some measures targeting certain business entities which have many small sites. First, for factories or buildings, which have had their energy consumption regulated on an each site basis only, after the latest amendment, they are required to conduct energy management of the whole entity. Companies, whose total annual energy consumption level of all factories or buildings as a whole exceeds a certain designated level would be classified as a “Designated Company”. The designation per unit as a Type 1 Energy Management Factory or Type 2 Energy Management Factory is also conducted the same as before. Furthermore, the new “Specified Chain Business Entities System” was started to introduce 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 level to be designated as a “Specified Chain Business Entity”. The “Specified Business Entity” and “Specified Chain Business Entity” must prepare the Middle and Long Term Plans and Periodical Reports per the whole entity, appoint an energy management supervisor from board members, appoint the “Energy Manager for Energy Management Planning and Promotion” who supports the Energy Management Supervisor, and appoint energy managers for each designated factory or designated building.

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

Substantive introduction of new regulations took place in April 2010. Therefore, the following sections introduce the previous regulations before April 2010.

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".

Fuel	▪ Crude oil, volatile oil (gasoline), heavy oil and other oil products ▪ Combustible natural gas, ▪ Coal, coke and other coal products ▪ Other materials for combustion, etc.
Heat	▪ Heat generated from Fuel (Steam, Hot Water, Cold Water, etc.) (Excluded: heat generated that is NOT "Fuel-based", such as solar heat, geothermal heat etc.)
Electricity	▪ Electricity generated by fossil fuels (Excluded: NON-fossil-fuel such as photovoltaic generation, wind power generation, waste power generation, etc)

Figure 2-2 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 2-1 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

(c) 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.

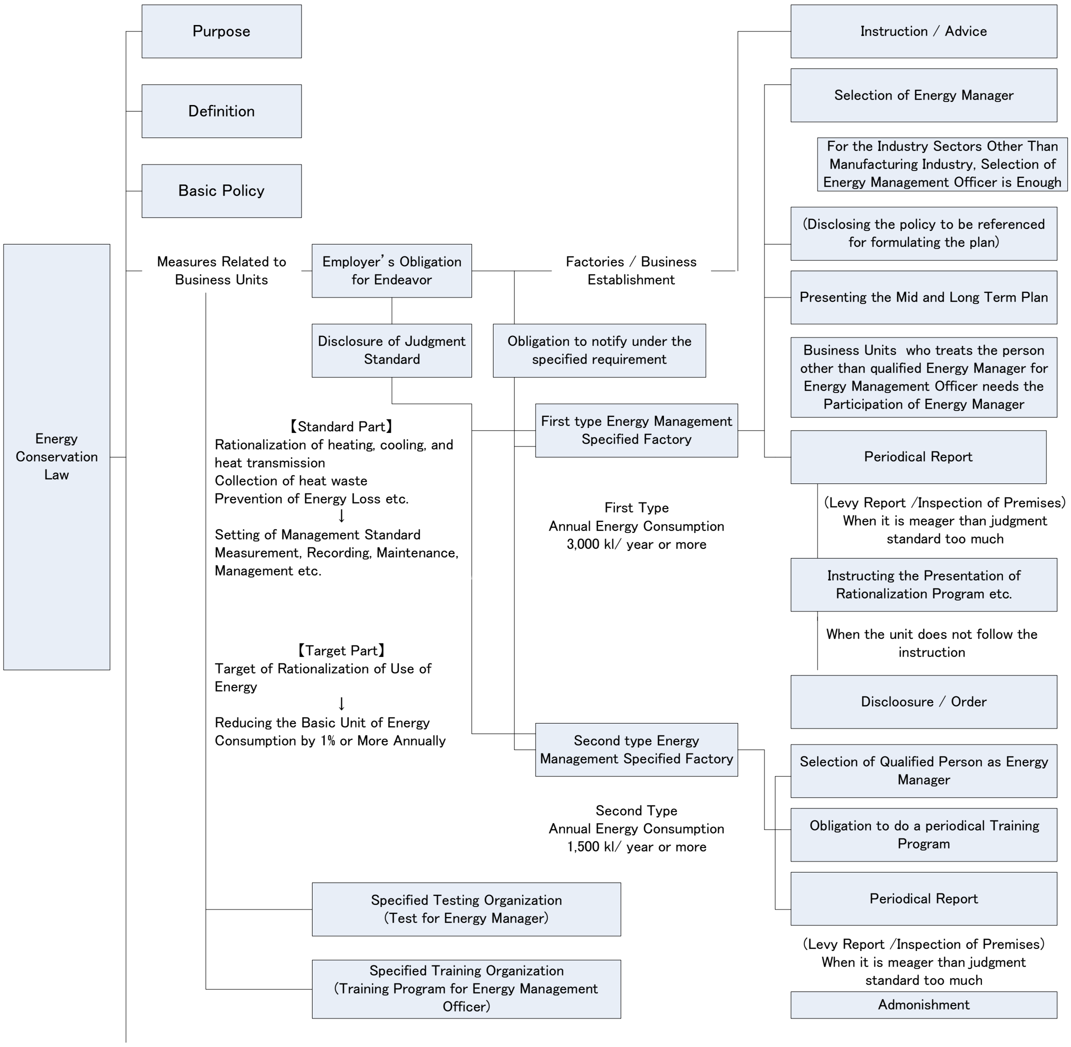


Figure 2-3 Overview of Energy Management System in the Energy Conservation Law

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 2-2 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 2-3 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 Report（Type 1 Energy Management Factory）（Article 14） ▪ Periodical Report 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 Report（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.

2.1.2 Japanese Energy Management System

(1) Schematic Overview

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

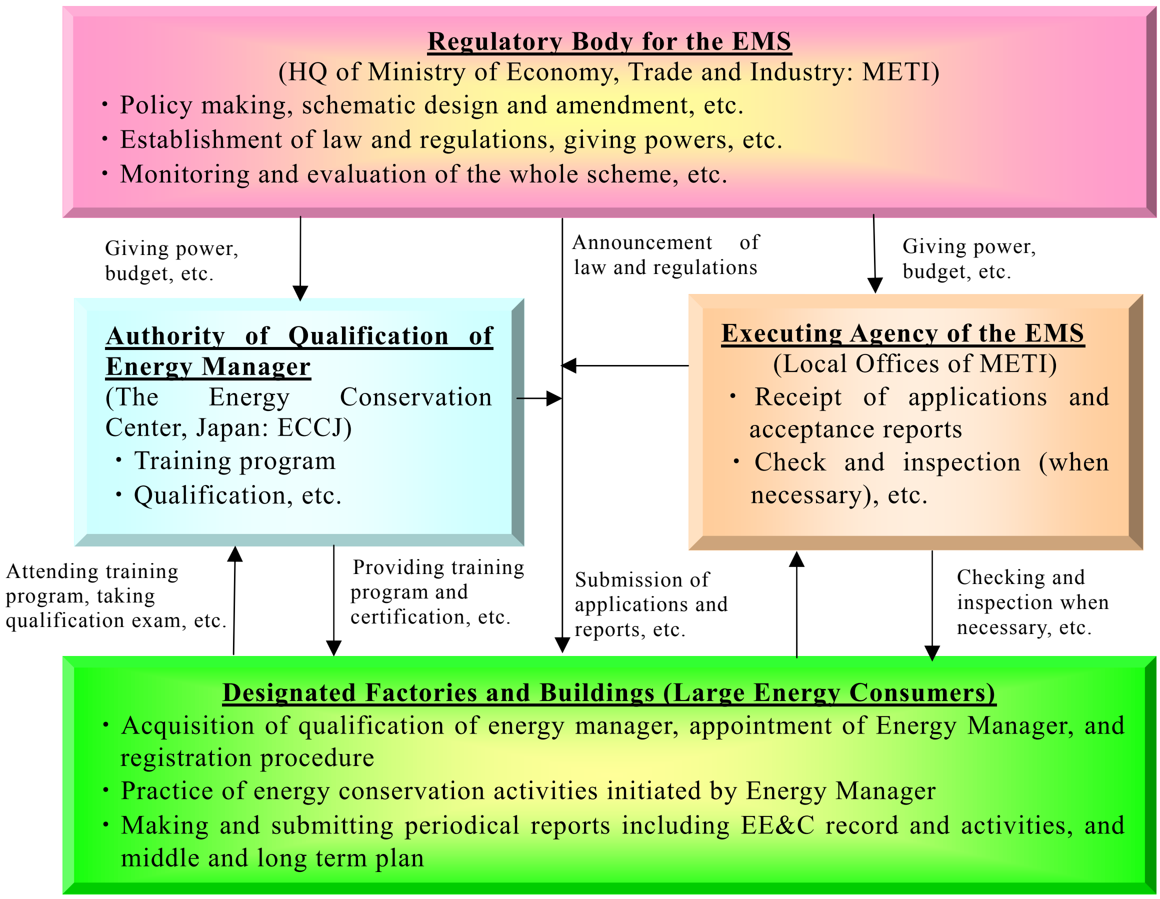


Figure 2-4 Overview of Japanese Energy Management System

(2) Periodical Report

Designated Organizations must submit Periodical Report 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 Report 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

Check List for Compliance with Evaluation Criteria

Figure 2-5 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 2-6 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 2-4 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 promotional and organizational framework after coordinating 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 adhering to given 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 a basic units management chart.
5	Energy-saving plan and target setting	Designates the energy-saving tasks for the entire company and for each department once a year, and quantitatively sets out applicable targets.
6	Education and prize-giving for employees	Educates employees collectively as one whole corporate entity and individually per department. Works with the employer to establish a prize-giving scheme that honors a department or worker that contributes to energy conservation.

Table 2-5 EE&C Activities and Tasks of Energy Manager (Sample) （2/2）

	Activity	Tasks of Energy Manager (Sample)
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 receiving opinions from related departments. Drafts a workplace-level improvement plan after receiving 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	Keeps updated on the latest state-of-the-art technologies and other practices that would be in the firm's best interests.

(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

6 Fields to be Managed

1. Rationalization of combustion of fuels
2. Rationalization of heating and cooling as well as heat transfer
3. Recovery and utilization of waste heat
4. Rationalization of conversion of heat into power, etc.
5. Prevention of Energy loss due to emission, conduction, resistance, etc.
6. Rationalization of conversion of electricity into power, heat, etc.

4 Methods to be Managed

1. Management Methods
2. Measurement and Record
3. O&M and Inspection
4. Treatment when New Installation

Making Management Standards

Standard Value to be Complied

1. Standard of Air Ratio
2. Standard of Exhaust Gas Temp.
3. Standard of Heat Recovery Rate
4. Standard of Outside Surface Temp. of Incinerator
5. Standard of Power Factor at Receiving Point

Target: Average 1 % per year improvement of energy intensity in the past 5 years

Figure 2-7 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.

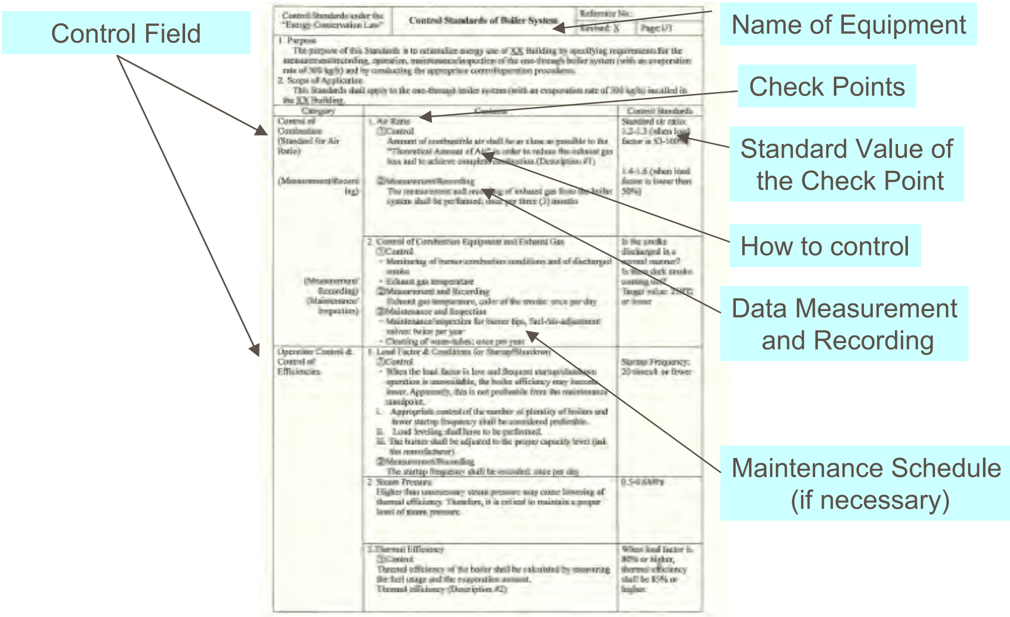


Figure 2-8 Sample of Management Standards (Boiler Case)

(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 Report (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 Report. Via the Periodical Report checks and the random checks, a judgment is made concerning the necessity of having an inspection.

Table 2-6 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 Report
Designated Organizations	Submission of Energy Use Report	Appointment of Energy Manager	Submission of Periodical Report	Response if necessary		-
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Executing Agency	Checking Periodical Report	Check by site visit (at random)		Inspection (for insufficient designated organizations in Periodical Report 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) Periodical Report

Data and information input in the Periodical Report 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

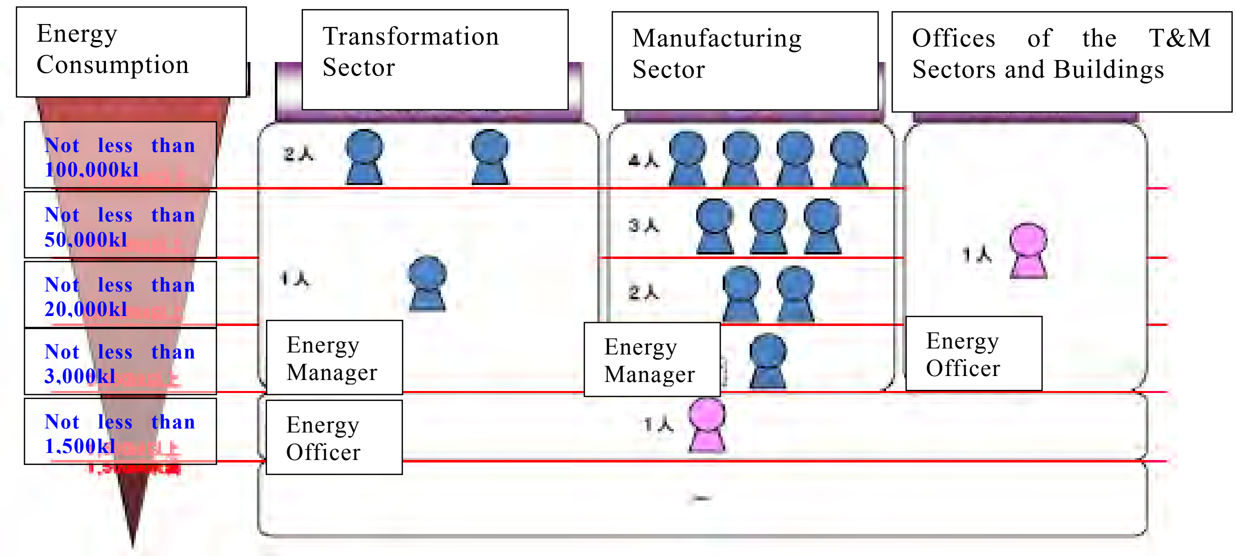
(7) Qualification System

(a) 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) as a national qualification respectively at each factory that consumes not less 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.

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 not less than 1,500 kl (crude oil equivalent) / year and less than 3, 000 kl may also appoint an Energy Officer regardless types of sector. The detail is shown below.



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

Figure 2-9 Appointment of Energy Manager and Energy Officer

(b) Methods of Qualification

(i) 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.

(ii) 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 Manager.

(8) Training System

(a) Training Program Classification

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)

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

Table 2-7 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 Report ● (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.)

(b) 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 2-8 Training Program with Certification Examination (Japanese Case)

	Subjects			Contents	Lecture Time
Common	I	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)	II	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
	III	Fuel and Combustion		1 Fuel and combustion management 2 Calculation of combustion	4 hours 3 hours
	IV	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)	II	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
	III	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
	IV	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)

(c) 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 2-9 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 2-10 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 2-11 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)

(d) 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 2-12 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	

2.1.3 Support Scheme for Energy Efficiency in the Industry and Commercial Sector

(1) Overview

Categorizing support schemes for energy efficiency in the industry and buildings by the Japanese government in respect of financial options, there are subsidies, financial support (incentives for loan), and tax incentives as shown below (the information is as of 2009).

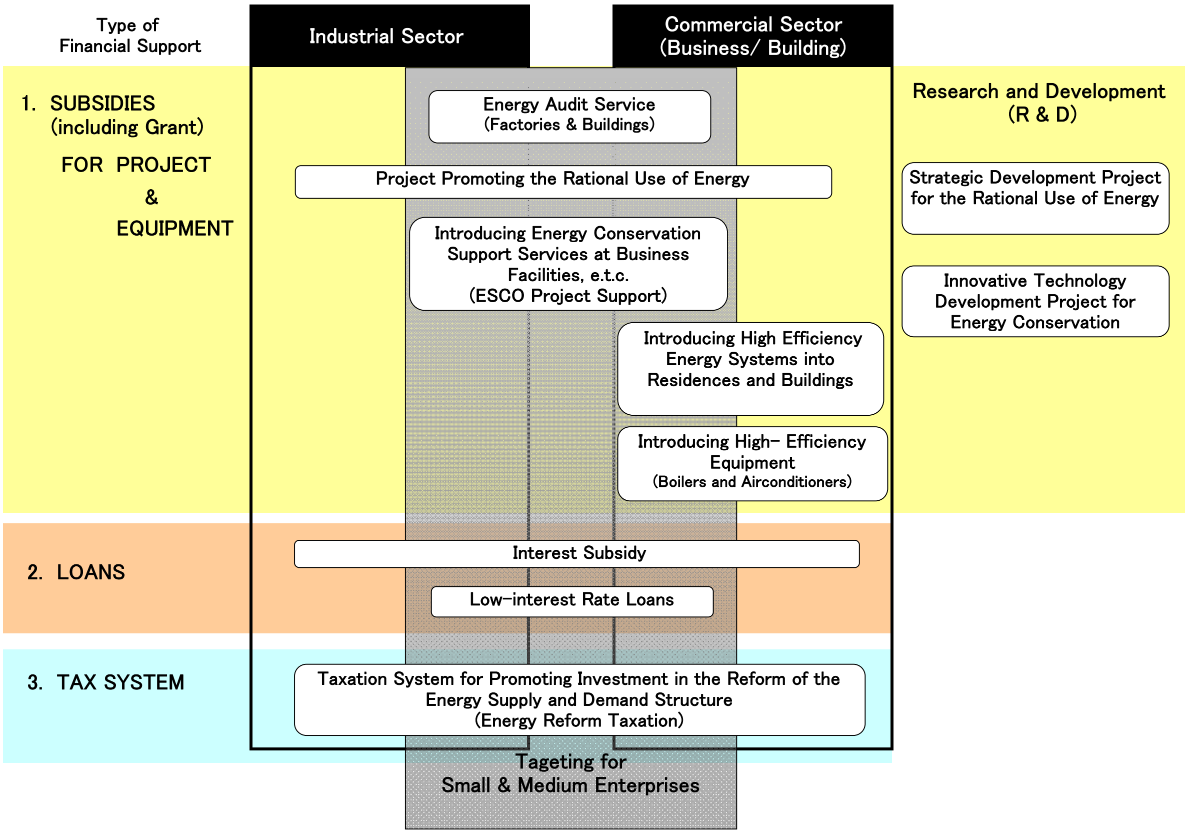


Figure 2-10 Financial Support Scheme for Industry and Commercial Buildings Conceptual Map

(Source: Table made from the documents from Ministry of Economy, Trade and Industry and Agency for Natural Resources and Energy "Financial Support with Subsidy FY2008" and others)

Other than the aforementioned direct financial assistance, the government attempts to promote EE&C through awarding enterprises and individuals. Details for these schemes are described below.

(2) Subsidies for Project and Equipment

(a) Energy Audit Service

With subsidies by the Resources and Energy Agency, Ministry of Economy, Trade and Industry (METI), ECCJ is in charge of this service and implements it for factories or buildings for free of charge. For 11 years from the year 1997 to 2007, the ECCJ executed energy audit services for about 2,700 factories and 2,400 buildings.

The planned budget amount by METI for fiscal year 2009 is 1.25 billion yen in total for energy audit services together with the ESCO support project which is described in the following (b).

Table 2-13 Summary of Energy Audit Service for Factory and Industry by ECCJ

Content	Conducting energy audit services for factories, office buildings, and others, including examining the potential of introducing energy efficient technologies Factories and Office buildings
Target	Type 2 designated energy management factories and buildings by the Energy Conservation Law, and also undesignated factories which annual energy consumption is, as a principle, 100kL and more in terms of crude oil equivalent
Audit Scheme	Experts dispatched by ECCJ visit factories and buildings directly and make recommendations. They conduct surveys and diagnosis on the current situation of energy management, data survey for energy use, electricity, heat, air-conditioning, boilers etc. and prepare an audit report.
Type of recommendations for improvement	Recommendations are made from the following 3 perspectives: Category I : Feasible recommendation by operation Category II: Feasible recommendation by investment Category III: Feasible recommendation upon renewal

(Source: ECCJ Website as of November in 2009)

Beside ECCJ, New Energy and Industrial Technology Development Organization (NEDO) implemented free-of-charge energy audit service for large-scale factories and others, on average 30 to 40 cases yearly by fiscal year 2007. As of the fiscal year 2009, however, it is no longer conducted.

(b) Subsidy for EE&C Projects

As for the subsidy for EE&C projects, “Project Promoting the Rational Use of Energy” by NEDO and “Introducing Energy Conservation Support Services at Business Facilities, etc. (ESCO Project Support)” for small and medium scale enterprises by Medium and Small Scale Enterprises Development Organization (until FY 2008, ECCJ was executing agency) are raised as main schemes. Moreover, for energy efficiency systems for buildings, “Introducing High Efficiency Energy Systems into Residences and Buildings” are being implemented by NEDO. Details on the content of these projects are described in the following table.

Table 2-14 Examples for Subsidy for EE&C Projects

Program Title	Project Promoting the Rational Use of Energy	Introducing High Efficiency Energy Systems into Residences and Buildings	Introducing Energy Conservation Support Services at Business Facilities, etc. (ESCO Project Support)
Implanting Agency	New Energy and Industrial Technology Development Organization（NEDO）		Medium and Small Scale Enterprises Development Organization
Implementing period	FY 1998 - 2009[1)]	FY 1999-2010	FY 2008-
Target entities	Private enterprises or organization in any sector	Such as owners of construction project of introducing high efficient energy system for houses and buildings in Japan (comprising of air conditioner, hot water supply, lightening, and heat insulating materials and others) in existing, newly constructing, enlarging or reconstructing ones	Middle ranking enterprises (their capital is 100 million yen and more, less than 1 billion yen) Medium and small size enterprises (their capital is 10 million and more, less than 100 million yen)
Target projects	Projects which introduce EE&C equipment and technology with expectation of high energy efficiency and very cost effective	Projects which introduce high efficient energy systems for construction and introduce also BEMS (Building Management System) in order to conduct optimum energy demand management, etc.	ESCO projects in existing factories and offices, with expectation of high energy efficiency and very cost effective
Number of approved projects for a year (Number of applied projects) [1)]	385 projects (585 projects)	593 projects (631 projects)	21 projects
Maximum amount of subsidy (Subsidy ratio)	Single project: 500 million Yen / project (1/3 and less) Multiple coordination projects: 1.5 billion yen/ project (1/3 and less) Large-scale project: The same as above (1/2 and less)	100 million yen/ project (1/3 and less)	30 million yen / project (1/2)
Yearly budget [2)]	29.646 billion yen	4.79 billion yen	Approx. 450 million yen

(Source: NEDO Website, ECCJ Website, Medium and Small Scale Enterprises Development Organization Website as of September in 2009)

(Note1) Japanese fiscal year, from April to March
(Note 2) Executed in the fiscal year of 2008

(c) Support for Research & Development (R&D)

Through publicly offerings to universities and research institutes regarding research on technology contributing EE&C, selected research are implemented as projects under contract with all or a part of its cost financed by NEDO. After fiscal year 2003, support for research and development was implemented as the "Strategic Development Project for the Rational Use of Energy". Then, through the review on this project, after fiscal year 2009, "Innovative Technology Development Project for Energy Conservation" started as a new support scheme including the technology development that can be expected to yield large scale energy efficiency although requiring much more time until its actual application (For details, refer to table below).

Table 2-15 Support for Technology Development Research for EE&C in industry by NEDO

Project title	Strategic Development Project for the Rational Use of Energy	Innovative Technology Development Project for Energy Conservation
Implementation period	8 years (FY2003 – 2010)	5 Years (FY 2009-2013)
Target entities	Single or Multiple enterprises, Autonomous governmental institutions	As principle, enterprises, autonomous, governmental institutions, universities and other judicial organizations which has a base of research and development (single or multiple organizations)
Target projects	Studies or research on technological fields which is expected to yield an energy efficiency of more than 30% by year 2030, crisscrossing such sectors such as industry, housing (residential and commercial), and transportation. For example, regarding investment in energy efficient facilities, the energy efficiency rate is 1% or more, or the energy efficiency quantified is (converted to crude oil equivalent) 1,000kl/year and more.	Research on innovative technology for rational use of energy, with large-scale effects on energy efficiency, based on a "Cool earth energy innovative technology plan", which is a long-term target to reduce the half of current gas emissions in total in the world by year 2050.
Number of studies approved for a year (Number of studies applied)	Leading research 12 (29) Development of practical use 4 (13) Research to prove the actual use 1 (2) Pre-research 3 (10) (Result of year 2008)	-
Limitation of Subsidy for Total cost of Research Development (Subsidy ratio)	Leading research : 100 million yen /year (total) Development of practical use : 300 million yen/year (2/3) Research to prove the actual use 500 million yen/ year (1/2) Pre-research Less than 10million yen (total)	Challenging research : 100million yen/ year (total) Leading research 100 million yen / year (total) Development of practical use : 300 million yen/year (2/3) Research to prove the actual use 500 million yen/ year (1/2) Pre-research Less than 10million yen (total)
Yearly Budget	6.63 billion yen (result in FY 2008)	7.2 billion yen (plan in FY2009)

(Source: NEDO Website as of November 2009)

(d) Subsidy for Energy Efficient Equipment

There is a partial-cost subsidy for introducing high-efficiency hot water supply (boilers) and air conditioners compared to other equipment which has a larger energy efficiency effect and cost effectiveness in comparison with conventional ones. The budget allotment for this subsidy was 14.5 billion yen for FY2009. This allotment is provided by private associations, entrusted by the Agency for Natural Resources and the Energy of METI.

Table 2-16 Examples of Subsidy for Energy Efficient Equipment

Target Equipment	High-efficiency Boilers	High efficiency Air conditioner
Eligible entity	Individuals and private enterprise owners	The Same as the left
Executing Agencies	private associations and others (Japan Electro-Heat Center and others)	The Same as the left
Subsidy Amount/ Ratio	(1) CO2 Refrigerant Heat-pump Boiler：42 thousand yen. (2) Latent-heat Recovery Boiler：23thousand yen (3) Gas Engine Boiler：132 thousand yen	1/3 and less of the price difference between the new and conventional machines (for new installment) 1/3 of purchase prizes for high-efficiency machines (for existing installment)

(Source: Agency for Natural Resources and Energy, METI)

(3) Support for Credit Scheme

(a) Interest Subsidy

Under this scheme the "Interest subsidy for finance of designated facilities and equipment for rational use of energy" by Agency for Natural Resources and Energy, METI (for details, refer to the table below), introduction of energy efficiency facilities and equipment is promoted by interest subsidy for financial institutions that implement credit for measures for EE & C, that is, financing with lower interest for private enterprises' owners. Planned budget for FY 2009 was approximately 500 million yen, increased by 5 times from about 100 million in the year 2007.

Table 2-17 Interest Subsidy for Designated Facilities and Equipment for Rational Use of Energy

Target Project	Content	Target Entities	Interest Subsidy Rate
Designated Facilities and Equipment for Rational Use of Energy	Introduction of large-scale energy efficient facilities and equipment and investment in necessary EE&C projects for buildings in order to achieve medium and long-term plans prepared by enterprises based on "the Law Concerning the Rational Use of Energy	Private enterprise owners	1.0 %
Designated high performance energy consumption facilities	Introduction of designated high-efficiency energy consumption facilities in medium and small-scale enterprises	Private enterprise owners	0.15 %

(Source: Energy Efficiently and Conservation Division, Agency for Natural Resources and Energy, METI)

(b) Low-interest Rate Loans

The Japan Finance Corporation (JFC) provides the loans with a policy interest rate for EE & C projects of medium and small enterprises under "the loan program for medium and small enterprises support" and "the loan program for micro business and individual"(for details, refer to the table below)

Table 2-18 Loans for Medium and Small Enterprises Investing in EE&C Project

Target projects	Lending Period (Grace period) Limitation of Lending Amount	Interest rate[1)] (reference as of August, 2008) [1)]
1. Facilities for EE&C (1) Necessary finance for acquisition of EE&C facilities (including ESCO's acquisition for lease and rentals) (2) Necessary finance for acquisition of for self-propelled operation machinery by leasing / rental companies	15 year and less (2 years) 720 million yen (direct lending)	Special Interest B (1.55-2.45%)
2. Designated high performance energy consumption facilities (1) Necessary finance for installment of high performance industrial furnace and boilers (2) Necessary finance for high performance industrial furnaces replaced from current ones and boilers, or for special additional facilities to increase performance up to the same level as high performance industrial furnaces	The same as the above	Special Interest J (1.15-2.05%)
3. Use of alternative energy to oil Necessary finance for acquisition of facilities which use or supply alternative energy to oil (including upgrades and replacements)	The same as the above	Special Interest B or C (1.3-2.2%)

(Source: ECCJ website, JFC website as of November 2009)

(Note 1) According to special interest rate category A to Z, determined by JFC.

(Note 2) This scheme has received the interest subsidy in Table 2-17.

In the past, financial supports for the following projects were implemented for large enterprises although these are not conducted any more as of 2009.

- EE&C countermeasures projects
- Industry Sector EE&C promoting projects
- Building EE&C promoting projects (only for ESCO and ESP projects)
- Acquisition of machinery and equipment which satisfy the criteria of judgment as designated ones based on energy conservation law (Top runner equipment)
- Electric-load leveling projects

(4) Tax Incentives

In the context of tax system, enterprises or individuals who obtain designated energy efficiency facilities and use them within one year for their business can have special depreciation of equipment or special tax exemption of corporation tax (or income tax). This is stipulated in "the Taxation System for Promoting Investments in the Reform of Energy Supply and Demand Structure (Taxation System for the Energy Reform)" (for details, refer to the table below). Tax exemption is, however, applicable to only medium and small enterprises. At the time of establishing this system, this system had a limited period of validity until FY 2007. After implementation, this system has been proven effective, therefore the validity period was extended to another two years.

Table 2-19 Tax Incentive System for EE&C Projects

Title of System	Taxation System for Promoting Investments in the Reform of Energy Supply and Demand Structure (Taxation System for the Energy Reform)
Validity period	FY 1992 to 2009
Target entities	Entrepreneurs including judicial persons or individuals
Scheme	Those who purchase designated facilities (88 in FY 2008) directly and use them with in one year can apply for either of the following measures. Only medium and small enterprises can apply for tax exemptions. 1. Tax exemption which is equivalent to 7 % of the reference purchase value (base price for calculation). It is applicable to only medium and small enterprises. 2. Special depreciation that is not greater than 30% of the reference purchase value, in addition to the normal depreciation of the equipment.

(Source: ECCJ Website as of November 2009 and others)

(5) Awarding system of EE&C

ECCJ implements awarding system for individuals, groups, factories, project sites or enterprises and equipment or systems that contributed to promoting EE&C. By issuing awards in public, ECCJ intends to disseminate the spirit of EE&C among the nations and to promote EE&C implementation. Awarded persons are: “persons of merit in energy management” or “excellent skilled workers in energy management” those who made efforts to promote energy management for many years and have remarkable performance records, and “excellent factories in energy management (including project sites)” that attempted to rationally use energy and had great results in promoting energy management. Besides the awards for individuals, factories and others, there are several awards such as: “excellent cases of EE&C at national competition” which is an award system for groups, technical development staff, and others in any factories and/or project sites regardless of business type and scale, and the “EE&C Prize” which issues out awards for personnel, organizations, equipment and systems through public participation.

Cases of excellent EE&C are inputted into the database so that anyone can search them on the website.

2.2 European Union (EU)

2.2.1 Basic Strategy for Energy Efficiency

(1) Target

EC member countries committed to a 20 % reduction of primary energy consumption by 2020 (compared to the energy consumption forecasts for 2020) in the “Communication from the

Commission (2008/11/13)". This commitment is also known as the "20-20-20 Goal" which aims at a 20 % reduction of CO2 emission and 20 % utilization of renewable energy.

(2) Policy for Energy Efficiency

To achieve the above target, EC proposes the following "Next Steps" and "Further Actions".

Next Steps

Energy efficiency in buildings

Energy use in residential and commercial buildings is responsible for about 41% of EU's total final energy consumption (2006). The cost-effective energy saving potential by 2020 is expected to reach 30 %. Buildings that have more than 1,000 m2 of total floor area are targeted and improve the efficiency by introduction of "Energy Performance Certificate". The contents of the certificate are described in the "2002/91/EC Directive on Energy Performance of Buildings".

Energy efficiency of products

The existing labeling and standard system has been revised to expand to wider products (ex. tire, waiting power, street and office lighting, etc.) through new "Ecodesign Directive".

Cogeneration

To enhance the utilization of cogeneration that is a highly efficient technique, EU continuously promotes further utilization through "2004/8/EC Directive on Promotion of Cogeneration".

Financing

To support investments to improve energy efficiency, financing schemes exist and the first results are positive: more urban development and renewal projects take energy efficiency into account. On the other hand, Designing effective energy efficiency measures targeted at households and SMEs requires a well coordinated financing framework.

EC is also working with the EIB and EBRD to set up an "EU Sustainable Energy Financing Initiative" to mobilize large-scale funding from capital markets for investments in energy efficiency, renewable energies, the clean use of fossil fuels and combined heat and power from renewable.

Further Actions

Evaluation of the European Energy Efficiency Action Plan (EEAP)

In 2009, EC evaluates the EEAP issued in 2006 and prepares a revised Action Plan. The objectives of the revision will have to be more demanding in the longer term e.g. 2030 and 2050, focusing on energy supply, transmission and energy consumption sectors.

International relations

Exchanging views and best practices on energy efficiency with third countries, international partnership in energy efficiency is promoted.

(3) Action Plan

EC prepared "European Energy Efficiency Action Plan (EEAP)" in 2006/10/19 that aimed at reduction of primary energy consumption of 20 % by 2020. The plan proposed the following 10 priority actions.

Table 2-20 Priority Actions in EEAP

Priority	Outline
Action 1	Updated and dynamic labeling and minimum energy performance standards for appliances and other energy-using equipment will be developed from the former framework, "92/75/EC Framework Directive on Labeling". 14 appliances such as boilers, water heaters, consumer electronics, televisions, standby modes, lighting, and other products have been newly targeted.
Action 2	It will develop EU minimum performance requirements for new and renovated buildings (kWh/m2) and a deployment strategy for very low energy or passive houses. The former framework, "2002/91/EC Directive on Energy Performance of Buildings" is expanded.
Action 3	It promotes efficiency of power generation and distribution. It will also develop with the energy supply industry guidelines on good operating practices to raise average generation efficiency, utilization of cogeneration, reduction of distribution loss and decentralized generation.
Action 4	It aims at fuel efficiency for cars. It proposes a legislation to ensure that the 120 g CO2/km target is achieved by 2012. In parallel it will propose to strengthen EU requirements for labeling of cars.
Action 5	It facilitates appropriate financing of energy efficiency investments for small and medium enterprises and Energy Service Companies (ESCO). EC will call upon the banking sector to offer finance packages specifically aimed at small and medium enterprises and Energy Service Companies to adopt energy efficiency savings identified in energy audits.
Action 6	It promotes energy efficiency in new Member States. EC will promote networking amongst Member States and regions to ensure financing of best practices in energy efficiency.
Action 7	It reviews to facilitate a more targeted and coherent use of energy taxation by integrating notably energy efficiency considerations and environmental aspects.
Action 8	It promotes raising energy efficiency awareness. Recipients elaborate guidelines on how to promote energy-efficient products and provide for education and training plans for energy managers.
Action 9	It promotes energy efficiency in built-up areas. A "Covenant of Mayors" will be created by the EC bringing together a permanent network the mayors of 20-30 of Europe's largest and most pioneering cities, aiming at aim is to exchange and apply best practice.
Action 10	It promotes energy efficiency worldwide. EC will take the initiative in 2007 to reach a framework agreement with key external trading partner countries and international organizations, focusing on improving energy efficiency in end-use sectors and in energy transformation.

2.2.2 EU Directives in Energy Efficiency

Existing directives relating to energy efficiency in end-user side are introduced as follows.

(1) 2006/32/EC Directive on Energy End-User Efficiency and Energy Services

This directive was issued in 2006 to promote end-user energy efficiency and energy services. Main contents are described below.

2006/32/EC Directive on Energy End-User Efficiency and Energy Services

1. General Targets
   - National Indicative Energy Savings Target (9% by 2016)
2. Energy End-Use Efficiency in the Public Sector
   - Public Sector has to adopt at least 2 measures in Annex VI
3. Energy Distributors/Operators and Retail Sales Companies
   - Provision of statistical information
   - Provision of competitively priced energy services, energy audit or funding mechanisms
   - Provision of voluntary agreements such as white certificates
4. Availability of Information
   - Information provision on energy efficiency mechanisms, financial and legal frameworks
5. Availability of Qualification, Accreditation and Certification Schemes
   - Appropriate qualification, accreditation and certification schemes for providers of energy services energy audits and energy efficiency improvement measures
6. Financial Instruments for Energy Savings
   - Repeal or amendment of national legislation and regulations that unnecessarily impede use of financial instruments for energy savings
   - Making model contracts for those financial instruments
7. Energy Efficient Tariffs and Other Regulations for Net Bound Energy
   - Removal of incentives in transmission and distribution tariffs to unnecessarily increase energy volume
8. Funds and Funding Mechanism
   - Establishment of funds to subsidize the delivery of energy efficiency improvement programs and measures (grants, loans, guarantees, etc.)
9. Energy Audits
   - Preparation of high-quality energy audit schemes (carried out in an independent manner)
10. Metering and Informative Billing of Energy Consumption
    - Provision of individual meters to accurately reflect actual energy consumption and information on actual time of use (technically possible and financially reasonable)

(2) 2002/91/EC Directive on Energy Performance of Buildings

This is the directive issued in 2002. This indicates evaluation method of energy performance of buildings and recommended technology and maintenance.

Main contents are described below.

2002/91/EC Directive on Energy Performance of Buildings

1. Adoption of a Methodology
   - Calculation of energy performance of buildings is based on the Annex
2. New Buildings (total useful floor area over 1,000m2)
   - Consideration into design, (i) Decentralized energy supply system based on RE, (ii) CHP, (iii) District or block heating or cooling, (iv) heat pumps, before start of construction of new buildings
3. Existing Buildings (total useful floor area over 1,000m2)
   - For renovation as a whole or renovated systems, energy performance is upgraded to meet minimum requirement in technically, functionally and economically feasible
4. Energy Performance Certificate
   - Availability of the Certificate not exceeding 10 years

5. Inspection of Boilers
   - Establishment of regular inspection of boilers at 20 kW-100 kW (output)
   - Inspection at least every 2 years for more than 100 kW boilers
   - For heating installation with boilers with more than 20 kW, one-off inspection of the whole heating installation
6. Inspection of Air-Conditioning Systems
   - Establishment of regular inspection of AC at 12 kW (output)
7. Independent Experts
   - Regarding certification of buildings, drafting of accompanied recommendations and inspection of boilers and AC, Qualified and/or accredited experts carries out in an independent manner.

2.2.3 Current Situation in Standardization of Energy Efficiency Activities

(1) European Standard

The European Committee for Standardization is preparing a draft "Energy Management Systems- Requirements with Guidance for Use" to standardize energy management method in an organization.

This standard is a guide that recommends the assignment of Energy Manager, planning, formation of internal team, check & monitoring, internal audit method, evaluation, etc. The Plan-Do-Check-Action (PDCA) methodology is adopted like ISO14001. This standard does not stipulate an obligation on reporting outside and energy reduction.

The following figure shows an image of energy efficiency activities within an organization proposed in the European Standard.

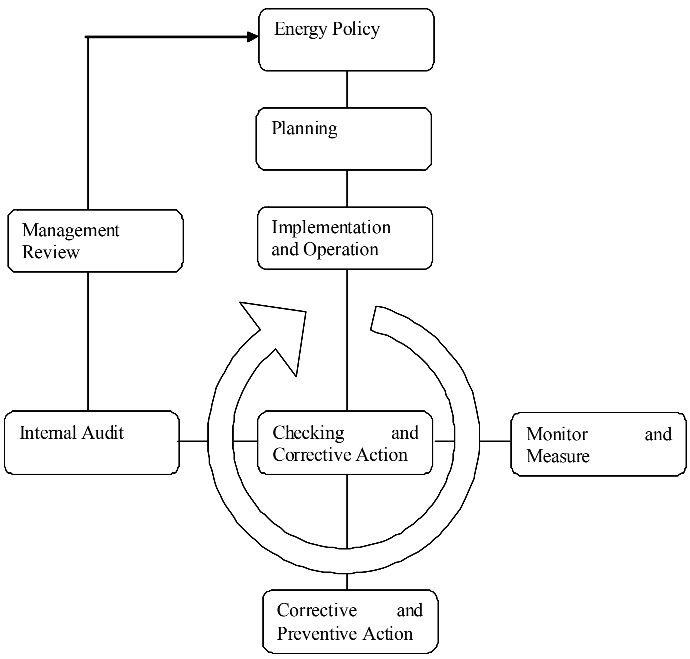


Figure 2-11 Image of Energy Efficiency Activities Proposed in European Standard

(2) ISO50001

International Organization for Standardization (ISO) is now formulating a new standard, ISO50001 that is an international framework to control energy management in a whole organization. This standard will provide technical and management strategy to organizations and companies having objectives to improve energy efficiency, reduce energy costs and improve environmental performance. This standard will utilize the PDCA approach like the European Standard. At this moment, a pending draft is being prepared for possible completion by the third quarter of 2011.

2.3 United Kingdom of Great Britain and Northern Ireland (UK)

2.3.1 Policy on EE&C

(1) Overview

The UK sets energy efficiency policy as one of its key policies for tackling global warming. Energy efficiency policy lies at the heart of the measures against global warming by 2020, since it is cost effective and can achieve results in the short-term. Sectoral strategies, based on the policy, have been set and implemented in order to realize a low carbon society.

EU's greenhouse gas reduction target in Kyoto Protocol is 8 % on average from 2008 to 2012 according to the 1990 baseline. UK set its (national) 26 % carbon dioxide reduction target by 2020 (Climate Change Act, 2008). "National Energy Efficiency Action Plan (NEEAP)", which is designed to comply with the "EU Directive 2006/32/EC on energy end-use efficiency and energy services", set a 9 % carbon dioxide reduction target on average between 2008-2016.

(2) Climate Change Act, Energy Review, and White Paper on Energy

Responding to the "Energy Review" conducted by the Performance and Innovation Unit (PIU), which considered the demand-supply planning of UK's energy by 2020 and 2050, the Department of Trade and Industry (DTI), published the "White Paper on Energy" in 2003 and an energy policy "The Energy Challenge" in 2006. In 2007, a new White Paper on Energy, "Meeting the Energy Challenge" was announced responding to the energy policy. It sets four energy policy goals, described below, and the newest "White Paper on Energy" also stands on the same base.

- To put ourselves on a path to cutting the UK's carbon dioxide emissions – the main contributor to global warming – by some 60 % by about 2050, with real progress by 2020
- To maintain the reliability of energy supplies
- To promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity, and
- To ensure that every home is adequately and affordably heated

White Paper on Energy (2007) expects 6–9 MtC emission reduction (4–6 % of 2005) by energy efficiency in addition to 12 MtC emission reduction anticipated by existing measures (Climate Change Programme). In November 2008, a Climate Change Act was eventually established as a binding law.

(3) Executing Agency

On October 3, 2008, the Department of Energy and Climate Change (DECC) was established as a center towards global warming, succeeding the role formerly taken by DTI, Department of Food and Rural Affairs (DEFRA) and others. UK's Carbon Budget is still being delivered to the DTI, DEFRA and DECC. DECC has the following 5 sections.

- National Climate Change & Consumer Support
- Energy Markets & Infrastructure
- International Energy & Climate Change
- Chief Scientific Advisor
- Corporate Support & Shared Services

(4) Overview of EE&C Policy and Measures

White Paper on Energy (2007) describes the measures for each sector as follows.

- Domestic Sector, which consists of 28 % (2004) in carbon dioxide emissions, expects the introduction of smart meters which enables households to monitor energy consumption in real time, and strengthening the energy performance of buildings. Annual energy consumption under the new energy performance standards will become one forth of that of existing buildings. A measure, Energy Performance Certificate (EPC), which became mandatory in 2008, forces building owners to present the EPC during the purchasing, selling and leasing of properties.
- Main measures for industrial and business sectors, which consumes 40 % of the carbon dioxide emissions (2004), is the Emissions Trading Scheme/System (EU ETS) and Climate Change Levy (CCL). Carbon Reduction Commitment Energy Efficiency Scheme (CRC) is provided for energy saving users with high potential. In addition, buildings in business sectors are also covered by EPC.
- The Governmental and public sector is also a big energy consumer, which emits 3.8% of carbon dioxide (2004), that it should play an important role with its public nature. It set a target to make properties of central governments carbon neutral by 2012. The Public sector is also covered by CRC according to energy consumption volume. In addition, a new guideline "Buy sustainable – Quick Wins" has been applied to UK government procurement policy.
- Energy suppliers now play important roles and they are in a transition stage. Former Energy Efficiency Commitment (EEC) and its successor, the Carbon Emissions Reduction Target (CERT) is a measure to force energy (power and gas) suppliers to reduce the carbon dioxide emissions of their customers. They have to provide some measures for energy saving (retrofit etc.) for customers they selected. The cost will be collected from all the customers. This measure originally started with an intention to save Fuel Poverty, which is one of the social issues in the UK. Thus, it was supposed to achieve more than half of the energy saving from the fuel poor.
- In the product market, there are measures to remove inefficient white goods and to

restrain the stand-by power of TVs, stereos and other electric appliances.

- The Transport sector, which consists of 29 % of carbon dioxide emissions, has measures, for example, to improve fuel efficiency and use low carbon fuel (including biofuel). The modal shift of the transport sector is also considered.

2.3.2 Major Schemes of the EE&C (Industry and Building)

Energy efficiency measures for the industrial and building sectors are explained here. Key measures for the industrial sector are the Climate Change Levy (CCL) and the EU Emissions Trading System (EU ETS). Another inventive, the Climate Change Agreement (CCA) accompanies CCL. Energy intensive users which are not covered by the measures above are targeted by the Carbon Reduction Commitment Energy Efficiency Scheme (CRC). Each measure is briefly described as follows.

(1) EU Emissions Trading System (EU ETS)

The EU ETS (EU Emissions Trading System, formerly referred to as the EU Emissions Trading Scheme) is one of the key policies to achieving EU's greenhouse gas emissions target of 8 % below 1990 levels under the Kyoto Protocol. It is a cap and trade scheme of carbon dioxide emissions, having started in 2005. 40 % of greenhouse gas emissions in the UK is targeted and the energy sector and industrial sector are covered. UK has started emissions trading ahead of other countries and its experience contributes to formulating this system.

Firstly, each EU member state must develop a National Allocation Plan (NAP) and must be approved by the European Commission. Then, allowances are allocated to each facility operator. Actual emissions are measured and certified. At the end of the fiscal year, installations are required to surrender allowances to account for their actual allowances. The facility operator must acquire and submit surplus allowances by buying when actual emissions exceed the allocated allowances. Phase I will be in 2005-2007 and Phase II is in 2008-2012. Phase III is planned to take place in 2013-2020.

These are the key energy efficiency policies for the industrial sector, which covers power generation and major energy intensive industries (power stations, refineries, iron and steel, cement, paper, food and drink, glass, ceramics, engineering and the manufacture of vehicles). This measure covers 43 % of carbon dioxide emissions.

(2) Climate Change Levy (CCL) and Climate Change Agreements (CCAs)

The Climate Change Levy is a tax on all energy consumption except the domestic and transport sectors, which was introduced as one of the Climate Change Programmes under the Finance Act in 2001 as an incentive for energy efficiency. Renewable energy and energy consumption by designated certified schemes (e.g. cogeneration) are excluded. The Tax rate is shown in the next table. It increased in April 2008. Tax payment gives an exemption of 0.3 % of the National Insurance of which employers are obliged to pay. Part of the revenue goes to funds for energy efficiency including Carbon Trust.

Table 2-21 Tax Rate of Climate Change Levy

Taxable Commodity	1 April 2007 -	1 April 2008 -
Electricity	£0.00441 per kWh	£0.00456 per kWh
Gas supplied by a gas utility or any gas supplied in a gaseous state that is of a kind supplied by a gas utility	£0.00154 per kWh	£0.00159 per kWh
Any petroleum gas, or other gaseous hydrocarbons, supplied in a liquid state	£0.00985 per kg	£0.01018 per kg
Any other taxable commodity	£0.01201 per kg	£0.01242 per kg

(Source: http://www.decc.gov.uk; Dec. 2009 Accessed)

Climate Change Agreements (CCA) is a scheme targeted at energy intensive industries. Given their energy usage and their exposure to international competition, an 80 % discount from the levy was allowed for those sectors that agreed with the DECC on the targets for improving their energy efficiency or reducing carbon emissions. The regulations cover the ten main energy intensive sectors of industry, (aluminum, cement, ceramics, chemicals food& drink, foundries, glass, non-ferrous metals, paper, and steel) and over thirty smaller sectors, and in agriculture, livestock units for the intensive rearing of pigs and poultry.

Energy intensive industries were defined initially as industries covered by the Pollution Prevention and Control (England and Wales) Regulations 2000. In 2006, the criteria was expanded to those sectors whose "energy intensity must be 3 % or more (i.e. energy costs must be 3 % or more of the production value for the sector."

CCAs have a two-tier structure: sector-level agreements between DECC and the sector or trade association (known as umbrella agreements) and individual agreements between DECC and the facility operator (known as underlying agreements).

(3) Carbon Reduction Commitment Energy Efficiency Scheme (CRC)

This measure was formerly called the Carbon Reduction Commitment. It was renamed as the above under the Climate Change Act 2008 and it will be implemented in April 2010. It is a compulsory cap & trade scheme of carbon dioxide emissions allowances to encourage energy efficiency. In order to avoid overlap amongst the measures, energy consumption or carbon dioxide emissions targeted by EU ETS, CCL and CCA are exempt. As a result, its target is mainly the business sector. The full participation of around 5,000 organizations will be required and about 20,000 organizations will be required to participate via information disclosure. Participants are defined as single entity, including subsidiaries and group companies.

After the introductory phase, it will be implemented fully and goes along in the way described below.

- A cap of the total amount of carbon dioxide allowances of the scheme (summation of all the participants) is calculated.

- Participants purchase allowances at an auction or at the beginning of a fiscal year.
- Participants buy or sell allowances at secondary market levels when necessary
- Participants surrender allowances equal to their carbon dioxide emissions with a report on their actual carbon dioxide emissions at the end of the fiscal year
- A performance league table is complied and published by the scheme administrator.
- Annual sale or auction of allowances is recycled to participants, according to their proportion of carbon dioxide emissions and their performance (CO2 emissions reduction and CO2 intensity reduction).

Figure 2-12 Process Flow of CRC (Carbon Reduction Commitment)

The scheme cycle of monitoring and energy efficiency activities is basically one year, but it takes more than half of a year for revenue recycling. In the introductory phase, carbon dioxide is to be sold at £12/tCO_2 at the first auction of the fiscal year.

This scheme provides incentives for energy efficiency, one as a mandatory incentive for carbon allowance purchases, and at the same time, another as a positive incentive of revenue recycling based on energy efficiency performance.

(4) Energy Performance Certificate (EPC)

Energy consumption or carbon dioxide emissions in the building sector of UK are estimated to be around 20 %. The Energy Performance Certificate (EPC) has been implemented as a measure to tackle this issue since 2006. Initially, only the buildings with an effective total floor area of more than 10,000 m^2 were targeted, but all the buildings have been covered since 2008.

This scheme, corresponding to the "European Directive 2002/91/EC on the Energy Performance of Buildings", evaluates the energy efficiency of buildings and forces building owners to present the evaluation results to business contacts when

Figure 2-13 Label Sheet

undergoing construction, purchase/sales, and leasing.

The EPC evaluates energy efficiency in simulated values and classifies the results into 7 ranks of A to G (A: zero emission). The EPC is accompanied by a scheme of energy efficiency display, Display Energy Certificate (DEP). The DEP evaluates and classifies energy consumption under operation according to benchmarks. Public facilities are compulsory to DEP, as an indicator of energy efficiency.

2.3.3 Information Provision Services

(1) Department of Energy and Climate Change (DECC)

The DECC is a focal implementing agency of energy and global warming/low carbon policy and measures of UK. It provides information on legislation and reports on climate change etc. It also presents statistical data and reports on national energy consumption and carbon dioxide emissions.

http://www.decc.gov.uk/

(2) Energy Saving Trust (EST)

Energy Saving Trust, EST, a non-profitable organization established by the government, provides financial and technical supports for projects or companies/institutions which promote energy efficiency, global warming countermeasures and sustainable energy usage. It mainly targets domestic and business sectors and focuses on cooperation with homebuilders, local communities and local authorities. In addition, it financially supports the networking of regional energy efficiency advice centres.

The EST provides information on subsidies for home retrofit, efficient electric appliances, thermal insulations, PVs, solar water heaters etc for the domestic sector. For the business and public sectors, it provides, for example, explanation concerning building codes and good practices on energy efficiency.

http://www.energysavingtrust.org.uk

(3) Energy Efficiency Advice Centres

There was a network of 52 energy efficiency advice centres under the EST. They are now under different names depending on each region and continue to provide advice on energy efficiency.

- Essex Energy Efficiency Advice Centre http://www.essexeeac.com/
- Act on Energy (former Warwickshire Energy Efficiency Advice Centre)
  http://www.actonenergy.org.uk etc.

(4) Carbon Trust

Carbon Trust is an independent company established by the government in 2001. It operates under government financing and other relevant agencies. Its mission is to promote a low carbon economy by providing financial and technical support, including loans, for the business and public sectors. It has achieved a reduction of 23 MtC in carbon dioxide emissions and 1.4 billion pounds in energy costs.

http://www.carbontrust.co.uk

(5) Business Link

Business Link is an organization established by governmental support and plays a role in the information hub center for business, including energy efficiency and the environment. It provides information in 13 areas including "finance and grants" and "environment & efficiency". Environment & efficiency, classified into 23 areas, provides information on the relationship of climate change and business, explanations on energy and carbon dioxide emissions and advice for each industrial sub-sector. It really is a central link of information search.

http://www.businesslink/gov.uk (There is also a link in DECC website)

2.4 Germany

2.4.1 Policy on EE&C

(1) Overview

In October 2008, Germany announced their target of reducing 40 % of GHG emissions by 2020 through the "National EE&C Plan", which will change the current energy supply situation which relies on importing energy. The plan includes specific plans such as issuance of building energy requirements, tax incentives for the reconstruction of old buildings, and consideration of vehicle taxation based on CO2 emissions. EE&C activities on the demand side are listed as one of the required items.

(2) Law & Regulations

(a) Energy Conservation Law (Energieeinsparungsgesetz)

The Energy Conservation Law is the legal basis of regulation on energy conservation that has undergone continual revision. This law is necessary for the complete conversion of European Guidelines over the total energy efficiency of buildings.

The law authorizes the government to conduct the following activities:

- To demand certain standards referring to heat insulation in future buildings yet to be constructed,
- To demand certain standards referring to the installation of heating engineering, ventilation, and air-conditioning technology, as well as water service installations,
- To demand certain standards referring to the operation of the aforementioned installations
- To demand the distribution of operation costs of collaboratively shared installations of heating engineering, ventilation, and air-conditioning technology, as well as water service installations, and
- To regulate the inspection and monitoring of combustion installations

(b) Energy Conservation Ordinance (Energieeinsparverordnung)

The Energy Conservation Ordinance (EnEV) covers not only residential buildings, but also buildings in the industrial and tertiary sector. The target of the EnEV is to reduce the energy demands of new buildings by an average of 25-30 % compared with former standards.

According to the holistic approach as applied in the EnEV, the primary energy demand of buildings is used as a measure. A certain standard for the constructional heating insulation is set in order to ensure minimum standards. For existing houses, retrofitting regulations are set under requirements to be fulfilled under certain circumstances and within a certain period of time. They refer to the following components:

- Especially aging boilers
- Non-insulated tubes for heating and warm water in cold rooms
- Non-insulated top-floor ceilings to attic floors, if accessible but not able to be walked on

The execution of the EnEV is under the responsibility of the each state (Bundesländer), and regulates following the items;

- Responsibilities for exceptions and exemptions
- Dispatching of verifications and energy passes
- Monitoring of re-fitting regulations
- Monitoring of implementation of regulations
- Regulatory offences
- Utilization of building products and installations

(3) Executing Agency

The Federal Ministry of Economics and Technology (BMWi) acts as main agency for energy policy including the EE&C, and the ministry is in charge of energy consumption efficiency and support for renewable energy. The state governments are responsible for the implementation of federal law and are in charge of granting permission and authorization within each state. State government and public authorities are providing funding for EE&C activities such as loans and grants for industrial and commercial companies.

In September 2000, BMWi established the German Energy Agency (DENA) as a public agency sponsored by the government and governmental bank for implementing policies of “The Action against Global Warming”, which includes actions to reduce CO2 emissions targeted in the Kyoto Protocol and an additional 25% reduction target. DENA organizes a network with various energy industries and its activities include implementation of EE&C activities, renewable energies, protection from climate changes, and promoting the development of sustainable development. The main activities of the DENA are implementing projects using new technologies in collaboration with the industrial sector and the dissemination of information.

2.4.2 Major Schemes of EE&C (Industry and Building)

(1) Energy Management System

A mandatory or comprehensive management system does not exist in Germany. The federal government relies on activities on a market basis such as voluntary agreements in the industrial sector rather than regulatory and administrative frameworks. The industrial sector considers that they do not require any additional governmental regulations for EE&C because they can develop the most cost-effective approaches for maintaining their competitiveness.

However there are some special regulations for boilers and heat metering as follows.

- ✓ Inspection of boilers
  - Small and Medium Combustion Plant Ordinance (BimSchV): last amendment in 1997
  - The Inspection of boilers should be exclusively conducted by the district masters of the chimney sweep
- ✓ Air conditioning
  - Functional inspection of air conditioning equipment should be included in the maintenance schedule
- ✓ Heat metering
  - Since January 1996, utilization of heat metering equipment became required in former East Germany new as former West Germany had already been regulated since 1981.

(2) Voluntary Agreement in the Industrial Sector

The voluntary agreement signed by the industrial sector targets carbon gas reductions and energy efficiency improvements. The agreement includes the valuation and monitoring conducted by research institutions, and the results of the voluntary targets are analyzed by them continuously. Upon request, independent research institutions deal with the valuation and monitoring of the federal government and private sectors.

(3) Comprehensive Energy and Climate Change Programme

In this programme, the German government plans to increase the ratio of domestic energy including renewable energy (renewable energy ratio will be developed by 30 % of the whole energy consumption). Further, it aims to promote EE&C in buildings.

2.4.3 Information Provision Services

(1) BMWi

Information such as “Energy consumption of the tertiary sector (trade, commerce and services) for the years 2004 to 2006” is available on the BMWi website.

http://www.bmwi.de/English/Navigation/root.html

(2) DENA

The DENA is an agency implementing EE&C, renewable energy, and related international relationships. The DENA website provides information about its projects, information about equipment and devices of EE&C or renewable energy.

http://www.DENA.de/en/

2.5 India

2.5.1 Policy on EE&C

(1) Overview

The Indian Government has announced in August 2009, that as a part of the nation's climate change efforts, India aims to save 5 % of India's annual fossil fuel usage by 2015 (compared to 2009).

The industrial operations, nine different sectors including power generation and cement production, identified to participate in the energy management system accounting for around 40 % of the country's fossil fuel consumption (At the beginning of this scheme (2001), 15 sectors were selected).

In addition, the Government plans to grant Energy Saving Certificates to those organizations that exceed their targets, which they in turn will be able to save or trade. Those that miss their targets may be subject to fines.

(2) Energy Conservation Act 2001

The Energy Conservation Act was issued in 2001 by the Ministry of Power. The act stipulated the basis of Bureau of Energy Efficiency (BEE) that is an executing agency of EE&C as well as the following three important measures including the energy management system.

- Standard and Labeling Programme
- Indian Industry Programme for Energy Conservation (Energy Management System)
- Energy Conservation Building Code

(3) Bureau of Energy Efficiency (BEE)

(a) Legal Basis

The BEE is an agency established in March 2003 under the Ministry of Power based on the Energy Conservation Act 2001. The mission of the BEE is to assist in developing policies and strategies with a thrust on self-regulation and market principles within the overall framework of the Act.

(b) EE&C Measures of BEE

BEE has two functions that are a regulatory function and a promotion function. Major regulatory functions include:

- Developing minimum energy performance standards and labeling design for equipment and appliances
- Develop specific Energy Conservation Building Codes
- Activates focusing on designated organizations (Energy Management System)
  - Develop specific energy consumption norms
  - Certify Energy Managers and Energy Auditors
  - Define the manner and periodicity of a mandatory energy audit
  - Develop a reporting format on the energy consumption and action taken based on recommendations given by the energy auditors

Major promotion functions include:

- Create awareness and disseminate information on EE&C
- Arrange and organize training of personnel and specialists in the techniques for efficient use of energy
- Strengthen consultancy services in the field of energy conservation
- Promote R&D
- Develop testing and certification procedures and promote testing facilities
- Formulate and facilitate implementation of pilot projects and demonstration projects
- Give financial assistance to institutions for promoting EE&C
- Prepare an educational curriculum on EE&C
- Implement international cooperation, etc.

2.5.2 Major Schemes of EE&C (Industry and Building)

(1) Energy Management System

(a) Implementation Structure

Description of Indian Energy Management System (EMS) is as follows. The feature of the Indian EMS is to monitor the designated organizations by designated agencies appointed by each state government, and to force them to conduct external energy audit. Designated Organizations have to submit periodical reports based on recommendations by on-site the Energy Manager as well as externally Accredited Energy Auditors.

A Framework of the Indian Energy Management System is shown below.

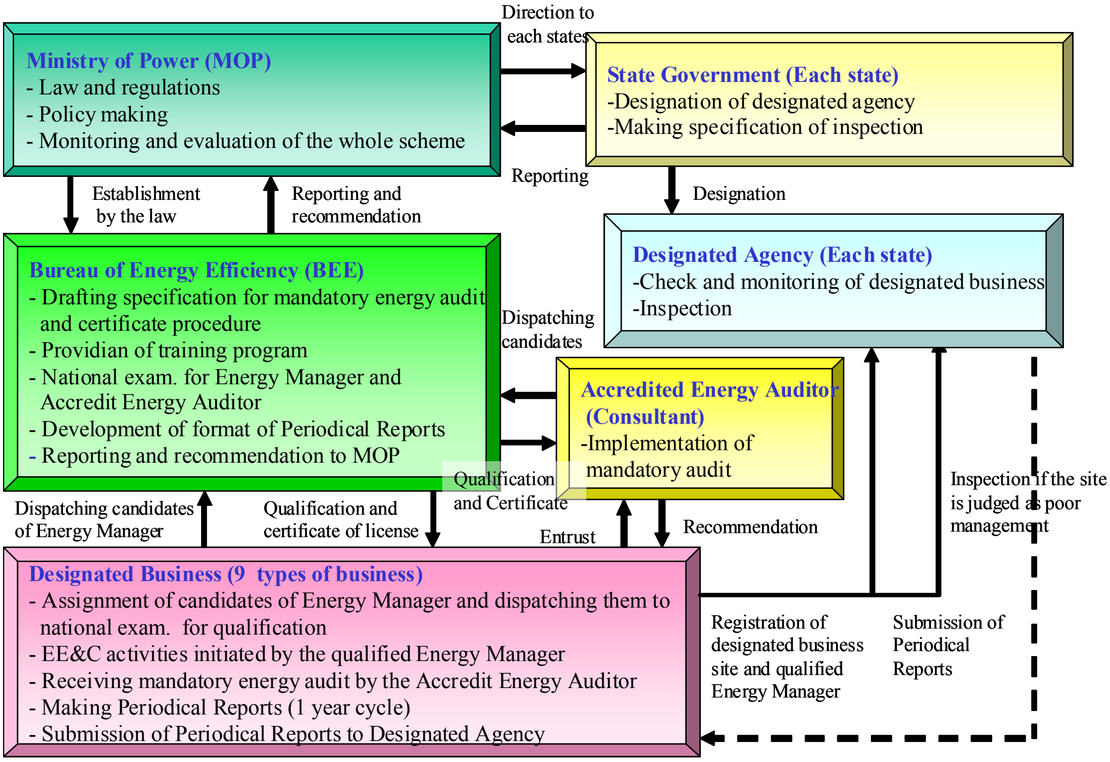


Figure 2-14 Framework of Energy Management System in India

(b) Designated Organizations

The Indian EMS originally targeted 15 sectors in the Energy Conservation Act 2001 and then revised down to nine sectors and define designation unit by the amendment of the Act in March 2007. According to the BEE Homepage, 714 consumers are designated as of February 2009.

Table 2-22 Designation Criteria of Indian EMS

Designated Industry	Designation Unit	Threshold (Final Energy Consumption)
Thermal Power Station	Power Station	30,000 toe/year
Fertilizer	Factory	30,000 toe/year
Cement	Factory	30,000 toe/year
Iron & Steel	Factory	30,000 toe/year
Chlor-Alkali	Factory	12,000 toe/year
Aluminum	Factory	7,500 toe/year
Railways	Traction sub-section, diesel loco shed and workshop	30,000 toe/year
Textile	Factory	3,000 toe/year
Pulp & Paper	Factory	30,000 toe/year

(Source: BEE Homepage)

(2) Energy Conservation Building Code (ECBC)

The Energy Conservation Building Code (ECBC) was initially launched in 2007 by the Ministry of Power on a voluntary basis. The ECBC, targeting large buildings with a connected load of 500 kW or 600 kVA, provides the minimum standards in design and construction for buildings and their facilities. The BEE has made efforts to promote the ECBC through preparing ECBS guidelines. ECBC Regulated fields are as follows.

- Building envelop
- Heating, Ventilation and Air-conditioning (HVAC)
- Water heating and pumping
- Lighting
- Electric power facilities (transformer, motor, etc.)

(3) Energy Conservation Award

The scheme has been introduced since 1993 to encourage consumer's EE&C activities. Ministry of Power has designated the "National Energy Conservation Day" take place on December 14 and holds an award ceremony on that day. The best practices are selected from industries, office buildings, hotels, zonal railways, State Designated Agencies and municipalities. In 2006, out of 388 applicants, there were one Top Ranked Award, 17 First Prizes, 24 Second Prizes and 19 Certificate of Merits were selected.

2.5.3 Information Provision Services

(1) Bureau of Energy Efficiency (BEE)

The BEE homepage provides various information concerning the EMS and the labeling and standard systems etcetera as well as their legal basis. In addition, there is a lot of information on promotion and awareness as follows.

- Announcement of policy and scheme
- National Energy Conservation Campaign
- Training programs
- Certification system of Energy Managers and Energy Auditors
- Various guidelines on EE&C
- Information on EE&C education

http://www.bee-india.nic.in/

(2) Petroleum Conservation Research Association (PCRA)

The PCRA is an agency established to promote the saving of oil product consumption in 1978 under the Ministry of Oil and Natural Gas. PCRA shows EE&C case studies in its homepage and publishes periodical journal on EE&C.

http://www.pcra.org/

(3) The Energy and Resources Institute (TERI)

TERI was an energy institute belonging to the Tata group before 2003. In 2003, TERI was freshly organized as an independent institute. The main activities of TERI are proposal of energy policy, activities entrusted by BEE, and so on. In the Indian EMS, a mandatory energy audit is conducted by the accredited energy auditors qualified by BEE. TERI is one of the most popular auditors. TERI has sufficient experience (more than 650 cases) in conducting energy audits for industries such as cement, fertilizer, paper & pulp, glass, rubber, iron & steel, aluminum, ceramic, electronics and so on. TERI publishes a summary of the results through a yearly journal. In addition, TERI publishes country-wide energy balances.

http://www.teriin.org/

2.6 Thailand

2.6.1 Policy on EE&C

(1) Overview

The energy policy in Thailand is issued under the Energy Minister's name. According to the policy, the following goals are targeted.

- The EE&C target will be raised 20 % via additional efficiency achievements in the industrial and transportation sectors
- Reducing unit energy consumption in industrial sector by 20 % from 2006
- Implementation of 11 strategies at the local government level and save 100,000 million Baht per year
- Promotion of EE&C at the city government level

(2) Energy Conservation Law

Energy Conservation and Promotion Act E.E 2535 was established in 1992. It regulates the following measures.

Table 2-23 Overview of the Energy Conservation Law in Thailand

No.	Title	Features
1	Energy Management System for Designated factories and Assignment of Energy Managers	- Designation of factories by criteria of energy consumption (Power contract: 1,000 kW, Transformer: 1,175kVA or Energy consumption of 20 mil MJ/year) - Assignment of Energy Managers - Submission of periodical reports and middle-term plan document - Qualification of the Energy Manager (Upper class job course graduation and 3 years experience, or bachelor degree of engineering or science, trainee of specific training Course)
2	Energy Management System for Designated buildings and Assignment of Energy Managers	Same as the above
3	Promotion of Energy Saving Machines and Equipment	- Designation of energy conserving machines and equipment for receiving support
4	Energy Conservation Fund (ENCON Fund)	- Establishment of a fund to support and subsidize energy conservation

(Source: JETRO Bangkok Website)

(3) Department of Alternative Energy Development and Efficiency (DEDE)

The Department of Alternative Energy Development and Efficiency (DEDE) is the main organization that promotes EE&C in Thailand. The DEDE conducts nationwide programs for the promotion of EE&C and renewable energy. It also provides various training regarding EE&C and has its own Practical Energy Training Center (PETC) which provides examinations and training programs for the EE&C.

The PETC developed its systems such as the examination systems, training systems, and the EE&C practical training center, by JICA support conducted in 2002-2005 (support amount totaled 440mil Japanese yen).

PETC has five training courses including those for designated factories and buildings:

1. Training on Energy Management for Designated Factory/Building
2. Training on Energy Technology of Energy Conserving Material, Equipment and Machinery
3. Training on Energy Use System by Industrial Classification
4. Training on Energy End-use System by Building Category
5. Training in the Educational Institutes by a course development and a training provision

2.6.2 Major Schemes of EE&C (Industry and Building)

(1) Energy Management System

(a) Overview

Energy management system was introduced in 1992 when the Energy Conservation Law was implemented. DEDE has an authority for EE&C policies and measures.

The energy management system covers factories and buildings over certain sizes and such factories and buildings are required to designate energy managers and submit periodical reports to the DEDE. They are required to submit periodical reports including energy consumption data every 6 months and lists of energy conserving equipment. They also need to submit a mid-term plan including a target to be accomplished and implemented plan every 3 years.

(b) Conditions for Designation

Subsequent to several amendments being introduced, the latest (since Y2000) conditions for designations are those with a contract capacity of electricity exceeding 1,000 kW, with the total capacity of transformers exceeding 1,175 kVA, or with annual electricity consumption exceeding 20 mil MJ/year. As of 2008, the number of designated factories was 3,313, and 1,929 for buildings (source: DEDE Website).

(c) Energy Manager

Designated factories and buildings are required to assign Energy Managers. Such Energy Managers need to meet one of the three conditions below.

- Having more than 3 years of working experience after completing the graduation requirements of the Senior management course

- Bachelors degree in Mechanical Engineering
- Completed the EE&C training course or a course of equivalent level

Duties of the Energy Managers are defined in the Energy Conservation Law

- Conducting periodical maintenance and inspections for all energy conserving equipment
- Setting policies for EE&C and promotion of energy efficiency
- Examination of periodical reports submitted to DEDE by owners of designated factories or buildings
- Document control of periodical records for checking and examination by DEDE staff
- Supporting owners of designated factories or buildings for setting EE&C plans and targets
- Guarantee of analysis results for implementation of EE&C plans and targets
- Supporting owners of designated factories or buildings regarding actions needing correction upon request by the director of the DEDE.

(d) Penalties

Violations of each regulation caused the levy of a fine of from 50,000 Baht to 200,000 Baht.

(2) Technical Support Services

Technical support services provided by DEDE are as follows

- Energy audit service for factories
- Energy audit service for buildings

(3) Energy Conservation Promotion Fund (ENCON Fund)

Thai government conducts the promotion of EE&C through the Energy Conservation Promotion Fund (ENCON Fund) as stipulated in Energy Conservation Law. The fund is being budgeted based on 5 year periods for implementation of each program. The fund covers programs of free energy audit service for designated factories and buildings.

2.6.3 Information Provision Services

(1) Department of Alternative Energy Development and Efficiency (DEDE)

As DEDE is an organization for the implementation of EE&C, detailed information such as regulations, guidelines, and how to write periodical reports, are available from DEDE.

Also, DEDE provides much information listed as follows.

- Energy audit service
- Expert list of EE&C
- Information regarding EE&C projects
- Report of the result of energy audits
- Information regarding the Training Center and its programs

http://www.dede.go.th/

(2) Energy Policy and Planning Office (EPPO)

Energy Policy and Planning Office (hereinafter "EPPO") is an extra-governmental organization and conducts consultancy services regarding energy policies and planning. EPPO has data of energy statistics and conducts research and analysis. The EPPO provides information as follows.

- Papers regarding governmental energy policies
- Energy statistics data
- Production, consumption, import, and reserves of primary energy and final energy consumption.
- Production, consumption, and import of oil products such as petroleum, natural gas, and crude oil.
- Production, consumption, imports and exports, capacity of coal and electricity

http://www.eppo.go.th/

2.7 Australia

2.7.1 Policy on EE&C

(1) Overview

The main policies on EE&C in Australia are decided by the Ministerial Council on Energy (MCE). The Council announced the "National Framework for Energy Efficiency (NFEE)" on December 2004 that aimed at promotion of energy efficiency in the consumption sector. The Framework raised the following nine priority sectors and expected annual energy saving of 50 PJ/year by 2015.

- Residential buildings
- Commercial buildings
- Commercial/industrial energy efficiency
- Government energy efficiency
- Appliance & equipment energy efficiency
- Trade and professional training & accreditation
- Commercial/industrial sector capacity building
- General consumer awareness
- Finance sector awareness

Further, the Council set up the second stage of the NFEE in December 2007 covering the following fields.

- Expending and enhancing the Minimum Energy Performance Standards (MEPS) program
- Heating, ventilation and air conditioning (HVAC) high efficiency systems strategy
- Phase-out of inefficient incandescent lighting
- Government leadership though green leases
- Development of measures for a national hot water strategy, for later consideration.

(2) Energy Efficiency Opportunities Act 2006

In 2006, in order to target large energy consumers, the Energy Efficiency Opportunity Program (that is Australian EMS) was introduced based on the "Energy Efficiency Opportunities Act 2006". The EMS orders a reporting duty to corporations which consume 0.5 PJ/year. There are more than

220 corporations (incorporating about 1,200 subsidiaries) registered and covers 45 % of all the energy used in Australia.

(3) Department of Resources, Energy and Tourism (DRET)

A member of MCE, Department of Resources, Energy and Tourism (DRET) is responsible for policy-making on energy industry and resources as well as implementation of the Australian EMS.

2.7.2 Major Schemes of the EE&C (Industry and Building)

(1) Energy Efficiency Opportunity Program (Australian EMS)

Energy Efficiency Opportunity Program was introduced in 2006. The framework of the program is shown below. The features of the program are to target corporation units and to evaluate plans, implementation and results in a 5 year cycle. A designated corporation submits an EE&C plan at the beginning of the cycle and a result reports at the end of the cycle. Public reporting has to be updated on a yearly basis.

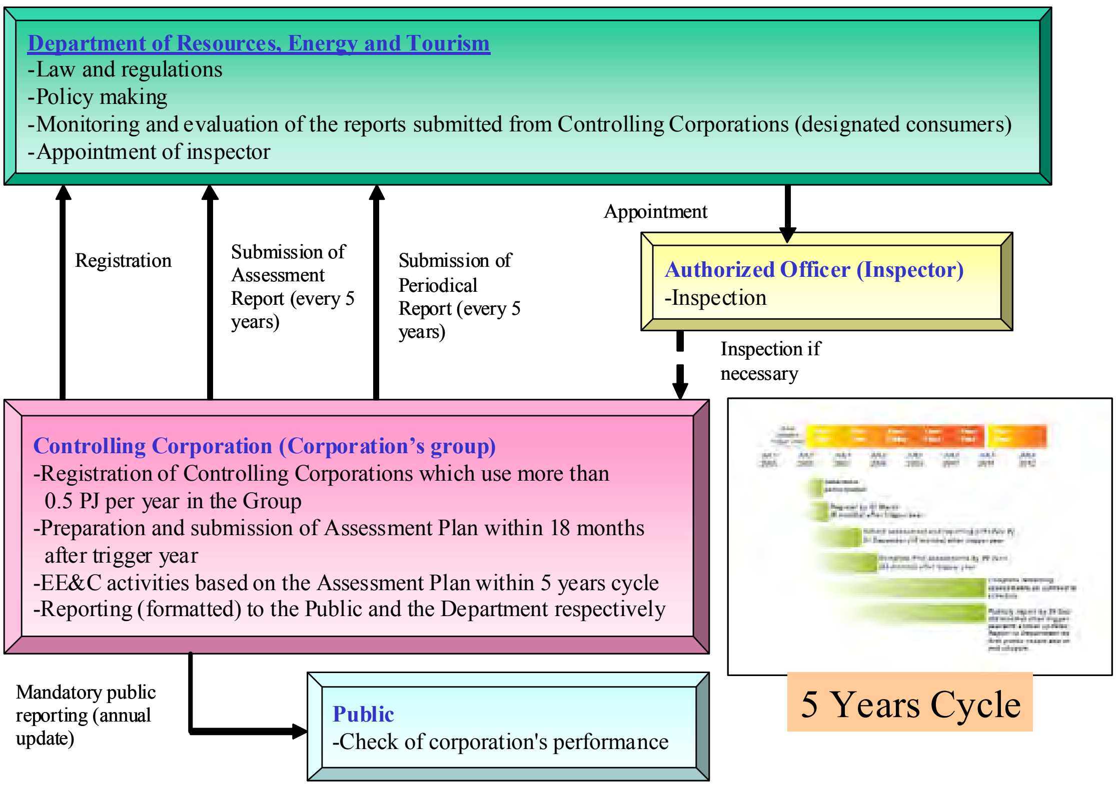


Figure 2-15 Framework of Energy Management System in Australia

(2) National Framework for Energy Efficiency (NFEE)

NFEE promotes energy efficiency in various sectors including industry and buildings. The main schemes targeting industry and buildings are summarized below.

- **Commercial/Industrial Energy Efficiency**
  This introduced the Energy Efficiency Opportunity Program. It provides a training program for energy auditors as well.
- **Commercial & Industrial Sector Capacity Building**
  This implements demonstration projects to provide best practices in main industries, and new and renovated buildings. It establishes a network of the best practices on a national level.
- **Government Energy Efficiency**
  In order to demonstrate government leadership, a measurement and reporting system has been introduced for the Government sector. The Government sector has to positively install energy efficient equipment.

2.7.3 Information Provision Services

(1) Ministerial Council on Energy (MCE)

MCE provides information on policies relating to the NFEE on the homepage.

http://www.ret.gov.au/Documents/mce/about/default.html

(2) Department of Resources, Energy and Tourism (DRET)

DRET's homepage is the one of the most informative websites regarding energy efficiency. The homepage provides policies, legal documents, implementation guidelines, databases etcetera. The following items have been obtained from the homepage.

- Various information on Energy Efficiency Opportunity Programs (legal basis, implementation guidelines, announcements, corporation's public report, etc.)
- Detailed information on NFEE activities
- Best practices and case studies
- EE&C information on energy consuming equipment
- Information on finance
- National energy statistics, etc.

http://www.ret.gov.au/energy/efficiency/eeo/pages/default.aspx

2.8 Summary

2.8.1 Policy on EE&C in Each Country

(1) Policy on EE&C

Policy on EE&C of each country is summarized as follows.

Table 2-24 Policy on EE&C of Each Country (Summary)

Country	Policy on EE&C
Japan	A "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.
UK	UK sets energy efficiency policy as one of its key policies for tackling global warming. Energy efficiency policy lies at the heart of the measures being taken against global warming by 2020, since it is cost effective and can achieve results in the short-term. EU's greenhouse gas reduction target in Kyoto Protocol is 8 % on average from 2008 to 2012 according to the 1990 baseline. UK sets its (national) target 26 % reduction in carbon dioxide emissions by 2020.
German	In October 2008, Germany announced their target of reducing 40 % of GHG by 2020 through the "National EE&C Plan", changing the current situation of energy supply which relies on imported energy. The plan includes specific plans such as requiring the issuance of building energy certificates, tax incentives for the reconstruction of old buildings, and the consideration of vehicle taxation based on CO2 emissions.
India	The Indian Government has announced in August 2009, that as a part of the nation's climate change efforts, India aimed at saving 5 % of India's annual fossil fuel use by 2015 (compared to 2009). The industrial operations, nine different sectors including power generation and cement production, enlisted to participate in the energy management system accounting for around 40 % of the country's fossil fuel consumption.
Thailand	The energy policy in Thailand is issued under the name of Energy Minister. According to the policy, reducing unit energy consumption in industrial sector by 20 % from 2006.
Australia	Main policies on EE&C in Australia are decided by the Ministerial Council on Energy (MCE). The Council announced the "National Framework for Energy Efficiency (NFEE)" on December 2004 that aimed at promotion of energy efficiency in the consumption sector. The Framework raised the following nine priority sectors with an expected annual energy saving of 50 PJ/year by 2015.

(2) Law on EE&C

The following table is a summary of Laws on EE&C for each country. In the report, a "Law on EE&C" defines a complexity of obligatory regulations for the purpose of enforcing comprehensive EE&C promotion and implementation.

Table 2-25 Law on EE&C of Each Country (Summary)

Country	Law on EE&C	Stipulated Contents
Japan	Act on the Rational Use of Energy	• Energy Management System for Designated Organizations • EE&C for transportation (carriers and consigners) • EE&C for houses and buildings (owners and administrators) • EE&C for machinery and equipment (Labeling and Standard System)
UK	Climate Change Act, 2008*1	• Emissions Trading Scheme/System (EU ETS) • Carbon Reduction Commitment Energy Efficiency Scheme (CRC), etc.
German	Energieeinsparungsgesetz	• EE&C for building insulation, HVAC, etc.
India	Energy Conservation Act 2001	• Energy Management System • Energy Conservation Building Code • Labeling and Standard System
Thailand	Energy Conservation and Promotion Act	• Energy Management System • Designation of EE&C equipment and promotion • Energy Conservation Fund (ENCON Fund)
Australia	Energy Efficiency Opportunities Act 2006	• Energy Efficiency Opportunity Program

*1: Climate Change Act is regarded as a law on EE&C for UK.

2.8.2 Energy Management System of Each Country

In this section, the cases of four countries (Japan, India, Thailand and Australia) that have already introduced the Energy Management System are summarized.

(1) Implementation Formation

Implementation formation of Energy Management System of each country is as follows.

Table 2-26 Implementation Structure of Each Country

Country	Responsible Ministry	Monitoring and Inspection	Training and Exam. of Energy Manager	External Compulsory Energy Audit
Japan	METI	Local Offices of METI	ECCJ (Designated Agency)	-
India	Ministry of Power	Designated agency designated by state Government	Bureau of Energy Efficiency	Accredited Energy Auditor (qualified)
Thailand	Ministry of Energy	Department of Alternative Energy Development and Efficiency (DEDE)	DEDE	-
Australia	Department of Resources, Energy and Tourism (DRET)	DRET	-	-

(2) Comparison of Scheme Design

Comparison of the scheme design of each country is shown below.

Table 2-27 Scheme Design of Each Country (1)

Country	Designated Organizations	Threshold	Monitored Energy	Monitoring Boundary
Japan	Factory and building	3,000 kl/year in crude oil equivalent	Primary energy consumption	Both by site and by company
India	9 industries	3,000 toe/year - 30,000 toe (according to type of industry)	Final energy consumption	By site
Thailand	Factory and building	1,000 kW or 20 million MJ/year	Final energy consumption	By site
Australia	Factory and building	0.5 PJ/year	Final energy consumption	By corporation

Table 2-28 Scheme Design of Each Country (2)

Country	Responsible Person for Energy Management	Qualification of Energy Manager	Periodical Report	Inspection
Japan	Energy Manager	Examination or training with certificate exam.	Submission every year	Inspector
India	Energy Manager	Examination	Submission every year	Inspector
Thailand	Energy Manager	Experience or training with certificate exam	Submission every year	Inspector
Australia	Representative of the corporation	-	Submission of EE&C plan and result report in 5 years cycle	Inspector

2.8.3 Energy Indicators of Other Countries

(1) Energy Consumption and Intensity

(a) Primary Energy Consumption

When comparing primary energy consumption (equivalent to Primary energy supply) including renewable energy, the comparison results are as follows.

Table 2-29 Trends of Primary Energy Consumption (million toe)

	2000	2001	2002	2003	2004	2005	2006	2007	2007/2000
Serbia	13	15	15	16	17	15	16	16	2.9
Japan	518	509	509	505	521	519	518	514	−0.1
UK	224	225	219	223	223	223	219	211	−1.0
Germany	337	347	339	342	344	339	341	331	−0.3
India	457	464	476	489	517	534	561	595	4.5
Thailand	72	76	81	87	94	97	100	104	6.3
Australia	109	107	111	112	112	121	123	124	2.2

(Source: IEA Database)

As can be seen in the above table, developed countries such as Japan, UK and Germany did not increase their energy consumption from 2000 to 2007. On the other hand, in developing countries such as India and Thailand, energy consumption increased at an annual average growth rate of 5 %. Serbia and Australia increased their energy consumption by 2 %-3 %. There is almost a direct correlation between a nation’s increase in energy consumption and its economic development. Hence, usually, the energy demand of a country with high economic growth experiences rapid future growth.

The respective energy consumption for the nations in 2007 are, Japan: 32 times, UK: 13 times, Germany: 21 times, India: 37 times, Thailand: 6.5 times and Australia: 7.8 times when the energy consumption of Serbia is assumed to be 1.

(b) Primary Energy Consumption per GDP

Primary energy consumption per GDP in the countries is compared in the following table under the assumption of a US$ base real GDP at 2005 price levels (the 2005 exchange rate is used for converting national currency to US$ for all years). As one of the results, every country causes their energy intensities to decrease which means that their energy efficiencies improve economic efficiency and residential energy efficiency. Such phenomenon was particularly apparent in counties who grow their economy rapidly.

Table 2-30 Trends of Primary Energy Consumption per GDP (ktoe/Billion US$)

	2000	2001	2002	2003	2004	2005	2006	2007	2007/2000
Serbia	1,129	953	920	910	874	699	673	644	−8.9
Japan	121	119	119	116	117	114	112	108	−1.9
UK	111	108	104	103	100	98	93	87	−3.9
Germany	125	127	124	125	124	121	119	113	−1.7
India	790	761	753	712	694	657	628	611	−4.2
Thailand	522	536	543	549	558	551	537	533	0.3
Australia	179	172	171	167	161	169	167	163	−1.6

(Source: IEA Database)

Primary energy consumption per GDP in Serbia has been on the decline since 2005, due to the independence that Monte Negro achieved from Serbia. By independence, it is estimated that the Serbian GDP did not change although the primary energy consumption in Monte Negro experienced a reduction. Serbian energy intensity to the GDP during 2005-2007 was almost the same as Thailand and India, it can be said that the Serbian Energy intensity to the GDP at the time belonged to the category of developing counties. Therefore there is a room for Serbia to improve its energy intensity to the GDP in the future.

(c) Primary Energy Consumption per Population

Based on the following table, the primary energy consumption per capita of Australia, Germany, Japan and UK are around double to that of Serbia's, and the primary energy consumption per capita in Serbia does not change from 2000 to 2007. By looking at the phenomenon of Serbia, it can be considered that the future primary energy consumption per population in Serbia will increase to double of the current situation.

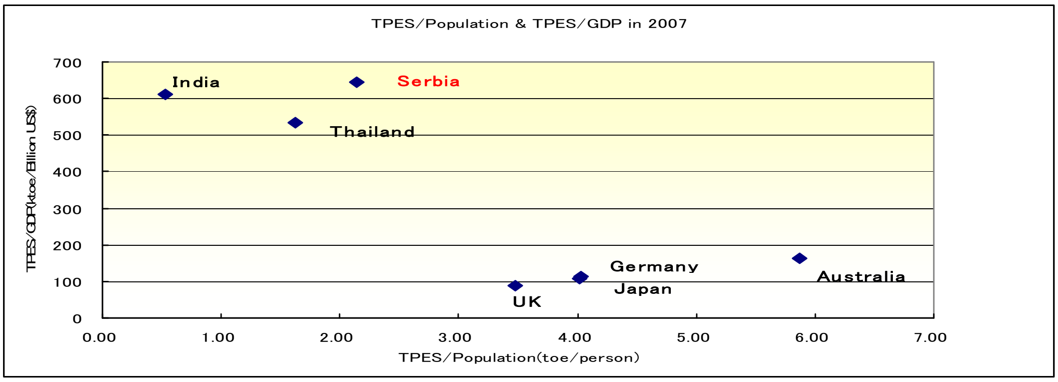
Table 2-31 Trends of Primary Energy Consumption per Capita (toe/capita)

	2000	2001	2002	2003	2004	2005	2006	2007	
Serbia	1.63	1.78	1.89	1.99	2.16	2.02	2.12	2.14	4.7
Japan	4.08	4.01	3.99	3.95	4.08	4.06	4.06	4.02	−0.3
UK	3.80	3.80	3.69	3.75	3.72	3.70	3.62	3.48	−1.5
Germany	4.10	4.22	4.11	4.15	4.16	4.11	4.14	4.03	−0.3
India	0.45	0.45	0.45	0.46	0.48	0.49	0.51	0.53	2.7
Thailand	1.19	1.24	1.31	1.41	1.51	1.54	1.57	1.63	5.4
Australia	5.65	5.49	5.61	5.58	5.54	5.88	5.89	5.87	0.6

(Source: IEA Database)

Until 2004, the primary energy consumption per capita of Serbia has been steadily increasing. After 2005, with the exception of the UK, the pace of increase has slowed down considerably in comparison with other countries. However, the UK's primary energy consumption per capita of decreased even though the population did not decrease. It can be considered that energy efficiency improvements in the UK had been being implemented smoothly.

The following figure shows the relation between primary energy consumption per capita (toe/capita) and per GDP (ktoe/billion US$). Generally speaking, primary energy consumption per capita in developed countries is higher than that of developing countries, and primary energy consumption per GDP is comparatively lower. Australia, Japan and UK belong to the high energy efficient nations in the developed countries. However in Serbia, India and Thailand, the primary energy consumption per capita is smaller and primary energy consumption per GDP is larger than that of developed countries.



(Source: IEA Database)

Figure 2-16 Relation between Primary Energy Consumption per Capita and per GDP

(2) Power Consumption and Intensity

(a) Power Consumption

Power consumption of Serbia is only 3 % of that of Japan. Meanwhile, the growth rates of power consumption in India and Thailand are annually an average of 7 % from 2000 to 2007, while the growth rate of Serbia did not increase during the same term.

Table 2-32 Power Consumption (TWh)

	2000	2001	2002	2003	2004	2005	2006	2007	2007/2000
Serbia	32	33	34	32	32	29	30	31	-0.5
Japan	1,011	994	1,008	997	1,027	1,048	1,053	1,083	1.1
UK	360	363	365	368	368	377	377	373	0.6
Germany	546	557	569	576	584	587	591	591	1.3
India	408	416	437	463	494	521	567	610	6.9
Thailand	91	96	104	111	119	125	132	138	7.1
Australia	193	201	212	213	220	230	235	237	3.5

(Source: IEA Database)

(b) Power Consumption per GDP

Power consumption per GDP of the counties did not change from 2000 to 2007 except Serbia. However, Serbia's power consumption per GDP had decreased from 2.68 kWh/US in 2000 to 1.25 kWh/US$ in 2007. It can be considered that the power consumption per GDP in UK and India will incrementally improve 2 % per year. However, it shows a tremendous decrease of power consumption per GDP in Serbia. There is a possibility that the statistics underwent change.

Table 2-33 Power consumption per GDP (kWh/US$, 2005 price)

	2000	2001	2002	2003	2004	2005	2006	2007	2007/2000
Serbia	2.68	2.18	2.00	1.83	1.59	1.36	1.28	1.25	−11.9
Japan	0.24	0.23	0.24	0.23	0.23	0.23	0.23	0.23	−0.6
UK	0.18	0.18	0.17	0.17	0.16	0.16	0.16	0.15	−2.3
Germany	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.20	0.0
India	0.71	0.68	0.69	0.67	0.66	0.64	0.64	0.63	−2.0
Thailand	0.66	0.68	0.70	0.69	0.70	0.71	0.71	0.71	1.1
Australia	0.32	0.32	0.33	0.32	0.32	0.32	0.32	0.31	−0.3

(Source: IEA Database)

(c) Power Consumption per Capita

The power consumption per capita of India and Thailand has increased. That of Serbia has also increased at 1.2 % per year.

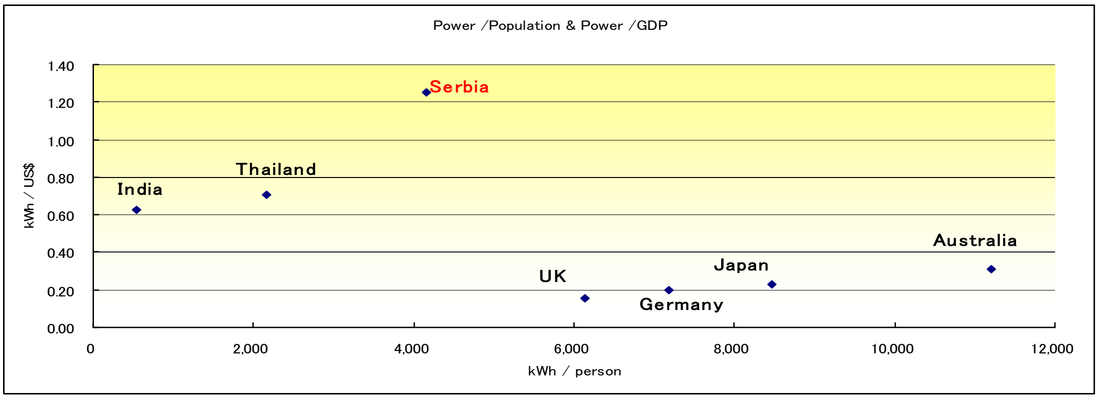
Table 2-34 Power Consumption per Capita (kWh/Capita)

	2000	2001	2002	2003	2004	2005	2006	2007	2007/2000
Serbia	3,855	4,074	4,121	3,993	3,932	3,922	4,040	4,153	1.2
Japan	7,973	7,819	7,910	7,808	8,041	8,201	8,239	8,475	1.0
UK	6,115	6,143	6,148	6,185	6,155	6,253	6,217	6,143	0.1
Germany	6,637	6,763	6,902	6,984	7,084	7,114	7,175	7,185	1.3
India	402	403	417	435	457	476	511	543	5.1
Thailand	1,503	1,562	1,680	1,780	1,898	1,988	2,080	2,157	6.2
Australia	9,994	10,304	10,713	10,655	10,896	11,190	11,266	11,213	1.9

(Source: IEA Database)

The following figure shows the relation between power consumption per capita (kWh/capita) and power consumption per GDP (kWh/US$). It is found that power consumption per capita of developed countries is higher than developing countries, and power consumption per GDP of developed countries is lower than developing countries.

On the other hand, the power consumption per capita of Serbia, Thailand and India indicates lower value even though the power consumption per GDP is higher.



(Source: IEA Database)

Figure 2-17 Relation between Power Consumption per Capita (kWh/capita) and per GDP (kWh/US$)

Chapter 3 Energy Situation of Serbia

3.1 General Information

3.1.1 Country's History

After the World War II, Kingdom of Yugoslavia became Federal Republic of Yugoslavia with Tito. The country was walking own way during the Cold war between the USA and USSR. The country had experienced a high economic growth age from 1950 to 1960. In the 1990s, Slovenia, Croatia, Macedonia Bosnia and Herzegovina achieved independence from Yugoslavia; and the remaining countries consisted of Serbia, Montenegro which comprised the new Yugoslavia.

Along with the collapse of Milnshevich's Government, in October 2000, Serbia and Montenegro changed country formation from being a Republican institutions to a federation of nations. After that, in June 2006, Montenegro became independent from the Federation of Nations through national votes. And the Republic of Serbia was born in June 2006.

3.1.2 Climate and Administration District

(1) Climate and Weather

Serbia is an inland area and belongs to a continental climate that is characteristically cold in the morning and night time. The metropolitan city, Belgrade, is located at the merging between the Donau and Sava rivers in the center of the country (North latitude 44.8, East longitude 20.3). It can be considered that the heating demand is in extreme high demand due to the temperature reaching under zero in the winter. The accumulative yearly rainfall is small, it is 628 mm. The following table is the temperature and rainfall by month in Belgrade.

Table 3-1 Monthly Average of Temperature and Rainfall in Belgrade

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Average high temperature (C)	3.5	6.4	11.9	17.5	22.5	25.3	27.3	27.3	23.7	18.1	11.0	5.3
Average low temperature (C)	-2.3	-0.2	3.3	7.8	12.1	15.0	16.3	16.1	13	8.3	4.0	-0.2
Rainfall (mm)	49	44	50	59	71	90	66	51	51	40	54	58
Rain fall days	13	12	12	13	14	14	10	9	9	8	12	14

(Source: World Temperature HP)

(2) Administration District

The Administration districts in Serbia are separated into 24 districts and Belgrade. Those districts included more than 160 municipalities.

3.1.3 Overview of Politics and Economy

(1) Overview of the Country

The following table shows the overview of the social and economic data of the country.

Table 3-2 Country and Social Affairs of Serbia（as of 2007）

Items	Contents
Country name	Republic of Serbia
Capital	Belgrade (Population 1,560,000)
Area	88,361km2
Population	7,540,000 (at 2007)
Labor forces	2005=2,730,000, 2006=2,630,000, 2007=2,660,000
Language	Serbian Language
Religion	Serbian Orthodox, Catholic, Islam
Character	Cyrillic alphabet (Latin alphabet are usually used)
Time difference	Minus 8 hours to Japan (Minus 7 hours in Summer time)
Climate	Continental climate
Currency	Dinar (1 US$≒58.45Dinar/average in 2007)
Nominal GDP	2007=18,74 billion Dinar (32.1Billion US$)
Real GDP growth rate	Average 8.2 % during 2001-2007
GDP per Capita	2007=4,375 US$/Capita
Unemployment rate	2005=25.3%, 2006=26.6%, 2007＝24.4%
CPI increase rate	2005=17.1%, 2006＝6.0%, 2007＝6.3%

(Source: NBS (National Bank of Serbia) and Serbian Embassy）

(2) Political Environment

The political system is republic and the head of the state is the President, ”Boris Tadic” (First Inaugurate June in 2004, Second inaugurate Feb 2008), he is in charge of diplomacy and defense affairs, As a domestic policy, the Democratic union associated with the Democratic party, the Serbian social party and other parties have the governmental power. The Government led by Prime Minister “Mirko Cvetkovic” (inaugurated in July of 2008, the term is 4 years) promotes union with EU. Therefore, the Government placed top priority in having itself join the EU. The Government had already signed the agreement of Stabilization and Union with the EU in April 2008. EU has one condition which is that the Serbian Government cooperates with the Yugo International Criminal Court. Further, also that the PFP (Peace for Partnership) between Serbia and NATO is promoted, Serbia’s entry into the PFP was recognized in 2006, and Serbia joined the UN in November 2000.

(3) Economic Trends

Recent movement concerning the (the year of 2007 and 2008) Serbian economy is as follows.

- The Serbian economic growth rate was 5.0 % in 2007, 5.4 % in 2008 and –2.0 % in 2009 (estimates by the Government). Even though the economic growth rate was minus in 2009, the recent economic trends of Serbia are looking strong.
- One of the main factors for economic growth is private consumption. In recent residential

sectors, the private consumption boom occurred. However, the boom cooled down in 2009.

- The export growth rates in 2007-2008 increased more than 40 % in comparison to the previous year. The increase of the exports brings the evaluation of the Dinar to the US dollar. The service sector has become the driving force of the Serbian economy in recent years.
- Agriculture sector was greatly damaged by the deserts that occurred in 2007. The economic growth rate in 2008 was 5.4 %, even though a more than 10 % growth rate is expected.
- Monetary and fiscal policies have increasingly diverged over the past year. The National Bank of Serbia has operated a tight monetary policy, implementing a series of increases in the key policy rate in the first half of 2008. Nevertheless, both domestic and global inflationary pressures have kept the inflation rate in double digits during 2008.
- Serbia’s high growth rate is likely to slow down in 2009 – 2010 due to the global financial crisis. However, provided political stability is maintained, Serbia is likely to be of great interest to foreign investors in the coming years, not only because of the major privatizations and infrastructure projects slated for the next few years, but also for the country’s geographical advantages, particularly the capital, Belgrade and how its connected to other parts of the region.
- The short-term macroeconomic challenge is on the fiscal side. Promises made during the parliamentary election campaign by parties that are the current government, especially those concerning pensions and other social payments, will be difficult to keep without further increasing the budget deficit.
- As the other key risk lies on the external side, trade and current account deficits are increasingly financed by borrowing from abroad, and careful management and supervision of lending standards will be necessary to avoid a painful contraction of the economy.

(4) Economic Indicators

The following table shows the major economic indicators in Serbia.

Table 3-3 Main Economic Indicators

Indicators	2002	2003	2004	2005	2006	2007	2008
Nominal GDP (Billion Dinar)	861	969	1,184	1,435	1,699	1,874	2,074
Real GDP at 2005 price (Billion Dinar)	1,118	1,182	1,331	1,435	1,559	1,637	1,725
Real GDP at 2005 price (Billion US$)	16.8	17.7	19.9	21.5	23.4	24.5	27.4
GDP per capita (US$)	2,061	2,180	2,460	2,889	3,157	3,317	3,637
Real GDP Growth rate (%)	9.8	5.7	12.6	7.8	8.6	5.0	5.4
CPI growth rate (%)	19.5	11.7	10.1	16.5	12.0	6.3	12.6
Average monthly Wages (US$)	205.9	288.5	352.1	382.5	472.7	662.9	N.A.
Population (Million)	8.15	8.12	8.08	7.44	7.50	7.54	7.54

(Source: National Bank of Serbia)

(5) Economic Policy

Serbia's transition to a market economy began much later that of other countries in the region, after the lost decade of the 1990s. Serious reforms began after the formation of a broad coalition government in January 2001. Since then, the pace of reform under successive governments has generally been rapid, at present, privatization, law reform and financial system reform are being implemented. The EBRD recommends the following items as reforms that the Government should have carried out.

(a) Privatization

The privatization program has advanced significantly in recent years. The privatization of small-scale companies is on course for completion by 2007 and more than 200 companies were privatized in 2005, with a similar pace being maintained so far in 2006. Several large industrial enterprises are being prepared for privatization, notably the oil and gas company Naphtha Industrija Srbija (NIS) is governed by Promgas (Russian company), Because Promgas is a 51 % shareholder of NIS, meanwhile the Serbian Government is a 49 % shareholder. However, progress on privatization of other large enterprises has been slower than planned.

(b) Business Environment

The business environment improved quite a bit compared to a few years ago. The implementation of new laws in bankruptcy and company legislation has advanced slowly in 2005 and 2006. More than 1,000 bankruptcy cases were registered in 2005, but so far, only a small number has been processed. Implementation is being held up by slow progress in training new licensed bankruptcy administrators, and by the reluctance of the authorities to speed up this painful process. Business registration procedures have been greatly simplified, but evidence from surveys such as the EBRD/WB suggests that corruption remains a major problem.

(c) Infrastructure Reforms

The biggest privatization since reforms began took place in August 2006 in the telecommunications sector. However, there has been little progress in effective market liberalization within the fixed line sector. Although a new regulator, the Telecommunications Agency, was established in 2005, the majority state-owned Telekom Srbija retains a stranglehold in the market without any competition being introduced in the near future. Further, reforms have occurred in the roads and railways sectors over the past two years. In roads, out of approximately 25 maintenance companies, some 20 companies were privatized during the course of 2005. In addition, the former Roads Directorate has been transformed to Public Enterprise Serbian Roads as per the new Roads Act passed in 2005. Consolidated road user charges are above the cost recovery level. In railways, the government finally adopted a new railway law in 2006. The Railway Act stipulates for the separation of infrastructure and operations, the implementation of access charges and open access to other operators, and the introduction of a Public Service Obligations. As noted earlier, the Serbian railways have implemented a major program of staff reduction. Staff numbers have declined to 22,617 from 33,741 in 2001. Moreover, it has implemented the divestiture of non-core activities with 16 non-core subsidiaries.

(d) Power Sector Reforms

In the power sector, the groundwork has been laid for further sector reform via the separation of the transmission company from the integrated utility, the reconnection to the Union for the Coordination of Transmission of Electricity (UCTE) network, the establishment of an independent regulatory agency and participation in the regional energy market. However, there is currently little political will to take these reforms to the next step of full unbundling of the sector, market liberalization, and privatization.

(e) Privatization of Banks

A number of significant privatizations have occurred in the banking sector over the past year. As a result, the state’s share of banking capital has shrunk to 21 % by 2006. In the insurance sector, the National Bank of Serbia (NBS) has withdrawn the license of a number of companies that did not satisfy required standards, and it has put up for sale a number of companies which resulted, in promoting the privatization of insurance companies.

3.2 Energy Situation

3.2.1 Energy Policy

(1) Overview

In terms of transfer progression over to a market economy and the harmonization of the EU after October 2000, MOME established itself as an Independent Regulatory Body to improve and speed up the work of license control, decision of energy prices and power tariffs, and energy supply service. In this context, MOME has promoted an effective energy market system as shown below.

- Introduction of Energy Law（Issued from August 2004）
- Energy Sector Development Strategy of Serbia (2005-2015) (Acceptance of congress in May 2005)
- Establishment of Serbian Energy Agency (SEA) (June 2005)
- Establishment of Serbian Energy Efficiency Agency (SEEA) (August 2004)
- Ratification of the energy community between the EU and Eastern Europe (June 2007)
- Utilization of gasification in Serbia (Acceptance of congress in May 2005)
- Energy Sector Development Program during 2007-2012 (Acceptance of congress in 2007)

(2) Energy Law and Strategy

(a) Energy Law

The main milestone of the reforms was entering into force the new Energy Law in August 2004. Directives and regulations guided by the EU Directives are transposed in Serbian legal framework, as accession to EU is one of the main overall objectives of the country. The details of the objectives are as follows.

- Safe, good quality and reliable supply of energy and energy sources
- Balanced development of energy activities aimed at providing the required quantities of energy and energy sources for meeting the needs of consumers of energy and energy sources
- Stimulating market competition based on the principles of nondiscrimination, transparency and market competition incentives
- Creating conditions for the safe and reliable operation and functioning of energy systems
- Ensuring the development of energy infrastructure and the introduction of state-of-the-art technologies
- Providing conditions for promoting energy efficiency in carrying out energy activities and energy consumption
- Creating transparent, attractive and stable conditions for investments in the construction, reconstruction and modernization of energy facilities and systems as well as conditions for linking them to the energy systems of other countries
- Creating conditions for stimulating the use of renewable energy sources and combined heat and electrical power generation
- Promoting environmental protection
- Decentralization in energy sector development programs planning and implementation

The Energy Law provides a framework for the development of the energy sector and for the establishment of the SEA and SEEA. The Energy Law regulates the generation, transmission, distribution and supply of electricity, the organization and functioning of the electricity market, the transportation, distribution, storage, trade and supply of petroleum products and gas and the production and distribution of heat. Besides, the global objectives of the new Energy Policy and Energy Sector Development Strategy will stimulate the economic development of the country, environmental protection and international integrations, including faster integration of our country into the EU as well.

(b) Energy Strategy

The Energy Sector Development Strategy of Serbia (2005-2015) was adopted by MOME in May 2005, based on the Energy Law. The Strategy defines five basic priorities towards 2015 as follows.

- Continuous technological modernization of the existing energy facilities/systems/sources, in the energy sector
- Economical use of quality energy products and increase in the energy efficiency

- Use of NRES (new renewable energy sources) and new, more energy efficient and environmentally acceptable energy technologies, installations/equipment for energy utilization
- Extraordinary/urgent investments in new power sources, with new gas technologies (combined gas-steam thermal energy installations).
- Long-term developmental and regional strategy for constructing new energy infrastructure facilities and electric and thermal power sources within the energy sectors of Serbia, as well as capital-intensive energy infrastructure, within the frameworks of regional and pan-European infrastructure systems

As a concrete plan described in the above Strategy, MOME prepared the “Program for Implementation of Energy Sector Development Strategy for the period from 2007 to 2012” that was adopted by the Serbian Government in January 2007. This Program defines the following conditions, methods and the time schedule by each energy field by 2012.

- Coal Sector: Underground and open pit mines,
- Oil Sector: Domestic exploitation, refinery and transportation
- Gas Sector: Enhancement of utilization
- Power Sector: Hydro and thermal generation and transmission and distribution
- District Heating System (DHS)
- Industry Energy Sector
- Energy Efficiency of End-users Sector
- Protection of Environment in Energy Sector

3.2.2 Structure of Energy Supply and Demand

(1) Total Primary Energy Supply (TPES)

According to the IEA database, the domestic primary energy production of Serbia in 2006 is 10,558 ktoe (1,000 ton oil equivalence), as shown below. The coal share of the production is 80 %, and the next big shares are hydro power and combustion renewable energies. Geothermal and solar is negligibly small. Oil, petroleum products and gas are dependent on imports. Some electricity is imported. The import ratio of the domestic energy demand is 44 %.

Table 3-4 Primary Energy Balance of Serbia in 2006 (ktoe)

	Coal and Peat	Crude Oil	Petroleum Products	Gas	Nuclear	Hydro	Geothermal, Solar, etc.	Combustible Renewables and Wastes	Electricity	Heat	Total
Production	7,812	660	0	236	0	943	0	907	0	0	10,558
Imports	913	2,538	1,557	1,755	0	0	0		737	0	7,501
Exports	-46	0	-68	0	0	0	0	-100	-806	0	-1,020
Stock Changes	30	0	0	0	0	0	0	0	0	0	30
TPES	**8,710**	**3,198**	**1,489**	**1,991**	**0**	**943**	**0**	**807**	**-70**	**0**	**17,068**

(Source: IEA Database)

(2) Energy Supply Capacity

According to the Energy Sector Development Strategy of Serbia (2005-2015) issued in 2005, the energy supply capacity of Serbia has been summarized as follows.

(a) Oil Sector

- Domestic exploitation of crude oil: Annual production is approximately 0.66 million tons (2006)
- Oil transport is performed predominantly through the trunk oil pipeline (Janaf) from Omisalj in Croatia to the oil refineries in Pančevo and Novi Sad.
- Processing of crude oil in two refineries: Annual production approximately 4.0 million tons of oil derivatives
- Total installed petroleum refineries capacity is 7.8 million tons per year (4.8 million tons in Pančevo and 3 million tons in Novi Sad).

(b) Natural Gas Sector

- Domestic exploitation of natural gas: Annual production approximately 0.3 million m3 of natural gas (2007)

(c) Coal Sector

- Domestic exploitation of coal: Annual production approximately 38.7 million ton (2008).
- Three open pit mines in three mining basins: Kolubara, Kostolac and Kosovo-Metohia basins (the latter temporarily is not operating as a part of Serbia's energy system)
- Underground mines: Over 95 % of the total coal production from the open pit mines is used for power production)

(d) Power Sector

- Generation capacity as of 2008 is a total of 8,539 MW provided by the Energy Power Industry of Serbia (EPS).

(e) District Heating System

- District heating systems exist in 45 municipalities and supply heat at 6,000 MJ/s (2007).
- These systems cover 450 thousand houses and offices.

(3) Energy Demand

(a) Power Demand

The consumption shares of sectoral power demand are Residential 53 %, Industry 26 %, Commercial 20 % and the others 1 %. The residential sector has the highest shares in the Serbian sectoral energy consumption. However, regarding the growth rate of energy demand, the commercial sector is higher than other sectors, and the residential sector hardly increases from 2000 to 2007. In terms of power consumption efficiency, it is useful to improve the power utilization efficiency of the residential, industrial and commercial sectors. The total power demand does not increase from 27 TWh in 2000 to 26.5 TWh in 2007.

Table 3-5 Sector-wise Power Demand and Shares

			2000	2001	2002	2003	2004	2005	2006	2007	07/00
Power demand	Agriculture.Fishery	(GWh)	185	205	209	195	207	216	214	209	1.8
by sector	Industry	(GWh)	6,331	7,016	7,151	6,684	6,005	6,054	6,526	6,756	0.9
	Commercial & Service	(GWh)	4,249	5,007	5,164	4,643	4,593	4,953	5,198	5,372	3.4
	Transportation	(GWh)	250	240	250	250	239	246	256	256	0.3
	Residentials	(GWh)	16,300	16,338	16,300	16,300	13,626	14,191	14,062	13,930	-2.2
	Total	(GWh)	27,302	28,791	29,058	28,058	28,477	25,663	26,256	26,523	-0.4
			2000	2001	2002	2003	2004	2005	2006	2007	07/00
Shares	Agriculture.Fishery	%	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	2.2
	Industry	%	23.2	24.4	24.6	23.8	21.1	23.6	24.9	25.5	1.4
	Commercial & Service	%	15.6	17.4	17.8	16.5	16.1	19.3	19.8	20.3	3.8
	Transportation	%	0.9	0.8	0.9	0.9	0.8	1.0	1.0	1.0	0.7
	Residentials	%	59.7	56.7	56.1	58.1	47.8	55.3	53.6	52.5	-1.8
	Total	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

(Source: IEA Database)

(b) Energy Demand as Fuel (fossil energy and renewable energy)

When looking at fossil and renewable energies by sector in 2007, the consumption shares are for Industry 41 %, Residential 41 %, Transportation 26 % and others 4 %. For improving fossil energy, it is said that Industry, Residential, and Transportation are the sectors being targeted.

Table 3-6 Sector-wise Energy Demand and Shares

			2000	2001	2002	2003	2004	2005	2006	2007	07/00
Fossil Enegy	Agriculture.Fishery	(ktoe)	113	111	115	119	127	167	209	251	12.1
Demand by Sector	Industry	(ktoe)	1,632	1,936	2,071	2,407	2,974	2,814	2,900	2,941	8.8
	Commercial & Service	(ktoe)	0	0	0	0	0	73	103	87	0.0
	Transportation	(ktoe)	774	1,215	1,477	1,618	1,773	1,772	1,752	1,827	13.1
	Residentials	(ktoe)	1,725	1,754	1,807	1,850	1,949	1,825	1,891	2,035	2.4
	Total	(ktoe)	4,243	5,016	5,470	5,994	6,823	6,651	6,854	7,141	7.7
			2000	2001	2002	2003	2004	2005	2006	2007	07/00
Shares	Agriculture.Fishery	%	2.7	2.2	2.1	2.0	1.9	2.5	3.0	3.5	4.0
	Industry	%	38.4	38.6	37.9	40.2	43.6	42.3	42.3	41.2	1.0
	Commercial & Service	%	0.0	0.0	0.0	0.0	0.0	1.1	1.5	1.2	0.0
	Transportation	%	18.2	24.2	27.0	27.0	26.0	26.6	25.6	25.6	5.0
	Residentials	%	40.7	35.0	33.0	30.9	28.6	27.4	27.6	28.5	-4.9
	Total	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

(Source: IEA Database)

(c) Total Energy Demand

Shares of total energy demand summing up power and fuels in 2007 are for Industry 37 %, Residential 34 %, Transportation 20 % and others 9 % as shown below.

Table 3-7 Sector-wise Total Energy Demand and Shares

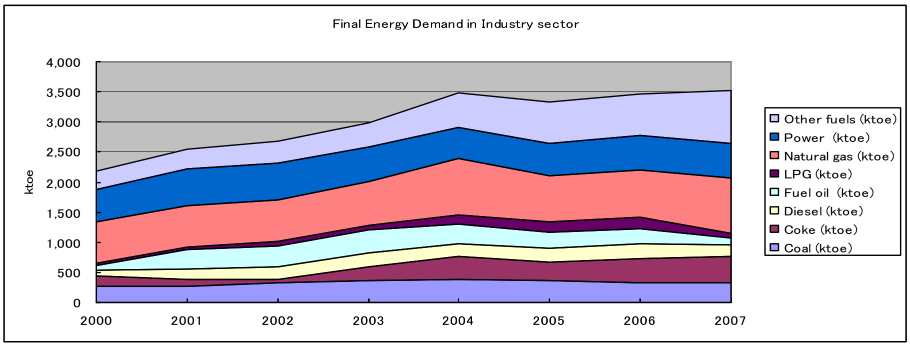
			2000	2001	2002	2003	2004	2005	2006	2007	07/00
Final Energy	Agriculture.Fishery	(ktoe)	129	129	133	136	145	186	227	269	11.1
Demand by Sector	Industry	(ktoe)	2,176	2,539	2,686	2,982	3,490	3,335	3,461	3,522	7.1
	Commercial & Service	(ktoe)	365	431	444	399	395	499	550	549	0.0
	Transportation	(ktoe)	795	1,236	1,498	1,639	1,794	1,793	1,774	1,849	12.8
	Residentials	(ktoe)	3,127	3,159	3,209	3,252	3,121	3,045	3,100	3,233	0.5
	Total	(ktoe)	6,592	7,494	7,970	8,408	8,945	8,858	9,112	9,422	5.2
Shares			2000	2001	2002	2003	2004	2005	2006	2007	07/00
	Agriculture.Fishery	%	2.0	1.7	1.7	1.6	1.6	2.1	2.5	2.9	5.5
	Industry	%	33.0	33.9	33.7	35.5	39.0	37.6	38.0	37.4	1.8
	Commercial & Service	%	5.5	5.7	5.6	4.7	4.4	5.6	6.0	5.8	0.0
	Transportation	%	12.1	16.5	18.8	19.5	20.1	20.2	19.5	19.6	7.2
	Residentials	%	47.4	42.2	40.3	38.7	34.9	34.4	34.0	34.3	-4.5
	Total	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

(Source: IEA Database)

(4) Sector-wise Energy Consumption

(a) Industrial Sector

The industrial sector uses the energies such as power, natural gas, LPG, fuel oil, diesel oil, coke and coal, etc. Regarding the growth rate of each sector's energy consumption during 2005-2007, coke is 1.4 times for the iron and steel industry, natural gas is 1.2 times and other energies are 1.3 times. And LPG and fuel oil decreased during the term.

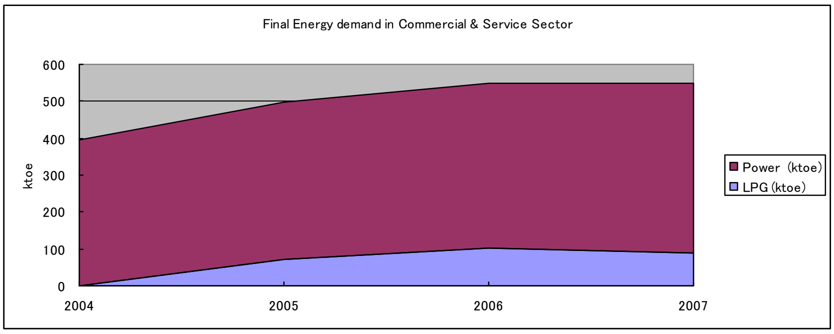


(Source: IEA Database)

Figure 3-1 Energy Consumption in the Industrial Sector

(b) Commercial Sector

In the commercial sector, electricity and LPG are used. LPG consumption increased 20 % from 2005 to 2007 (annual growth rate 10 %), and electricity consumption only is 8 % (annual 4 %). It is expected that electricity and LPG consumption will be increased in the sector.

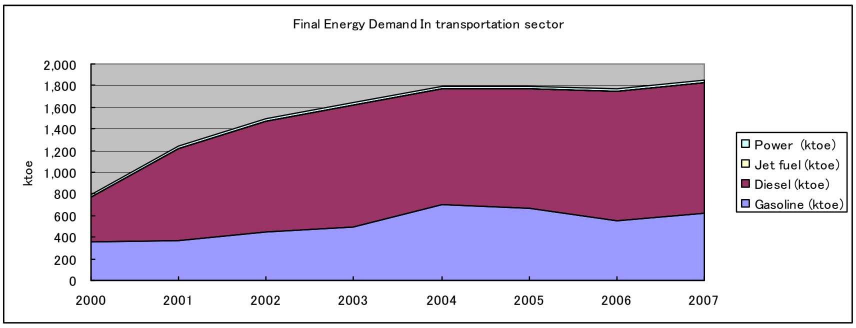


(Source: IEA Database)

Figure 3-2 Energy Consumption in the Commercial Sector

(c) Transportation Sector

The transportation sector consumes diesel oil, gasoline and electricity. Diesel oil consumption comprises an exceptionally big share. Diesel oil consumption increased 9 % from 2005 to 2007. This is higher than gasoline and electricity. The consumption shares in 2007 are diesel oil 65 %, gasoline 33 % and electricity 2 %.

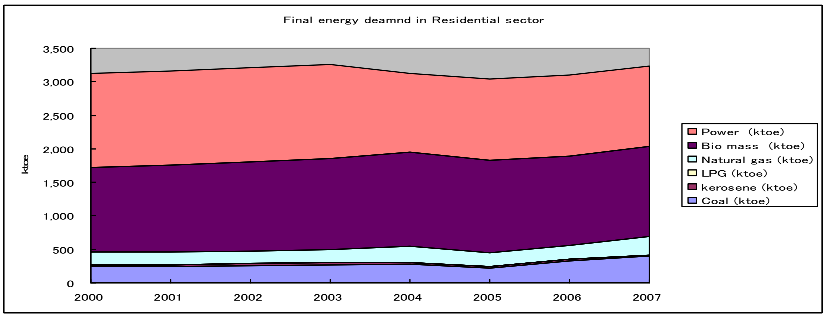


(Source: IEA Database)

Figure 3-3 Energy Consumption in the Transportation Sector

(d) Residential Sector

In the residential sector, electricity, renewable energy, natural gas and coal are used. LPG is consumed slightly. Energy consumption in the residential sector during 2005-2007 increased 6 %.



(Source: IEA Database)

Figure 3-4 Energy Consumption in the Residential Sector

(5) Summary

(a) Total Primary Energy Supply

Recently the coal production of Serbia has been decreased. In the Energy Law, as substitution energy of the coal, import of natural gas and its supply to domestic is described as an important theme. Besides, development of renewable energy production like hydro and biomass are also weighted in the Energy Law.

(b) Energy Demand

In the industrial sector, much fossil energies are used. Since 2005, coke for iron company (1.4 times), natural gas (1.2 times) have been increased. On the other hand, in the commercial sector, electricity occupies a large share. The annual growth rate of electricity records 4 %.

As for energy efficiency in the industrial and commercial sector, it is said that manufacturing equipment in the industrial sector and utilization of electricity in the commercial sector are mainly targeted.

3.2.3 Energy Efficiency of Serbia

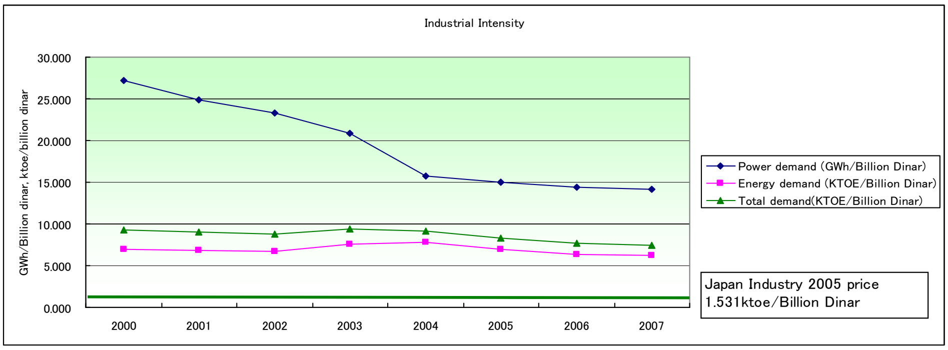
Energy efficiency is defined by production volume (or amount) as the denominator and energy consumption as the numerator. Further, energy efficiency is sometimes compared to other countries to evaluate whether energy utilization is effective or not. In the section, by comparing Serbian and Japanese energy efficiency by sector, Serbian energy efficiency is evaluated. The data used for the evaluation come from the IEA database.

(1) Energy Efficiency of Industrial Sector

Energy consumption per GDP in the industrial sector (2007 data, GDP at 2005 price) is shown below.

- Electricity consumption per GDP: 14.2 GWh/Billion Dinar or 1.22 ktoe/Billion Dinar
- Fuel consumption per GDP: 6.17 ktoe/Billion Dinar
- Final consumption per GDP: 7.39 ktoe/Billion Dinar

Final consumption per GDP in the Japanese industrial sector in 2005 is 1.53 ktoe/Billion Dinar. Based on these indicators, the final consumption per GDP of the Serbian industrial sector is 4.8 times that of Japan.



(Source: IEA Database)

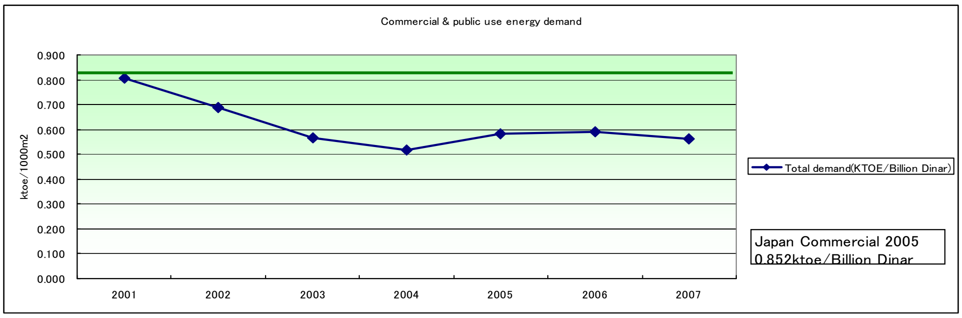
Figure 3-5 Energy-GDP Intensity of Serbian Industrial Sector

(2) Energy Efficiency of Commercial Sector

Energy consumption per GDP in the commercial sector (2007 data, GDP at 2005 price) is shown below.

- Electricity consumption per GDP: 5.50 GWh/Billion Dinar or 0.47 ktoe/Billion Dinar.
- Fuel consumption per GDP: 0.09ktoe/Billion Dinar.
- Final consumption per GDP: 0.56 ktoe/Billion Dinar.

Final consumption per GDP in the Japanese commercial sector in 2005 is 0.85 ktoe/Billion Dinar. Based on these indicators, the final consumption per GDP of Serbian commercial sector is 0.66 times that of Japan. In this report, the commercial sector is defined as buildings (excluding residential houses) such as office, hospital, shops, school, etc.



(Source: IEA Database)

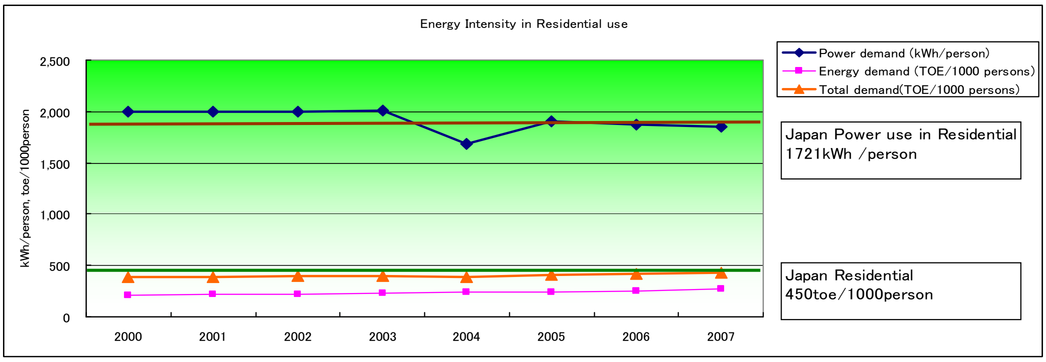
Figure 3-6 Energy-GDP Intensity of Serbian Commercial Sector

(3) Energy Efficiency of Residential Sector

Energy consumption per capita of Serbian residential sector (2007 data) is as follows.

- Electricity consumption per capita: 1,848 kWh/capita or 0.159 toe/capita.
- Fuel consumption per capita: 0.270 toe/capita.
- Final consumption per capita: 0.429 toe/capita.
- Final consumption per capita in the Japanese residential sector in 2005 is 0.450 toe/capita.

Final consumption per capita in the Japanese residential sector in 2005 is 0.450 toe/capita. Based on these indicators, the final consumption per capita of Serbia is almost the same as Japan's.



(Source: IEA Database)

Figure 3-7 Energy-Population Intensity of Serbian Residential Sector

(4) Summary

Final consumption per GDP in the industrial sector in Serbia (2007) is 7.39 ktoe/Billion Dinar. On the other hand, final consumption per GDP in the industrial sector in Japan equals to 1.53 ktoe/Billion Dinar in 2005. The final consumption per GDP of Serbia is 4.8 times to Japan. It means that energy efficiency is sough for the industrial sector immediately.

Meanwhile, final consumption per GDP in the commercial sector in Serbia is 0.56

ktoe/Billion Dinar, and final consumption per GDP in the commercial sector in Japan equals to 0.85 ktoe/Billion Dinar in 2005. Final consumption per GDP in the commercial sector of Serbia is lower than that of Japan. It is guessed that the difference is caused by the characteristics of commercial sector between the two countries. In the future, it is assumed that energy consumption of the commercial sector in Serbia increases together with an economic growth. In this context, it is also required to improve energy efficiency of the commercial sector as well.

3.3 Overview of the Power Sector

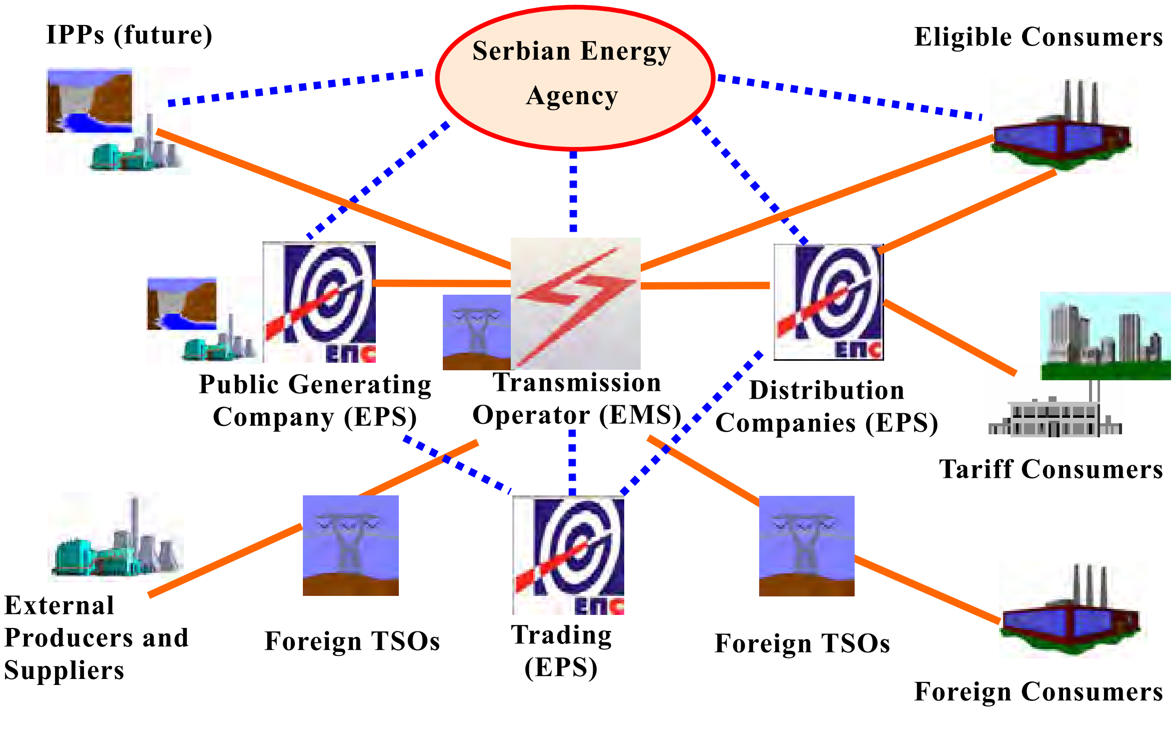
3.3.1 Structure of the Power Sector

The Energy Agency of Serbia (EAS), established in June 2005 as an energy regulatory agency based on the Energy Law (2004), is holding jurisdiction over development of the energy market, promotion of fair competition, monitoring of enforcement of regulation, fair energy supply, and consumer protection.

The power industry in Serbia is managed by the Energy Power Industry of Serbia (hereinafter “EPS”) and the Transmission System and Market Operator of Serbia (EMS). Business activities of EPS comprise electricity generation, combined heat and power (steam and hot water generation in combined process: CHP), coal production for electricity generation, distribution and distribution system control. The EPS has five distribution companies as subsidies. The installed capacity of the EPS in 2008 was 8,359 MW, and the electricity generation was 39,715 GWh. 62 % of the net output capacity was produced by coal thermal power, and 33 % was produced by hydro power. The total supply of electricity in Serbia in 2008 was 32,473 GWh, and the total consumption was 33,697 GWh. The balance was provided by imports.

EMS is dealing with power transmission, power transformation, and management of the trading of the power market. EMS divides Serbia into six regions, owns a national control center in Belgrade and six regional dispatch centers. A transmission network is connected to eight neighboring countries’ systems. EMS owns substations with a total installed capacity of 17,758 MVA, and power transmission lines with a total length of 10,000 km with voltage of 110 kV, 220 kV, and 400 kV. Various projects of construction, upgrade, and the rehabilitation of power systems sponsored by international resources such as EBRD loan, EIB loan, EAR grant, and Swiss grant, are in process.

The following figure diagrams the structure of the power sector in Serbia.



(Source: EPS)

Figure 3-8 Structure of the Serbian Power Sector

3.3.2 Policy on Power Sector

The electricity consumption ratio in Serbia is 28 % of the total energy consumption. The electricity business is managed by state-owned companies, EPS, EMS. Legally, the IPP are eligible to join the electricity business in Serbia, but as the electricity tariffs in Serbia are controlled to be the lowest level in Europe, IPP hesitates to join the electricity business, and in effect, an ongoing monopolization by state-owned companies in generation and transmission is ongoing. During the peak season, electricity shows an excess of surplus imports, so the EPS promotes some generation construction projects. As current electricity tariffs do not cover such construction costs, the EPS will manage such projects by donor assistance, and investment by foreign investors. Renewable energy projects are currently being planned and small hydro projects especially possess a large potential of 900 sites, with a total generation capacity of 1,800 GWh.

As an EE&C target, the target rate of energy intensity as of 2015 in the Energy Sector Development Strategy by 2015 is 1.1 %-2.2 % in total and 1.6 %-2.1 % in the industry sector. So electricity-related policies include not only enhanced generation and transmission efficiency, but also EE&C management on the demand side.

3.3.3 Power Supply and Demand, and Power Development Plan

(1) Existing Power Plants

The following table shows EPS's existing power plants.

Table 3-8 EPS Power Plants

Power Plant		Net Output Capacity (MW)	Electricity Generation (GWh)
Thermal Power Plant (TPP)	Total	5,171	29,337
	TPP Nicola Tesla A	1,502	9,680
	TPP Nicola Tesla B	1,160	8,377
	TPP Kolubara	245	1,091
	TPP Morava	108	636
	TPP Kostolac A	281	1,865
	TPP Kostolac B	640	3,012
	TPP Kosovo A	617	1,372
	TPP Kosovo B	618	3,304
Combined Heat and Power Plant (CHPP)	Total	353	367
	CHP Novi Sad	208	262
	CHP Zrenjanin	100	101
	CHP Sremska Mitrovica	45	4
Hydro Power Plant (HPP)	Total	2,835	10,011
	HPP Djerdap 1	1,058	5,398
	HPP Djerdap 2	270	1,510
	Vlasinske HPPs	129	168
	HPP Pirot	80	111
	HPP Bajina Basta	364	1,293
	PSHPP Bajina Basta	614	544
	HPP Zvornik	96	405
	HPP Elektromorava	13	47
	Other HPPs	211	535
Total		8,359	39,715

(Source: EPS 2008 Annual Report)

(2) Power Development Plan

Construction of new power projects have been planned with plans to decommission the old plants. Major projects are as follows.

- Thermal Power Plant (TPP) Kolubara B: 700 MW (2×350 MW) lignite fired power plant
- TPP Nikola Tesla B3: 700 MW lignite fired with supercritical parameters power plant
- Reconstruction / construction of the new unit at the Combined Heat and Power Plant (CHPP) Novi Sad
  : Optimization of existing CHPP and/or construction of a new gas-fired facility with a capacity of 450 MW-Combined Cycle Gas Turbine (CCGT) CHP
- Construction of Hydro Power Plant (HPP) Cornja Drina:
  : 4 HPPs in the upper part of River Drina and River Sutheska with total capacity of 250 MW

(3) Electricity Sales by Contract Categories

The following table shows the amount and ratio of electricity sales in 2008, categorized based on a 51% voltage level for households, 28 % was for industry, 19 % was for building, and 2 % was for public lighting.

Table 3-9 Electricity Sales in 2008

	Voltage Level/ Category of Consumption	Electricity Sales	
		GWh	%
Industry	High Voltage-110 kV	2,367	8.56
	Middle Voltage-35 kV	732	2.65
	Middle Voltage-10 (20) kV	4,613	16.69
Building	Low Voltage- (0.4 kV I Level)	3,216	11.34
	Consumer Spending- (0.4 kV II Level)	1,937	7.01
Households	Consumer Spending-Households	14,313	51.79
Public Lighting	Public Lighting	461	1.67
Total		27,639	100

(Source: EPS 2008 Annual Report)

(4) Power Demand Forecast

The following figure shows the power demand forecast by EPS. Based on the forecast, the demand will increase moderately, and it will increase by 11 % over the period between 2009 and 2020.

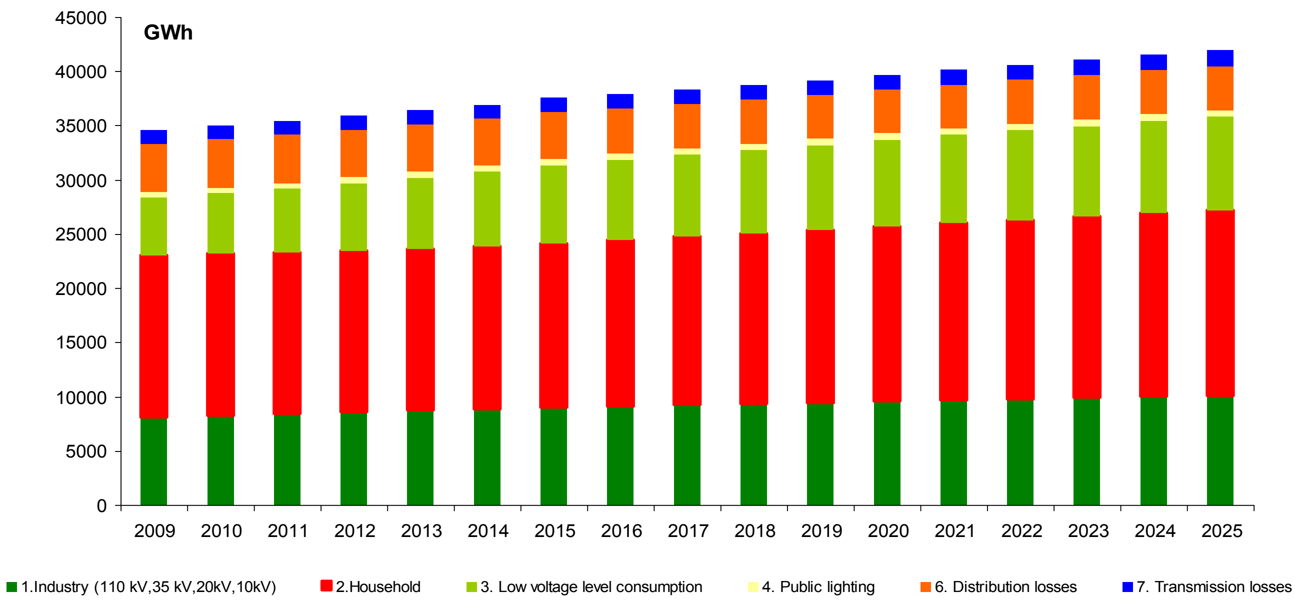


Figure 3-9 Power Demand Forecast (by Category) (Source: EPS)

3.3.4 Electricity Tariff System

(1) Electricity Tariff Table

Electricity contracts are categorized into seven types; High Voltage 110 kV, Middle Voltage 35 kV、Middle Voltage 10(20) kV, Low Voltage 0.4 kV I level, Consumer Spending 0.4 kV II Level, Consumer Spending, and Public lighting.

Table 3-10 Electricity Tariff System of EPS (as of 2009)

Consumption Category	Calculation Elements		Unit	Daily Tariff Rate	Dinars per Unit
High Voltage	Metering point fee				95.83
	Accounting demand		kW		397.042
	Excessive demand set-up		kW		794.084
	Active Energy		kWh	higher	3.105
			kWh	lower	1.035
	Reactive Energy ($\cos\phi \geqq 0.95$)		kvarh		0.135
	Excessive Reactive Energy ($\cos\phi < 0.95$)		kvarh		0.270
Medium Voltage	Metering point fee				95.83
	Accounting demand		kW		476.450
	Excessive demand set-up		kW		952.901
	Active Energy		kWh	higher	3.416
			kWh	lower	1.139
	Reactive Energy ($\cos\phi \geqq 0.95$)		kvarh		0.284
	Excessive Reactive Energy ($\cos\phi < 0.95$)		kvarh		0.567
Low Voltage	Metering point fee				95.83
	Accounting demand		kW		575.711
	Excessive demand set-up		kW		1,151.422
	Active Energy		kWh	higher	4.502
			kWh	lower	1.501
	Reactive Energy ($\cos\phi \geqq 0.95$)		kvarh		0.621
	Excessive Reactive Energy ($\cos\phi < 0.95$)		kvarh		1.242
Consumer Spending	Metering point fee				95.83
	Accounting demand		kW		25.808
	Active energy:				
	For consumers with Single-tariff metering	-for green zone	kWh		3.444
		-for blue zone	kWh		5.166
		-for red zone	kWh		10.332
	For consumers with two-tariff metering	-for green zone	kWh	higher	3.936
			kWh	lower	0.984
		-for blue zone	kWh	higher	5.904
			kWh	lower	1.476
		-for red zone	kWh	higher	11.808
			kWh	lower	2.952
	For consumers with controlled metering	-for green zone	kWh	higher	3.936
			kWh	lower	0.984
		-for blue zone	kWh	higher	5.018
			kWh	lower	1.255
		-for red zone	kWh	higher	10.037
			kWh	lower	2.509
	For controlled consumption with special metering	-for green zone	kWh		0.984
		-for blue zone	kWh		1.476
		-for red zone	kWh		2.952
Public lighting	Metering point fee				95.83
	Active energy:	-public lighting	kWh		4.374
		-neon signs	kWh		6.561

(Source: EPS Website)

(2) Electricity Tariff based on time of use

Tariffs for buildings and households are adopting the time of use method, and the deferential of tariffs between daytime and nighttime is around 1:4. And the tariff adopts three zone tariff systems.

Green zone	Monthly consumption <350 kWh
Blue zone	350 kWh/month≦Monthly consumption <1,200 kWh/month
Red zone	1,200 kWh/month≦Monthly consumption

(3) Charge for Reactive Power

In contract categories for High Voltage, Middle Voltage, and Low Voltage, the reactive power is charged. And based on a power factor of 95 %, the reactive power tariff has twice the deference in price and promotes power factor improvement to consumers.

(4) Electricity Tariff Control

Electricity tariff is controlled by the Government and it requires review and approval by the Serbian Energy Agency (SEA) and MOME.

3.3.5 Energy Relating Agencies

(1) Ministry of Mining and Energy (MOME)

MOME holds jurisdiction over planning, legislation, and control over mining and energy such as mineral resources, the power industry, oil industry and gas industry. MOME has seven departments (General Energy Department, Power Department, Oil and Gas Department, Mining and Geology Department, Department for Public Utilities, Department for International Relationships, Department for Sustainable Development of Mining and Energy), the administrative overall energy policy in Serbia, defines energy policies and strategies, legislations and regulations, and supervises energy related agencies.

(2) Serbian Energy Efficiency Agency (SEEA)

The SEEA is a government agency for promoting EE&C and renewable energy nationwide. SEEA was established in 2002 by the programs of the government for implementation of EE&C, and was reestablished as an organization in 2004 based on an Energy law put in force in August 2004. SEEA is financed through the budget of the government and donations by an international donor. SEEA has employed 12 staff as of 2009. SEEA is an advisor of governmental policies for MOME, but it does not have any authorities for the establishment of systems or making orders, doing business for a profit such as training with a fee.

The activities of SEEA are demonstration projects via industry-university collaboration, policy proposal to MOME.

(3) Serbian Energy Agency (SEA)

The SEA is a government energy regulatory agency established in June 2005, based on Energy law in 2004. The main tasks of SEA are the development of energy market, promotion of fair competition, monitoring of implementation of regulations and energy systems operation codes and fair energy supply and consumer protection. To ensure transparency of activities by energy companies, the SEA sets rules for setting tariffs for electricity prices, gas prices, and their network-connection fees, and fuel charges.

(4) Energy Power Industry of Serbia (EPS)

EPS solely owned by the government of which 100 % stocks are owned by the government. Formerly EPS was dealing in generation, transmission and distribution, but after restructuring in 2005, EPS was separated to two companies. One is EPS that deals with generation and distribution and the other is the Transmission System and Market Operator of Serbia (EMS) that deals with transmission and market operation.

The business activities of EPS are electricity generation, CHP, coal production for electricity generation, distribution and distribution system control. Further, EMS deals with the transmission of electricity and management of the power market. The installed capacity of EPS in 2008 was 8,359 MW, 62 % was produced by coal thermal power, and 33 % was hydro power. The EPS has 35,800 employees and half of them are in charge of electricity and CHP, and the others are in charge of the coal mining business. The EPS has five distribution companies as subsidies. The EMS is dealing with power transmission, power transformation, and the management of the trading power market. EMS divides Serbia into six regions, owns a national control center in Belgrade and six regional dispatch centers. EMS has 110 employees.

(5) Petroleum Industry of Serbia (NIS)

The NIS is a joint stock company dealing with business such as exploration of gas and oil, production, processing, supply, and sales. The NIS was established in 1991, restructured in 2005 and became an integrated company consisting of NAFTAGAS, PETROL, and TNG. In 2008, NIS became a subsidy of the Russian- capitalized Gazprom group (with an investment of 51 %). The NIS-NAFTAGAS is a branch for exploration and production of oil and natural gas, NIS-PETROL is a branch for the processing and trade of oil and oil derivatives and the NIS-TNG is a branch for liquid oil gas production and trade. The headquarters of NIS are located in Novi Sad with two large oil refineries, (NIS Petroleum Refinery Pancevo and NIS Oil Refinery of Novi Sad) it has an annual primary capacity of the refineries of 6.5 mil tones of crude oil.

Beopetrol, which has 200 oil stations and 74,000m^3 of oil depots was acquired by Lukoil in September 2003, and currently is one of the two large oil producers as well as NIS.

(6) Serbian Industrial Energy Efficiency Network (SIEEN)

SIEEN was established in 2006 by the Norwegian assist program as an independent network sector of the faculty of Mechanical Engineer’s innovative Center in Belgrade, for the purpose of promoting EE&C in Serbia. SIEEN targets companies in the industrial sector, and its activities are the organization of seminars and training programs for member companies, energy consumption analysis and comparison, accumulation of energy database, supplying the companies with information about energy effective solutions. Currently SIEEN has 60 member companies.

(7) Regional Energy Efficiency Center (REEC)

REECs supports SEEA, and REECs are organized at Belgrade University and universities in five cities. REECs were established with Norwegian governmental support. REECs have offices in Belgrade, Novi Sad, Kragujevac, Niš, and Kraljevo. Each office has several special members that collaborate with EE&C related organizations regarding activities such as the energy audit.

3.4 Policy and Countermeasure on Global Warming

In Serbia, Ministry of Environmental and Spatial Planning (MOESP) is responsible for protection of environment and global warming issues. Their responsibilities are as follows.

- Environmental protection systems
- Sustainable use of natural resources
- Environmental protection measures in the process of physical planning and construction
- Environmental monitoring, information system
- Trans-boundary waste movement
- Tran boundary pollution of air and water
- Climate changes and the ozone layer
- Permitting relevant to EIA
- Inspection on environmental protection
- International cooperation

Serbia has ratified the United Nations Framework Convention on Climate Change (UNFCC) in 2001. The ratification opens new excellent possibilities for Serbia to implement its energy policy in the area of energy efficiency, renewable energy sources and Combined Heat and Power Plant (CHPP) promotion through one of the Kyoto Protocol flexible mechanisms called the Clean Development Mechanism (CDM).

In order to be able to execute the CDM mechanisms, the Serbian Government has made a decision to develop a strategy for CDM implementation. According to this strategy, MOME, in parallel with the development of programs for the realization of energy strategies, develops strategies for CDM implementation in the energy sector. Both poverty reduction strategies and strategies of sustainable development were taken into consideration during the preparation of the CDM strategy. The Designated National Authority (DNA) was established within MOESP in 2008 and composed of representatives from all relevant ministries.

Chapter 4 Donor's Assistance in EE&C Field

4.1 Each Major Donors' Assistance to Serbia

Focusing on major donors assisting the EE&C, their project implementation is discussed below. Respective donors have the highest share of assistance to the energy sector in terms of their total assistance and have cooperated in each approach in the area of EE&C since 2002.

In terms of formulating the framework for the EE&C system, EU and Norway have been the primary supporters. EU has supported the EE&C system the since the first half of year 2000 and the establishment of the organization and Norway has provided assistance such as capacity building of EE & C for SEEA and MOME. This assistance was made available by the grant. EU assistance for this has been completed and assistance from Norway has been reduced gradually.

In addition to capacity building in terms of the organization and system, the World Bank and KfW of Germany have provided assistance for EE & C related projects via loans or grants.

At present, EU assistance for Serbia has been implemented as one of the regional assistances for the Western Balkan countries. Specifically, EU countries have established the regional fund related EE&C assistance for the Western Balkan countries including Serbia which applied for participation in EU and have provided grant funds for the EE&C project formulation through the financial institutions in each country. Furthermore, the funds by international financial institutions such as the European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), and others have been financed for EE&C related investment for the Western Balkan countries including Serbia.

The types of assistance provided by each institution are described as follows.

4.1.1 EU

(1) EU's Assistance

Since the year 2002, the EU had assisted with the promotion of EE&C through supporting the establishment of SEEA and SEA. EU granted a Special Fund for SEEA (total amount 3.75 million EUR) of which SEEA utilized to implement the industrial sector, building, and municipal EE projects. In addition to providing project funds, they also financed the current budget of SEEA including the salary of the personnel. Assistance by the Special Fund that ended in year 2006 and flowingly supported for SEEA's administration from June 2007 to October 2008. Therefore, EU did not provide further assistance for SEEA.

Projects implemented by EU assistance are energy audits, its training, and demonstration projects in the industrial, construction, and municipal sectors respectively. The table below shows contents of project.

Table 4-1 Summary of EU Assistance Projects for SEEA (Year 2002-2006)

Program Title	Subprogram	Main Content	Budget（EUR）
Energy Efficiency in the Buildings (1,650,000 EUR)	Energy Auditing	・Training program for energy audit of municipal government and public building	200,000
	Demonstration Programme for Energy Efficiency Projects in Existing Building	・Review, analysis, and design on demonstration projects, its' implementation and monitoring of the effect, and dissemination of the result ・Financial assistance for implementation of typical projects	1,100,000
	Awareness Campaign	・Strategy development of awareness campaign and implementation of the activities ・General campaign and houses and specific targeting group campaign	300,000
Energy Efficiency in Industry （900,000 EUR）	Industrial Energy Audits and Savings Potential	・Industrial energy audit and training program ・Grant assistance for regional Energy Efficiency Center (preliminary energy audit for 8 companies, presentation on factory energy management survey result, implementation of seminars with the local chamber of commerce four times) ・Procurement of measuring equipment for the energy audit	375,000
	Training Programme in Industry and Demonstration Projects	・Training program for energy management system (targeting 49 companies) ・Energy audit and demonstration projects (5 companies) implementation in industrial sector	400,000
	Awareness Campaign	・Information about energy management system and new energy efficiency technology	125,000
Energy Efficiency in Municipal Services （1,031,396 EUR）	Municipal Energy Management and Planning	・Training program for municipal government energy management （46 municipal government officers） ・Preparing Municipal government energy plan (targeting three municipals such as Sombor,Jagodina,and Kraljevo）	330,000
	Energy Efficiency in Municipal Services	・Installment of energy efficient equipment of facilities and street lights for municipal governments, a total of 7 projects	201,300
	Energy Efficiency in District Heating	・Installment of energy efficient equipment in heat supply facilities for four municipal governments	350,000
	Awareness Campaign	・Campaign for EE&C in municipal government service	150,000
Energy Efficiency in Renewable Energy Sources （200,052 EUR）	Demonstration `Projects	・Grant assistance for two demonstration projects ・Feasibility study on biomass energy in the school heating system, mini-hydro power plants, hot water supply system by solar power etcetera for 4 municipalities	170,000
	Workshops on geothermal Energy and Biomass	・Implementation of workshops	30,000

(Source: SEEA documents and Website)

(2) Other EU's Cooperation from Energy Efficiency

The EC supports financing for EE&C projects by European donors in candidate countries for EU members such as the West Balkan countries and also multiple donors cofinance for energy efficiency and renewable energy targeting the same areas.

As the financial assistance scheme targeting candidate countries for EU members (Instrument for Pre-accession Assistance: IPA), the EC provides grant assistance (Energy Efficiency Finance Facility :EEEF) for the technical assistance consulting service to implement EE & C projects by EBRD, EIB, and the Council of Europe Development Bank (CEB)/ KfW.

In addition, in the end of 2009, the Green for Growth Fund was established by the EIB and KfW as leading donors to finance the EE&C projects and Serbia is one of the target countries (for details, refer to the table below).

Table 4-2 Summary of Multiple Donor's Financial Scheme in Energy Efficiency and Renewable Energy

Period	Financial Scheme	Content	Loan Amount（EUR）
2007-2016	Energy Efficiency Finance Facility-EEEF	Assisting investment in energy efficiency of buildings and industrial sectors and the implementation of renewable energy projects in candidate countries for EU members（Instrument for Pre-Accession Assistance: IPA）[1)]	Providing 3.47 million EUR for total 138.8 million EUR of finance and risk share by EBRD, EIB, and others Financial assistance from EEEF for Serbia is planned as follows: ・ EBRD EEEF- 9 million ・ EIB EEEF-9 million ・ CEB/KfW- 5 million
2009-	Green for Growth Fund, Southeast Europe	Established by initiatives of EIB and KfW, with finance from other donors such as EBRD, EC, and IFC. Energy efficiency and small scale investment in renewable energy in West Balkan countries and Turkey.	Total 128 million (plan as of Sep. 2010) EIB provides 25 million and KfW plans to finance about the same amount.

(Source: Serbia MOF Document, EIB Web site)

(Note 1) This is to provide assistance for candidate countries for EU members during the period from 2003 to 2007.Serbia and all other counties in West Balkan are targeted.

4.1.2 Norwegian Government

In the Norwegian government's assistance policy for Serbia, capacity building and institutional building have been primarily concentrated in the energy sector. At the outset, according to the agreement of the 2002-2007 five-year financial cooperation between Norway and Serbia (grant assistance of 300,000 EUR for each year, cooperation for MOME in EE&C area was signed and SEEA implemented, as executing agency, programs such as;

- Support for establishment and management of Five REECs and SIEEN,
- Implementation of Training for REECs, SIEEN, SEEA, and MOME (financial engineering, energy management in the food industry, on-the-job training, EE&C in the

industrial sector and so on),
- Technical assistance for MOME and SEEA

According to SEEA's report, this assistance contributed to conceptualizing Energy Efficiency and Renewable Energy Source Fund (EE & RES Fund) and drafting the "Energy Strategy of the Republic of Serbia until 2015"

After year 2007, the Norwegian government continued in its support for establishing REEC and SIEEN, and MOME. Financial assistance for MOME was provided for the municipal energy manager system which is implemented as a pilot project and to implement the energy sector strategic plan (refer to the table below). In the beginning of the assistance, technical assistance was conducted mainly by a group of Norwegian consulting companies; however, after year 2005 it was reduced to the present level of financial assistance which is the amount mainly provided currently.

According to the Ministry of Foreign Affairs in Norway, in their strategic assistance plan from 2010 to 2014, the priorities in the area of energy are capacity building at the central, regional and local levels, concessions, licensing, permits, public procurements, environmental impacts and others.

Table 4-3 Summary of the Norwegian Government's Assistance for EE&C

Period	Executing agency	Project title	Content	Amount (EUR)
2003.12-2004.5	SEEA	Training in Financial Engineering	・Training on energy efficiency for 20 people (10 people from private companies and 10 people from REEC and SEEA) ・Business plan for 7 factories ・Training on energy technology, monitoring, economic evaluation theory and practice ・Presentation of business plans for the bank	322,000
2004.12-2005.6	SEEA	Training in Energy Management System for Food Industry	・Training on energy efficiency for 10 people from the REEC and SEEA and 10 people from food factories ・Energy audit and the modern energy management system (EMS) theory and practice	370,000
2005.7- (17months)	MOME SEEA	Norwegian Energy Efficiency Assistance to Serbia (Capacity Building of SEEA, REECs and SIEEN)	・Establishment and capacity building of 4 REEC ・Establishment of SIEEN in cooperation with SEEA and the preparation energy efficiency improvement program ・Advisory for MOME	357,800
2006.10-2009.9	MOME SEEA	Norwegian assistance to Serbia for introduction of the new energy efficiency policy, energy balance and implementation of the Kyoto Protocol	・Support for management and capacity building for REEC ・Technical and financial support for management of SIEEN. Study on introduction of EE&C benchmark, general data and company data collection ・Capacity building on CDM for relevant organizations ・Advisory for MOME	642,200 (Including technical assistance)
2008.5-2009.10	MOME SEEA	Norwegian Assistance to Serbia for Introduction of the New Energy Efficiency Policy and Establishment of Energy Planning on a Local Level	Continuous projects to aforementioned ones ・Support for the Serbian organizations on EE&C, particularly technical and financial support for newly established REEC in Kraljev ・Support for MOME : transfer of knowledge for municipal energy managers in order to implement energy efficiency and renewable energy source policies	160,000
2008-2009	MOME	Study on capacity building of the ROS in the field of strategic planning in the energy sector	According to the Energy Law, adjustment on the strategy of actual needs for energy and energy sources and coordination among the strategies of national development, regional development, and sustainable use of natural resources. Based on actual needs for energy and energy sources, review on strategic implementation program at least once in two years.	229,800

(Source: SEEA document and The Serbian Government HP)

4.1.3 German Government

The German government's assistance for Serbia is the largest amount in accumulated totals after year 2000 (870 million EU) among bilateral donors.
Gesellschaft fur Technische Zusammenarbeit (GTZ) has supported Serbia in drafting the "Law on Rational Use of Energy" since year 2008. Moreover, in terms of EE&C assistance towards the "Municipality Modernization Project", the GTZ provided assistance for municipal governments (15 municipalities from 2005 to 2008) replacement of facilities and equipment of street lights, district heating systems, schools, and municipal buildings for EE&C. This project ended in year 2008 and GTZ continued their support to assist municipal governments to plan and implement infrastructure investment for EE&C, as a part of the components under the project "Strengthening Local Self-Government" (for details, refer to the table below).

Table 4-4 Summary of the GTZ projects for EE&C

Period	Executing agency（relevant agencies）	Project title	Content	Amount（EUR）
2002-2008	Association of Serbian Town	Municipality Modernization Project	Project implementation for 33municipals. For assistance in an area of EE&C, replacement of facilities and equipment for improving energy efficiency of street lights, district heating, schools, and municipal buildings and so on.	805,000（only related to EE&C area. Total of 2005 to 2008, including the cost shared by municipal governments）
2008-2010	MOME Ministry of Environment and Spatial Planning	Preparation of the Foundation for Drafting Law on Rational Use of Energy with Accompanying Secondary Legislation	With relevant agencies and ministries, the analysis of existing laws and regulations in comparison with the best practices of the European ones, review on regulations related to EE&C and buildings. The overall goal is to implement the measures for EE&C of houses and buildings.	
2009.5-2011.12	Standing Conference for Towns and Municipalities (SCTM), Selected Serbian Municipalities	Strengthening Local Self-Government	Via participatory planning at the municipal government level, identification, proposal, and implementation of infrastructure development projects. Assistance for SCTM, training and promotion among municipalities. This entails infrastructure projects for improving energy efficiency.	3,000,000（gross total ）

(Source: MOF of Serbia and GTZ document and GTZ project website as of December, 2009)

Kreditanstalt fur Wiederaufbau (KfW) has provided grants or loans for such municipalities as the three major cities of Serbia, Belgrade, Nis, Novi Sad, in order to replace the obsolete heating system of municipal governments. Currently, the Phase III project is being implemented targeting six municipalities. In addition, cooperating with municipal governments supported by GTZ, financial assistance is provided for municipal infrastructure investments including EE&C projects. In respect of investing in energy efficiency and renewable energy, KfW currently provides loans targeting housing and small and medium enterprises through the Serbian commercial bank (for details, refer to the table below).

Table 4-5 Summary of KfW Projects for EE&C

Period	Executing Agency	Project Title	Content	Amount (EUR)
2001-2010	MOME Municipal governments	Rehabilitation of District Heating Systems in Serbia (on-going project "Rehabilitation and Modernization of District Heating System (DHS)")	Replacement of district heating systems and support for introducing a new tariff system Phase 1, II, targeting Belgrade, Nis, Novi Sad Phase III, targeting Nis, Kragujevac, Kraljevo, Sombor, Zrenjanin and Pirot	Phase 1(2001) 7, 700,000 (Grant) Phase II (2002) 10,000,000 (Grant) Phase III (2006/07) 22,000,000 (Loan) +2,000,000 (Grant , consulting service) *Cost shared by the Serbian government 5,500,000 (Debt for Nature Swap)
2008-2011	Municipal government (Loans via commercial banks)	Credit line for financing municipal infrastructure	Targeting for small and medium-scale municipalities, provision of the loan for necessary infrastructure investment and purchase of equipment through the Serbian commercial banks (including EE&C related investment) SCTM conducts consulting services and implements the loan, in cooperation with GTZ municipal government support projects.	60,000,000 (Loan)
2008-	Loan for houses and small and medium scale enterprises through the Serbian private commercial banks (Cacanska Bank, Procredit leasing, Raiffeisen, Volksbank)	Stimulation of energy efficiency and renewable energy sources	Loans for use of energy which is economically sustainable and environmentally friendly, targeting houses and industries. Technical assistance is also provided for commercial banks and end-users.	45,000,000 (Loan) (additional loan 25,000,000 was decided in 2009)

(Source: KfW Project Documents)

4.1.4 WB

The country partnership strategy 2008-2011 of the WB group states support for the EE&C in their priorities "Dynamic Private Sector Led growth to Ensure Income Converge with Europe" and "Managing Emerging Environmental and Disaster Risk" respectively. In particular, in the context of strengthening the financial sector, EE&C is discussed as a target area for increasing access to finance and support for the energy efficiency improvement program is also mentioned. Projects in the EE&C area have been implemented through loans by the International Development Association (IDA) and the International Bank for reconstruction and Development (IBRD) and also by the International Finance Corporation (IFC).

The "Energy Efficiency Project Phase 1" by IDA and EBRD supported energy efficiency targeting 28 buildings and a maternity hospital. As a result of the project implementation, it is reported that more than 40% of the energy reduction in the heating system of schools was achieved and, in terms of CO_2 emission reductions, about 44% and 33% of schools and hospitals were respectively achieved. At first, a 21 million dollar loan by the IDA was planned, and in 2007, a positive decision was made for an additional 28 million dollar loan by the IDA and IBRD. Therefore, the total loan amount is currently 49 million dollars.

IFC financed for EE&C projects and renewable energy use investment of micro and small-scale enterprises through the Procredit Bank in Serbia, in total 1.28 million dollars (approved amount). As of November 2009, any similar type of continuous loans was not provided thereafter.

Table 4-6 Summary of WB Projects for EE&C

Period	Executing Agency (Relevant Agency)	Project Title	Content	Amount (USD)
2007- (Signed in November 2006)	Pro-Credit Bank	ProCredit Serbia – Energy (IFC)	• Financing for projects in energy efficiency and use of renewable energy and clean energy of micro and small scale enterprises through ProCreditBank	128,000
2006-2010 (Signed February 2004)	MOME SEEA Relevant Ministries such as Ministry of Health, Ministry of Education and so on	Energy Efficiency Project	• Rehabilitation and introduction of energy efficient equipment in public facilities such as 6 schools and 4 hospitals in 2005 and 10 schools and 8 hospitals in 2006 • Replacement of inefficient lignite and heavy oil boiler to gas boilers • Implementation of energy audits and others and technology transfer and human resource development	490,000 (IDA, IBRD Loan)

(Source: WB Project Documents and SEEA Documents)

4.1.5 EBRD

The European Bank for Reconstruction and Development (EBRD）has assisted Serbia in support of enterprises, transportation, energy, municipal infrastructure construction, and the financial sector (lending for privatization, medium and small scale enterprises, and others). The accumulated total investment by March in 2009 totaled approximately 140 million EUR, the largest amount among financial institutions in Serbia.

In terms of support for the EE&C area in the current assistance strategy for Serbia, it has been stated that the EBRD constantly supports the energy sector's infrastructure and development of renewable energy and EE&C activities. As for renewable energy financial schemes and the EE&C area, targeting Western Balkan countries (Albania, Bosnia-Herzegovina,Croatia, Macedonia, Monte Negro, Serbia) including Serbia, two schemes, Western Balkans Sustainable Energy Direct Financing Facility (WeBSEDFF) (Total 50million EUR) and Western Balkans Sustainable Energy Credit Line (WeBSECLF) (Total 60million EUR), were started in year 2009 (as shown below). The WeBSECLF has been implemented under the cooperation of the EU, it is expected to have the same results as a previous similar scheme in Bulgaria and Romania. In December 2009, four renewable energy projects were on –going with a financing amount totaling approximately 4 million EUR.

Table 4-7 Summary of EBRD Financial Scheme in Energy Efficiency and Renewable Energy

Scheme	Eligibility	Target Project	Loan Amount and Conditions
Western Balkans Sustainable Energy Direct Financing Facility （WeBSEDFF）	Local private small and medium scale enterprises. In case of renewable energy projects by concession, its acquisition should be done.	・Energy efficiency and small-scale renewable energy projects in industry (greenfield investment, rated output is 10MW) ・In case of EE&C projects in industry, the energy efficiency effect is 20% and above. In case of renewable energy projects, it is required to have a minimum energy efficiency ratio (utilization rate).	・Loan amount: 1-6 million EUR ・Repayment period: 12 years and less (with grace period) ・Interest rate: Market rate ・Incentive repaymentt : at the time of physical completion of project facility construction and success in the beginning of operation, up to 15 % of repayment amount of the principle was reduced based on the amount of reduction of CO2 emissions achieved.
Western Balkans Sustainable Energy Credit line （WeBSECLF）	Finance through local banks (in case of Serbia Banka Intensa) targeting local private small and medium enterprises	・Energy efficiency projects in industry (15 % or 20 % energy efficiency in boilers and facilities such as small co-generation) ・Renewable energy (15 % energy efficiency in countries with feed-in tariff system and 20 % in countries without it.) ・Commercial building energy efficiency projects (energy efficiency effect 20 %)	・Loan amount: 2 million EUR and less ・Interest rate: market rate ・Incentive Repayment: Incentive repaymentt : at the time of physical completion of the project facility construction and success in the beginning stages of the operation, up to 15 % - 20 % of the repayment amount of the principle was reduced based on the amount of reduction of CO2 emissions achieved.

(Source: EBRD Project Documents)

As for other support in the EE&C area, in the past, the EBRD financed the rehabilitation of the district heating system in Belgrade (Total 22 million EUR) in 2001. Further, within the framework of financing assistance for medium and small-scale enterprises, with the objective of support for energy efficiency projects of small and medium scale enterprises, the EBRD approved the finance for private banks, targeting eight countries. In Serbia, the financing for Unicredit Bank and Unicredit leasing was approved with the total loan amount reaching45 million EUR.

4.1.6 Other Donors Assistance

Besides the aforementioned donors' assistance, as of the time of this survey (in year 2010), there are financial assistance for medium and small enterprises which includes the purpose of energy efficiency improvement is provided by EIB and Italia.

In addition, the energy efficiency investment finance supported by the United Nations (UN) as a countermeasure for the climate change. Serbia is included in the target 12 countries of this finance. Implementation plan was from February 2009 to February 2010 and the total amount of the finance is 35 thousand US dollars.

As for other bilateral assistance, the US government conducted a feasibility study for the district heating system plant in Belgrade under the schedule from 2005 to 2007 and the Spanish government provides assistance for capacity building of SEEA in renewable energy areas (wind power generation and solar power generation).

4.2 Assistance from Japan to Other Countries

The Japanese Government has assisted projects for the EE&C in other countries. Out of them, two projects for Turkey and Poland are introduced as follows.

4.2.1 Case of Turkey

(1) Project Background

Turkey heavily depends upon imports for its energy with its self-sufficiency ratio for energy at less than 50 %. Hence, it has been eagerly promoting energy conservation since the oil crisis and the Turkish Government established Energy Manager System targeting about 500 factories which consume more than 2,000 toe per year according to the "Energy Efficiency Regulation for Industrial Establishment" stipulated in 1995.

The energy conservation activities were executed by the National Energy Conservation Center (NECC) under the General Directorate of Electrical Power Resources Survey and Development Administration (EIE) and the Turkish Government requested that the Japanese Government provide project-type technical cooperation for organizing a training course for practical energy managers to improve the current conditions as soon as possible.

JICA implemented the project; "Energy Conservation Project in Turkey" begun by offering energy conservation technology training plants as the initial step, and transferring training technology and methodology to the Turkish technical staffs by Japanese long-term experts and short-term experts for the second step together with the energy conservation audit execution and its technical instruction at several factories.

(2) Assistance from Japan

(a) Overview

Project Name	Energy Conservation Project in Turkey
Duration	From August 2000 to July 2005 (5 years)
Executing Agency	EIE and NECC
Granted Equipment	208 million JY (Training Units: Pump, Fan, Air Compressor, Boiler, Furnace, Burner, Steam Trap, and Lighting Equipment)
JICA Long-term Expert	Total 240.5 M/M (5 persons)
JICA Short-term Expert	Total 28 M/M (25 persons)
Assistance	Instruction on the training units during installation Instruction on the training text preparation for all training units Instruction on the training manual preparation for all training units Instruction on the training and exercise method Instruction on the factory energy audit

(b) Specific Training Activities

Training course for Energy Managers: 18 times (Participants 345 and awarded certificates 168)
International training course for surrounding countries: Total 3 times
Factory energy audits: Total 118 times (Audit with measurement 19 times)
Seminars and workshops: Total 136

(3) Current Activities (as of the end of 2010)

NECC has been carrying out the energy conservation training courses and the Energy Manager Certificate examination 11 times every year and the Third Country Energy Conservation Training course once a year. Recently, in order to cope with increasing requests for the energy audit for factories and buildings, the NECC started authorizing the energy audit execution organization for universities and consultant companies.

(4) Post-Evaluation

JICA and the Turkish Government jointly evaluated the achievement of this project as follows.

> The Joint Evaluation Team concludes that the Project has been carried out successfully and has produced concrete outcomes. The most significant outcome is that the C/Ps at the EIE/NECC have achieved the necessary energy conservation capacity defined by the Project. The C/Ps have adopted the newly acquired skills, knowledge and attitudes in the course of the technical cooperation and been able to utilize such capacity of the operation of the EIE/NECC. Empowered capacity of each C/P is integrated into the organizational capacity of the department.

(5) Study Tour (Turkey)

(a) Purpose

The JICA Study Team guided the Steering Committee members of Serbia to share their Turkey experiences of Turkey at a training center which JICA supported to establish as mentioned above.

(b) Schedule

The schedule of the Study Tour was as follows.

Table 4-8 Schedule of the Tour

	Location	Counterpart for Meetings
Sep 20, 2010	Ankara	- JICA Turkey Office - Electrical Power Resources Survey and Development Administration (EIE) - National Energy Conservation Centre (NECC)
Sep 21. 2010	Istanbul	- Daikin Turkey Office (AC Manufacturer)

(c) Participants

The following participants joined the tour.

<Steering Committee Member>

MOME Milos Banjac (Mr.)

SEEA Vesna Rodic (Ms.)

<JICA Study Team>

Tetsuya Maekawa (Mr.)

Izumi Ouchi (Mr.)

(d) Main Discussion

(i) JICA Turkey Office

- JICA supported the capacity building of the EIE staff and provided technological assistance for energy management (2001-2006). EIE established a training center to educate candidates for the energy manager in line with the enforcement of the Energy Conservation Law in 2007. The main purpose of the center is to carry out the practical training with the major hands-on facilities. JICA granted such hand-on facilities and the Turkish Government prepared the building at that time.
- Nowadays EIE independently administers NECC and JICA has continuously supported communication efforts between third-party nations and NECC.

(ii) EIE and NECC

- Applicants for the training center have been increasing rapidly due to the enforcement of the Energy Conservation Law in 2007 and the enlarged assignment of energy managers.
- The number of applicants for the energy management training is going to exceed the capacity of the training center. So, NECC has a plan to construct an additional training center in the near future. At this moment, there are approximately 3,000 energy managers

station at 1,000 factories and 600 buildings. The required number of energy manager will rise to 5,000 in the future.

- EIE has not set a numerical target for the energy-saving challenge, but they created an incentive program to subsidize 20 % of the expense when the facilities realize an energy saving of 10 % in three years.
- The budget for NECC's administration expenditures comes from the government's general account. The income from the training fee is deposited into the general account. The expenditure and income are almost balanced, except for expenses of the third nation support.
- NECC sends out invitation letters for the training program every year, mainly for the countries around Central Asia and the Black Sea. Three applicants from Serbia have joined the training up until now.
- About 85 % is the pass rate for the energy manager. A university degree is a minimum requirement for being able to take the training program.


Figure 4-1 Hands-on Facilities of the NECC

(iii) Daikin Turkey Office

- Daikin Industries has various products in high efficiency ACs and a record to supply equipment to the Energy Conservation Technology Center (ECTC) in Poland. The Daikin Office showed a model of high efficiency AC in their showroom.
- They explained that energy conservation and a comfortable lifestyle were realized via the effective use of an inverter and high efficiency AC.

4.2.2 Case of Poland

(1) Project Background

The Republic of Poland joined the EU members in 2004 and has been promoting energy saving activities in order to conform to energy efficiency and environmental regulations of the EU. For this purpose, JICA implemented the "Project on Poland-Japan Energy Conservation Technology Center (ECTC)" and the ECTC was established at the Polish Agency for Energy Conservation (KAPE SA) to train engineers and to disseminate EE&C and start its activities with substantial support from the Warsaw University of Technology in the Thermal Engineering Institute as a

4-year JICA technology project.

Through the project, the Japanese Government donated training units for practical energy conservation lecture and training and carried out technology transfer to the Polish engineering counterparts by JICA long-term and short-term experts.

(2) Assistance from Japan

(a) Overview

Project Name	Project on Poland-Japan Energy Conservation Technology Center
Duration	From July 2004 to June 2008 (4 years)
Executing Agency	Ministry of Economy, KAPE SA
Granted Equipment	137 million JY (Training Units: Pump, Fan, Air Compressor, Boiler, Burner, and Steam Trap)
JICA Long-term Expert	Total 159 M/M (4 persons)
JICA Short-term Expert	Total 24 M/M (19 persons)
Assistance	Instruction on the training units during installation Instruction on the training text preparation for all training units Instruction on the training manual preparation for all training units Instruction on the training and exercise method Instruction on the factory energy audit

(b) Specific Training Activities

Training course for company managements and Energy Managers: seven times (participants 109 and awarded certificates 168)

International training course for Ukraine trainees: Total 1 time

Factory energy audit: Total 18 times (audit with measurement 16 times)

(3) Current Activities (as of the end of 2010)

Within 2011, the Energy Efficiency Regulation will be established after the project period and a new EE&C organization (revised from the former KAPE SA) will launch the training courses and extermination system for the energy managers utilizing the ECTC. Because the ECTC was located in the campus of the Warsaw University, it is utilized for the energy conservation training courses for students and graduates.

(4) Post-Evaluation

JICA and the Polish Government jointly evaluated the achievement of this project in 2008 as follows.

The Polish and the Japanese evaluation team have concluded that the project has largely contributed to the laying of a solid foundation for the promotion of EE&C technology and measures for industries. The cooperation between the Polish and Japanese side has been fruitful and led to the substantial improvement of EE&C knowledge and practical skills in Poland. The project has received full support from both governments. The most significant outcome is that the ECTC has been established as a unique energy conservation training center in Europe which provides a practical energy management training base on Japanese technology aimed at various industrial sectors. C/P has acquired enough skills and knowledge to launch various training programs successfully and regularly. The center has trained 586 trainees since the commencement of the project. The project has been conducted effectively and timely. With a rapid increase of energy prices, Polish society faces various challenges in defining sustainable energy policies. EU is actively enforcing actively its energy policies to all member states. The government of Poland is undertaking a series of reforms on energy policies and is preparing to enact an energy efficiency law in January, 2009. The ECTC is now ready to fulfill its role as the leading national center and will play a vital role in promoting EE&C in Poland.

(5) Study Tour (Poland)

(a) Purpose

The JICA Study Team guided the Steering Committee members of Serbia to share their Poland experiences in a training center which JICA supported to establish as mentioned above.

(b) Schedule

The schedule of the Study Tour was as follows.

Table 4-9 Schedule of the Tour

	Location	Counterpart for Meetings
Nov 8, 2010	Warsaw	- Ministry of Economy (MoE)
Nov 9, 2010	Warsaw	- Energy Conservation Technology Centre (ECTC) - Warsaw University of Technology (WUT)

(c) Participants

The following participants joined the tour.

<Steering Committee Member>

MOME Gojko Baletic (Mr.)

SEEA Dimitrije Lilic (Mr.)

<JICA Study Team>

Susumu Takahashi (Mr.)

Ran Akaike (Ms.)

(d) Main Discussion

(i) Ministry of Economy (MoE)

- The Energy Efficiency Law is expected to be enacted in the beginning of 2011. Before starting the operation of the new system, it will take about one year and half to prepare the related laws and regulations.

- The Energy Efficiency Law stipulates that the White Certificate System (CO2 emissions quotas have been set for each organization, and once the organization has fulfilled its obligation, it can trade the certified amount of the reduced CO_2 with other organizations) targeting the industrial sector. The Energy Efficiency Auditors will certify the amount of CO2 emissions reduced by the organizations. The government will call for bids for the National Energy Regulator, which will be entrusted with the training and examinations for the Energy Efficiency Auditors.
- To take a qualification for an Energy Efficiency Auditor, a Bachelor of Engineering is required. The candidates will apply for the certificate individually, and will take the technical and logic training courses which will be followed by a final examination. The certificate will be valid for one's entire career and will be accepted at any organization related to energy.

(ii) Energy Conservation Technology Centre (ECTC)

- For small/medium-size industries, 57 training courses were conducted where 880 participants were trained from 2005 to 2009.
- There are one/two-day courses for specific equipment or systems, a five-day comprehensive course, a twelve-day course for the training of European Energy Manager, and a special course made to order.
- Because the KAPE (Polish National Energy Conservation Agencies) is a joint stock company, the ECTC has to provide appropriate training courses to meet the needs of the participants for sustainable sales.
- The ECTC is ready to provide the training courses and examinations for the Energy Efficiency Auditor for the White Certificate System, which is expected to be included in the Energy Efficiency Law.

Figure 4-2 Hands-on Facilities of the ECTC

(iii) Warsaw University of Technology (WUT)

- 50 to 100 students per semester utilize ECTC facilities.
- The boiler is most utilized among the ECTC facilities.
- Placing the training center inside the university has greatly improved the students'

understanding of their studies.

Chapter 5 Questionnaire and Energy Audit Survey

5.1 Questionnaire Survey

5.1.1 Overview

In order to grasp the local technological level of the sites and available data to be reported in the event of the introduction of Energy Management System (EMS), a questionnaire and interview survey was commissioned to the local consultants. The period is approximately eight months from November 2009 to September 2010, including the energy audit survey. (There is a three month blank). It targets the industrial and building sectors. In total, 28 sites were selected in consideration of the energy consumption amount and sub-sector diversity. Local consultants visited sites and conducted interviews based on the questionnaires sent in advance. The study was divided into two surveys, one for Southern Serbia and one for Northern Serbia, based on the on limited the time-frame and the contents. The execution was commissioned by two consultants, the Serbian Industrial Energy Efficiency Network (SIEEN), and the REEC, Regional Energy Efficiency Centre (REEC), Kragujevac. The former consists of REEC Belgrade and Novi Sad, and the latter of REEC Kraljevo and REEC Nis.

The following four items are to be confirmed in this survey;

- Availability of data to be reported in the event that EMS is introduced
- Personnel capacity to deal with possible EMS
- Technological level of the sites
- Possibility of introducing energy efficient technology

An outline of the questionnaire sent in advance has been described below (Original questionnaire is attached in Appendix 1).

1. Basic Information
2. Data Availability when the Energy Management System is introduced
    - Energy data
    - Equipment data
    - Operational manual
3. Capacity/Possibility to Deal with EMS (Awareness & Activities)
    - Energy audit/assessment experience
    - Personnel capacity
    - Will for energy efficiency
4. Technological Level of Sites and Possible Technology for Improvement
    - Steam system
    - Hot water boiler system
    - Air-Compressor system
    - Chiller system

- Air-Conditioning system
- Power system
- Lighting system

5. Detailed Data: Equipment
   - Equipment capacity and energy used
6. Detailed Data: Energy
   - Monthly energy consumption of a year
   - Characteristics of energy (unit energy, tariff etc.)

5.1.2 Survey Results

Results of the survey were summarized as follows.

- In total, 28 sites (industry: 16 sites and buildings: 12 sites) were selected from various sub-sectors.
- All the sites hold and can report the data to be reported, such as annual energy consumption.
- Although both industrial and building sectors seem to be able to deal with periodical reports in terms of collecting annual energy consumption and making an equipment list, they, especially building sector needs certain support, such as experts' expertise and financial support, to make operational manuals and mid- and long- term energy efficiency plans. Building sector also needs certain support in terms of personnel capacity or its development.
- On the other hand, industrial sector is more adjustable since it has engineers within the sites or company.

The local consultants commented that it should be kept in mind that the level of sites selected for this survey must be higher than the Serbian average, since they have certain connections with the local consultants in the past who have been promoting energy efficiency.

(1) Fundamental Information of the Sites

The list of sub-sector of the sites, which were selected considering the variety of sub-sectors, is shown in the next table.

Table 5-1 Sub-Sector of the Sites

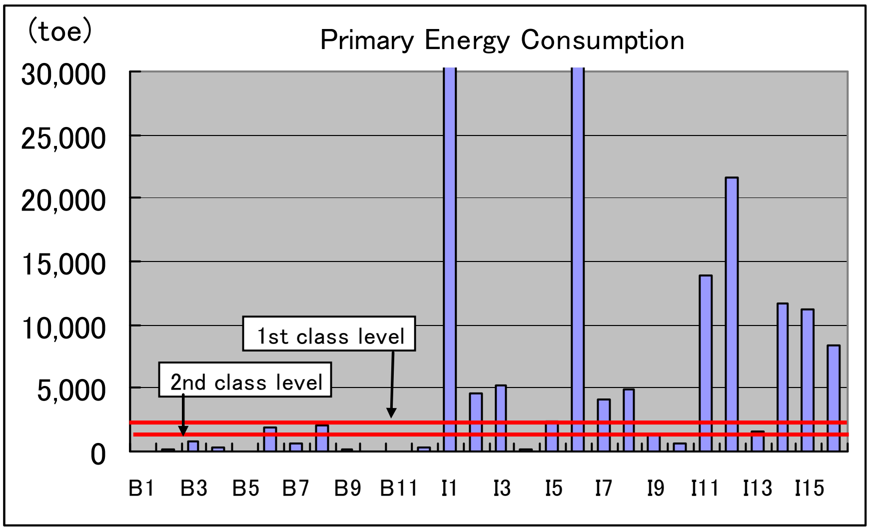
Industrial Sector		
Heavy Industry	Cement, Aluminum, Chemistry etc.	4 sites
	Furniture, Chipboard, floorings etc.	5 sites
Food Industry	Confectionary, Soybean, Vegetable Oil etc.	5 sites
District Heating	Public district heating company	1 site
Building Sector		
Commercial Service	Sports center, Shopping mall, Hotel	4 sites
Hospital	Public hospital	2 sites
Education	High school and university	3 sites
Office	Municipality office, Bank	3 sites

(2) Situation of Energy Usage

Needless to say, annual energy consumption of industrial sector generally surpasses those of building sector. The number of sites which correspond to designated consumers of Japanese EMS is shown in the next table; 1st class: annual primary energy consumption is equal to or more than 3,000 kloe, 2nd class: the same is equal to or more than 1,500 kloe. About half of the industrial sites correspond to the 1st class. Only two sites of building sector correspond to the 2nd class (The efficiency from primary energy to electricity is assumed here as one third, 1/3).

Table 5-2 Number of Sites corresponding to Designated Organizations in the Japanese EMS

	More than 3,000 kloe	Not less than 1,5000 kloe
Industrial Sector (16sites)	8 sites	2 sites
Building Sector (12 sites)	0 sites	2 sites



(Note : B# indicates buildings, and I# factories. I1 and I6 is equal to or over 30,000 toe)

Figure 5-1 Primary Energy Consumption (toe)

Regarding energy sources, although no factories utilize DH (District Heating), 8 out of 12 sites from the building sector, receive heat from DH. Thus, the efficiency improvements of DH are important. Energy sources vary more in the industrial sector; for example, they use coal, biomass and other forms of sub production as energy sources in addition to common energy sources such as natural gas, heavy fuel oil, and diesel oil.

For reference, a power ratio revealing a proportion of power out of the total energy consumption was calculated. However, it varies much over the sectors and there were no findings in particular.

(3) Availability of Data to be reported in the Periodical Report

Availability of data to be reported under the assumption that the EMS will be introduced was surveyed.

- Annual energy consumption data

  Most of the sites appeared to be capable of reporting annual energy consumption without particular difficulties. In the building sector, energy consumption is mostly confirmed by their bills of electricity and heat suppliers. In addition, a majority of the sites (22 out of 28 sites) have a person in charge of energy data recording.
- Monthly energy consumption data (which is not required to be reported in EMS, but just for reference purposes)

  Some sites maintain monthly energy consumption data. This also depends on energy sources.
- Equipment List

  Regarding the equipment list which consists of equipment consuming more than 80% of the total energy consumption, 22 out of 28 sites think that they will be able to prepare for it. However, most of the sites in building sector also mentioned that they need certain support by experts.
- Operational Manual (Management Standards)

  Although five (5) sites have operational manuals in the building sector, many of the sites require certain support by experts for the creation of management standards. On the other hand, some sites in the industrial sector already have their operational manuals for the production line.

  Necessary supports expressed in the answers are, for example, experts' support, education of employees, and the introduction of best practices (The next figure shows the answers to the question of whether or not they have operational manuals).

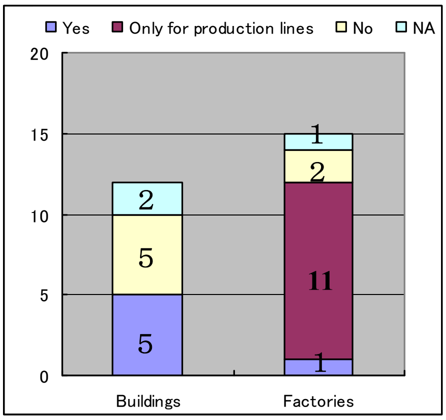


Figure 5-2 Operational Manual

(4) Capacity towards the Introduction of the Energy Management System

The survey results on capacity towards the introduction of EMS were as follows.

- Current Activities and Future Plans for Energy Efficiency

  In terms of energy efficiency, factories are more positive for energy efficiency than the buildings (the following figures).

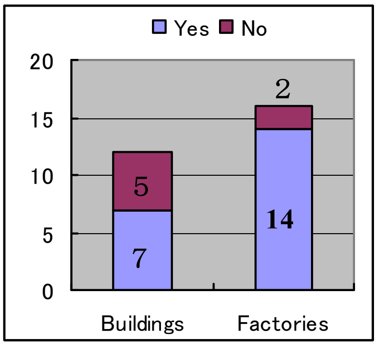


Figure 5-3 Current Activity for Energy Efficiency

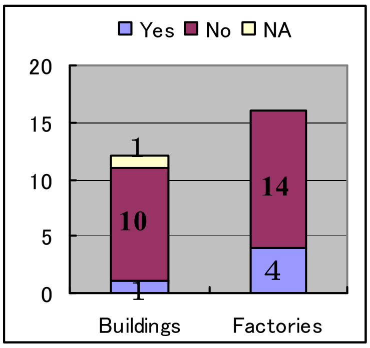


Figure 5-4 Future Plan for Energy Efficiency

- Energy Audit Experience
  About half of the factories and one third of the buildings have experience conducting energy audits. However, half of them did not implement the recommended measures due to lack of finance and confidence in the energy audit results. They hardly have any chances to receive financial support.

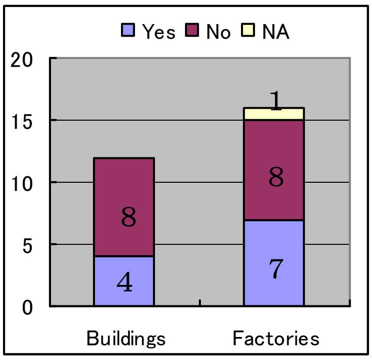


Figure 5-5 Energy Audit Experience

- Personnel Capacity
  There are a few cases that appoint a person or a team in charge of energy efficiency. Half of the factories and one third of the buildings answered that they have candidates for energy managers.

(5) Technological Level of Sites and Possible Technological Improvements

Although there are some questions to those of which answers are limited, the overall trend of technological level can be described as follows;

- Some measures dealt by operation, such as shortening lighting hours or lessening lighting equipment, have already been adopted in some cases. However, the measures of measurement or maintenance to improve the efficiency of equipment or systems have hardly been implemented.
- In addition, retrofitting (e.g. equipment replacement to more efficient ones) which requires investment has hardly been adopted and it appears that there is no desire to retrofit. Some of the reasons for this reluctance are indicated as lack of confidence in energy audit estimation such as payback period as well as a lack of the necessary finance skills.

More detailed descriptions to indicate technological level are as follows;

- Even in the industrial sector, there are some factories which are not equipped with the measurement apparatus (O2 nozzle etc.) necessary to monitor the efficiency of equipment and systems.
- Only half of the sites conduct maintenance to maintain the efficiency of equipment and systems, such as cleaning filters and checking steam traps.
- About half (to 80% depending on the items) of the sites are conducting measures dealt by operations, such as decreasing the lighting hours (lunch time off) and removing the lighting bulbs, and reducing air-conditioning use during operation hours.
- Retrofitting towards energy efficiency requires a sizeable initial investment of which steps have hardly been taken to achieve.

The technologies possibly introduced were evaluated from the questionnaire answers. They include the retrofit of equipment due to deterioration, optimum controls according to the load by utilizing inverters and thermometers, and other measures. However, optimum operations and maintenance which must be achieved at relatively low costs were hardly proposed or answered. The answers mainly concern about boilers and thermal insulation.

The outline of answered measures is shown below. For reference, a list which shows the classification of energy efficiency measures and its proposed numbers is attached in the table on the next page.

<Boiler and Steam System>

- Reconsideration of the steam supply system (boiler room location, auto-introduction of control valves etc.)
- Optimum adjustment or replacement of burners or the addition of auto-control
- Introduction of a monitoring and control system (SCADA system)
- Introduction of measuring equipment such as the O2 level and its measurement.
- Introduction of CHP（Combined Heat and Power）system

<Air-Conditioning and Ventilation System>

- Introduction of the thermo-sensor and flux regulating valves onto the heating convectors
- Introduction of inverters for pumps
- Replacement to the individual air-conditioning system (VRV)
- Introduction of inverters for ventilating fans

<Air-Compressor System>

- Control of the numbers of air-compressors in operation

<Power System>

- Introduction of the control of maximum power

<Lighting System>

- Replacement of incandescent lamps to fluorescent lamps or Compact Fluorescent Lamps

<Building>

- Improvement of the thermal insulation of walls and roofs and the improvement of air-tightness by replacing windows and doors

<Energy Source>

- Utilization of geothermal water

Table 5-3 Answered Measures and its Numbers

System	Measures*	Number		
		Building	Industry	Total
Heating	- automatic control of heating substation - developing a new central heating system - boiler house re-location - balancing heating network - oxygen trim control - waste heat utilization, cascade utilization of heat of chillers	8	5	13
Boiler	- SCADA system for boiler system - replacement of boiler with automatic burners - direct heat substations with indirect ones - O2 measurement - speed control of boiler draft fan (VSD) - reduction of combustion air	1	7	8
Steam	- automatic control according to temperature - installation of thermostatic valves - installation of biomass and CHP - VSD - steam distribution system	2	4	6
Air Compressor	- air supply control and reduction - VSD - repair and re-location	0	7	7
Air-Conditioning	- thermo-regulating valve and balancing valves - cooling by VRV - replacement of split system to central system	3	0	3
Pump	- installation of VSD system for pump	1	1	2
Power	- monitoring power consumption and power demand - power station reconstruction - analysis of electricity data	1	5	6
Lighting	- replacement of incandescent lamps to fluorescent lamps or tubes	4	1	5
Building	- insulation of outer walls and windows - replacement of roof, windows and doors	6	2	8
Monitoring	- energy management, monitoring of energy consumption	0	1	1
Maintenance	- improvement of housekeeping measures and aggressive maintenance	2	6	8
Metering	- implementation of payment system according to consumption	0	1	1
Energy source	- use of geothermal water	1	0	1
Total		29	40	69

*: Category of “Measures” depends on the category which was chosen in the questionnaires.

5.2 Energy Audit Survey

5.2.1 Overview

Initial energy audit (one day walk-through type) was commissioned to the local consultants in order to grasp the energy efficiency potential and possibility of energy efficient technology introduction. Out of the 28 sites selected in the questionnaire survey, 10 sites were selected. The survey period is the same as that of the questionnaire survey. What is to be revealed in this survey is as follows;

- Evaluation of EE&C potential for the sites and proposal of EE&C concrete measures
- Analysis on applicable EE&C technology
- Evaluation on implementation capacity of the sites for EMS

The next table shows the selected sites for energy audits from the sites for questionnaires based on such criteria as the sub-sector variety and amount of energy consumption. While almost all the sites of the industrial sector correspond to the size of the to-be-designated sites in terms of Japanese Energy Management System, no sites of the building sector correspond to the size.

Table 5-4 Sites for Energy Audits

Industrial sector			
	Sub-sector	Final energy consumption (toe)*	Primary energy consumption (toe)**
A	Cement	65,590	81,467
B	Chemical	7,600	11,758
C	Car tire	1,479	2,301
D	Food	2,685	4,818
E	Food	9,119	13,914
F	District heating***	7,893	8,151
Commercial sector			
G	University	683	729
H	Municipality	58	117
I	Special hospital	73	156
J	General hospital	197	300

*: In case the discrepancies of the data between those of questionnaires and those of energy audit, the data of the latter were used.
**: Primary energy consumption is calculated assuming the overall efficiency of power generation as 1/3.
***: Energy consumption of district heating is defined as input energy or fuel. Sold energy is included.

5.2.2 Survey Results

(1) Energy Saving Potential and Energy Efficiency Measures of the Sites

The potential proposed through the one-day walk-through energy audit is shown in the next table. The final energy consumption and potential are estimated in terms of the final energy, since the concept of converting to primary energy is not common in Serbia.

Table 5-5 Energy Saving Potential of the Sites of Energy Audit

	Sub-sector	Final Energy Consumption	Energy Saving Potential		Pay Back Period
		(toe)	(toe)	(%)	(years)
Industrial sector					
A	Cement	65,590	NA	NA	NA
B	Chemical	7,600	241	3.2	NA
C	Car tire	1,496	45	2	1.1-4.0
D	Food	2,685	687	26	0.85-4.85
E	Food	9,119	40	0.4	0.2-4.88
F	District heating**	7,893	NA	NA	NA
Commercial sector					
G	University	747	74	10	1.4-26.2
H	Municipality	58	26	45	0.4-19.8
I	Special hospital	216	11	17	3.5
J	General hospital	197	135	68	1.3-12.9

Note: When the unit of energy is not written in terms of toe in the energy audit reports, the conversion was conducted by the JICA Study Team.
In case the summation of energy potential is not explicitly shown in the reports, the summation was conducted by the JICA Study Team.

It is difficult to evaluate the trend because the number of audits is limited. The following is just an attempt to evaluate the results;

- Although the amount of energy saving potential is large in the industrial sector, its proportion is small (about 0.4 to 2 %, only one case shows 26%). However, the measures of which payback period is about less than 5 years were proposed.
- The energy saving potential percentage of the building sector appears to be rather large such as 10 to 68 %. The measures mainly consist of the ones for building envelops (such as window replacements and thermal insulation). Thus, the payback period seems to be longer compared to the ones of the industrial sector.

In evaluating the abovementioned results, the following should be noted;

- In the case of a huge factory, the measures for proposal were recognized, but the estimation of the energy saving potential was not achieved due to time and data limitations from the one-day energy-audit.

- There are some cases which show only a numerical percentage without the bases for potential evaluation. This is one of the limitations of the one-day walk-through energy audit. Thus, the estimation in this sector should be treated as reference.
- In addition, it can also be mentioned that the reliability in estimating the investment cost seems to be not so high.

The overview of the proposed measures is as follows;

1. For the industrial sector, the focus was put on air-compressors, steam systems and boilers.
    - Measurement and management of air-compressors
    - Introduction of inverters for air-compressors
    - Reconsideration of the steam supply system
    - Insulation of steam pipes and valves
    - Introduction of economizers for boilers
    - Retrofit of the boiler house
    - Appointment of the energy managers and the introduction of the energy management system
2. For the building sector, focus was placed on the building envelope and lighting system. A consideration of air-conditioning system was also raised.
    - Replacement of the doors and windows
    - Insulation and replacement of the outer walls and roofs
    - Replacement of the incandescent lamps
    - Management or operational control of the air-conditioning system

As an overall trend, the measures such as "replacement" and "reconstruction" are outstanding. The management of optimum operations and maintenance, which are low cost, such as the maintenance of steam traps are overlooked.

(2) Applicable Technologies for Energy Efficiency and the Sectorlal Potential for Energy Efficiency

Although both the industrial and building sectors have the potential for energy efficiency, due to the limited number of audits, the below is just a conjecture based on the energy audit results.

Industrial Sector

- Factories utilize large energy consuming equipment such as boilers and air-compressors. As a result, it has the potential to save energy through every phase such as through the adjustment of operation & maintenance and replacements. Although low cost measures such as operation and maintenance improvement must be effective from the experience of pilot projects, which are described later, these measures were not often pointed out in these energy audits.

- The applicable technologies are as mentioned above and the knowledge and experience of Japan can be adaptable. Existing and proven measures are required rather than the state of the art technologies.

Building Sector

- The energy saving potential of buildings seems to be high, such as the improvement of insulation and air-tightness, due to the fact that the buildings are old and poor. However, such measures require a rather big initial investment cost and long payback periods. Thus, it would be preferable to have a certain support scheme.
- An air-conditioning system (mainly heating equipment) has not been controlled in most of the cases. This provides the energy saving potential concerning the introduction of the temperature and flux control.
- Based on the interview, building sector hardly has any knowledge concerning the optimum control of facilities and is simply operating under the principle of “if it is operating, it doesn’t need to be touched.” In another words, with just some slight improvements and a change in attitude, the sector has much energy-saving potential.

(3) The Evaluation of the Site Capacity for the Energy Management System

The evaluation is basically the same as the one mentioned in the questionnaire survey results. The overall evaluation of the technological and personnel aspects can be described as follows;

- Although both the industrial and building sectors seem to be able to deal with periodical reports, they, especially the building sector needs certain support, such as experts’ expertise and financial support, to create operational manuals and mid to long- term energy efficiency plans. The Building sector also requires certain support in terms of personnel capacity or its development and financial support.
- On the other hand, industrial sector is more adjustable since it has engineers within the sites or the company.

(4) Others

This survey was commissioned to the REECs and SIEEN which was based on the universities, which are expected to play important roles in promoting energy efficiency. Other countries are already supporting in their energy audits, but the practical experiences of the measures of operation and maintenance seem to be limited. Thus, there is more room to improve their ability in the following fields;

1) Ability to propose low cost measures regarding the improvement of operation and maintenance, based on practical experience
2) Ability to roughly estimate energy saving potential
3) Ability to roughly estimate initial investment cost

In addition, the questionnaire results also present the opinion that sites cannot invest in energy efficiency due to lack of liability of the proposals through energy audits. Thus, it is essential to train more engineers who can conduct practical energy audits as described above.

Chapter 6 Pilot Implementation of Energy Management System

6.1 Overview

6.1.1 Objective

In the model sites (Factory A (Dairy Products) and Building B), the Japanese Energy Management System is introduced as a pilot implementation. It can estimate the skill level of the site staff and their capacity to make Periodical Report. Through this pilot implementation, issues and lessons are feedbacked into the design scheme of the Energy Management System for Serbia.

6.1.2 Overview

(1) Selection of Model Sites

The six candidate sites (three factories and three buildings) were short-listed by the Steering Committee. Through the site visit and the interview, two sites, out of the six short-listed candidates, namely (i) Factory A and (ii) Hospital B were selected in consideration of EE&C potential, a variety of energy consuming equipment and their strong willingness to achieve EE&C.

(2) Scope of the Pilot Implementation

The following activities have been conducted by the JICA Study Team together with the site staff. In Japan, the following activities are initiated by an Energy Manager within an organization.

Component 1: Training Program (provided by the JICA Study Team)
- Internal training program to raise awareness and skill of site staff (focus on the middle management class)

Component 2: EE&C Study (provided by the JICA Study Team)
- Initial measurement and data analysis for energy consuming equipment
- Study for EE&C potential and methods by three classes (O&M improvement, simple investment, large investment)
- Measurement for targeted energy consuming equipment between “before” and “after” EE&C (based on the proposed Management Standards)

Component 3: Periodical Report (Joint Activities by the JICA Study Team and the Site)
- Appointment of temporary Energy Manager within the site
- Discussion of format of Periodical Report consisting of energy consumption data/energy consuming equipment list, and EE&C plan that realize a certain level of improvement (ex. annual 1% improvement of energy intensity
- Collection of monthly data and making Periodical Report utilizing the temporary Energy Manager
- Proposal of Management Standards (that is O&M manual for EE&C) for energy consuming equipment (if some potential is identified)

(3) Implementation Plan

The implementation plan is as follows.

Table 6-1 Implementation Plan

	2009				2010										
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Orientation	■														
Component 1															
● Training Program (Management)			■												
● Training Program (Technical)													■		
Component 2															
● Initial Measurement			■												
● EE&C Potential Study			□	□											
● Initial Reporting						■									
● Internal Review by the Site						■	■	■							
● Trial of EE&C Actions										■	■	■	■		
● Second Measurement (before and after)													■		
Component 3															
● Assignment of Temporary EM			■												
● Discussion of Formant of Periodical Report			■							■					
● Monthly Data Collection										■	■	■	■		
● Trial of Making Management Standards										■	■	■	■		
● Making Periodical Report													■	■	
Final Reporting															■

■ Work in Serbia □ Work in Japan

6.2 Results

6.2.1 Training Program (Component 1)

(1) Objectives

The following two training programs were provided.

- Management training program for the staff of Factory A and Hospital B to raise EE&C awareness.
- Technical training program (Support program to improve the skills to write the middle and long term plan report) for the staff in charge of energy management at factories (including Factory A) and at the municipalities (including Hospital B and cities)

An additional technical training program for the staff in charge of energy management at factories and at the municipalities was planned in fiscal 2010, having acknowledged the need to support skills to write the middle and long term plan report through the activities carried out at Factory A and Hospital B in fiscal 2009.

(2) Management Training Program

(a) Site and Date

Factory A	November 5th and 6th, 2009
Hospital B	November 6th, 2009 (The second day was cancelled according to the spread of the new influenza)

(b) Target

The target of the programs is as follows. There were 12 attendees at Factory A and 15 attendees at Hospital B.

- Staff responsible for on-site energy management
- Middle managers who have their own staff
- Operators concerning energy management

Figure 6-1 TQM Training (Factory A and Hospital B)

(c) Contents

The contents covered in the program were as follows (The planned contents were same at Factory A and Hospital B). Material of the training is attached in the Appendix 2.

Table 6-2 Contents of TQM Training Program

	1st Day	2nd Day
10:00	1. Objectives and Schedule of the Training 2. General Theory of Management • What is management? • Management issues in the workplace	1. Review of the 1st Day Program 2. Cultivation of Motivation (Motivation Theory)
11:00	3. Necessity of EE&C • External factors • Internal factors	3. Communication Skill
12:00	4. Importance of Quality Control • What is Quality? • What is TQM?	4. TQM Methodology • ISO9001 and TQM • Improvement steps
13:00	5. Team Building and Leadership	• Introduction of methodology (QC 7 Tools, New 7 Tools)
14:00		5. Presentation of Certificate of Completion

(d) Results

The following are the results of the questionnaires collected from the attendees. The questionnaire survey was conducted only at Factory A, because the second day at hospital B was cancelled according to the spread of the new influenza.

Factory A : Effective Answers 5（Evaluated by 1 - 5）

Evaluation Results

Effectiveness of the training…….4.4

Evaluation of each item: Objective……..…………….4.2

Contents……………………4.6

Instructor (facilitation)……4.8

Duration……………………4.8

Teaching Materials………..4.8

Environment……………….5.0

Content you want to learn further: Data of energy consumption at a similar factory

Examples of EE&C in Japan

QC tools

(e) Points of Reflections and Lessons on Administration

The following are the points of reflection and lessons regarding the administration of the training programs.

Table 6-3 Reflection and Lessons

	Points of Reflection	Lessons
1	Because the teaching materials were in English, some of the attendees whose English ability was limited were less interested.	Not only an interpreter but also teaching materials in the local language should be prepared.
2	It took some time to create an atmosphere conducive to hearing the opinions of the attendances, because the training room was furnished with a big round table, which interfered with their group discussion.	The desks and chairs should be arranged in a classroom style, which can be easily rearranged, in order for seminars including group discussions.
3	-	The trainer wrote on a paper hung on the wall to share the comments from the attendances, which helped better their understanding.
4	While the presence of an interpreter helped non-English speakers' participation, it also diminished the degree of interactiveness and quickness.	-
5	-	The teaching materials (ppt. documents) were not distributed in the beginning of the training, which enabled the trainer to capture the attention of the attendances.

(g) Analysis

An analysis of the executed training programs is as follows.

- The attendees in the managers' positions lack a management perspective. For example, they do not correctly acknowledge internal office problems at their offices nor do they seem to understand the importance of taking responsibility for problems that arise, and appear to be operating under the assumption that problems can be solved by simply throwing money at them.

- Although the attendees were informed that the program's objective was management awareness enhancement, they requested a technical training program. To enhance the management awareness, a program should be focused on management training that covers not only conceptual management but also EE&C and related examples.
- The training program should be targeted for managers and operators respectively, because there is a considerable gap between managers and operators in terms of a sense of purpose and techniques.

According to the aforementioned analysis, the training programs for Energy Managers and operators should be separated. Each program should cover the following points.

Points: Energy Managers

Items such as the Construction of the framework to promote EE&C and an execution of EE&C measures, Methods of data measurement and its analysis, EE&C activity examples, and how to write Periodical Report should be learned systematically.

Points: Operators

The skills of EE&C measures (boiler, compressor, pump, etc.) should be focused. Not only theoretical but also practical drills such as the operation of devices and visits to factories versed in good practices should be covered in the training program. It is also important to introduce items like TQM tools to support building a mechanism to promote EE&C in the workplace.

(3) Technical Training Program for the Energy Manager in Factories and Municipalities

(a) Place, Time and Date (Three days each: Two-day Lectures and One-day Factory Walk-through)

Training in Belgrade	2010/9/14, 15, 16
Training in Kragujevac	2010/9/21, 22, 23

(b) Trainees

The staff in charge of energy from the factories and the municipal organizations in each region joined.

Figure 6-2 Technical Training Courses (Belgrade (Left) & Kragujevac (Right))

(c) Program (same contents in Belgrade and in Kragujevac except Day 3): Presentations are attached in Appendix 2

- Day One

  EE&C methods at factories/ buildings

  - Introduction of EMS (tentative) in Serbia
  - The methods of organizational EE&C promotion
  - The means of EE&C (i.e. the ways to find the defects, the chart for calculating the effects of the improvements and the method of its utilization) for the utilities at factories and buildings (i.e. boilers, pumps, blowers, compressors)

- Day Two

  Instruction on making the Periodical Report including Middle and Long Term Plan Report

  - The creation methods of the Periodical Report and Mid-term/Long-term report
  - Case studies of the boilers, pumps, compressors, and lights (The trainees were divided into two groups and each group gave presentations after the discussions.)

- Day Three

  Walk-through and a demonstration audit at a factory

  - Belgrade: A paper manufacturing company (nine trainees)
  - Kragujevac: An electric wire manufacturing company (fourteen trainees)

The programs for the lectures were as follows.

Table 6-4 Programs of Technical Training Courses

	1st day	2nd day
9:00-12:00	1. How to promote EE&C factory activities 1. How to improve the EE&C of utility energy For instance, boiler, steam system, pump, compressor, blower, lighting and others	1. Introduction of scheme of Periodical Report 2. Explanation of formats of Periodical Report & how to prepare Periodical Report
12:00-15:00	1. How to promote EE&C building activities 2. How to improve the EE&C of energy equipment on building For instance, heat source and heat conveying equipment, air conditioning, lighting and others	1. Explain how to prepare a Middle and Long Term Plan Report 2. Give exercise tasks concerned with utility facilities to attendees and attendees to try to examine the exercise tasks of each group 2. Announcement of the exercise answer per each group 3. Explanation of one of the example answers for the exercise tasks

(d) Results

The results of the questionnaires collected at each training courses are as follows.

Table 6-5 Results of the Questionnaires

	Belgrade (14 answers)			Kragujevac (15 answers)		
	Yes	To some extent	Not especially	Yes	To some extent	Not especially
1. Were you interested in the lectures on EE&C at factories?	13/14	1/14	0/14	15/15	0/15	0/15
2. Were you interested in the lectures on EE&C at buildings	14/14	0/14	0/14	14/15	1/15	0/15
3. Were you interested in the lectures on the preparation methods of the periodical report?	13/14	1/14	0/14	13/15	2/15	0/15
4. Mid/long-term Report 4-1. Did you understand the contents of improvement in the lecture?	12/14	2/14	0/14	13/15	2/15	0/15
4-2. Did the case study help your understanding?	14/14	0/14	0/14	14/15	1/15	0/15
5. Will the lectures be of help in the future?	14/14	0/14	0/14	13/15	2/15	0/15
6. Will you incorporate the principle learned into your workplace?	9/14	4/14	1/14	11/15	4/15	0/15
7. Did the lecturer make effective use of the time available?	8/14	5/14	1/14	10/15	5/15	0/15
8. Was the number of trainees appropriate?	Yes 11/14	No 3/14		Yes 15/15	No 0/15	

The comments and impressions given by the trainees in the questionnaires are as follows.

- The program and the teaching materials were very useful because they were highly practical and applicable to the daily work. (There were many similar comments)
- The interpreter was not able to accurately translate some of the technical terms.
- Lectures concerning new energy, the introduction of the ESCO business, the introduction of the smart grid, and further EE&C cases in Japan are to be expected.

(e) Administrative Reflection and Lessons

The reflection and lessons learned from the training courses are as follows.

Table 6-6 Reflection and Lessons

	Reflection	Lessons
1	There were some trainees who were not engineers. They were not many in number, but most of them were not able to actively participate in the discussion.	Appropriate training materials should be prepared for each of engineer and non-engineer. This time the contents targeted the engineers.
2	Some trainees may not have fully understood the training materials because they were in English.	Translation of the training materials needs to be considered.
3	There was not enough time to verify the trainees' grasp of the materials presented to them.	The training should be divided into the beginners' course and the advanced course. Some methods of testing the trainees' understanding should be prepared to make the course more fruitful.
4	At the electric wire manufacturing company, the trainees watched and heard an explanation of the measurement methods of the current and pressure of the compressor, but the time was not enough.	Enough time should be reserved for the walk-through in order to find more points to improve and enrich the contents of the training course.

(f) Analysis

The analysis of the training of the engineers capable of practical work is as follows.

- Each group discussed the cases to discover the defaults in terms of the EE&C, which were welcomed by the trainees and helpful to enhance their understanding.
- Considering that many participants were interested in the training course utilizing the practical materials, these types of programs should be arranged in more places throughout the country in order to turn out sufficient EE&C engineers in Serbia.
- It can be more efficient by having a training course targeting middle-class engineers who are in charge of the practical work of EE&C.
- It is important to include a walk-through in the program. This time, the trainees were given instruction of the processes to find out EE&C measures by utilizing the data of the electric current showing the operating conditions of the compressor. Giving an explanation based on the real data attracted the trainees and led to their better understanding. It is desirable to provide an audit demonstration, the analysis for EE&C measures using the collected data, and the calculation of the effects.
- Additionally, the audit of an operating boiler and calculating the amount of heat can be very effective in training EE&C engineers and in supporting the trainees to acquire auditing and in measuring the effects.

(4) Other (Training Program for Instructor)

The training program was conducted for the future Energy Manager instructors of the Energy Management System to provide know-how in the planning and administration of the training program. This is also one of the pilot implementation activities.

(a) Venue and Date

Room 518, Belgrade University November 9th, 2009

(b) Target

REEC, University staff, SEEA (15 participants)

Figure 6-3 Instructor Training

(c) Contents

The contents covered in the program are as follows. Material of the training is attached in the Appendix 2.

Table 6-7 Contents of Instructor Training Program

	1 Day
10:00	1. Objectives and Schedule of the Training
	2. Each Participant's Task as an Instructor (group discussion)
11:00	3. How to Plan Training Program
	• Grasp needs
	• Understand the restrictions
12:00	• Effective training methods etc.
13:00	4. Instruction Skills
	• Delivery, how to ask and answer questions
	• How to use various tools
14:00	5. What is TQM?
	• Objectives of TQM (How it relates to ISO)
	• Keywords of TQM
	• Steps for improvement
15:00	6.Future Tasks, Questionnaire
16:00	7. Presentation of Certificate

(d) Results

The following are the results of the questionnaires collected from the attendees.

Instructor Training: Effective Answers 15 (Evaluated by 1-5)

Evaluation Results

Effectiveness…….4.7

Evaluation of each item: Objective……..…………….4.9
Contents……………………4.7
Instructor (facilitation)……5.0
Duration……………………4.2
Teaching Materials………..4.4
Environment……………….4.7

Other opinions: It needs more time (ex. 2 days)

Content you want to learn further: TQM, Project Cycle Management (PCM),
Statistical treatment
Planning of Energy Manager's Training

(e) Consideration

The JICA Study Team received the following impressions regarding the training program.

- Trainees recognized that there were various methodologies (group discussion, case study, roll playing, etc.) for training and that such methodologies were more effective for energy efficiency training.
- Trainees recognized that other fields such as TQM, PCM, and 6 Σ statistical treatment were effective for energy efficiency training.
- In order to improve an instruction skill continuously, an advisory framework that realizes the evaluation of a personal skill or receives advice from other persons within a team or partner might be effective.

<Reference> Various Types of Methodologies for Training

Methodology	Advantage	Disadvantage
Lecture	・Much information can be transferred to trainees within in a short time. ・High trainee acceptability rate ・Easily implemented Time Management	・It is not easy to keep attention of trainees. ・It is not easy to determine whether the trainees understand or not.
Group Discussion	・An environment conducive to problem-sharing ・It is easy to encourage practice. ・Opinions can be shared among trainees.	・It takes a long time. ・It is not easy to control the discussion.
Case Study	・It might lead a practical resolution via discussion. ・It is more practical.	・Contingent on the capability of facilitator's skill. ・It takes a long time.
Roll Playing	・It might lead to a practical resolution via discussion. ・It is more practical. ・It has practical experiences. ・It can observe various communication styles.	・If this methodology is not understood well, it might not be effective. ・There is a risk that role playing does not match the trainees. ・It depends on the capability of the facilitator's skill.

6.2.2 EE&C Study (Component 2)

(1) Objectives

The EE&C study and the review of the results of the study countermeasures have the following objectives.

- Understand the series of EE&C activities in which Energy Managers play a key role by implementing the activities in the corporation within the site and the JICA Study Team
- Commonly recognizing a series of EE&C activities such as the standard case based on this report

(2) Work Schedule (Actual Results)

The following table shows the actual work progress of the EE&C study. In addition to these visits the JICA Study Team paid several visits for other purposes, and this table reveals only the EE&C study work.

These activities were fundamentally carried out by two heat and electricity specialists of heat of EE&C technology in the JICA Study Team. Depending on the scale and complexity of the facilities in the site that has been targeted for the study, in general this formation would be preferable for the EE&C study because of their double-verification and mutual confirmation characteristics.

Table 6-8 Work Schedule (Actual Results)

	Stage	Activities	A Factory	B Hospital
1	Stage of Preparation	Request to fill out questionnaires about energy consuming facilities and energy consumption	Oct. 21 (1 person)	Oct. 22 (1 person)
2		Collection of questionnaires and clarification of the contents	Oct. 28 (2 persons)	Nov. 2 (2 persons)
3	Stage of Energy Audit	Energy audit via a site inspection survey (including measurement)	Oct. 29, Nov. 3 (2 persons)	Nov. 6 (2 persons)
4		Analyses of energy audit results and creating energy audit report by the JICA Study Team	Net 2 weeks (2 persons)	Net 2 weeks (2 persons)
5		Reporting the energy audit results	Feb. 9 (2 persons)	Feb. 12 (2 persons)
6	Stage of Follow up at the Sites	Implementing the EE&C measures (installing insulation jackets) and measurements	Feb. 9	Feb. 12
7		Comments from the site on energy audit results	Feb. 23	-
8		Reporting on the effect of EE&C measures (installing insulation jackets)	Feb. 23	-

* The follow-up stage is to be continued.

(3) Study Results（Factory A）

The results of the study at Factory A have been summarized below. The detailed results are attached in Appendix 3.

(a) Outline of the Site

The outline of site is as follows.

Organization:	Private Company
Number of Employees:	450
Operation Hours:	365 days, 24 hours
Energy Consumption (Electricity):	5,403,000 kWh/y (19,450 GJ) in 2008FY
Energy Consumption (Heavy Fuel Oil):	2,229 ton/y (Oct 2008- Sep 2009)
Total Energy Consumption:	116,515 GJ/y
Main Products:	Dairy Products (Yogurt, Milk, Cheese, etc.)

Figure 6-4 Scenery of Factory A

(b) Major Energy Consuming Facilities

Steam Boiler

No.1 : 3.5 t/h, 10.5 bar, Heavy Fuel Oil

No.2 : 8.0 t/h, 10.5 bar, Heavy Fuel Oil (Main Boiler)

No.3 : 3.5 t/h, 10.5 bar, Heavy Fuel Oil

Air Compressor

No.1 : 756 m3/h, 8 bar, 82 kW, FIAC AIR BLOK 100

No.2 : 830 m3/h, 8 bar, 75 kW, Atlas Copco

Receiving Power Transformer

No.1 : 1,000 kVA

No.2 : 1,000 kVA

(c) Unit Price of Energy

Electricity:	3.4 RSD/kWh (0.035 €/kWh)
Heavy Fuel Oil:	37.4 RSD/kg (0.376 €/kg)

(d) Summary of the EE&C Study Results

The results of the EE&C study conducted by the JICA Study Team are shown below. 11 items for EE&C were recommended to the site.

Table 6-9 Recommended 11 Items

No.	Item	Kind of Saved Utility	Reduction of Utility Consumption /year	Reduction of Utility Cost €/year	Investment €	Payback Period year	Remarks
1	Reduction of Evaporation Steam Pressure at Boiler	Fuel Oil	37 ton	13,900	None	0	1) In case of the pressure 10.5 →8 bar 2) In production area as well, the pressure should be lowered as low as possible.
2	Insulation on Non-Insulated Valves, etc.	Fuel Oil	51 ton	19,200	15,000	0.8	
3	Management of Steam Traps	Fuel Oil	67 ton	25,200	10,000	0.4	1st year
4	Steam Condensate Recovery	Fuel Oil	118 ton	44,400	100,000	2.3	
5	Installation of Economizer at 8t/h Boiler	Fuel Oil	55 ton	20,700	70,000	3.4	
6	Decrement of Compressed Air Pressure	Electricity	14,800 kWh	520	None	0	
7	Decrement of Leaking Compressed Air	Electricity	35,100 kWh	1,230	2,000	1.6	1st year
8	Changing the Operation Pattern of Atlas Copco and FIAC AIRBLOCK Air Compressor	Electricity	75,000 kWh	2,630	None	0	
9	Replacing Incandescent Lamps to CFLs (Compact Fluorescent Lamps)	Electricity	57,800 kWh	2,000	650	0.3	
10	Replacing Ballast of Fluorescent Lamps to Hf lamps	Electricity	22,600 kWh	800	4,000	5.0	
11	Adding Leading Phase Condenser (reactive power compensation unit) to the Power System	Electricity	1,717,000 kvarh	7,250	–	–	

(e) Discussion with the Site regarding the Recommended Items

The JICA Study Team discussed the contents of the recommended 11 items with the person in charge of energy in the site. As a result, 8 items except No.6, No.10 and No.11 were targeted to be examined by the site. The remaining three items (No.6, No.10 and No.11) were excluded from consideration due to the following reasons.

- No.6: It was judged that the measure would be difficult considering the present status.
- No.10: Long payback period (5 years)
- No.11: The measure was already completed after the EE&C Study

The EE&C potential of the said eight items excluding the three items is shown in the following table. Assuming the eight items are achieved, these are expected to bring a 13 % reduction of heavy fuel oil consumption and a 3.1 % reduction of electricity consumption. In other words, the cost saving amount is expected to be 129,260 Euros/year against the investment amount of 197,650 Euros.

Table 6-10 EE&C Potential of the Selected 8 Items

Utility	Annual Utility Consumption	Quantity of Reduction	Factor of Intervene	Corrected Quantity of Reduction	Rate of Reduction	Reduction of Utility Cost	Investment	Payback Period	Remarks
	ton or kWh	ton or kWh		ton or kWh	%	€	€	y	
Fuel Oil	2,229	328	0.9	295	13.2	123,400	195,000	1.6	Item-1,2,3,4,5
Electricity	5,403,000	167,900	-	167,900	3.1	5,860	2,650	0.5	Item-7,8,9
Total	116,515 GJ	14,887 GJ	-	13,398 GJ	11.5	129,260	197,650	1.5	NHV of Heavy Fuel Oil:
	32,358 MWh	4,134 MWh		3,721 MWh					43.544 GJ/ton

(f) Sample of EE&C Measure (Insulation Jacket)

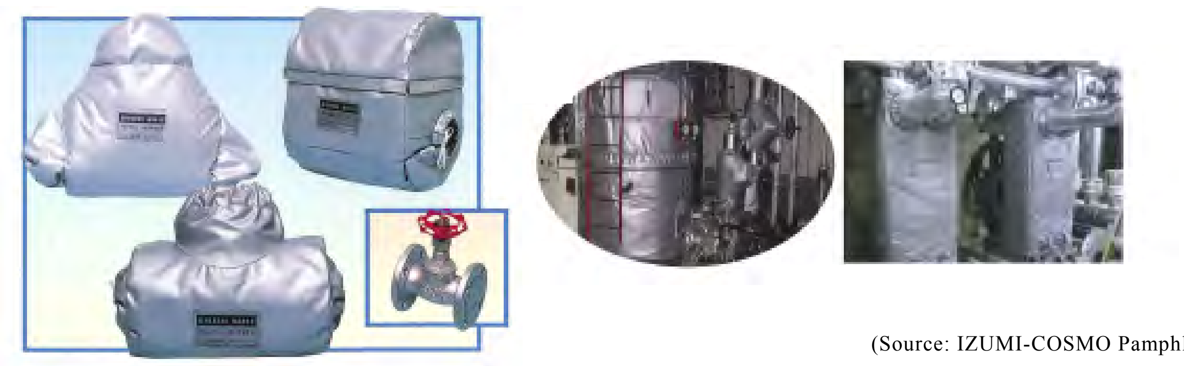
Among the 11 items recommended by the JICA Study Team, the No.2 ”Insulation on Non-Insulated Valves” was implemented as an actual demonstration so as to prevent heat radiation by insulating non-insulated valves. In Japan, insulation jackets are generally used, and on the other hand in Serbia, their application would be limited.

Because the insulation jacket can be easily installed within a short period of time and the effects can be easily confirmed, the insulation jackets procured in Japan were installed on four non-insulated valves in Factory A, the results of which were subsequently confirmed.

(i) Specifications of Insulation Jacket

Manufacturer:	IZUMI-COSMO COMPANY, LIMITED
Insulation Material:	Glass Wool
Insulation Thickness:	30 mm
Covering Material:	Silicon Cloth
Service Temperature:	- 40 ℃ ─ + 200 ℃
Application:	Valve, Flange, etc.
Flange、Valve Spec.:	DIN-PN16

<u>Valve Size</u>
2 inch, 3 inch, 4 inch, 5 inch,
6 inch, 8 inch



(Source: IZUMI-COSMO Pamphlet)

Figure 6-5 Examples of Products of Insulation Jackets and the Installation

(ii) Installation of Insulation Jackets

The following shows the installation of the insulation jackets on 4 non-insulated valves (2 inch x 1, 3 inch x 1, 4 inch x 2) at Factory A. The insulation jackets were easily installed within 10 minutes, because the precise shape and size had been grasped.

Figure 6-6 Installation of Insulation Jackets (Left: Before Installation, Right: After Installation)

(iii) Measurement Results of the Effects

The following table shows the results of the measurements and calculations. As a result, it was confirmed that the actual insulation efficiency was higher than the theoretical calculations (90.0 %- 90.7 %).

Table 6-11 Effects of Insulation Jacket

Valve Size inch	Ambient Temp. ℃	Surface Temp. ℃		Heat Radiation kJ/h		Insulation Efficiency %	
		Non-Insulated	Insulated	Non-Insulated A	Insulated B	Result (1-B/A)x100	Theoretical Calculation
2	26	185.2	45.5	2,569	210	91.8	90.0
3	26	185.2	45.5	4,455	313	93.0	90.5
4	26	185.2	45.5	5,560	391	93.0	90.7

(4) Study Results（Hospital B）

The results of the study at Hospital B are summarized below. The detailed results are attached in Appendix 3.

(a) Outline of the Site

The outline of the site is as follows.

Organization:	Public Hospital under Ministry of Health
Business Hours:	365 days, 24 hours
Energy Consumption (Electricity):	3,165,778 kWh/y (11,396 GJ/y) in 2008 FY
Energy Consumption (Natural Gas):	463,413 Sm3/y (15,782 GJ/y) in 2008 FY
Energy Consumption (Heavy Fuel Oil):	0 ton/y (Emergency use only) in 2008 FY
Total Energy Consumption:	27,163 GJ/y
Total Floor Area:	31,516 m^2 (40 buildings)

Figure 6-7 Scenery of Hospital B

(b) Major Energy Consuming Facilities

Steam Boiler

No.1 : 2.1t/h, 1.05 bar, Natural Gas

No.2 : 1.1 t/h, 1.05 bar, Heavy Fuel Oil (Standing-by)

Hot Water Boiler

No.1 : 2.9 MW, Natural Gas

No.2 : 2.9 MW, Heavy Fuel Oil (Standing-by)

Receiving Power Transformer

No.1 : 600 kW

No.2 : 400 kW

(c) Unit Energy Price

Electricity: 4.5 RSD/kWh (0.045 €/kWh)

Natural Gas: 30 RSD/Sm3 (0.302 €/Sm3)

(d) Summary of EE&C Study Results

The results of the EE&C study conducted by the JICA Study Team are shown below. Seven items for the EE&C were recommended to the site.

Table 6-12 Recommended 7 Items

No.	Item	Saved Utility	Reduction of Utility Consumption /year	Reduction of Utility Cost RSD/year	Investment RSD	Payback Period year	Remarks
1	Improvement of Steam Boiler Efficiency Case-1 : Replacement of burner Case-2 : Replacement of boiler	Natural Gas	11,600 Sm3	348,000	Case-1: 1,480,000 Case-2: 4,000,000	Case-1: 4.3 Case-2: 11.5	1) Changing to continuous combustion from intermittent combustion 2) Considering the worn-out of steam boiler (installed in 1982), it would be better to replace with new one.
2	Insulation on Non-Insulated Valves, etc. at Steam System	Natural Gas	13,000 Sm3	390,000	700,000	1.8	
3	Management of Steam Traps	Natural Gas	9,000 Sm3	270,000	200,000	0.7	1st year
4	Improvement of Hot Water Boiler Efficiency	Natural Gas	7,340 Sm3	220,000	200,000	0.9	
5	Installation of Thermostatic Valves for Radiators and VWV system	Electricity	65,700 kWh	295,700	3,500,000	12	
6	Replacement of incandescent lamps to CFLs	Electricity	219,000 kWh	985,500	280,000	0.3	
7	Replace ballasts of fluorescent lamps to Hf lamps	Electricity	1,500 kWh		-	5 - 10	

(e) Discussion with the Site regarding the Recommended Items

The JICA Study Team discussed the contents of the recommended seven items with the on-site person in charge of energy. As a result, a decision was made to exclude the following two items due to the following reasons.

- No.5: A review the overall hot water circulation system was required
- No.7: There is a long payback period

As for the other five items, the site could not judge the adoption of each measure, because the Ministry of Health is in charge of planning investment.

The EE&C potential of the five items (excluding No.5 and No.7) are shown below. Assuming that the five items are achieved, these are expected to yield a 8.8 % reduction of natural gas consumption and 6.9 % reduction of electricity consumption. In other words, the cost saving amount is expected to be 2,213,500 SDR/year against an investment amount of 2,860,000 SDR.

Table 6-13 EE&C Potential of the Selected 5 Items

Utility	Annual Utility Consumption Sm3 or kWh	Quantity of Reduction Sm3 or kWh	Factor of Intervention	Corrected Quantity of Reduction Sm3 or kWh	Rate of Reduction %	Reduction of Utility Cost SDR	Investment SDR	Payback Period y	Remarks
Natural Gas	463,413	40,940	0.9	40,940	8.8	1,228,000	(1-Case-1) 2,580,000	2.1	Item-1,2,3,4
Electricity	3,165,778	219,000	-	219,000	6.9	985,500	280,000	0.3	Item-6
Total	27,163 GJ	2,183 GJ	-	2,183 MW	8.0	2,213,500	(1-Case-1) 2,860,000	1.3	NHV of NG:
	7,544 MWh	606 MWh	-	606 MWh					34.058 MJ/Sm3

(f) Sample of EE&C Measures (Insulation Jacket)

In Hospital B as well, an insulation jacket has been demonstrated and the effects have been confirmed by measurement.

(i) Installation of Insulation Jackets

The following figure shows the installation of an insulation jacket on a 6-inch non-insulated valve in Hospital B.

Figure 6-8 Installation of Insulation Jacket **(Left: Before Installation, Right: After Installation)**

(ii) Measurement of the Results of the Effects

The following table reveals the results of the measurements and calculations. As a result, it was confirmed that the actual insulation efficiency was higher than theoretical calculations (89.8 %).

Table 6-14 Effects of Insulation Jacket

Valve Size inch	Ambient Temp. ℃	Surface Temp. ℃		Heat Radiation kJ/h		Insulation Efficiency %	
		Non-Insulated	Insulated	Non-Insulated A	Insulated B	Result (1-B/A)x100	Theoretical Calculation
6	20	109.2	31.6	4,326	384	91.1	89.8

6.2.3 Trial for Creating Periodical Report (Component 3)

(1) Objectives

Creating a Periodical Report is one of the main activities within a designated organization or site, initiated by the Energy Manager. Through a trial of creating the Periodical Report in the pilot site, the JICA Study Team can grasp the skill level and receive feedback regarding the scheme design of the Energy Management System.

(2) Main Activities

This component is a trial implementation utilizing the Energy Management System and the following activities are executed in a mandatory way. Given that the format of the Periodical Report and the Management Standards should be adjusted according to the capacity level of a site, the JICA Study Team will revise the original format. The trial has been implemented at Factory A.

- Assignment of the Energy Manager
- Discussion of the Format of the Periodical Report
- The Trial of Creating a Periodical Report
- Trial of Creating Management Standards

(3) Results

(a) Appointment of the Energy Manager

The Director, the focal point of the A factory for this project, was selected as a temporary energy manager in terms of position and ability. He will be appointed as an energy manager when the Energy Management System is implemented. He also adheres to the application criteria set down for the Energy Manager as well as possessing sufficient ability to fulfill his duties as an energy manager. At this moment, energy efficiency is not his mission, but he and his team understands energy efficiency well and is doing what they can do when possible.

It can be induced from the pilot project that factories over a certain size would have qualified engineers for Energy Managers and would not have difficulties in appointing an Energy Manager. However, at this moment without any incentives, it is rare to clearly set energy efficiency as one of their responsibilities. It will be necessary to give authority within the company for promoting energy efficiency.

(b) Discussion on the Periodical Report Format

A draft format of the Periodical Report was presented and it was understood without problems.

(c) The Trial to Create a Periodical Report

A draft format was understood easily, as mentioned above, and it will not be difficult to create a Periodical Report with their data. However, there are slight differences in the degree of difficulty amongst items (refer the next table).

It was difficult to decide what should be the denominator of energy intensity, which should have strong relations with energy consumption, since the data of energy consumption is only for two years. It might be possible to find standardized items and the amount through analyzing the energy intensities of various products, but here raw milk, which is the main material of the factory, was temporarily adopted for this project due to a lack of data.

Table 6-15 Items of the Periodical Report and Degree of Difficulty

	Periodical Report	
	Contents	**Degree of Difficulty**
1	Energy consumption calculation sheet	**Easy:** The data of energy and water is easily collected. So as the water consumption
2	Energy consuming equipment list and its operational status	**Moderate:** It is not so difficult to make a list, but it requires a certain amount of paper work. When it requires an estimation of the amount of energy consumption for each piece of equipment, it will become rather difficult.
3	Calculation of energy intensity	**Rather difficult:** Choosing the denominator of the intensity, which has a strong relationship with the energy consumption, is difficult, since they were not able to collect enough data easily to see its correlation. The data for two years was not enough for the analysis. They decided to use the “amount of raw milk” temporally.
4	Historical trend of energy intensity	**Moderate:** When the denominator of the energy intensity was decided, it would be rather easy to calculate. However, the data was not limited for two years when beginning.
5	Numerical target and reasons if not achieved	**Moderate:** Even if they could not reach the target, it was evaluated that they can explain the reasons.
6	Compliance with EE&C guideline	**Probably easy:** There would be no problems to report the compliance status with EE&C guidelines.
Middle and Long Term Plan for EE&C		
	Contents	**Degree of Difficulty**
7	EE&C investment plan and its effects	**Moderate:** They will be able to conduct energy audits and make a plan for EE&C, although it will require a certain amount of work.

(d) Creating Operational Standards

The samples of Operational Standards have been presented and its objective, contents, items were understood. However, due to time constraints, operational standards for general issues and boiler and steam systems were temporarily made. Although the factory shows enough understanding of management with records or documents and easily understands operational standards, it was difficult to practically use operational standards at this stage, namely before the implementation of the mandatory scheme, EMS.

(4) Feedback to Scheme Design

Through this pilot project, the following points can be induced;

- Industrial sites can make operational standards when the samples of operational standards are provided. However, it requires a certain amount of work. If such work is asked, it is necessary to conduct data collection, study for optimal operation and decision of operational standard value, etc. To do this work, mandatory scheme might be necessary.
- Industrial sites already hold the necessary amount of data for facility operation. It will be additionally required to systemize the data adapting to the Energy Management System.
- Industrial sites, which will be targeted in the EMS, have candidates for Energy Managers and will have no problems in setting up an organizational structure for energy efficiency.
- Industrial sites may require some support (training program for how to create) in order to create mid- and long-term energy efficiency plans through energy audits. They will easily evaluate the measures and execute them.

Chapter 7 Basic Policy for Scheme Design

7.1 Basic Approach

The scheme design of the Energy Management System takes into account Serbia's current situation such as existing organization and related schemes, as well as other countries experience including EU. Workflow of the scheme design is shown below.

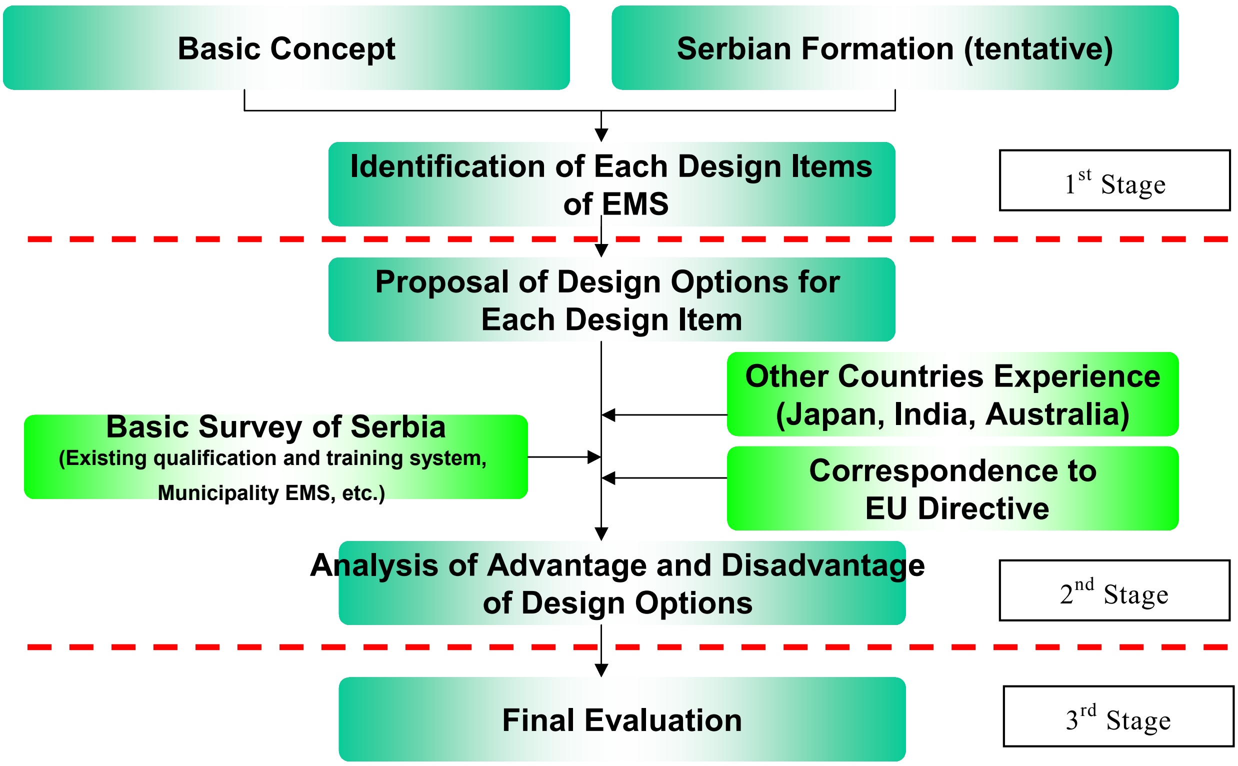


Figure 7-1 Workflow of Scheme Design of Energy Management System

As shown in the above workflow, the overall work is divided into 3 stages below. At each stage, consultation with the Steering Committee (MOME, MOF and SEEA) was made for decisions concerning the scheme design. In addition, workshops to collect stakeholder's opinions were periodically conducted.

1st Stage	Making a consensus of the basic concept of EMS, formation and design items of EMS
2nd Stage	Proposal of design options in each design item, in consideration of existing relating system and other countries' experiences, and analysis of the advantages and disadvantages of the design options
3rd Stage	Final evaluation of each design item

7.2 Consideration Points for Scheme Design

As mentioned above, the scheme design considers the existing relating system and other countries' experiences. The following points to consider are described below.

7.2.1 Existing Relating System of Serbia

(1) Municipality Energy Management System (MEMS)

(a) Overview

(i) History

Based on article 7 and 9 of the Energy Law (2004), municipalities must submit their energy plans and energy balance upon MOME's request. In order to correspond with the request, the Municipality Energy Management System (MEMS) was planned to be introduced and the pilot project was started in 2007 with the assistance of the Norwegian Government. Currently the MEMS are voluntary based activities executed by 37 municipalities (as of 2009).

The following items are required by the MEMS toward municipalities. In the MEMS, those requirements are initiated by a responsible person, the "Municipality Energy Manager", assigned by each municipality.

- Collecting data via the "Questionnaire" and monitoring on energy consumption and energy costs in public consumption facilities, as well as in other facilities on the energy demand side.
- Preparation of the municipal energy balance in accordance with the recommended or prescribed methodology.
- Preparation of the municipal energy plan in accordance with the recommended or prescribed methodology.
- Identification of energy saving possibilities, and preparation and execution of energy-efficiency projects and the use of renewable energy sources in the public consumption sector.

(ii) Monitoring Targets of MEMS

MEMS targets the following facilities. Regardless of the volume of energy consumption, all municipality buildings, municipality-related facilities, municipality-funded facilities, public utilities owned by municipalities and public lighting are monitored.

▪ Administrative buildings, or spaces used by: - The buildings of the municipality and municipal services (court, police, etc.) - Community health centers - Kindergartens - Local communities - Schools
▪ Other establishments that the municipality looks after and if they are financed from the municipal budget
▪ Sports and recreation centers in the ownership of the municipality
▪ Public utility companies observed through their service or production function: - City/town district heating plant - Company for distribution of natural gas - Company for water supply and sewerage - Company providing the services of public transport
▪ Public lighting

(Source: Guide for Preparation of Municipal Energy Balances, MOME 2007)

(iii) Municipality Energy Manager

In the currently system, the Municipality Energy Manager is appointed by the mayor of the municipality and authorized by MOME through a registration procedure. The authorization is judged by job experience. However, the procedure is not official as of today.

MOME issued a guideline, "Guide for Preparation of Municipal Energy Balance (2007)" and it describes expected tasks of the Municipality Energy Manager as follows.

- Collection, follow-up and analysis of data related to energy purchases, transformation and consumption in public utility companies, in public buildings, and in other systems belonging to the public consumption facilities, as well as in other buildings on the side of energy demand;
- Collection, follow-up and analysis of other information relevant to energy production, transformation and consumption;
- Regular periodic reporting to the municipal energy board on collected data, with the presentation of energy consumption and energy costs as well as other relevant data;
- Direct cooperation with the municipal energy board in preparation of reports for the municipal government or for higher state authorities, making proposals of required measures and preparation of projects;
- Preparation of the municipal energy balance in accordance with the prescribed methodology;
- Preparation of the municipal energy plan in accordance with the recommended or prescribed methodology;
- Identification of technical possibilities for energy saving in public utility companies, public buildings and other systems belonging to the public consumption buildings, as well as in other buildings on the side of energy demand;
- Identification of possibilities for the use of renewable energy sources in the territory of the municipality, and particularly in public utility companies, public buildings and other systems belonging to the public consumption facilities;
- Identification of economic operation measures in public utility companies, public buildings and other systems belonging to the public consumption facilities;
- Preparation of projects for energy-saving or use of renewable energy sources, as well as making required technical and economic analyses;
- Identification and proposing methods of financing projects for saving energy or use of renewable energy sources (budget transfers, donations, loans, performance* contracting, etc.);
- Preparation and/or monitoring of the execution of public purchases of energy sources for public utility companies, public buildings and other systems belonging to the public consumption facilities;
- Preparation and/or monitoring of the execution of public purchases of relevant equipment and works for the current and investment maintenance of public utility companies, public buildings and other systems belonging to the public consumption facilities;
- Preparation of public purchases for the execution of projects for energy saving or use of renewable energy sources;
- Monitoring of the execution of projects for energy saving or use of renewable energy sources;
- Maintaining communication with the employees in public utility companies and public buildings related to energy issues;
- Identification of needs for energy-management related training of the employees in public utility companies, public buildings and other systems belonging to the public consumption facilities;

(iv) Questionnaire

Questionnaire survey is the method to collect data and information from each monitoring facility. The questionnaire is sent to the site energy managers (if he/she stations), and is filled by the site energy managers under the supervision of the Municipality Energy Manager. The answers to the questionnaire are collected by the fiscal year (January to December). The questions inquire into the energy usage situation of each main facility for the analysis of EE&C potential and the energy efficiency plan.

The contents of the questionnaire are as follows.

Tab 1.1	Title and classification
Tab 1.2	Address and the contact person of the building
Tab 1.3	Financing of energy costs, as well as costs of current and investment maintenance
Tab 1.4	Basic data on the building

Tab 1.5	Services – technologies – Energy sources
Tab 1.6	Electricity tariffs
Tab 1.7	Monthly electricity bills
Tab 1.8	Water payment details
Tab 1.9	Water Bills
Tab 1.10	Details on the payment for energy sources (use this table for each energy source, except for electricity)
Tab 1.11	Bills for energy sources due on a yearly payment basis – do not fill in for energy sources with the monthly payment basis
Tab 1.12	Total consumption and expenditure for energy sources on a yearly payment basis
Tab 1.13	Bills for energy sources with monthly payments
Tab 1.14	Total consumption and costs for the energy sources on a monthly payment basis
Tab 1.15	Total annual consumption and costs of energy sources, except for the electricity and district heating which are collected at a flat rate
Tab 1.16	Bills for district heating which is paid at a flat rate on a monthly basis
Tab 1.17	Estimated needs for implementation of the EE measures (one or more measures)
Tab 1.18	Observations and Comments
Tab 1.19	Energy indicators of the building (auto-calculation)

(v) Energy Balance

Municipality Energy Manager is responsible for compiling municipal energy balance based on the answers to the questionnaire. The monitoring target of the energy balance is the same as the MEMS (i.e. Municipality's facilities). The municipal energy balance is created for the following objectives.

- Estimation of actual energy consumption
- Analysis of total energy costs
- Analysis of actual energy efficiency
- Abstract of EE&C potential
- Abstract of EE&C measures
- Provision of short, middle and long term plan

(b) Scheme Design-Points to Consider

The Study has been conducted to formulate a nation-wide Energy Management System (nation-wide EMS). If the nation-wide EMS covers a Municipality Energy Management System (MEMS) that has been already introduced as the pilot stage, the scheme design of the nation-wide EMS should consider corresponding with the existing MEMS as much as possible, not to avoid confusion. The consideration points are as follows.

- Terminology and methodology used in MEMS
- Reporting format and questionnaire format between the nation-wide EMS and MEMS
- Reporting format from municipality to MOME
- Qualification method of the Energy Manager in the nation-wide EMS and MEMS
- Annual schedule of the nation-wide EMS and MEMS

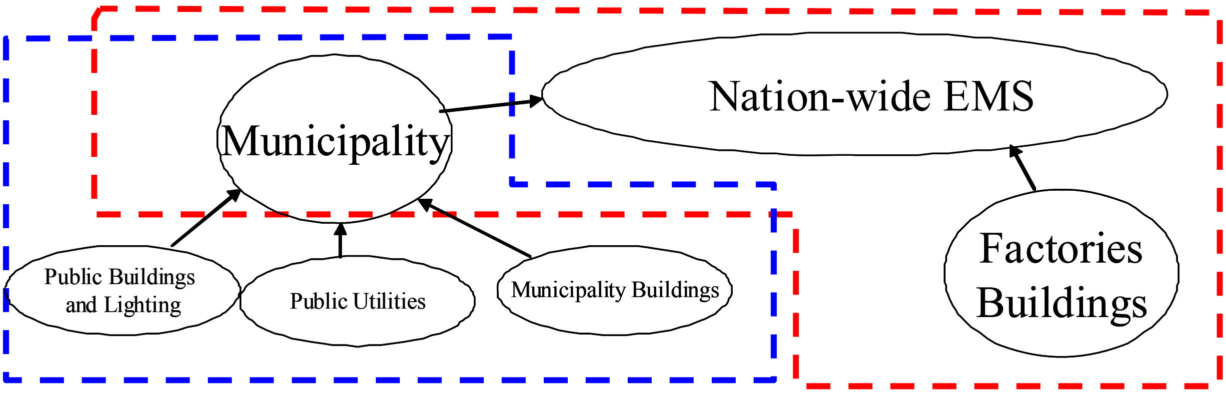


Figure 7-2 Image of Linkage between EMS (Red Column) and MEMS (Blue Column)

(2) Database (DB) System

(a) Existing System

Three existing systems are introduced as follows.

- SEEA's Energy DB
- SIEEN's Benchmark DB
- MOME's Geographic Information System – Database (GIS-DB)

SEEA's Energy DB and SIEEN's Benchmark DB were established under the support of EU and the Norway Government respectively. Both of the DB systems were made from the direct collection of consumer energy consumption data. Currently MOME operates and maintain GIS-DB but this does not have any energy consumption data yet. MOME has a plan to link the analysis results of future EMS data to GIS-DB and enhance the roles of current GIS-DB.

(b) SEEA Energy DB

(i) Overview

SEEA established the Energy DB in 2002 supported by EU, aiming at data collection from large-scale energy consumers. The data had been collected via the questionnaire survey. However as the data were not collected from all energy consumers, it cannot be said that all energy consumption data was fully covered. The DB has not been updated since 2002.

The SEEA's Energy DB display energy consumption data and records by individual consumer, and it can easily arrange data in order to analyze it. Samples of such analysis results are shown in the following table (A and E are introduced as samples).

A. <u>Annual final energy consumption (1999-2002) by industrial sub-sectors</u>

B. Time series final energy consumption (1999-2002) by industrial sub-sectors

C. Production index by industrial sub-sectors at 1990 =100 (1999-2002)

D. Final energy consumption at 1990=100 by industrial sub-sectors （1999-2002）

E. <u>EE&C potential by industrial sub-sectors (2002)</u>

Table 7-1 Annual Final Energy Consumption of Industrial Sub-sectors (2002)

OVERVIEW OF FINAL ENERGY CONSUMPTION IN INDUSTRIAL SECTORS/BRANCHES IN 2002.

(energy consumption in 1000 toe; lower heating value of oil equivalent is 41,800 kJ/kg)

INUSTRIAL SECTOR	INDUSTRIAL BRANCH	Final Energy of Fossil Fuels			Heat Energy	Electric Energy	TOTAL
		Solid	Liquid	Gaseous			
		(1000 toe)	(1000 toe)	(1000 toe)	(1000 toe)	(1000 toe)	(1000 toe)
BLACK METALLURGY	**Black Metalurgy**	**187**	**0**	**142**	**55**	**29**	**411**
METALLURGY OF NON-FERROUS METALS	Production of Ores of Non-Ferrous Metals	4	9	-	-	27	39
	Production of Non-Ferrous Metals	25	2	0	3	10	39
	Processing of Non-Ferrous Metals	-	1	0	0	11	11
	Total for the Sector *	**29**	**11**	**0**	**3**	**47**	**90**
INDUSTRY OF BUILDING MATERIALS	Production of Stone, Gravel and Sand	5	4	-	-	3	11
	Production of Building Materials	45	75	266	0	46	432
	Total for the Sector *	**50**	**78**	**266**	**0**	**49**	**443**
CHEMICAL INDUSTRY	Production of Basic Chemical Products	0	49	321	75	54	498
	Processing of Basic Chemical Products	0	2	3	11	21	36
	Total for the Sector *	**0**	**51**	**323**	**85**	**75**	**534**
INDUSTRY OF NON-METALS	Production of Non-Metallic Minerals	0	5	0	-	2	7
	Processing of Non-Metallic Minerals	2	2	98	2	11	114
	Total for the Sector *	**2**	**7**	**98**	**2**	**12**	**121**
TEXTILE INDUSTRY	Production of Textile Materials	0	2	1	9	11	22
	Production of Final Textile Products	1	3	22	4	9	38
	Total for the Sector *	**1**	**5**	**23**	**12**	**19**	**60**
WOOD INDUSTRY	Production of Wood Timber/Lumber	-	0	-	3	2	5
	Production of Final Wood Products	0	0	-	5	9	13
	Total for the Sector *	**0**	**0**	**0**	**8**	**11**	**18**
FOOD INDUSTRY	Production of Food Products	22	77	90	72	60	321
	Production of Animal Food	0	0	0	1	2	3
	Production of Beverages	0	14	12	11	13	52
	Total for the Sector *	**22**	**91**	**102**	**84**	**76**	**375**
METAL INDUSTRY	Production of Plants/Machines	0	1	3	2	8	13
	Production of Traffic Vehicles	0	4	2	8	13	27
	Processing of Metals	1	2	17	1	35	56
	Production of Electrical Machines and Devices	0	2	2	2	12	18
	Total for the Sector *	**1**	**9**	**24**	**12**	**69**	**115**
PULP AND PAPER INDUSTRY	**Production and Processing of Paper**	**2**	**6**	**5**	**65**	**16**	**94**
ENERGETICS WITHOUT ELECTRIC POWER INDUSTRY	Production of Coal	5	10	-	-	44	58
	Production of Naphtha and Natural Gas	-	-	5	-	1	6
	Production of Naphtha's Derivates	-	30	22	97	10	158
	Total for the Sector	**5**	**39**	**27**	**97**	**55**	**222**
OTHER INDUSTRY	Building of Ships	0	0	0	-	1	1
	Production of Leather and Fur	-	1	-	2	1	4
	Production of Leather Shoes & Gallantry	0	0	0	0	1	1
	Processing of Gum	0	1	3	22	11	36
	Production and Processing of Tobacco	0	1	1	2	2	6
	Graphical/Printing Services	0	1	0	0	4	5
	Recycling of Raw Materials	0	0	0	-	1	1
	Production of Various Products	-	-	2	-	1	3
	Total for the Sector	**0**	**4**	**6**	**26**	**21**	**57**
TOTAL	**TOTAL**	**298**	**301**	**1015**	**449**	**478**	**2540**

(Source: SEEA Database)

Table 7-2 EE&C Potential by Industrial Sub-Sectors (2002)

Breakdown by Sector and Energy Consumption of the Serbian Industry** for the year 2002.									Potential for Energy Savings**** (percent)		Share of Energy Cost over Total Production Cost
Industry Sectors	Number of Companies***			Energy Consumption			Energy Consumption Share	Average Consumption (1000 toe/co)			
	Small *	Medium	Large	Electricity (GWh)	Fossil Fuels (1000 toe)	Total Energy (1000 toe)			Measures A	Measures B	
Black Metallurgy	0	2	11	337.85	382.33	411.43	16.2%	31.65	5 to 7%	5 to 13%	20 to 40%
Food Industry	179	189	124	870.14	301.29	376.23	14.8%	0.76	8 to 18%	12 to 30%	10 to 40%
Chemical Industry	23	67	38	863.32	459.77	534.13	21.0%	4.17	2 to 5%	20 to 25%	10 to 40%
Metallurgy of Non-Ferrous Metals	1	6	16	553.30	43.43	91.08	3.6%	3.96	2 to 4%	10 to 15%	20 to 40%
Industry of Building Materials	44	76	23	560.23	393.04	441.29	17.4%	3.09	10 to 20%	10 to 30%	10 to 40%
Metal Industry	72	210	181	799.60	44.90	113.77	4.5%	0.25	-	-	5 to 15%
Industry of Non-Metals	5	19	22	149.58	107.20	120.08	4.7%	2.61	10 to 12%	15 to 20%	5 to 30%
Textile Industry	31	87	100	219.31	40.49	59.37	2.3%	0.27	12 to 15%	15 to 17%	5 to 15%
Pulp and Paper Industry	5	9	14	185.95	76.44	92.45	3.6%	3.30	12 to 14%	14 to 16%	5 to 30%
Wood Industry	23	72	33	124.04	7.60	18.29	0.7%	0.14	-	-	5 to 15%
Industry of Energetics (excluding Electric Power Industry)	11	7	21	625.02	167.16	220.99	8.7%	5.67	7 to 12%	15 to 25%	10 to 30%
Other Industry	73	118	68	248.33	38.25	59.63	2.3%	0.23	5 to 10%	10 to 15%	-
TOTAL	**467**	**862**	**651**	**5536.69**	**2061.90**	**2538.75**	**100.0%**	**1.28**	**73 to 117%**	**126 to 206%**	**9.5 to 30.5%**

* Small Industrial Company has up to 60 employees;
Medium Industrial Company has from 61 to 250 employees;
Large Industrial Company has more than 250 employees.
** Only active Industrial Companies for which the Republic Statistical Office has data.
*** Numbers of active Industrial Companies are corresponding to the year 2000.

**** Data estimation published for the World Bank publication "Industrial Energy Rationalization in Developing Countries", Copyright 1986.
Measures from group 'A' - short-term, low-cost measures
Measures from group 'B' - longer-term, more expensive measures (% of energy savings potential in addition to measures 'A')

(Source: SEEA Database)

(ii) Consideration Points for Scheme Design

SEEA's Energy DB can show information on energy consumption in the industrial sector, and the DB can easily analyze and rearrange the data into summary tables as mentioned the above.

When the data collected through the Energy Management System is arranged, the concept of SEEA's Energy DB might be referred for the newly developed DB for Energy Management System (hereinafter "EMS-DB"). However, in order to avoid duplicate data in the entire task, it is recommended that this SEEA'S Energy DB is not used for the newly DB system.

(c) SIEEN's Benchmark DB

(i) Overview

The SIEEN's Benchmark DB collects data for energy consumption and productivity of participating companies in the Serbian industrial sector, and. By the information, the participants can know their own position among the same sub-sector. As of 2009, 900 participants have been registered including Norway's network. Out of 900, 60 Serbian participants have been registered.

The features of the DB are as follows.

- Voluntary participants input their company's data that is protected with confidentiality.
- Input data such as energy consumption and production by products are also entered into the DB. The data are entered by themselves through internet directly, or by SIEEN's staff who obtains such data through a questionnaire sheet.

- The benchmark of same categorized participants is calculated by SIEEN, and indicated in the SIEEN DB as Specific Energy Consumption (SEC).
- For a factory to make several kinds of products from different industries like the food industry, energy consumption coefficients are measured by products. By using the coefficients, the product volume of each product is converted into one product. The total product volume that is obtained by the summation of adjusted product volumes of each product. The energy intensity is calculated by the total energy consumption divided by the total product volume.
- The data is calculated by factory or by the branch office like the Japanese EMS.

(ii) Consideration Points for Scheme Design

The SIEEN's DB strengthens the benchmark method (that is a comparison of the efficiency position among the sites). The methodologies of data collection and disclosing such data from the SIEEN's DB can be referred to the Serbian EMS. In the SIEEN's DB, when several kinds of products in a factory are produced, conversion factors are needed for unifying energy consumption of the products. However it seems that such a calculation process is established by a lot of analysis for making such conversion factors. Besides, it cannot be denied that the conversion factors include the estimation error and heterogeneous difference in the factories. Therefore it might be difficult to adopt the same methodology to indicate benchmarks in the Serbian EMS-DB.

(d) MOME's GIS-DB

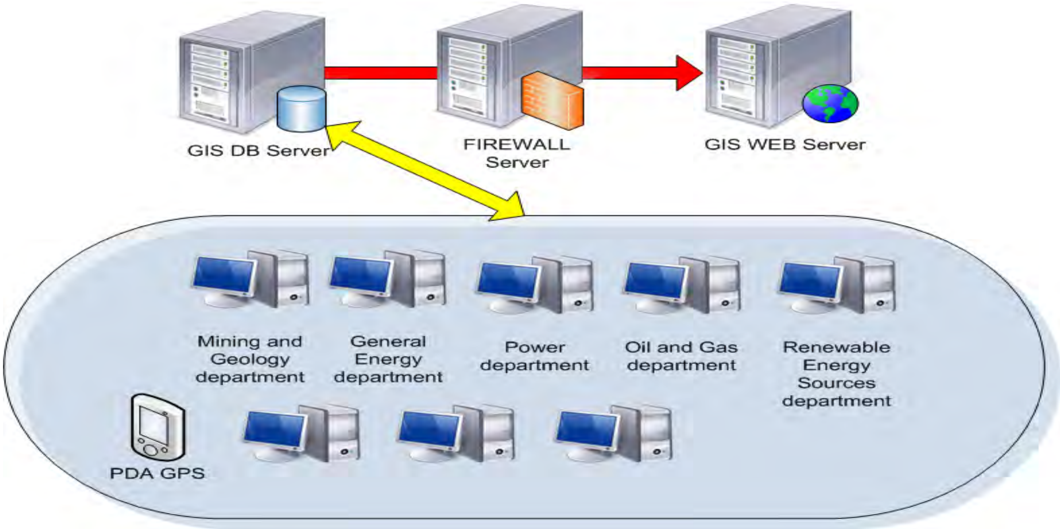
(i) Overview

MOME retains the GIS-DB and manages deposits and locations of mining and energy resources (metal, industrial resources and energy) in Serbia. The system has been developed by a donation from the France Government. Map scale in the DB is displayed with 1:250,000, and resource deposits and locations are displayed in the level of the district. The GIS-DB is operated in the computers (IBM) of MOME.

(Source: MOME)

Figure 7-3 Components of GIS-DB

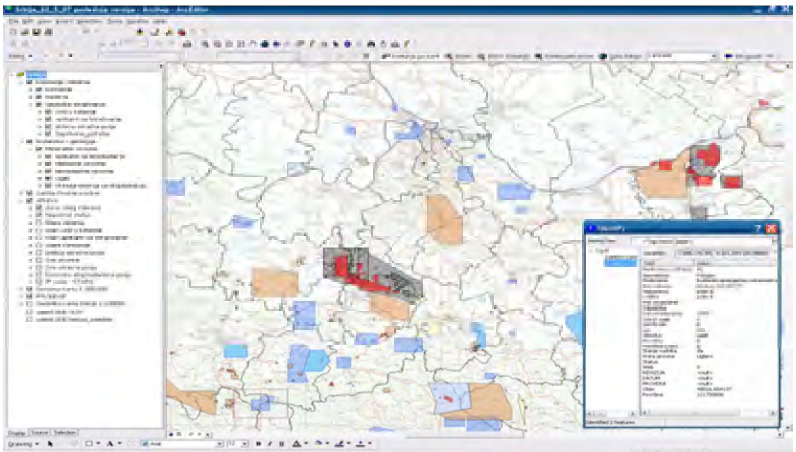
"The Study on Master Plan for Promotion of Mining Industry in Serbia" implemented by JICA in 2007-08 assisted the formation of the GIS-DB.



(Source: MOME)

Figure 7-4 LAN of GIS-DB

The following figure is a sample of a district map in GIS-DB. The total number of mining location records is 199. The record has information of deposit maps, geological layers, ages, main mineral ores, economical data, environmental data and ecological distribution etc. Out of such information, the 12 main locations have enough information.



(Source: MOME)

Figure 7-5 Sample Screen of GIS-DB (Deposit Map)

(ii) Consideration Points for Scheme Design

MOME wishes to formulate the new EMS-DB for Serbia using SQL2005 platform like GIS-DB. This has an advantage that existing regional data in the GIS-DB can be utilized in the EMS-DB in common.

(3) Current Qualification System

(a) Existing Qualification System

In order to design the qualification system of the EMS regarding the Energy Manager and the Inspector, the information of the following existing qualification system was collected for reference purposes

- Licensed Engineer
- Diploma Engineer
- Inspector

(b) Licensed Engineer

(i) Overview

The Licensed Engineer System authorizes the qualified engineers who are eligible for scrutinizing and approving design documents and drawings of buildings and plant construction. It was regulated in "The Law on Planning and Construction" by the Ministry of Planning and Construction in June 2003, and now is under the control of the Ministry of Environment and Spatial Planning (MOESP).

This system is a bit similar to the authorized architect and builder system in Japan but the biggest difference is that it covers not only buildings but also all kinds of structural construction objects.

(ii) Fields of Engineering in the Licensed Engineer

The following fields have been prepared for the Licensed Engineer.

- Space Planners
- Architectural Engineers
- Civil Engineers
- Mechanical Engineers
- Electrical Engineers
- Other Graduate Technical Engineers

(iii) Serbian Chamber of Engineers

The Serbian Chamber of Engineers is an organization responsible for issuing and maintaining the license although the qualification examination has not been directly conducted by the organization. In addition to the issue and maintenance of tasks, the organization provides some supporting services such as issuing periodical journals (3 times in a year) and training programs, etc. to the licensed engineers (members).

The Licensed Engineers must be a member of The Serbian Chamber of Engineers and pay 65 Euros as an annual membership fee in order to maintain its membership. When they join the association, an authorized seal of the licensed engineer will be awarded and design drawings and documents are required to have the seal affixed prior to launching the construction work.

Now there are approximately 20,000 licensed engineers in Serbian Chamber of Engineers and the Serbian Chamber is operating in conjunction with the Chamber of the Licensed Engineer of other European countries.

(iv) Examination for Licensed Engineers

The examinees must have more than three years of practical work experience for university graduates or more than five years of practical work experience for college graduates. In the beginning, the examinees have to receive recommendation papers from two Licensed Engineers and must attend training seminars on the related regulations and standards. After that, the examinees can take the paper examination. After passing the paper examination, the examinees must perform two cases of actual design work. The results of the design and the passing of an oral examination are the final hurdles that must be overcome in order to become a fully Licensed Engineer. The examination fee costs 250 Euros.

(c) Diploma Engineer

Graduates from the technology faculty of a university will be awarded a Diploma Engineer qualification if they pass the internal examination of their company after a half a year of job experience. This is not a national qualification, but the Diploma Engineers can have this title put on their name card.

(d) Case of Pressurized Vessel Inspector (MOME)

(i) Overview

In Serbia, there are inspection systems in each regulating Ministry for public safety and security. Normally MOME staff who are technical university graduates are appointed as Inspectors by the Ministry. Any official specific conditions are not required for the appointment.

In the case of MOME, there are several types of Inspectors, such as the pressurized vessel (gas tank, gas bomb and boiler), mine safety and electric facilities safety.

In this Study, the case of inspection for pressurized vessels has been surveyed as follows.

(ii) Conditions to be Inspected in the Pressurized Vessel

The conditions to be inspected by the MOME Inspectors regarding pressurized vessel are as follows.

- Pressure is not less than 1 Bar, not less than $0.3\,m^3\cdot$Bar, and a vessel that handles gas steam and hot water, etc.
- Material inspection in the manufacturing factory
- Installation inspection at its installed site –welding part or safety valve inspection, etc
- Internal inspection of the welding part and material thickness measurement every three years and pressure-resistant tests every six years
- Special post-accident inspections
- All expenses will be covered by the ministry

(iii) Steps in the Inspection

Necessary steps for the inspection are as follows.

- The factory will request the inspector a preset site inspection during the manufacturing period. A special inspection may be carried out when there is a neighborhood complaint.
- The inspector will announce a 3-year factory inspection at least 24 hours in advance
- A special inspection will be executed soon after the accident.
- If the vessels are manufactured in a foreign country, a document examination by the authorized organization will be applicable. In the case of EU member countries, inspections will not be acceptable if the product is manufactured based on the EU Directive.
- When the inspector points out any defects, he can order the operation to be suspended.

(iv) Implementation Structure

MOME Inspectors are organized as follows.

- Normally the inspection will be carried out by one inspector and it will take one or two days.
- There are ten inspectors in the MOME.
- One inspector visits five factories and numerous sites per month (on average).

(e) Case of Building, Spatial Planning, Environment Inspector (MOESP)

(i) Overview

MOESP regulates the inspection of environmental affairs and buildings and there are the following eight inspection fields.

- Protection and use of natural goods and resources
- Environmental pollution protection
- Water pollution protection and fishery
- Cooperation of inspection with international networks, local self-government and integrated approach on the border
- Hazardous and other waste management control
- Chemical accidents
- Republic construction inspection
- Republic urbanistic inspection

(ii) Number of Inspectors and Assignments

Inspectors are allocated based on the managed object of the republic level, the local government level and the municipality level. The numbers of inspectors are shown below.

- National level

  Environment 122, Building and spatial planning 10
- Local government level

  Environment 16, Building and spatial planning 3

- Municipality level
  Environment Approx. 200, Building and spatial planning Approx. 400

(iii) Steps in the Inspection

Necessary steps in the inspection are as follows.

- Annual inspection will be planned in the Ministry based on the previous year's achievements. The period of the inspection is not regulated but based on the related laws and regulations.
- Inspectors may sometime provide advance notice prior to a site inspection but more often than not conduct inspections without notice. Hence, one cannot usually predict when an inspection will be executed
- The chief inspector performs inspections eight times a month and the regular inspector conducts inspections 15 times a month.
- Construction work approval and the inspection of big projects such as hydro power plants, wide scale roads and large bridges are executed at the republic level.
- Inspection of buildings will be carried out at the municipality level.
- If measurement activities are required for the inspection, the inspectors will pick its sample at the site and request the measurements to the authorized republic organization.

(iv) Penalties

In the event that the inspection reveals some problems, the following treatments are to be considered.

- There are three types of penalties, namely light faults (verbal warning), faults (written warning and review), and serious faults (criminal indictment). In the case of an indictment, the final penalty will be decided by a court. In FY 2009, the annual number of indictment cases came to about 40.
- The inspector will send improvement orders to a site's business division if the air pollution value exceeds standard levels such as Sox emissions. If the site does not make any effort to improve, they will be convicted. However, when actual implementation of countermeasures is difficult (ex. Sulfur desulfurization equipment), the inspector and the site manager should negotiate for future improvement plans.

(f) Consideration Points for Scheme Design

Based on the experience of dealing with existing qualification system in Serbia, the consideration points for the EMS scheme design have been summarized as follows.

(Consideration Points from the Licensed Engineer System)

- ◆ Membership fees financially support the maintenance of the total system
- ◆ Members can enjoy the services of membership, which has issues of periodical journals including important information and training programs.

(Consideration Points from Diploma Engineer System)

- ◆ In Serbia, technical university graduates are highly respected (more so than in Japan), and this status has been one of the important conditions for some technical licenses.

(Inspection System Consideration Points)

- Inspectors are stationed in the Ministry and enjoy the status of being one of the Ministry's staff.
- Because safety and/or environmental violations can seriously affect human health and security, an inspection that results in a conviction can result in a heavy penalty being leveled. However, since energy management violations do no directly affect the security and health of human beings, the resulting conviction penalties are considerably lighter.

(4) Training System

(a) Overview

The existing training system for EE&C has been developed and implemented by SIEEN and REEC with the assistance of the EU and the Norwegian Government. The training programs with certification examination have been provided to factory engineers and municipality staff in the system. The programs cover comprehensive contents from basic theory to individual technology in EE&C and spend 1 to 4 days in the classroom.

Through the implementation of the aforementioned system, lecturers and textbooks have been matured in SIEEN and REEC.

SIEEN has prepared 12 textbooks in EE&C as shown below.

Best Practice Booklet 1: Energy Efficient Electro Drives
Best Practice Booklet 2: Energy Efficiency Improvements in Compressed Air System
Best Practice Booklet 3: Energy Efficiency in Steam Supply and Condense Return Systems
Best Practice Booklet 4: Energy Efficiency in Electromotor Drives
Best Practice Booklet 5: Modern Systems for Combustion
Best Practice Booklet 6: Improvement of Energy Efficiency in Energy Production in Industrial Boiler Systems

(b) Consideration Points for Scheme Design

Basic programs in the training system for Energy Management System have been already developed. So the Study can focus on a training program for specific themes of the Energy Management System. In other words, the Study proposes a training program including an EMS guidebook with an explanatory note, legal interpretation, method of making Periodical Report and a description of the qualification and tasks of the Energy Manager.

7.2.2 Other Countries' Experience in the Energy Management System

Japan, India, Thailand and Australia have introduced the Energy Management System and their comparisons are made in Chapter 2. From their comparisons, implementation formation and a trend of key design items are summarized as follows.

Table 7-3 Implementation Formation of Each Country

Category	Executing Agency
Monitoring and Inspection	In Thailand and Australia, the Ministry directly handles these tasks. In Japan, the local offices of METI handle them. In India, a designated agency by the state Government handles them.
Training and Exam. of Energy Manager	In Thailand, the Ministry manages these tasks. In India, a Government agency is responsible. In Japan, METI appoints and entrusts an autonomous agency.
External Mandatory Energy Audit	Only India obliges designated organizations to conduct a mandatory external energy audit.

Table 7-4 Key Design Items of Each Country

Design Items	Trend
Designated Organizations	Japan, Thailand and Australia designate factories and buildings that have a certain volume of energy consumption. India designates large energy consumers from 9 designated industries.
Threshold	All 4 countries have each threshold for designation.
Monitoring Energy	All 4 countries monitor fuel, electricity and heat. In Japan, primary energy consumption is monitored, and final energy consumption is monitored in the other 3 countries. In Japan, renewable energy is neglected from the energy consumption to be monitored.
Monitoring Boundary	Japan, India and Thailand monitor by site. From 2010, Japan introduces by company as well. Australia monitors by corporation (group companies).
Responsible Person for Energy Management	Japan, India and Thailand each have an appointed Energy Manager. In Australia, a corporation's representative is appointed as a responsible person of energy management.
Qualification of Energy Manager	Japan and Thailand use both a national examination and a training program with certification examination for qualification. In India, a national examination is the only one qualification method used.
Periodical Report	Japan, India and Thailand have an annual basis reporting system. In Australia, reports are submitted in 5 year cycles.
Inspection	All 4 countries can dispatch an inspector to designated organizations who are judged as poor managers.

7.2.3 EU Directives

(1) Overview of EU Directive

EU Directive is a legislative act of the EU that requires member states to achieve a particular result without dictating the means of achieving that result. Basically member states comply with the requirements of the Directive according to the situation of each state. Serbia is waiting to become an EU member states within several years. In this context, Serbian EMS should be designed in consideration of related EU Directives.

The following EU Directives which relate to the scheme design of the Serbian EMS are introduced as follows. These Directives stipulate requirements for nation-wide strategies and energy management methods to promote a rational use of energy in the consumption sector.

- ◆ 2006/32/EC on energy end-use efficiency and energy services
- ◆ 2002/91/EC on the energy performance of buildings

(2) Consideration Points to Comply with EU Directives

Terminology and general instructions like the evaluation methods in the EMS design should corresponded to those of the EU Directives. In addition, some requirements described in the Directives also take into account the EMS design as much as possible.

2006/32/EC on energy end-use efficiency and energy services **(<u>Underlined</u> is consideration points)**

1. General Targets
   - <u>National Indicative Energy Savings Target (9 % by 2016)</u>
2. Energy End-Use Efficiency in the Public Sector
   - <u>Public Sector has to adopt at least 2 measures in Annex VI</u>
3. Energy Distributors/Operators and Retail Sales Companies
   - Provision of statistical information
   - Provision of competitively priced energy services, energy audit or funding mechanisms
   - Provision of voluntary agreements such as white certificates
4. Availability of Information
   - <u>Information provision on energy efficiency mechanisms, financial and legal frameworks</u>
5. Availability of Qualification, Accreditation and Certification Schemes
   - <u>Appropriate qualification, accreditation and certification schemes for providers of energy services energy audits and energy efficiency improvement measures</u>
6. Financial Instruments for Energy Savings
   - Repeal or amendment of national legislation and regulations that unnecessarily impede use of financial instruments for energy savings
   - Making model contracts for those financial instruments
7. Energy Efficient Tariffs and Other Regulations for Net Bound Energy
   - Removal of incentives in transmission and distribution tariffs to unnecessarily increase energy volume
8. Funds and Funding Mechanism
   - Establishment of funds to subsidize the delivery of energy efficiency improvement programs and measures (grants, loans, guarantees, etc.)
9. Energy Audits
   - <u>Preparation of high-quality energy audit schemes (carried out in an independent manner)</u>
10. Metering and Informative Billing of Energy Consumption
    - <u>Provision of individual meters to accurately reflect actual energy consumption and information on actual time of use (technically possible and financially reasonable)</u>

2002/91/EC on the energy performance of buildings **(Underlined is consideration points)**

1. Adoption of a Methodology
   - Calculation of the energy performance of buildings is based on the Annex
2. New Buildings (total useful floor area over 1,000m2)
   - Design considerations, (i) Decentralized energy supply system based on RE, (ii) CHP, (iii) District or block heating or cooling, (iv) heat pumps, before start of construction of new buildings
3. Existing Buildings (total useful floor area over 1,000m2)
   - For renovation as a whole or renovated systems, energy performance is upgraded to meet minimum requirements so that they are technically, functionally and economically feasible
4. Energy Performance Certificate
   - Availability of the Certificate not exceeding 10 years
5. Inspection of Boilers
   - <u>Establishment of regular inspection of boilers with 20 kW-100 kW (output)</u>
   - <u>Inspection at least every 2 years for 100 kW or more boilers</u>
   - <u>For heating installation with boilers with more than 20 kW, one-off inspection of the whole heating installation</u>
6. Inspection of Air-Conditioning Systems
   - <u>Establishment of regular inspection of AC with 12 kW (output)</u>
7. Independent Experts
   - <u>Regarding certification of buildings, drafting of accompanied recommendations and inspection of boilers and AC, Qualified and/or accredited experts executes these duties independently</u>

7.2.4 Others

(1) European Standard

The European Standard is drafting the "Energy Management Systems (prEN 16001)". This is a standard energy management methodology within an organization. Activities within an organization might be referred to the scheme design of EMS for Serbia.

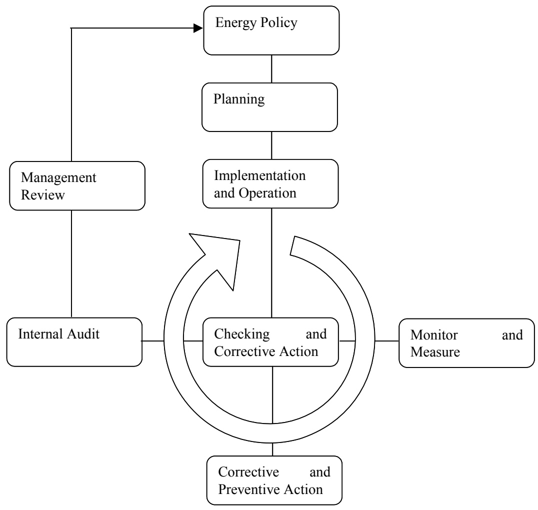


Figure 7-6 Energy Management System of the European Standard

(2) ISO 50001

ISO is now drafting ISO 5001 as an energy management standard and aims at issuing it in the third quarter of 2011. It provides technical and management standards for the improvement of energy efficiency for the whole plant or company. This takes care of the "Plan-Do-Check-Action" approach within an organization to correspond with existing ISO 9001 and 14001.

7.3 Energy Consumption Analysis of Serbia

7.3.1 Objectives

The threshold to distinguish the target of the Energy Management System needs to be fair and easily calculable and acknowledged by the energy organizations. Although energy efficiency is a goal that every organization strives towards, the Energy Management System targets should be kept within a reasonable limit in order to realize Energy Management System cost-effectiveness utilizing the limited human resources and the budget of the regulatory agency which will administrate the system by applying the rules and collecting reports from the designated organizations. In Japan, organizations voluntarily report to the regulatory agency when the amount of their energy consumption (total heat, fuel, and electricity) in the previous fiscal year has exceeded the threshold prescribed in the Energy Efficiency Law. Assuming that a similar system will be applicable in Serbia, the Study Team estimated the threshold for designating the target of Energy Management System by basing it on the amount of energy consumption.

The methods for setting the threshold can be classified into two patterns. One is to focus on cost-effectiveness. In this method, the threshold is realized by calculating the point (inflection point) at which we can achieve the greatest effect with the lowest cost. In Japan, when the Energy Efficiency Law was first introduced in 1980, the thresholds for designating the organizations under Energy Management System were 3,000 ktoe/year (heat and fuel) and 12,000 MWh/year (electricity). The number of designated factories was approximately 3,000, which accounted for about 0.3 % of the total and covered almost 70 % of the consumed energy in the industrial sector. These thresholds were set by calculating the inflection point according to the energy consumption statistics considering mainly cost-effectiveness and the possibility of the system. It is unlikely that targeting more organizations by applying a lower threshold would have had a more remarkable effect. The target of the system has steadily expanded to cover more than 90% of the energy consumption in the industrial sector.

The other method is to calculate the threshold by considering the limited amount of human resources and budget for realizing the system. Under this method, the relevance of a threshold is evaluated according to the number of the designated organizations and the amount of administrated energy. This method is appropriate for those cases in which the first method may cause a considerable error; cases where the target needs to be reduced or the system is initially applied, etc.

7.3.2 Procedures behind the Assumption

In Japan, coming up with an estimation of the threshold is relatively easy, because we have access to the accurate figures of energy consumption of the respective organization (especially large scale organizations) under the Energy Management System and a variety of statistics. On the other hand, in Serbia, because energy consumption data is not collected from each organization under the present state of affairs, they needed to be collected and put in order to start test calculations. Electricity consumption data was provided by the EPS after discussion with C/P. The other data (consumption of heat and fuels of each organization) were hardly obtainable at present, therefore, the energy consumption of respective organizations was estimated from calculations based on certain available data and IEA statistics etc. Using the energy consumption data acquired this way, organizations were arranged in descending order and the threshold was analyzed in terms of the number of the organizations and the total energy consumption.

The following conditions have been set to estimate the energy consumption of each organization.

- ◆ Target sectors: Industrial Sector and Building Sector
- ◆ Target energy: Electricity and Heat (including Fuels) Electricity consumption data (2008) is the effective consumption of the upper 7,058 organizations provided by EPS. Effective heat consumption data does not exist. Therefore, after estimating the electricity ratio to the heat based on the statistics by IEA etc. the total energy consumption was calculated backward from electricity consumption. The estimations were calculated based on the primary energy and the final energy. After discussion with the Steering Committee, attaching more importance to the equality between electricity and heat, a method using primary energy was adopted.
- ◆ Unit: toe (ton of oil equivalent) was adopted. kloe (kiloliters of oil equivalent) was adopted in Japan. 1 kloe equals to about 0.92 toe.
- ◆ Others: Conversion ratio from final energy to primary energy was presumed to be 100/33.3 %, presupposing that the power generation efficiency was 33.3 %.

Example of organization A (Type of business: Steel industry (power radio: 15.1 %), Electricity consumption 10,534 MWh);

- ◆ Final Energy

(1) Total energy consumption calculated based on electricity consumption

Total energy consumption (sum of electrify, heat, and fuels)

= Electricity Consumption / Assumed Electricity Ratio

= 10,534 MWh / 15.1 %

= 69,761 MWh (Final Energy: MWh)

(* The energy from heat and fuels corresponds to 59,227 MWh (=69,761 MWh -10,534 MWh))

(2) Measured value in terms of toe.

69,761 MWh × 0.086 toe/MWh = 5,999 toe (Final Energy: toe)

- ◆ Primary Energy

(1) The total energy consumption is calculated based on electricity consumption, assumed electricity ratio, and assumed power generation efficiency (33.3 %) Electricity

consumption is converted using the power generation efficiency, while the same values as final energy are used for heat and fuels.

Total Energy Consumption (Primary Energy)

= Electricity Consumption × Conversion Ratio based on Power Generation Efficiency + Consumption of Heat and Fuels

= 10,534 MWh × 100/33.3 % + 59,227 MWh

= 90,860 MWh (Primary Energy: MWh)

(2) Measured values in terms of toe

90,860 MWh × 0.086 toe/MWh = 7,813 toe (Primary Energy: toe)

The energy consumption of each organization was estimated via the aforementioned method and arranged in descending order. The number of designated organizations and the total amount of energy consumption were analyzed assuming some of the standard values to be the threshold.

According to the list below, the threshold to cover 80 % of the energy consumption (primary energy) of the organization samples is 37 toe. The number of designated organizations is 1,362 in this case.

Table 7-5 Example of the List of Organizations for Setting Thresholds

Entities	NO.	Power use	Final En.	Primary En.	ACC	Shares
		MWh	toe	toe	toe	%
OS12	29	3,636	368	993	55,464	18.3
OS13	30	3,236	327	884	56,348	18.6
WR17	31	3,226	326	881	57,229	18.9
WR18	32	3,155	319	862	58,091	19.2
OS14	33	3,107	314	849	58,940	19.4
OS15	34	2,967	300	810	59,750	19.7
WR19	35	2,842	288	776	60,527	20.0
WR29	58	2,240	227	612	76,247	25.1
WR41	86	1,698	172	464	90,856	30.0
WR63	124	1,281	130	350	106,278	35.1
OS62	172	984	100	269	121,179	40.0
WR119	236	795	80	217	136,378	45.0
WR162	312	680	69	186	151,607	50.0
OS111	401	573	58	157	166,693	55.0
OS143	508	484	49	132	181,960	60.0
OS189	635	389	39	106	197,123	65.0
WR442	800	297	30	81	212,364	70.0
WR592	1023	206	21	56	227,478	75.0
WR803	1362	137	14	37	242,665	80.0
OS672	1864	90	9	25	257,826	85.0
WR1500	2614	62	6	17	272,997	90.0
WR3200	5300	19	2	5	303,169	100.0
		1,109,793	112,285	303,169		

Chapter 8 Basic Design of Energy Management System

8.1 Abstract of Discussion Points for Scheme Design

8.1.1 Selection of Design Items

Through discussions with the Steering Committee, an abstract of the design items was developed below.

Table 8-1 Design Items

Category	Design Items
1. Designation of Energy and Consumers	• Target Sector • Target Energy • Threshold of Designated Organizations • Boundaries to be Designated
2. Implementation Formation	• Roles of MOME and SEEA • Necessity of Outsourcing on Monitoring and Checking Tasks • Judgment Flow of Poor Management • Annual Schedule and Task Allocation
3. Status of Energy Manager and Accredited Energy Auditor	• Qualification Methods for Energy Manager, Energy Officer, Accredited Energy Auditor • Energy Manager’s Duty and Status • Status and Duties of Energy Officer, Accredited Energy Auditor, and Inspector • Assignment of Energy Manager and Energy Officer
4. EE&C Activities within the Unit	• Evaluation Criteria (Guideline) and Management Standards
5. Periodical Report	• Contents of Periodical Report • Collection Method of Periodical Report
6. Monitoring and Check	• Introduction of Numerical Targets its Status • Evaluation Method for Periodical Report • Evaluation Method for External Energy Audit • Utilization of Obtained Data (Benchmark)
7. Inspection and Penalty	• Inspection Method and Evaluation • Penalties and Methods
8. Dissemination	• Dissemination Programs and Expected Contents • Implementation Method for Dissemination Programs

8.1.2 Prioritization of Design Items

The Steering Committee and the JICA Study Team agreed to discuss the design items from the abstract in priority order. The design items were prioritized into four groups as follows, considering (i) upstream design items, (ii) items requiring long lead-time, and (iii) impact on the scheme design.

Items regarding the implementation formation of the Energy Management System were selected as the most important items to be decided, that is the “Priority S”; because it was judged that a tentative implementation formation was a fundamental factor and that the discussion of the next design items would be made based on the implementation formation.

Priority S: Fundamental items to decide implementation formation
Priority A: Important items that need long lead-time
Priority B: Important but secondary items or items that do not require a long lead-time
Priority C: Other items

Table 8-2 Priority of Design Items

Priority S	Priority A	Priority B	Priority C
■ Roles of MOME and SEEA ■ Necessity of Outsourcing on Monitoring and Checking Tasks ■ Judgment Flow of Poor Management	■ Target Sector ■ Target Energy ■ Threshold of Designated Organizations ■ Boundaries to be Designated ■ Annual Schedule and Task Allocation ■ Qualification Methods for Energy Manager, Energy Officer, Accredited Energy Auditor ■ Tasks of Accredited Energy Auditor ■ Evaluation Criteria (Guideline) and Management Standards ■ Contents of Periodical Report ■ Introduction of Numerical Targets and its Status ■ Utilization of Obtained Data (Benchmark) ■ Assignment of Energy Manager and Energy Officer	■ Status and Duties of Energy Manager ■ Status and Duties of Energy Officer ■ Status and Duties of Accredited Energy Auditor ■ Status and Duties of Inspector ■ Collection Method of Periodical Report ■ Evaluation Method for Periodical Report ■ Evaluation Method for External Energy Audit ■ Inspection Method and Evaluation ■ Penalties and Methods	■ Dissemination Programs and Expected Contents ■ Implementation Method for Dissemination Programs

To decide the scheme as shown above, (i) the JICA Study Team raises some options reflecting current situation of Serbia and site survey's experience obtained from the pilot implementation of the Energy Management System and the local consultants' survey, (ii) discusses on the optimum options with the Steering Committee, and (iii) finalizes the contents of the best option with some revision or addition.

8.2 Basic Design

8.2.1 Basic Concept

Basic concept of the EMS is (i) to effectively promote EE&C (effectiveness), (ii) to promote voluntary participation in EE&C activities (voluntariness), and (iii) if necessary enforce participation in EE&C activities (enforcement). In order to achieve these concepts, the following basic approach is adopted.

(Effectiveness)
- To effectively promote EE&C particularly focusing on large energy consumers

(Voluntariness)
- To urge the participation in voluntary EE&C activities by assigning a responsible person (Energy Manager) from EE&C to organize activities

(Enforcement)
- To have the power to monitor energy consumption of Designated Organizations and give instructions if necessary

8.2.2 Design Items on Implementation Formation

The Steering Committee and the JICA Study Team agreed that the following three design items regarding implementation formation should be studied as the first priority (Priority S). Options in each design item and the consultation results are described as follows.

S-1 Roles of MOME and SEEA

S-2 Necessity of Outsourcing on Monitoring and Checking

S-3 Judgment Flow of Poor Management

(1) Questionnaire Survey on Design Items regarding the EMS (1st)

Prior to the discussion with the Steering Committee regarding the EMS design items, a questionnaire survey was conducted utilizing an opportunity of workshop held on November 4th 2009 in the Serbian Chamber of Commerce. The results of the questionnaire survey were summarized as follows.

(a) Basic Information on Answerers

82 effective answers were obtained. The breakdown of the answerers is shown in the figure.

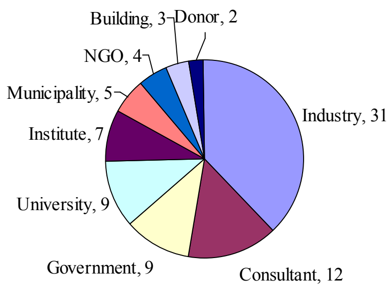


Figure 8-1 Breakdown of the Answerers

(b) Necessity of Mandatory Program for Energy Management

As shown below, all answerers recognized the necessity of mandatory energy management for specific sectors.

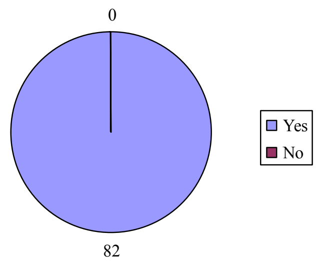


Figure 8-2 Necessity of Mandatory Program for Energy Management

(c) Reasons on Necessity of Mandatory Energy Management (multi-answers possible)

The reasons for the question of the above (b) are shown below. Global warming issue, energy security and money saving were the prominent answers.

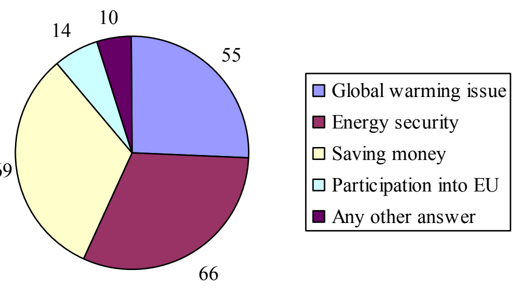


Figure 8-3 Reasons on Necessity of Mandatory Energy Management

(d) Target Sector for the Energy Management (multi-answers possible)

The answers indicated that large energy consuming factory/building and transformation sector should be targeted.

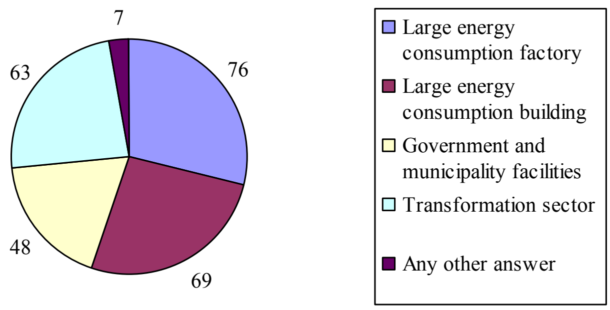


Figure 8-4 Target Sector for the Energy Management

(e) Monitoring Unit of the Designated Organizations (multi-answers possible)

The answer, “By company”, was the prominent.

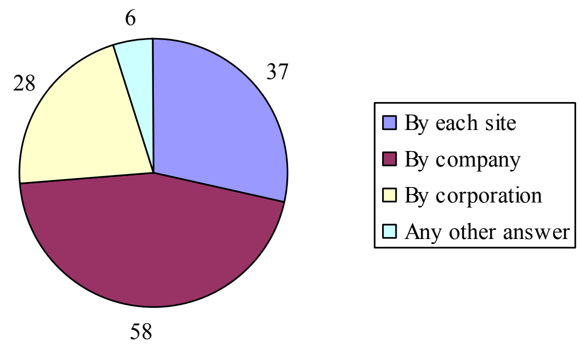


Figure 8-5 Monitoring Unit of the Target Consumers

(f) Qualification Method for Energy Manager (multi-answers possible)

The answer, “By training program with certificate examination”, was prominent.

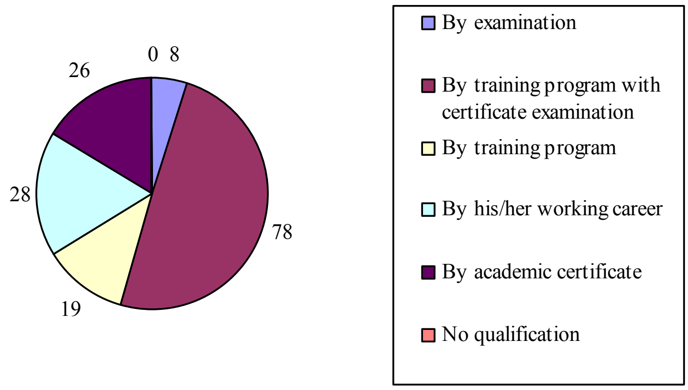


Figure 8-6 Qualification Method for Energy Manager

(g) Necessity of External Energy Auditor

The majority of the answerers recognized the necessity of external energy audit, to help tasks of Energy Manager.

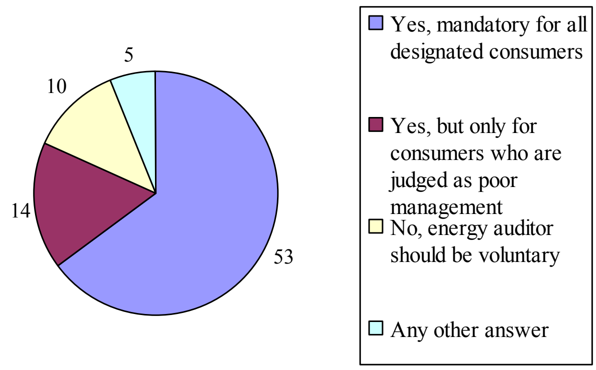


Figure 8-7 Necessity of External Energy Auditor

(h) Evaluation Method for Performance of the Designated Organizations

Regarding evaluation method for performance of the Designated Organizations, the energy intensity method was prominent. However, the major answers were split into “Primary energy” and “Final consumption” in the energy intensity method.

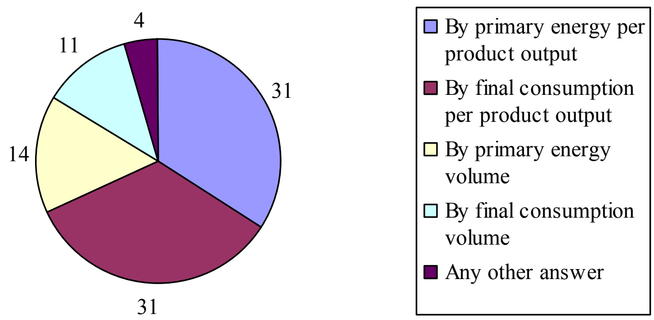


Figure 8-8 Evaluation Method for Performance of the Designated Organizations

(i) Effective Penalty for Violence in the Scheme (multi-answers possible)

Regarding effective penalty for violence in the EMS scheme, fine and publication of the company name were the prominent answers.

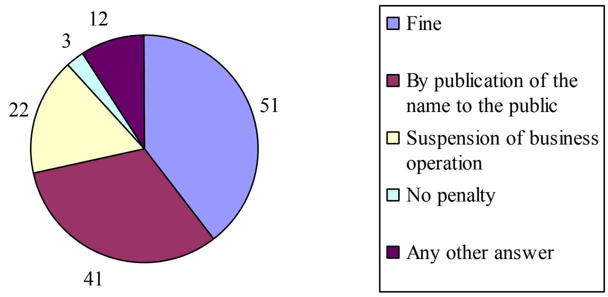


Figure 8-9 Effective Penalty for Violence in the Scheme

(2) S-1: Roles of MOME and SEEA

(a) Option Study

The JICA Study Team proposed 2 options regarding the respective roles of MOME and SEEA, as shown below.

<u>Option 1: MOME is responsible for monitoring and inspection role</u>

<u>MOME:</u>
- Law and regulations
- Registration of Designated Organizations and Energy Manager
- Check and monitoring of Designated Organization
- Inspection

<u>SEEA:</u>
- Training and qualification authority
- Arranging training program and examination

Option 2: SEEA is responsible for monitoring and inspection role

MOME:
- Law and regulations

SEEA:
- Registration of Designated Organization and Energy Manager
- Check and monitoring of Designated Organization
- Inspection
- Training and qualification authority
- Arranging training program and examination

(b) Consultation Result

Through consultation with the Steering Committee, Option 1 was adopted. This option is that MOME implements preparation of laws and regulations, monitoring and checking of Designated Organizations, and inspections, etc. and the Government agency, SEEA, is responsible for the training and examination of Energy Managers, Energy Auditors, etc.

The Option 1 was adopted for the following reasons.

- To enforce to request and monitor the data form Designated Organizations, MOME seems to be suitable for such tasks.
- MOME, that is presently managing GIS-DB, should directly manage the nation-wide energy data as well, in terms of efficient administration.

(3) S-2: Necessity of Outsourcing on Monitoring and Checking Tasks

(a) Study Options

The following two options are proposed. This is a choice between having the monitoring and checking tasks outsourced to an external cooperation agency, or a case where they are not outsourced (done by MOME).

Option 1: Outsourcing Case

Responsible Body for Monitoring and Database
- Registration of Designated Organization and Energy Manager
- Check and monitoring of Designated Organization

Data Arrangement and Analysis

Budgeting

Reporting Results

Cooperation Agency:
- Support for data arrangement and analysis
- Making an analysis report

Option 2: Non-Outsourcing Case

Responsible Body for Monitoring and Database
- Registration of designated consumers and Energy Manager
- Check and monitoring of designated consumers
- Data arrangement and analysis
- Making an analysis report

(b) Consultation Result

Through consultation with the Steering Committee, Option 2 was adopted. This option is monitoring and checking tasks to be directly handled by MOME, not outsourcing to an external cooperation agency. Because MOME wishes to secure confidentiality of energy data obtained from the EMS implementation and directly handle such data. The JICA Study Team judged that the reason was appropriate.

(4) S-3: Judgment Flow of Poor Management

(a) Study Options

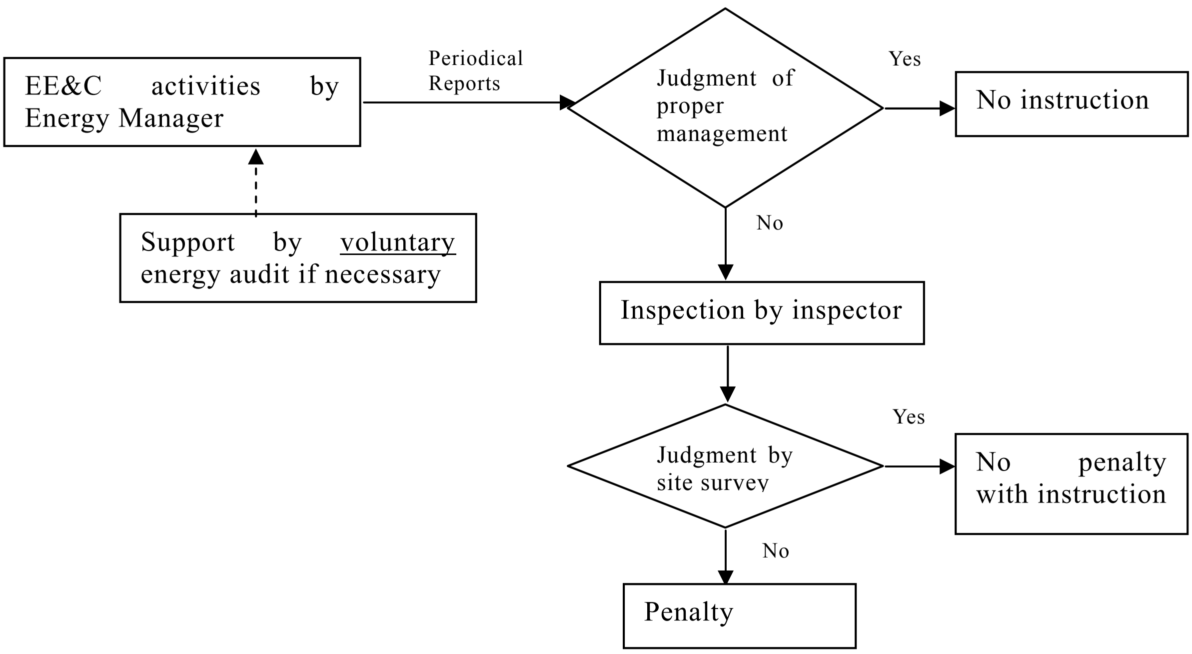
The following 3 options have been proposed as the flow of judgment to be adhered to in determining the existence of poor management practices:

Option 1: Judgment by Periodical Report prepared by the Energy Manager

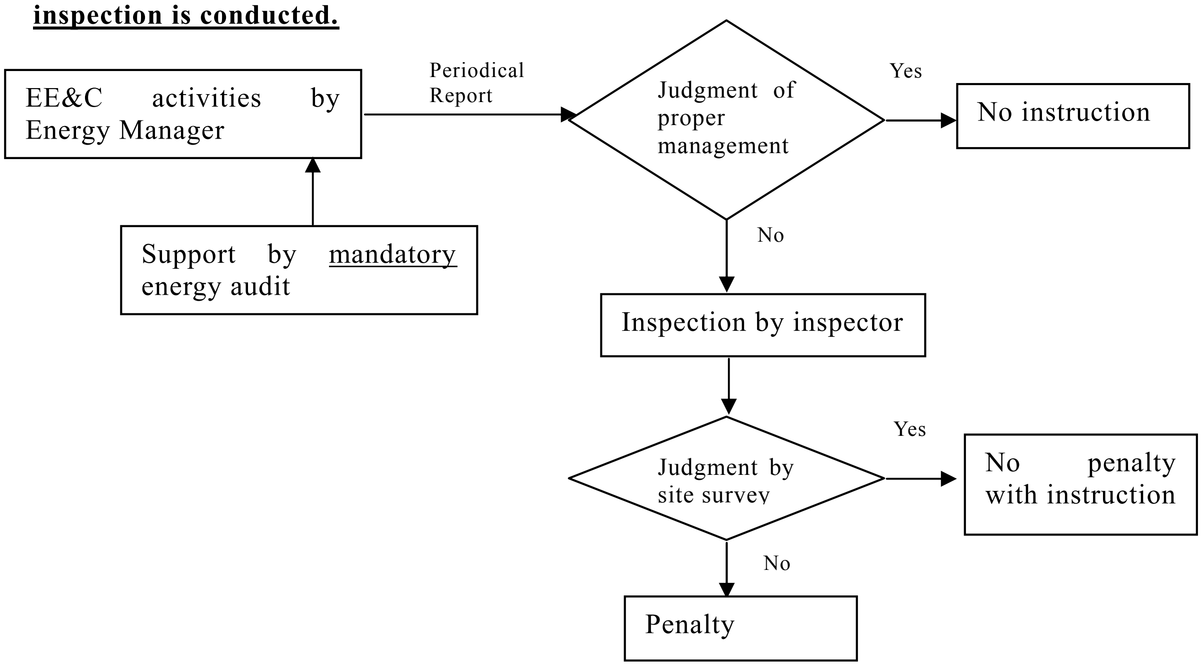
Option 2: Judgment by Periodical Report prepared by the Energy Manager and an energy audit conducted by the external energy auditor

Option 3: (i) Initial judgment of poor management consumers via Periodical Report, and then (ii) judgment by an energy audit conducted by external energy auditor only for those consumers engaging in poor management practices

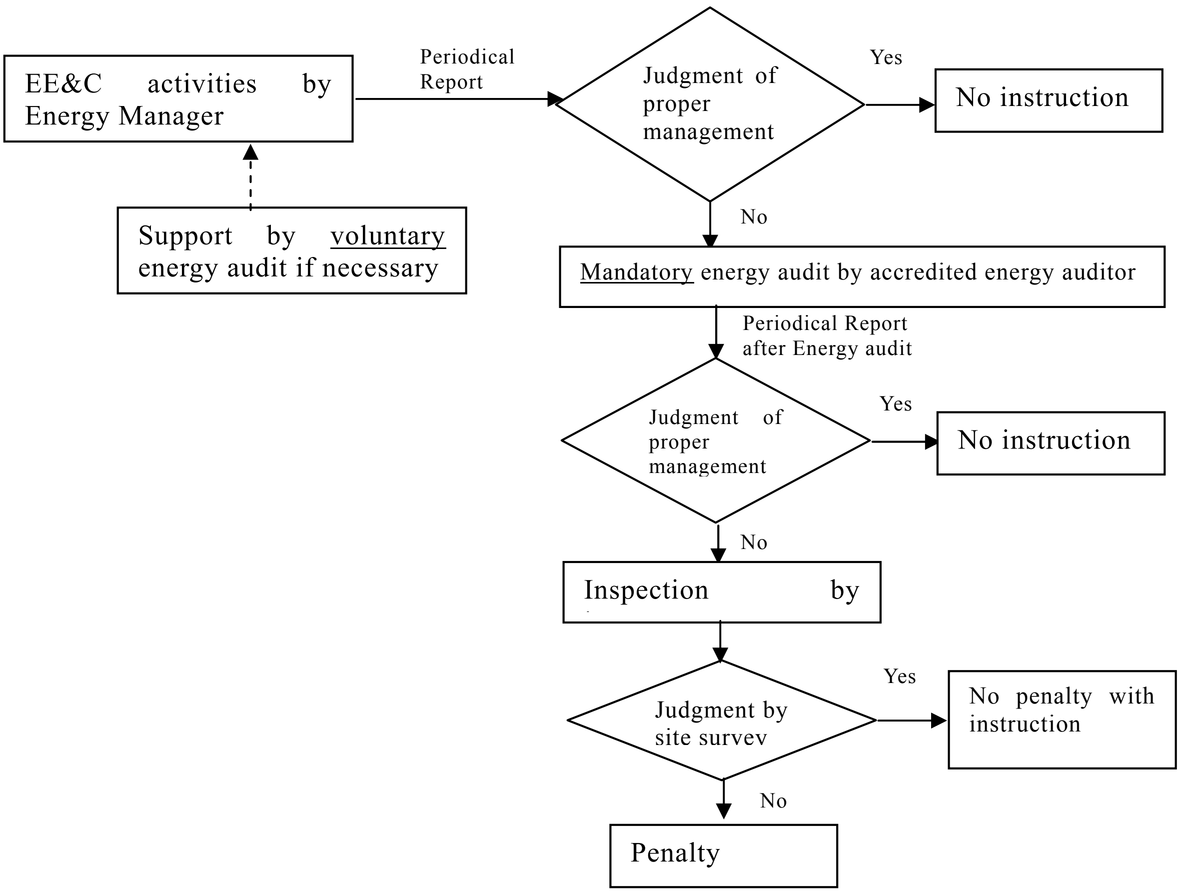
Option 1: Voluntary energy audit is conducted if the Designated Organization needs. When poor management is found through Periodical Report, inspection is conducted.



Option 2: Mandatory energy audit is conducted by Accredited Energy Auditor for all Designated Organizations. When poor management was found through Periodical Report, inspection is conducted.



Option 3: Energy audit by Accredited Energy Auditor is mandatory when poor management was found through Periodical Report. Even after mandatory energy audit, if poor management still continues, inspection is conducted.



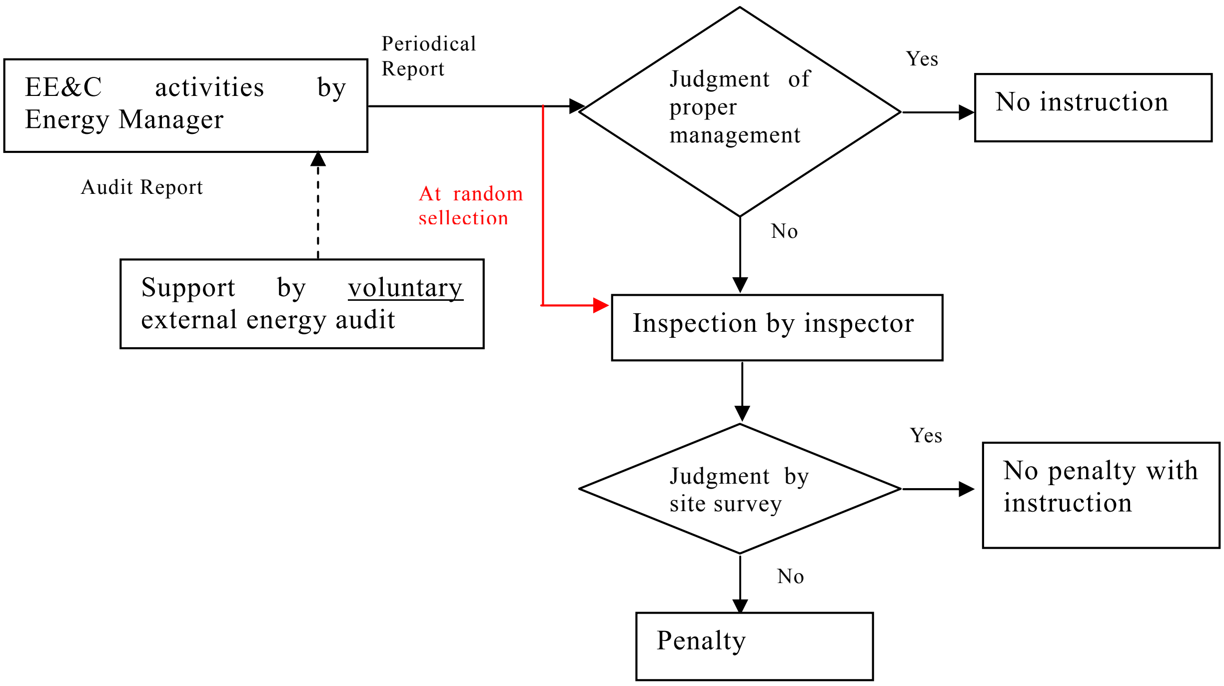
(b) Consultation Result

Through consultation with the Steering Committee, a revised version of Option 1 was adopted. The revision points from Option 1 are as follows.

- Because an energy audit by an Accredited Energy Auditor is voluntarily conducted based on a request from the Designated Organization, it is not necessary to submit a report to MOME, except for those cases where the Designated Organization utilizes an incentive program from the Government.
- MOME's Inspector can conduct an inspection to a Designated Organization by judgment from a Periodical Report or "at random" selection.

The revised Option 1 was adopted for the following reasons.

- The role of the Accredited Energy Auditor and the Inspector in the original Option 1 might overlap with each other. A judgment concerning the necessity of an external energy audit should be conducted by the Designated Organization.
- It might be difficult for the Accredited Energy Auditor to fulfill the roles of energy assessment and inspection at the same time.
- The role of inspection should be concentrated on MOME's Inspector to clear the responsibility. However, the resources of Inspectors may be limited. An inspection should be conducted in an efficient manner.



8.2.3 Implementation Formation

(1) Policy for Proposal of Implementation Formation

As mentioned in the previous section regarding option study for the implementation formation, the following 4 points have been confirmed.

- MOME is responsible for law and regulations as well as monitoring, inspection and database creation.
- SEEA is responsible for training the Energy Managers, Accredited Energy Auditors, etc. and establishing their qualification procedures.
- An external energy audit is a voluntary action taken by Designated Organizations. Designated Organizations can freely select a consultant from among Accredited Energy Auditors or non Accredited Energy Auditors. However, an Accredited Energy Auditor is expected to promote EE&C at a high level. It should be one of the national qualifications with a high status that is to be selected by Designated Organizations.
- MOME can conduct an inspection via examining a Periodical Report or "at random" selection. Based on the results of the inspection, correctional instruction can be provided to a poor management organization.

(2) Implementation Formation (Tentative)

A tentative implementation formation for the Serbian Energy Management System is proposed as follows.

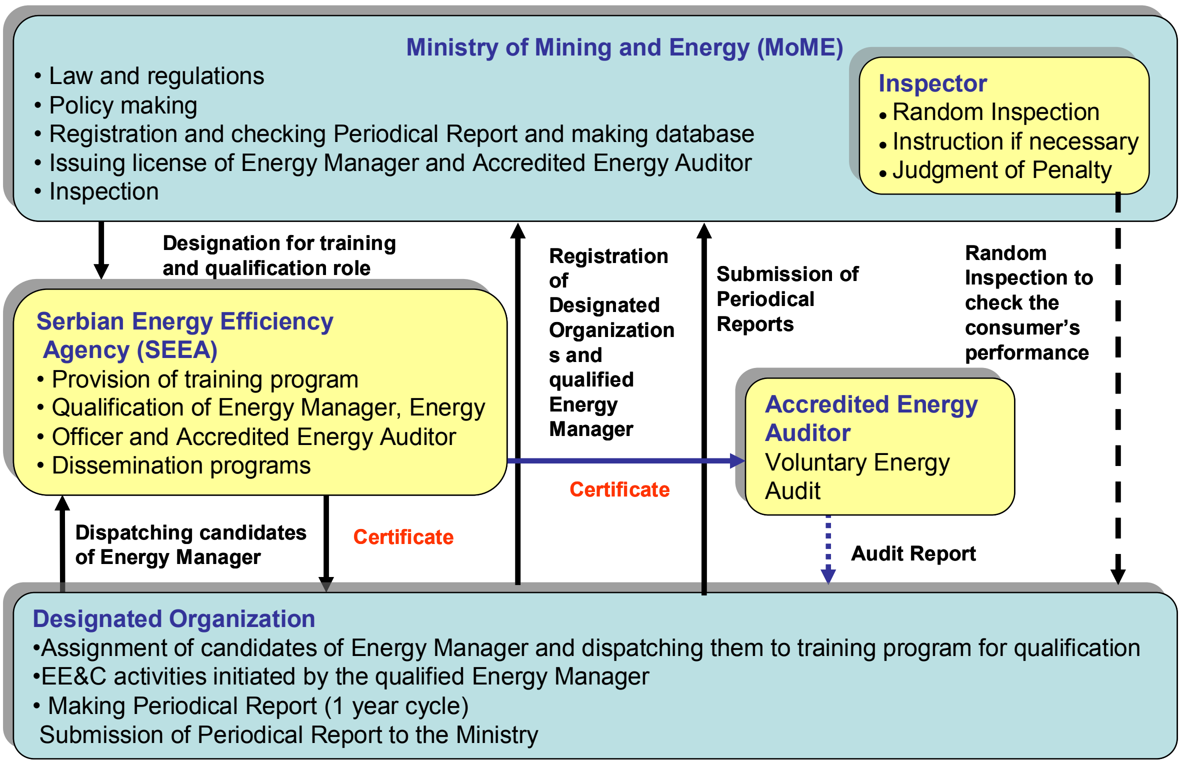


Figure 8-10 Implementation Formation for Serbian EMS (Tentative)

Chapter 9 Detailed Design of Energy Management System

All design items are proposed in Chapter 8. Out of these design items, Priority A, B and C items are described in this chapter. These design items (A, B & C), that include detailed scheme definitions and implementation methodologies, were designed based on the fundamental conditions (implementation formation) described in the last chapter.

9.1 Detailed Design of Priority A Design Item

9.1.1 Basic Approach

Design items of Priority A are selected as scheme details that include the definitions, designations, qualifications and so on. Selected items for Priority A are as follows.

A-1 Target Sector
A-2 Target Energy
A-3 Threshold of Designated Organizations
A-4 Boundaries to be Designated
A-5 Annual Schedule and Task Allocation
A-6 Qualification Methods for Energy Manager, Energy Officer, Accredited Energy Auditor
A-7 Tasks of Accredited Energy Auditor
A-8 Evaluation Criteria and Management Standards
A-9 Contents of Periodical Report
A-10 Introduction of Numerical Targets and its Status
A-11 Utilization of Obtained Data (Benchmark)
A-12 Assignment of Energy Manager and Energy Officer

The scheme design of the Priority A takes the same process as the Priority S items. That is:

- At first discussion points are identified.
- And then the JICA Study Team proposes some options.
- Through discussion with the Steering Committee, directions are decided.

In addition, the results of the questionnaire survey conducted at the workshop gathering of energy related stakeholders are also considered in the scheme design. The questionnaire survey to be considered is based on the results surveyed in the first workshop conducted on November 4th 2009 (refer to 8.2.2).

9.1.2 Study on Each Design Item

(1) A-1: Target Sector

(a) Classification of Category

Organizations to be targeted in the Energy Management System are categorized by their characteristics. Each category in the classification has its own energy management methodology.

(i) Study Options

The following sectors are to be discussed.

- Manufacturing, Mining and Transformation Sector (* Transformation Sector is the sector to convert from primary energy to final energy.)
- Commercial Sector
- Municipality Sector
- Central Government Sector

(ii) Consultation Results

Through consultation with the Steering Committee, the following definitions were decided on. Additional provisions are also discussed as follows.

- Manufacturing, Mining and Transformation Sectors are basically considered to be one category. However, the Transformation Sector is a bit unique in comparison with the Manufacturing and Mining Sectors; for example, the targeted methodology for energy consumption, boundaries to be monitored, and so on. In this context, for the Transformation Sector, another definition or calculation format in the Periodical Report should be prepared other than that of the Manufacturing and Mining Sectors.
- In the Municipality Sector, there are two types of facilities, namely Municipality Buildings and Municipality Control Facilities (school, public facilities, district heat supply facility, public lighting, etc.). The scheme of the nation-wide EMS should be harmonized with the existing Municipality EMS (MEMS). For the reporting method in the nation-wide EMS, collecting data in the MEMS is summarized and submitted to MOME (all the data in MEMS does not have to be submitted to MOME).
- All district heat supply facilities in Serbia are owned by municipalities. However, in the event that such a facility has a certain amount of energy consumption, it will have the same methodology as the Transformation Sector in energy management. In addition, the data of such district heat supply facilities are counted in the existing data collection system of MEMS as well.
- MEMS targets all of the facilities under the umbrella of the municipality and municipality control facilities. To be fair with the MEMS, the nation-wide EMS also targets all the facilities of the Central Government. The Central Government Sector also has two types of facilities, namely the Central Government Buildings and the Central Government Control Facilities. Because they have a different energy management flow in the

organizations, special care for the design scheme is necessary for the Central Government Buildings and Central Government Control Facilities.

Table 9-1 Target Sectors

Category	Target Sectors	Expected Facility or Business in the Category
A-1	Manufacturing and Mining Sector	Factory, mining site, etc.
	Transformation Sector	Plant of power, heat supply and oil refinery
A-2	Commercial Sector	Office, commercial buildings, hospital, department store, etc. (other then Government or Municipality)
B-1	Municipality Buildings	Municipality offices
	Municipality Control Facilities *1	Municipality Control Facilities such as school, public facilities, district heat supply facilities public lighting, etc.
B-2	Central Government Buildings *1	Central Government Buildings
	Central Government Control Facilities *1	Central Government Control Facilities such as hospital, school, etc.

*1: In case that a facility belonging to Municipality or Central Government has a certain amount of energy consumption, the facility takes the same methodology with A-1 or A-2 in energy management even in Municipality or Central Government Sector.

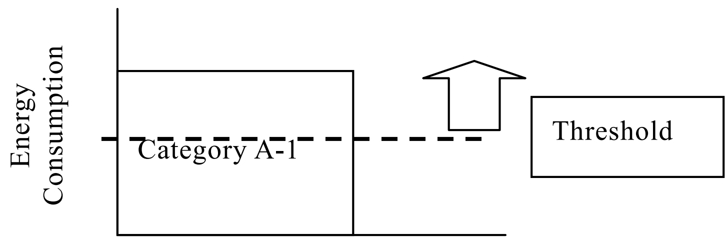
(b) Manufacturing, Mining and Transformation Sector (Category A-1)

Definitions regarding how to designate organizations from the Manufacturing, Mining and Transformation Sector are discussed as follows.

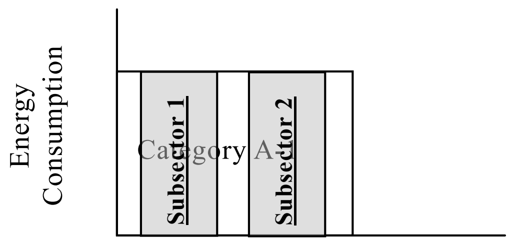
(i) Study Options

The following 3 options were discussed.

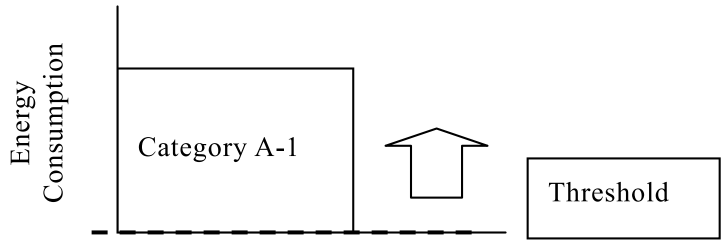
Option 1: Designation by a certain volume of energy consumption



Option 2: Designation by specific sub-sectors



Option 3: Designation of all organization regardless energy consumption volume



(ii) Consultation Results

Through consultation with the Steering Committee, Option 1 was selected, because it was recognized that this option, the selection by a threshold, was the fairest method for all the organizations.

The threshold for designation is reviewed in another discussion point (described in another section).

(c) Commercial Sector (Category A-2)

The Commercial Sector also adopted the same designation method as the Manufacturing, Mining and Transformation Sectors using a threshold.

(d) Municipality Sector (Category B-1)

As described above, all of the municipality facilities are managed by the Municipality EMS (MEMS). The nation-wide EMS is designed in consideration of this existing MEMS scheme. Under this MEMS scheme, the target has already been set at all of the facilities including the Municipality Building and Municipality Control Facilities. So the discussion point of this section focuses on how to deal with a facility which has a certain amount of energy consumption (exceeds a certain threshold) in the nation-wide EMS.

(i) Study Options

The existing MEMS targets all of the facilities including the Municipality Building and the Municipality Control Facilities. Two options were raised in the reporting flow of the nation-wide EMS as shown below.

Option 1: All the data are collected from each building and facilities belonging to Municipality (Flow 1)

Option 2: In addition to Flow 1, a facility which has a certain amount of energy consumption (exceed a threshold) is directly reported to MOME by the nation-wide EMS (Flow 1 and Flow 2).

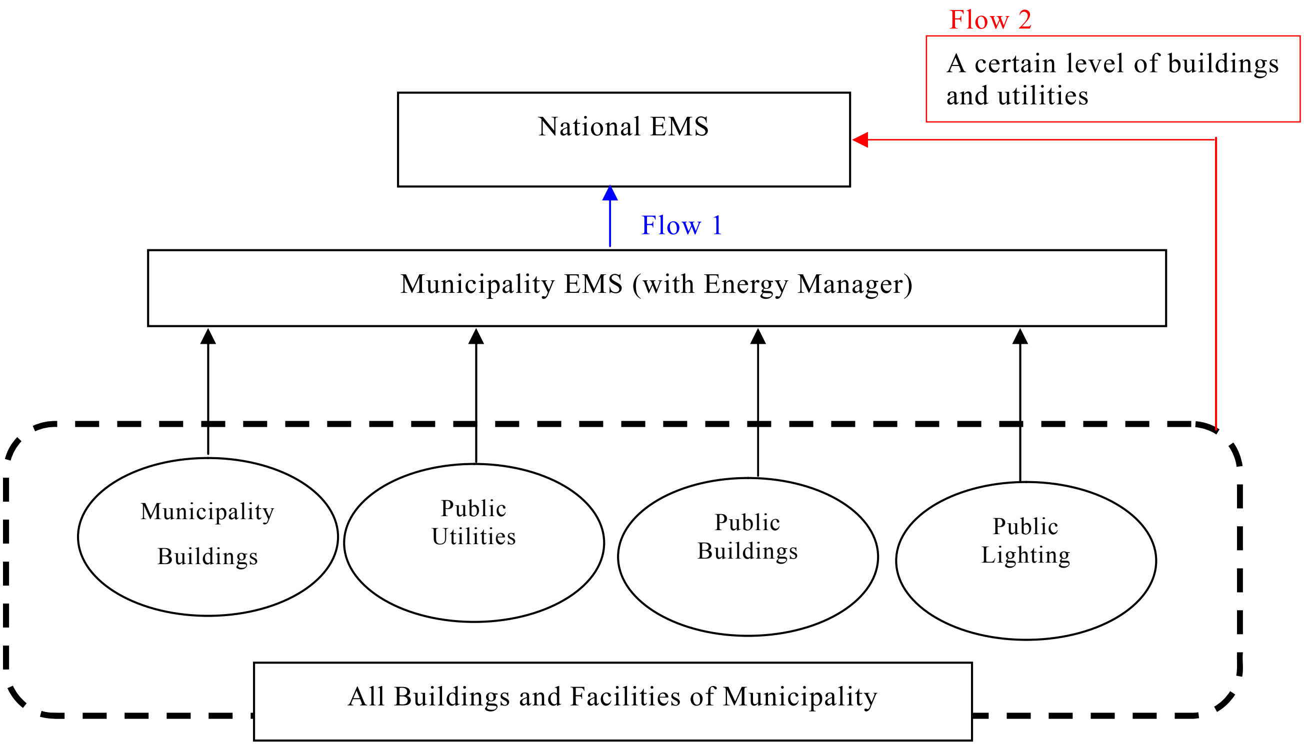


Figure 9-1 Reporting Flow of Municipality Buildings and Facilities

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected. The reasons are summarized as follows.

- The basic concept of the nation-wide EMS is management of large energy consuming facilities.
- The number of facilities which are designated by a threshold in the municipality facilities is expected to be limited, and these facilities are independently managed as a company. So even though such facilities are managed by a double system (MEMS and nation-wide EMS), there is not expected to be much confusion.

(e) Central Government Sector (Category B-2)

As mentioned above, to be fair with the MEMS, the nation-wide EMS also targets all the facilities of the Central Government.

The Central Government Buildings which are used by the staff of Ministries are managed by General Management Offices (GMO) which is a service organization that maintains and operates the Central Government Buildings.

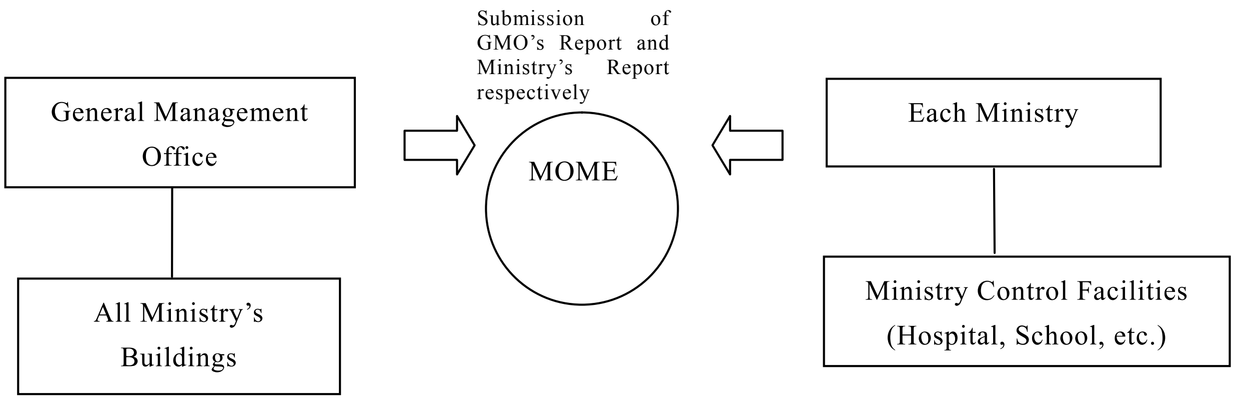
On the other hand, Central Government Control Facilities such as hospitals, schools, etc. are managed by each line ministry in terms of the budget. These facilities are maintained and operated by each site within their allocated budgets by the line Ministry.

In the same way as the Municipality Sector, a facility exceeding a threshold is managed individually in the nation-wide EMS, even in the Central Government Sector.

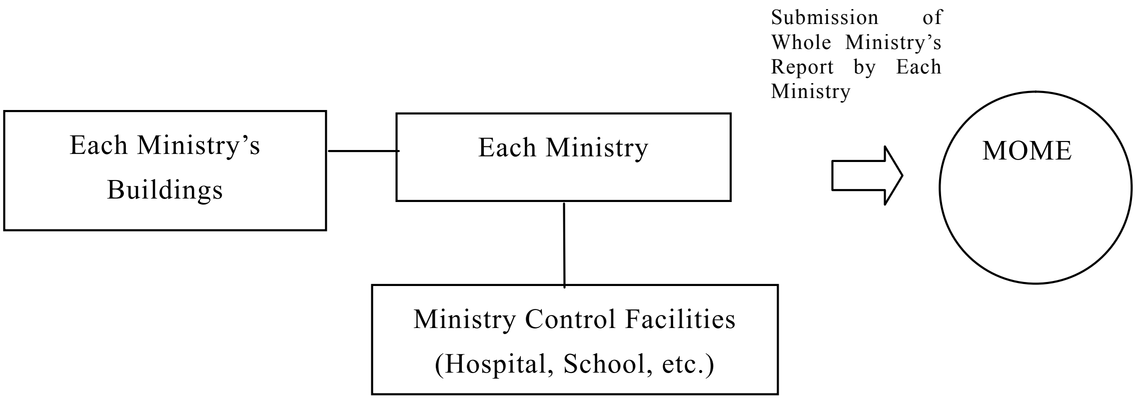
(i) Study Options

The discussion point is how to report the results of energy management in the Central Government Buildings and Central Government Control Facilities. The following two options were discussed.

Option 1: Reports are issued individually by the GMO whose jurisdiction covers the central government's offices and the ministries which are each respectively responsible for their local institutions.



Option 2: The case where each Ministry submits Periodical Report to MOME compiling the data of Central Government Buildings and Central Government Control Facilities.



(ii) Consultation Results

Through consultation with the Steering Committee, Option 1 was selected. Because buildings which are managed by GMO are shared by more than 2 ministries, it is difficult to define the consumption of each ministry.

Therefore, GMO (all ministries buildings) and each ministry (all ministries control facilities) respectively submit Periodical Reports to MOME.

(2) A-2: Target Energy

(a) Primary Energy or Final Energy

The discussion point in this section is on the evaluation value of energy management. To put it concretely, the point to be summarized is whether primary energy or final consumption should be made the control index.

In the event that it is decided to use primary energy as the control index, the value of the final consumption of electricity and heat purchased from the outside (based on fossil energy resources) is to be converted by the "Conversion Factor (thermal efficiency)" to be represented in the value of the primary energy.

(i) Study Options

The following figure shows the same value in the final consumption and primary energy. Purchased electricity and heat in primary energy is converted from those in final consumption. Conversion factors are represented by the thermal efficiency in the fossil fuel power plant or the fossil fuel heat supply plant.

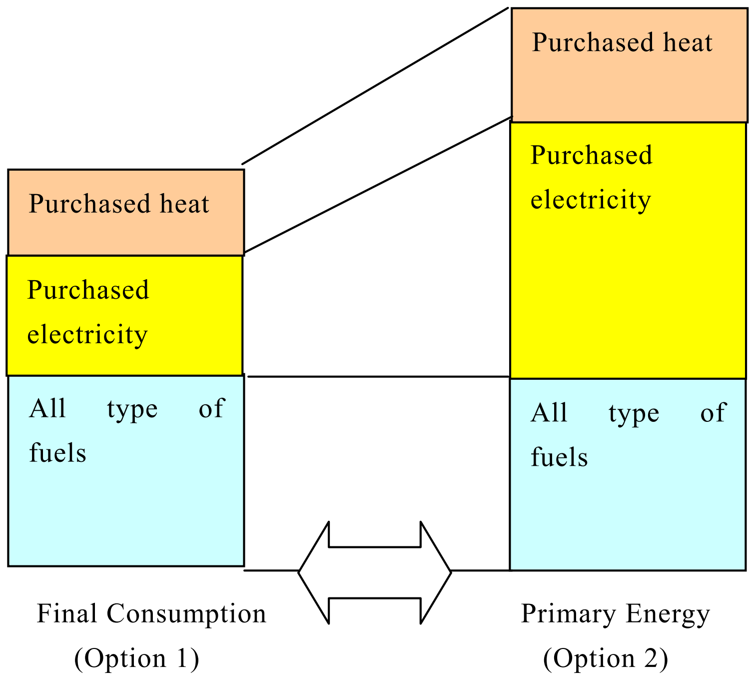


Figure 9-2 Final Consumption and Primary Energy

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected. Although making final consumption the control index is recommended in the EU Directive (2006/32/EC), the value of primary energy (which has also been adopted in Japan) was selected for the following reasons.

- Primary energy represents a real situation of a nation-wide energy balance.
- Final consumption in electricity is smaller than its primary energy due to conversion of thermal efficiency. If final consumption is adopted for evaluation in the EMS, power

consuming equipment might be utilized more. In this context, adoption of primary energy avoids to shift to the power consuming equipment too much

- Conversion to primary energy from final consumption is easy to accomplish utilizing MS Excel.
- In the format of the Periodical Report, the column of the final consumption is also prepared in parallel with the column of primary energy. The value of the final consumption can be easily collected if necessary.

(b) Definition of Energy Consumption

In this section, it is discussed about the definition of consumer energy consumption. In other words, the calculation method of consumer energy consumption is explained.

(i) Study Options

The following figure shows a general energy balance model of the consumer. The renewable energy generated on the consumer side is also considered in the model.

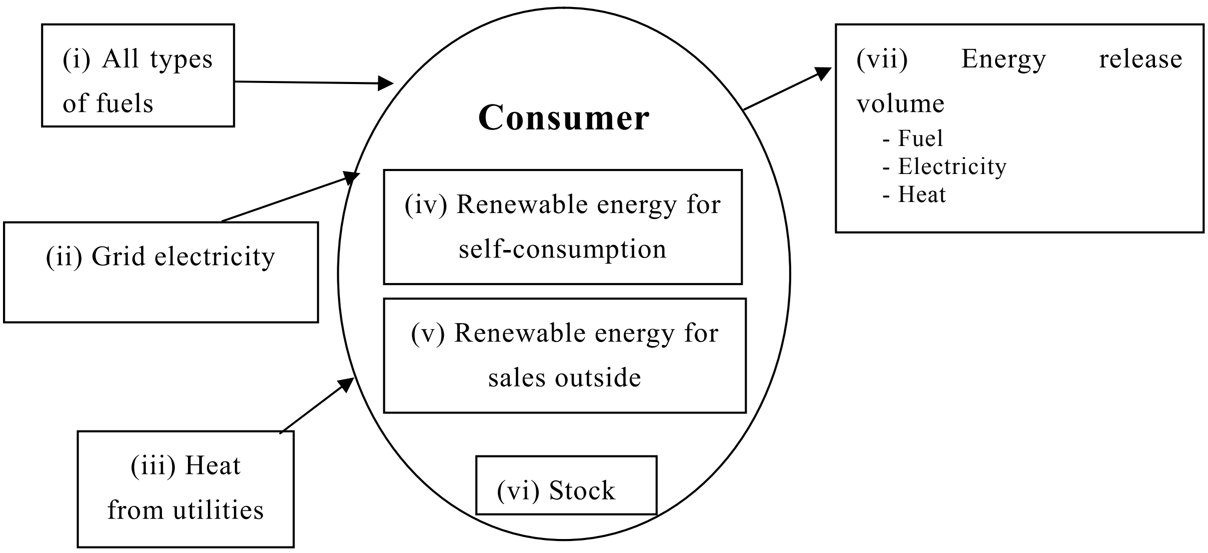


Figure 9-3 Energy Balance Model in a Consumer

Regarding the definition of consumer energy consumption, the following two options were discussed based on the energy balance model.

Option 1: Cases where the renewable energy generated on site is counted in the calculation.

In such cases, the following formula is proposed.

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

This option counts renewable energy as part of the consumer's energy consumption even if the renewable energy is used. In the aforementioned calculation formula, the value of renewable energy for outside sales (v) is cancelled out by the subtraction of the volume of energy released. Counting renewable energy as part of the consumer's energy consumption matches the concept of the EU Directive.

Option 2: Cases where renewable energy generated on site is subtracted from the calculation.

In this case, the following formula is proposed.

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

This option does not count the value of renewable energy generated on site as part of the consumer's energy consumption. This case gives an incentive for the introduction of renewable energy within the site (This case has been adopted by Japan).

(ii) Consultation Results

Through consultation with the Steering Committee, Option 1 was selected. Even renewable energy resources that are generated on site are counted as the consumer's energy consumption. As for incentives for renewable energy, because the other scheme (ex. Feed in Tariff) is now under consideration, it has been deemed that the scheme of the Energy Management System does not need to consider such incentives.

(c) Treatment of Renewable Energy in Grid Electricity

Electricity purchased from the EPS grid includes renewable energy resources like hydropower that has the same value between primary energy and final consumption (that is conversion factor is 1.0). In this section, a discussion point was whether such renewable energy in the grid is separated from energy taken from fossil energy, or not.

For safety purposes, in the Japanese EMS, hydropower electricity in the grid is regarded as fossil energy electricity in the calculation of primary energy.

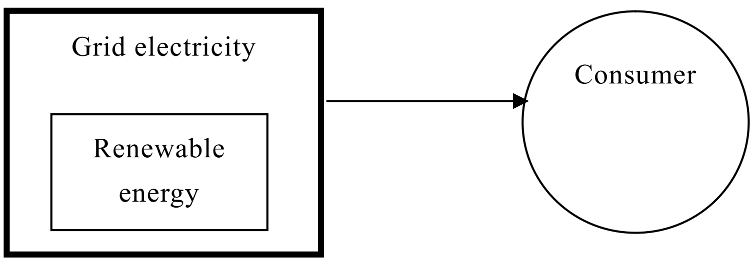


Figure 9-4 Renewable Energy in the EPS's Grid Electricity

(i) Study Options

The following two options were discussed.

Option 1: Renewable energy in the grid is not specified. Assuming all energy is regarded as fossil energy resources, primary energy is calculated by a single conversion factor.

Option 2: Renewable energy in the grid is specified. Separating renewable energy resources and fossil energy resources, primary energy is calculated by more than two conversion factors.

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected. Option 2 is a more accurate representation of reality but this option might have difficulty in setting individual conversion factors.

However, through the discussion with the Steering Committee, it was decided that setting individual conversion factors are not so difficult due to the following reasons.

- In Serbia, only one power utility (EPS) substantially operates all the generation in Serbia and it is easy to specify renewable energy in the grid.
- Even if the power generation composition changes, it does not seem to occur frequently.

(d) Treatment of Hydropower

The discussion point is whether all of the existing types of hydropower can be regarded as renewable energy regardless of their individual capacity. As a result of this consultation with the Steering Committee, all types of hydropower were regarded as renewable energy regardless of their individual capacity.

(3) A-3: Threshold of Designated Organizations

In this section, the threshold for the designation of the organization or site was discussed. Thresholds are set up for only the Manufacturing, Mining, Transformation and Commercial Sectors. As for the Municipality and Central Government Sectors, they do not need thresholds because all of the facilities of the Municipality and Central Government are targeted regardless of the volume of energy consumption. However, in the case of a facility belonging to a Municipality or Central Government that exceeds a threshold, such a facility will be regarded as a Designated Organization or a Designated Site and submit Periodical Report to MOME individually.

(a) Setting Policy for Threshold

(i) Study Options

In this section, the discussion point is whether a single or double threshold should be used for the Manufacturing, Mining, Transformation and Commercial Sectors.

Regarding energy consumption, it has already been discovered that the Commercial Sector experiences relatively small consumption compared to the Manufacturing, Mining, Transformation Sectors (hereinafter the "Industrial Sector"). Based on this fact, the following two options were discussed.

Option 1: The threshold of the Industrial Sector is used for the Commercial Sector as well.
Option 2: The threshold of the Commercial Sector sets up another one.

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected for the following reasons.

- An EU Directive sets up a policy that energy management should be concentrated in the Commercial Sector as well.
- However if the threshold of the Industrial Sector is used for the Commercial Sector, it was discovered that the number of targets will be very limited. To cover the Commercial Sector to some extent, the individual threshold for the Commercial Sector should be set up.

On the other hand, generally speaking, the Commercial Sector's management capacity is not so high. Hence, it has been decided that the management capacity including the appointment of the Energy Manager should pay special attention to the Commercial Sector.

(b) Threshold of Designated Organization

(i) Study Options

The following table shows the estimation results of energy consumption based on electricity consumption data for primary energy, and the targeted number of organizations by each threshold.

Table 9-2 Threshold and Covered Number in Each Sector

Thres-hold	Manufacturing, Mining &Transformation Sector (sample: 1,758 companies, 2,140 ktoe)				Commercial Sector (sample: 5,300 companies, 303 ktoe)			
	Companies (Accumulation)		Primary Energy (Accumulation)		Companies (Accumulation)		Primary Energy (Accumulation)	
	No.	%	ktoe	%	No.	%	ktoe	%
3,000 toe	90	5.1 %	1,550 ktoe	72%	4	0.1%	19 ktoe	6 %
2,500 toe	110	6.3 %	1,610 ktoe	75%	5	0.1%	22 ktoe	7 %
2,000 toe	150	8.5 %	1,720 ktoe	80%	10	0.1%	28 ktoe	9 %
1,500 toe	180	10.2 %	1,760 ktoe	82%	15	0.2%	38 ktoe	12%
1,000 toe	250	14.2 %	1,830 ktoe	85%	30	0.5%	63 ktoe	20%
500 toe					76	1.4%	86 ktoe	28%

The threshold was discussed in consideration of the coverage ratio of energy (* a ratio of accumulated energy consumption to the whole energy consumption) and designated number of organizations for the Industrial and Commercial Sectors respectively.

(ii) Consultation Results

As a result of consultation with the Steering Committee, the following thresholds were tentatively adopted.

Industrial Sector: 2,500 toe

(Reasons)

- In consideration of MOME's existing human resource capacity, it has been judged that MOME is able to deal with about 100 organizations (in the above table, 110 organizations by the threshold of 2,500 toe)
- Even if 2,500 toe is adopted as the threshold of the Industrial Sector, the energy coverage ratio will exceed 70 % of the total energy consumption of 1,758 samples. This coverage ratio seems to be enough.

Commercial Sector: 1,000 toe

(Reasons)

- The energy coverage ratio of the Commercial Sector is lower than the Industrial Sector in the case of 1,000 toe. However, the Steering Committee wishes to cover this sector to some extent in the Energy Management System.
- It expects more efficient work in terms of MOME administration when a certain volume of target organizations (about 30) are selected.

(iii) Issues and Necessary Steps

As shown below, there are some issues in the selection of threshold because the analysis is based on insufficient data.

- Original data of the analysis was obtained from EPS's customer's data. However, the customer's data is taken by whole organizations, not by sites. Therefore, it cannot grasp accurate energy consumption data by site. Designations made by site will result in a certain degree of ambiguity.
- In addition, energy consumption is estimated by the conversion of electricity volume using a power ratio (electricity-fuel consumption ratio). This method also has a certain degree of ambiguity.

In order to tackle the above issues of ambiguity, the JICA Study Team recommends that MOME conduct a pre-survey (complete count survey) for grasping the real energy consumption of consumers and review the results of the threshold analysis, before starting the scheme of the Energy Management System.

(4) A-4: Boundaries to be Designated

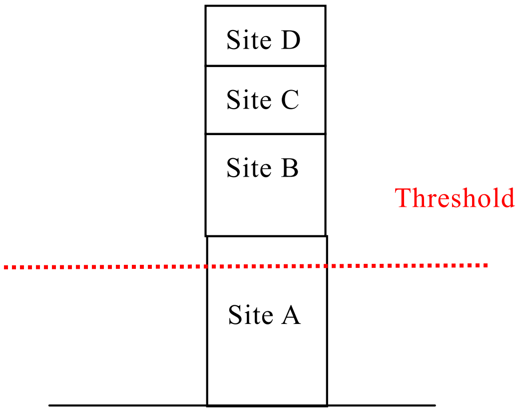
(a) Monitoring Unit in Industrial and Commercial Sector

Monitoring units in the Industrial Sector (Manufacturing, Mining and Transformation Sectors) and the Commercial Sector is discussed in this section. The discussion point is regarding which unit is designated, a whole organization (Designated Organization), individual site (Designated Site) or both

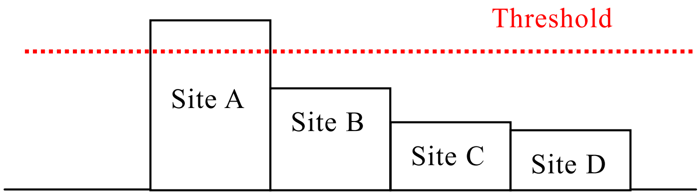
(i) Study Options

The following options were discussed

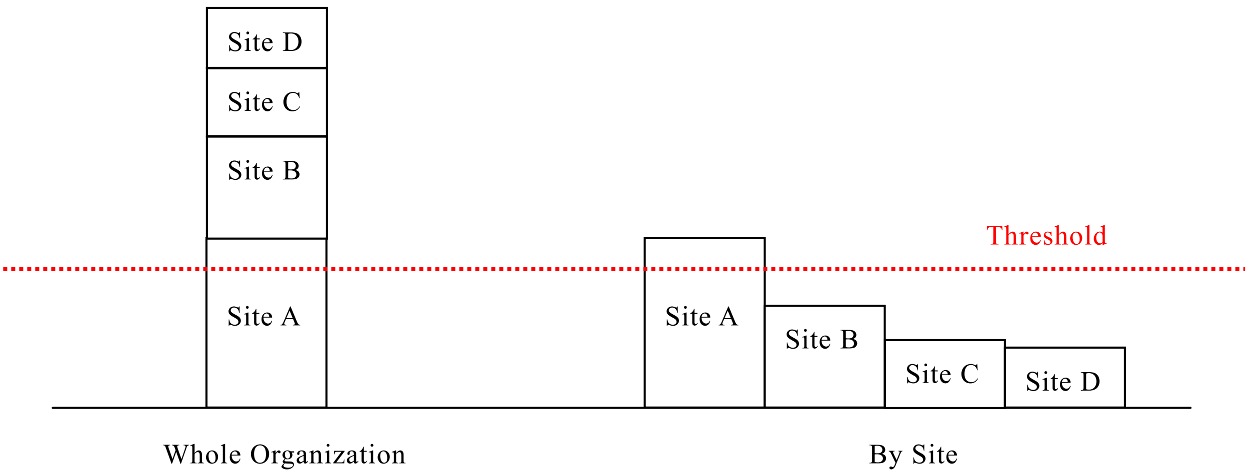
Option 1: Case where a whole organization is a monitoring unit if the total energy consumption of the whole organization exceeds a threshold.



Option 2: Case where each individual site is a monitoring unit if the energy consumption of the site exceeds a threshold. In the case below, only Site A has been designated for monitoring.



Option 3: Case that a whole organization and each individual site are monitoring units if the energy consumption of the whole organization or the site exceeds a threshold. In the case below, both the whole organization and Site A have been designated for monitoring.



(ii) Consultation Results

Through consultation with the Steering Committee, the aforementioned Option 3, both a whole organization and each individual site, was selected. Because the Steering Committee intended to include business entities which includes many franchise shops, not just large energy consumption sites. An individual shop itself has a small amount of energy consumption, but a whole organization consumes much energy. This method has already been adopted in Japan since 2010 (before 2010, individual sites had been monitored in Japan).

Under the assumption that Option 3 had been adopted, procedures outlining the submission of Periodical Report is shown below. The Periodical Report for both whole organizations and individual sites (if individual site is also designated by a threshold) is submitted to MOME through the HQ of the organization.

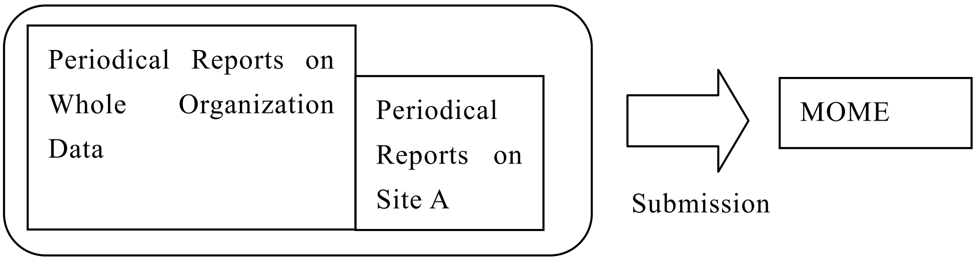


Figure 9-5 Submission Flow of Periodical Report

(iii) Issues and Next Steps

The JICA Study Team raised the following issues if Option 3 is adopted.

- In order to collect all the data of a whole organization, a data collection system for the whole organization should be established within the organization beforehand.
- It might be difficult for organizations in Serbia to collect whole organization data or newly establish such a data collection system from the beginning of the Energy Management System.

The Steering Committee reviewed the aforementioned opinions of the JICA Study Team and then considered an implementation plan that would have the monitoring start from Option 2 ("by site" data collection) and then switch to Option 3 (both a whole organization and site data collection) after establishing a data collection system within the site. The JICA Study Team basically designs the scheme assuming the adoption of Option 3, but makes a "2 steps (Option 2 and then Option 3)" implementation plan. In other words, at the first stage, a whole organization which exceeds a threshold is not monitored.

(b) Monitoring Unit in Transformation Sector

The Transformation Sector (Power, Heat Supply, Oil Refinery, etc.) has unique characteristics that transform primary energy to final energy at their plants and their own distribution system to consumer side.

So the monitoring unit of the Transformation Sector is elaborately defined apart from the discussion of the Manufacturing and Mining Sector.

(i) Case of Power Utility

The discussion point is determining the boundary of the monitoring units for power utilities in considering the respective boundaries of power plants, their buildings, and distribution.

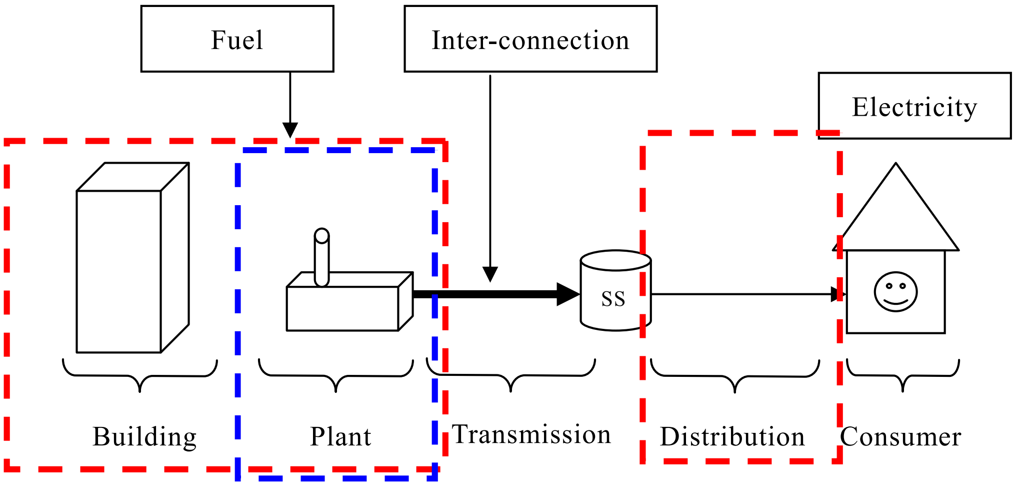
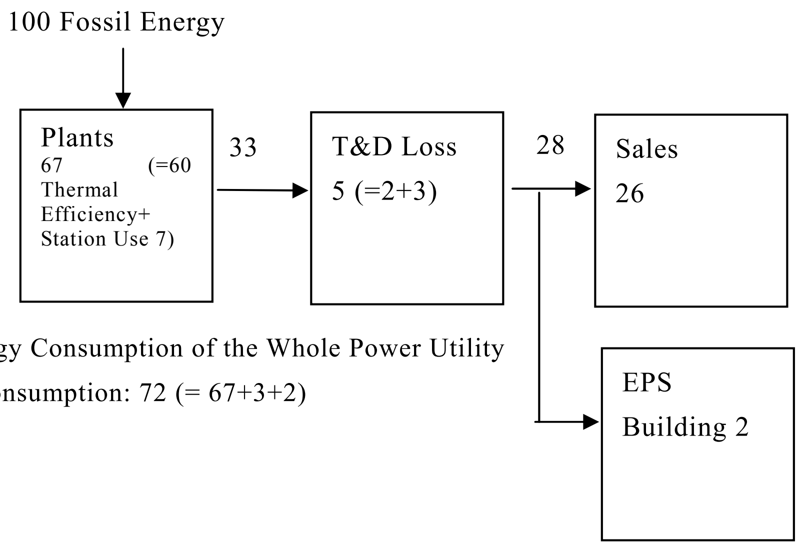


Figure 9-6 Energy Flow of Power Utility

Through consultation with the Steering Committee, it was confirmed that the whole organization would be monitored within the red column shown in the above figure. This is because MOME wishes to monitor not only the power plant but also distribution loss and building consumption of the power utility.

On the other hand, power plants as Designated Sites are monitored within the blue column shown in the above figure. The monitoring unit of the power plant is indicated separating transformation loss and plant use in the power plant.

For reference, the calculation sample of energy consumption in the whole power utility is shown below.



Definition of Energy Consumption of the Whole Power Utility

Total Energy Consumption: 72 (= 67+3+2)

Figure 9-7 Sample of Calculation of Energy Consumption in the Whole Power Utility

Because a power utility is different from manufacturers in terms of how energy is consumed, the Periodical Report for power utilities should be prepared in a specific format in the energy consumption calculation. In addition, in the calculation of energy consumption in the whole organization, power plant consumption (transformation loss and plant use), distribution loss and consumption of EPS's buildings are separately indicated. As for the calculation of energy consumption in power plants, transformation loss and station use are also separately indicated.

(ii) Case of Heat Supply Utility

The discussion point is determining the boundary of the monitoring unit for power utilities in considering the boundaries of heat supply plants, their buildings, transmission and distribution.

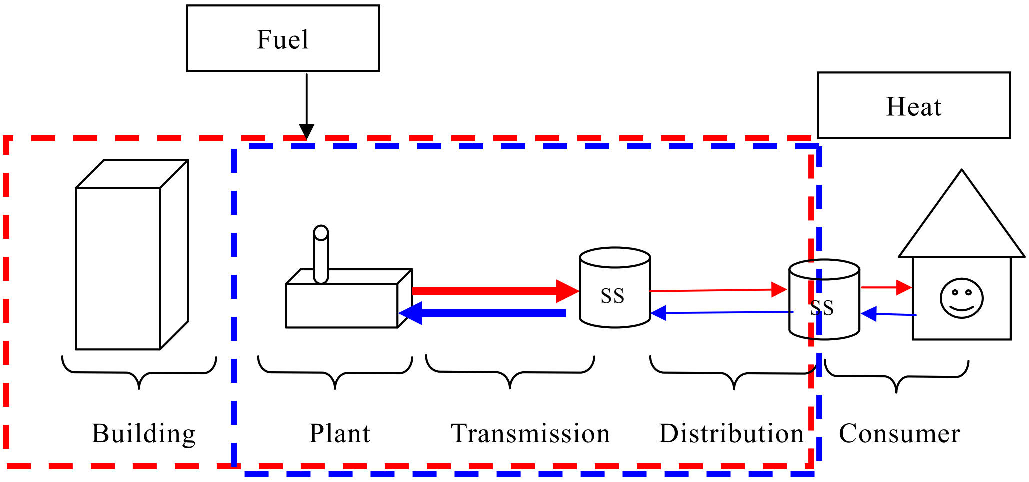


Figure 9-8 Energy Flow of Heat Supply Utility

Through consultation with the Steering Committee, it was confirmed that the whole organization would be monitored within the red column shown in the above figure. This is because MOME wishes to monitor not only the heating plant (transformation loss and plant use) but also transmission and distribution loss including energy loss by leakage, energy consumption of substations, and buildings.

On the other hand, heating plants as Designated Sites are monitored within the blue column shown in the above figure. The monitoring unit of the heating plant includes the heating plant itself, transmission and distribution loss and energy consumption of substations.

Like in the case of a power utility, the Periodical Report for the heating supply utility should be prepared in a specific format in the energy consumption calculation.

(iii) Case of Oil Refinery Company

The discussion point is determining the boundary of the monitoring units for an oil refinery company in considering the boundaries of refinery plants, their buildings, and transmission.

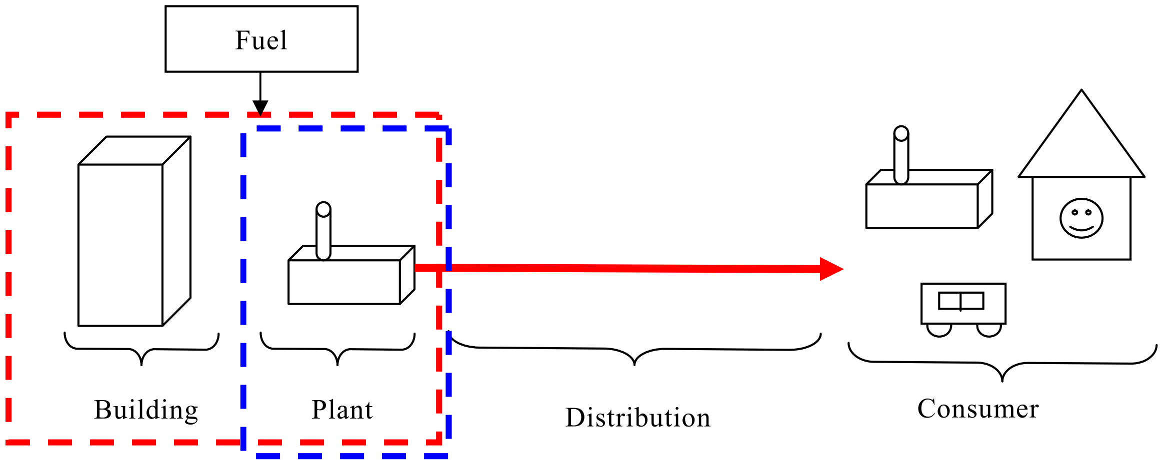


Figure 9-9 Energy Flow of Oil Refinery Company

Through consultation with the Steering Committee, it was confirmed that the whole organization would be monitored within the red column shown in the above figure. The boundary for the whole organization covers refinery plants (transformation loss and plant use) and buildings of the whole company. The distribution of products is out of the boundary of the refinery company because other organizations operate such a trading system.

On the other hand, refinery plants as Designated Sites are monitored within the blue column shown in the above figure.

Like in the case of a power utility, the Periodical Report for heating the supply utility should be prepared in a specific format in the energy consumption calculation.

(c) Monitoring Unit in Municipality Sector

The discussion point in this section also covers the monitoring unit in the Municipality Sector. As mentioned previously, Municipality Energy Management System (MEMS) has already begun as a pilot project. The nation-wide EMS is necessary to harmonize with the MEMS.

It has already been set so that a facility exceeding the threshold is monitored individually by the nation-wide EMS. In this section, the monitoring methods of Municipality buildings or facilities which do not exceed the threshold is the discussion point.

(i) Study Options

The following figure shows the boundaries of the Municipality EMS (MEMS) and the nation-wide EMS. In this section, the reporting contents from the MEMS to the nation-wide EMS were discussed.

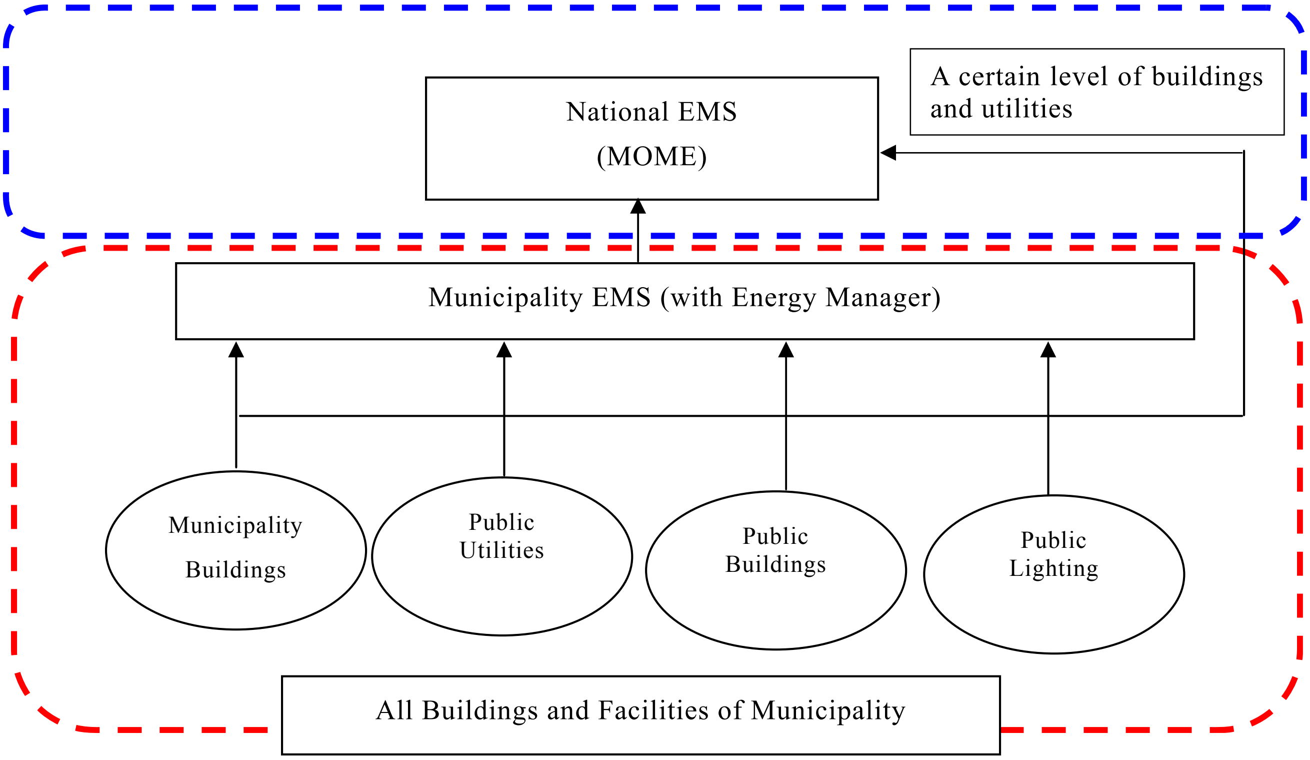


Figure 9-10 Reporting Flow in the Municipality Sector

Option 1: Case where the contents of the MEMS are summarized and submitted to MOME
Option 2: Case where all the data collected from MEMS are submitted to MOME

(ii) Consultation Results

Through consultation with the Steering Committee, Option 1, the summary of which has been submitted to MOME, was selected for the following reasons.

- A Municipality manages all the facilities within the MEMS and the nation-wide EMS should not cover the same depth in energy management in order to avoid duplication.
- The main purpose of the MEMS data collection within the nation-wide EMS is creating a nation-wide database of energy. In this context, the MEMS data should be summarized and converted for the nation-wide database of energy.

(d) Monitoring Unit in Central Government Sector

As described previously, all Central Government Buildings have been monitored by the nation-wide EMS regardless of energy consumption volume, and the Central Government Control

Facilities are monitored and a summary report from each Ministry is submitted to MOME, if an individual building does not exceed a threshold.

Monitoring units in the Central Government Sector have been summarized as follows.

Table 9-3 Monitoring Unit in Central Government Sector

	Area to be Reported	Reporting Flow
Central Government Buildings	All individual buildings regardless energy consumption volume	Reporting a whole Ministry's data and individual buildings under the Ministry to MOME
Central Government Control Facilities	Same as Category A-1 or A-2	Same as Category A-1 or A-2

(5) A-5: Annual Schedule and Task Allocation

(a) Frequency Submission of Periodical Report

Through consultation with the Steering Committee, it has been confirmed that the frequency submission of Periodical Report is once a year and tasks are rotated annually.

(b) Schedule of Each Category

Through consultation with the Steering Committee, all categories have the same schedule yearly due to the following reasons.

- If each category has its own schedule, there is a risk that the administration work of MOME may become disorganized and confused.
- The administration work of MOME is expected to be efficient if all categories have the same schedule.

(c) Timing of External Energy Audit

External energy audit is an action that the Designated Organization voluntarily takes based on their self-judgment. It is not necessary to specify the timing of the audit by any regulation.

(d) Annual Schedule and Task Allocation

In consideration of the aforementioned discussion results, under the schedule of the Energy Management System, Periodical Report will be submitted within the first quarter (January-March) of the fiscal year, and then MOME will check the contents of the Periodical Report in 6 months (April-September) as well as check for poor management of the organization or site during the remaining period (October-December).

Annual schedule and task allocation (tentative) is shown below.

Preparation **Checking Reports**

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**
MOME	Announcement for new registration and submission	Registration		Further requesting and clarification of PR		Check of PR
Designated Organization Category A-1&2 Category B-1&2	New registration into EMS and EM (if necessary) Preparation of PR		Closing Date of Submission of PR	Response to the request and clarification		
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
MOME	Check of PR	Check of PR	Check of PR	Judgment of poor management	Inspection	Instruction or penalty
Designated Organization Category A-1&2 Category B-1&2					Response to inspection	

Poor Management Judgment Flow

Figure 9-11 Annual Schedule (tentative)

(6) A-6: Qualification Methods for Energy Manager, Energy Officer and Accredited Energy Auditor

(a) Methods of Qualification

In this section, qualification methods for energy manager, energy officer and accredited energy auditor have been discussed. (As mentioned later) the Energy Officer is the supporter for the outsourcing Energy Manager that can be assigned for only designated buildings.

Through consultation with the Steering Committee, each qualification method has been set up as follows.

Energy Manager:	**National Examination or Official Training Program with a Certificate Examination**
Energy Officer:	**1 Day Training Program**
Accredited Energy Auditor:	**Official Training Program with a Certificate Examination**

(b) Certificate and License Issuing Process Flow Chart

Through consultation with the Steering Committee, the following points have been confirmed.

- The SEEA is a responsible body overseeing the examination and training programs and issues the Certificate once applicants fulfill the needed qualification process.
- The Energy Officer has been acknowledged by the Certificate of the training program.

- Energy Manager and External Energy Auditor are acknowledged by the applying to licenses to MOME after the examination or training program.
- All of the qualification methods require the Certificate of examination or training program, as a preset minimum requirement.
- The minimum requirements for the Energy Officer and External Energy Auditor are confirmed by showing proof before taking the training programs.
- It is only for the Energy Manager that proof substantiating having passed the minimum requirements are submitted at the time of application of the licenses to MOME (after passing the examination or training program). This is because, in order to broaden the opportunity to obtain the licenses of the Energy Manager, the minimum requirements are not necessary to be shown at the timing of the examination or training program.

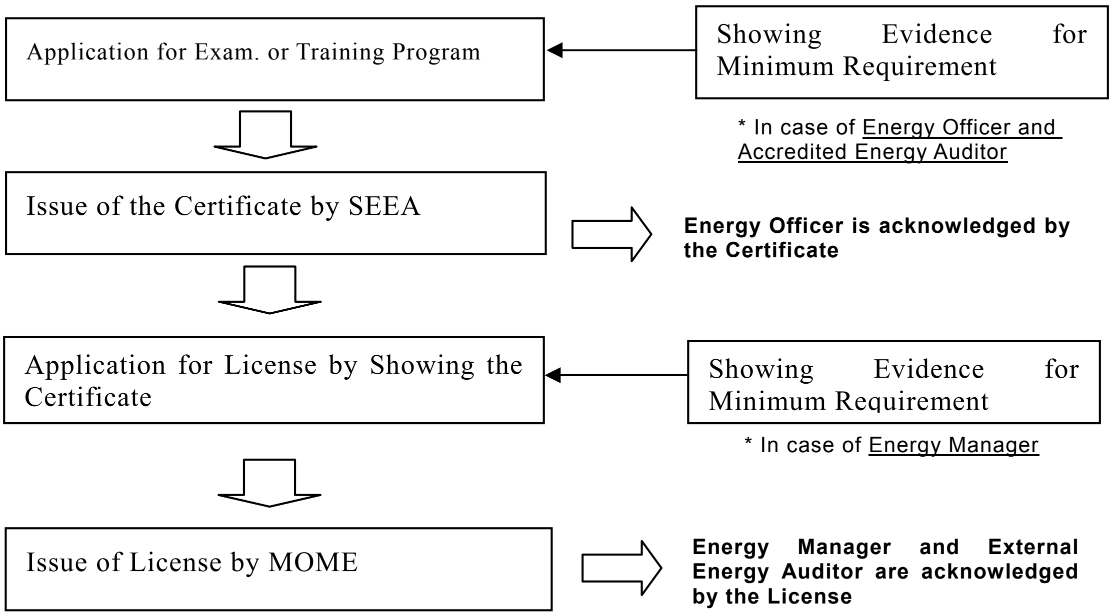


Figure 9-12 Workflow of Acquisition of Certificate and License

(c) Minimum Requirement of Qualification

The minimum requirements for each qualification have been set up as follows:

Energy Manager:	**Site Management Experience 3 Years and Graduate or Bachelor of Science (Technical Profile)**
Energy Officer:	**Site Management Experience 3 Years**
Accredited Energy Auditor:	**Certificate of Energy Manager or License of Energy Manager, Number of Experience of Energy Audit, and Master of Science**

(d) Summary of Qualification Methods

The following table is the summary of the qualification methods. Although the issue of whether or not the qualification requirement should be applied to MOME inspectors was brought up, it was eventually decided that a specific qualification for inspectors are not necessary if the individual in question is a staff of MOME.

Table 9-4 Summary of Qualification Methods

	Energy Manager (Municipal EM included)	**Energy Officer**	**Accredited Energy Auditor**	**Inspector**
National Examination (1 day)	x			
Training Program with Certificate Exam. (7-8 days)	x			
Training Program		x (1day)	x (2-3days) Orientation & Practical with Examination	-
Requirement for Training or Examination	Nothing	Site Management Experience 3 Years	(i) Certificate of EM and (ii) Number of Experience of Energy Audit and (iii) Master of Science	
Requirement for License	(i) Site Management Experience 3 Years and (ii) Graduate or Bachelor of Science (Technical Profile)			MoME staff

(7) A-7: Tasks of Accredited Energy Auditor

(a) Objectives of the Accredited Energy Auditor

As described in the previous part, an external energy audit is conducted based on the self-judgment of the Designated Organization. Therefore, the Designated Organization can freely select a consultant from among Accredited Energy Auditors or non Accredited Energy Auditors. However, MOME will recommend utilizing an Accredited Energy Auditor that can contribute to the smooth implementation of the Energy Management System by using some incentive schemes (subsidy, rental measurement tools, etc.). It has been planned that when an incentive scheme prepared by MOME is utilized for an external energy audit, the applicant must select an Accredited Energy Auditor and the audit method must be complied with prepared Audit Standards. In this section, the contents of the Audit Standards have been discussed as follows.

(i) Study Options

The following options were identified

1. Checking the contents of the Periodical Report and make improvement recommendations or proposals as needed
2. Conducting an EE&C study and recommending some countermeasures
3. Conducting staff training
4. Evaluating site performances in the light of EE&C activities
5. Making report on results of the EE&C study including recommendations and proposals

(ii) Consultation Results

Through consultations with the Steering Committee, the following tasks are to be conducted by the Accredited Energy Auditor (**Bolded** portions represent priority tasks). Checking the contents of Periodical Report and conducting performance evaluations have been identified as priority tasks. It has been confirmed that the training is not necessary for the Accredited Energy Auditor tasks.

1. **Checking the contents of the Periodical Report and making improvement recommendations or proposal as needed**
2. **Conducting an EE&C study and recommending some countermeasures**
3. ~~Conducting a training for staff~~
4. ~~Evaluating the performance of the site in terms of EE&C activities~~
5. **Making report on results of the EE&C study including recommendations and proposals**

(b) Submission of the External Energy Audit Report

Through consultation with the Steering Committee, when an incentive scheme prepared by MOME is utilized for an external energy audit, the applicant must select an Accredited Energy Auditor and the audit method must comply with prepared Audit Standards. And then the Accredited Energy Auditor should create a report to be submitted to the client as well as MOME with summaries included.

(8) A-8: Evaluation Criteria and Management Standards

(a) Direction of Evaluation Criteria

(i) Necessity

The Japanese EMS has introduced Criteria including Management Standards that are guidelines to be complied by the Designated Organizations or Sites. From the regulator's viewpoint of the scheme, the Evaluation Criteria can be a "yardstick" that measures the performance of the Designated Organizations or Sites in terms of energy management.

Through consultation with the Steering Committee, it was decided that the Serbian EMS should also guidelines similar to the Japanese model. Accordingly, the following directions were adopted.

- Like the Japanese EMS, Serbia will introduce Evaluation Criteria (Guideline) as a yardstick for evaluation. The Evaluation Criteria will assist in evaluating the proper methodologies and processes in energy management apart from the numerical evaluation of energy consumption.

- The evaluation Criteria in the Serbian version will be published in the regulations or announcements from MOME. The Evaluation Criteria does not require absolute compliance and will simply be used as general guidelines.

(ii) Methodology for Making Evaluation Criteria for Serbia

As the Evaluation Criteria is expected to be widely used by various types of stakeholders, it should be acceptable to them. In order to ensure the criteria's acceptability, it has been confirmed that Evaluation Criteria should be designed and discussed within an Advisory Committee that has been newly established by stakeholder representatives.

The Advisory Committee has discussed the following points that have been proposed by the JICA Study Team.

- Status and Objectives of the Evaluation Criteria in Serbia
- Contents
- Compliance Level
- Management Standards

In addition, the Advisory Committee can be an effective dissemination opportunity allowing for an understanding of the Serbian Energy Management System. The JICA Study Team together with MOME arranges the Advisory Committee while a local consultant serves as its facilitator.

A workflow of the Advisory Committee has been shown below.

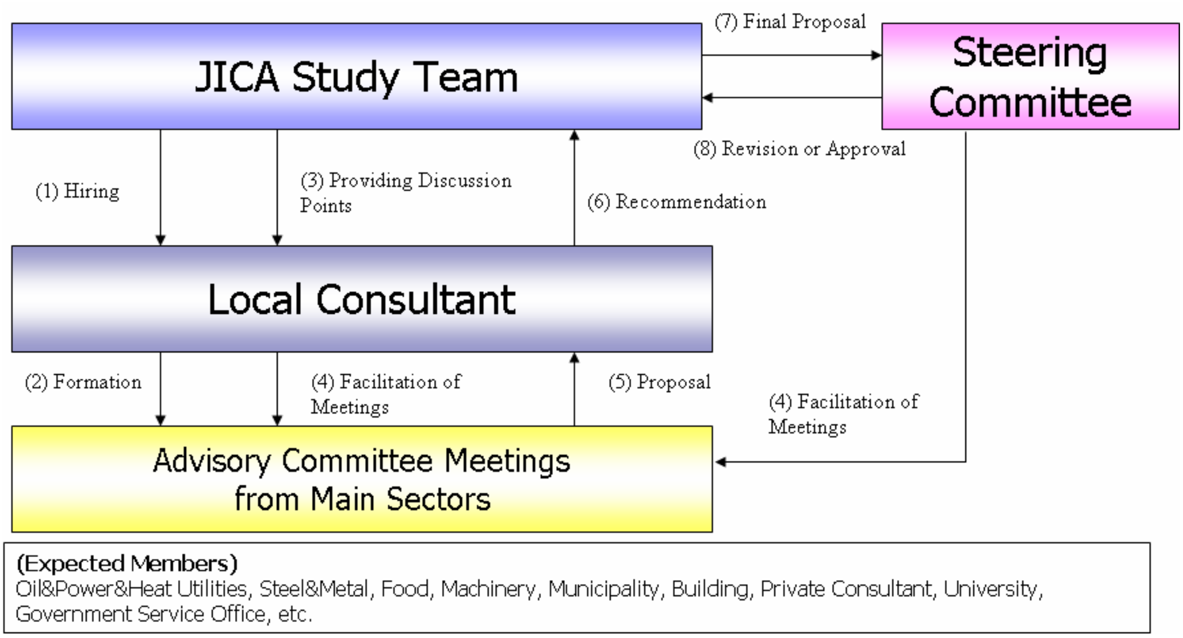


Figure 9-13 Work Flow of Advisory Committee

(b) Drafting of Evaluation Criteria and Management Standards

The Advisory Committee meeting which was organized by representatives from the major industrial world or literate was set to discuss the Evaluation Criteria for Serbia. Each discussion topic was proposed by the JICA Study Team and Steering Committee and the final draft of the Evaluation Criteria was made after discussions held during the Advisory Committee meeting and was confirmed by the members.

The proposed Evaluation Criteria for Serbia is based on the Japanese model. Therefore, discussions focused mainly on the adoption of contents in consideration of conditions in Serbia, various local standards, consistency with EU standards etc.

(i) Methodology

The Advisory Committee convened a total of four times (twice in September and November 2010 respectively) while discussions with each member were held with a local consultant during the intervening periods. In addition, the Pre-Advisory Committee meetings were held before the 1st and 3rd Advisory Committee meeting to ensure that the following meetings ran smoothly. The main issues covered by the Advisory Committee were as follows:

Table 9-5 Advisory Committee Agenda

1st AC Meeting	•**[Introduction]** •Explaining outline of the project •Explaining function of AC meeting •Proposing a EC for Serbia
2nd AC Meeting	•**[Identify actions]** •Collecting members comments on EC •Identify issues •Identify the next action
3rd AC Meeting	•**[Final discussion]** •Six categories •Standards •Items
4th AC Meeting	•**[Summary]** •Achievements through the AC meeting •Methodology to finalize EC for Serbia •Tasks and plans in the future

(ii) Members for the Advisory Committee Meetings

The Advisory Committee meeting members were as follows.

Table 9-6 Advisory Committee Members

Name	Belonging
1. Professor Goran Jankes	Mechanical Faculty Belgrade Univ
2. Professor Jovan Petrovic	Mechanical Faculty Novi Sad Univ
3. Mr. Mihajlo Mihajlovic	Serbian Electrical Company
4. Mrs.Vesna Stojanovic	NIS (Petrol Industry Serbia)
5. Mr.Milos Savic	Messer Tehnogas
6. Mr.Sasa Borzanovic	Petro Chemical Industry Pancevo
7. Mr.Nenad Misolic	US Steel Metal Factory Smederevo
8. Mr. Goran Milosavljevic	Electrical Cable Factory Jagodin
9. Mrs. Simonida Spiric	Serbian Electrical Company
10.Mr. Banjac Simo	Military Technical Institute

(iii) Results

As a result of the Advisory Committee's discussions, the following directions were set up (the final draft of the Evaluation Criteria is attached to Appendix 4).

■ Evaluation Criteria

- The Evaluation Criteria should function as guidelines (Evaluation Criteria to determine whether the activities carried out are appropriate with regards to regulations) to be implemented on sites where the Serbian Energy Management System is in use.
- Each commercial operator must establish Management Standards for each type of energy and each energy consuming system based on the Evaluation Criteria, and based on this work towards energy rationalization.
- Adoption of the framework of Evaluation Criteria. It consists of six categories and four management phases.
- Adoption of items to be managed in the Evaluation Criteria.
- The format of Management Standards was not determined. However it will be determined and shown by MOME based on the proposed format
- Adoption of four proposed numerical standards (Standard A: Standard combustion air ratio and combustion air ratios for industrial furnaces, Standard B: Standard exhaust gas temperature for boilers and Standard waste heat recovery rates for industrial furnaces, Standard C: Standard furnace outer wall surface temperatures, Standard D: Equipment to improve power factor). Addition of biomass to the types of energy that specify the combustion air ratio for Standards A. However, the management values specified in each standard shall be subject to ongoing review.
- Adoption of supporting documentation (Separate Equipment Operation Management Checklist) submitted by the members as backup material for Evaluation Criteria. However

the contents shall be subject to an ongoing review.

(Reference)

Regarding the individual items, the following comments were raised in the Advisory Committee meetings and those were adopted.

- (Item 1 /Management) - Addition of biomass and woodchips etc. to the types of fuel that require combustion management.
- (Item 1 /Management) – The addition of new items recommending the mixture of main fuel and auxiliary fuel (coal & heavy oil/light oil, or gas & heavy oil) to the initial fuel used for electrical power generation.
- (Item 5 /Management) - Clarification of facilities that heat and cool targets where heat insulation is specified.
- (Item 5 /Management) - Stated power factor changed from 90% to 95%
- (Item 6 /Management) - Addition of management items for compressed air leakage and compressor operation
- (Item 6 /Measures for renewal facilities) - Addition of the adoption of highly efficient electric motors
- (Item 6 /Management) - Presently there are no equivalent standards to the Japanese JIS criteria for lighting equipment. However, it is expected that they will be established in the future, and it was decided that such Evaluation Criteria shall be based on standards to be determined at a later date. Standards for other equipment shall also be reviewed henceforth.

(iv) Items to be Further Studied

Under the Study, management items and the function and framework of the Evaluation Criteria for Serbia's Energy Management System have been approved in the form of final proposals. Basically, the workable Evaluation Criteria for Serbia's Energy Management System have been drafted. However, ongoing discussions shall be necessary to determine concrete standard numerical values and to gather Management Standards for various types of facilities etc.

(9) A-9: Contents of Periodical Report

(a) Composition of Periodical Report

A composition of the Periodical Report of the Serbian EMS has been studied in consideration of the Japanese format and in compliance with EU Directives regarding energy management.

Through consultation with the Steering Committee, the adoption of the following directions has been confirmed:

- The Japanese format (EE&C Results Report and Middle and Long Term Plan Report) can be used as basis of Serbian format.
- The energy consumption calculation sheet also includes columns for carbon dioxide emissions, re-calculation of renewable energy utilization and the water usage amount.
- The conversion factors to the primary energy of fuels, electricity, provided steam etc. shall

be determined and announced by MOME.

- The Numerical target will be the energy intensity (However, at the beginning phase, the energy consumption amount will be applied)。
- Compliance with Evaluation Criteria shall be checked.
- Middle and long term EE&C plans may include not only the investment plans but also O&M improvement suggestions. They shall be described separately.

Table 9-7 Proposed Composition of Periodical Report (for Designated Site)

	EE&C Results
1	Energy consumption calculation sheet
a	**Renewable energy utilization (re-calculation)***
b	**Water consumption***
c	**CO_2 emission calculation****
2	Energy consuming equipment list and operation status
3	Calculation of energy intensity
4	Historical trend of energy intensity
5	Reasons of failure to achieve the target of energy intensity improvement
6	Compliance check with evaluation criteria
	Middle and Long Term Plan Report
1	EE&C investment plan and its effects
2	Difference between the existing plan and actual practice of the previous year

* Colored columns are additional from Japanese version.

** It is mandated to report by another law in Japan.

Two types of Periodical Report have been prepared for a Designated Organization (a whole organization) and a designated site (individual site). The proposed composition above is for the format of the Designated Site. As for a version of the Designated Organization, the following changes were made:

- “2. The Energy consuming equipment list and operation status” has been changed to the “List of Designated Sites”
- “3. The calculation of the energy intensity” has been changed to the “Calculation of energy intensity representing a whole organization”

As mentioned previously, whether or not to start reporting for the whole organization in the beginning stages of the Serbian EMS scheme is still being considered due to the complications involved with data collection. However, in this section, it has been assumed that the reporting for the whole organization has been adopted and that the formats for the Periodical Report have been designed and proposed.

Expected contents for Designated Organization and Designated Site were proposed as follows.

Table 9-8 Expected Contents of Periodical Report for Designated Organization

EE&C Results Report	Middle-Term Plan Report
(1) List of the Designated Sites (2) Energy consumption calculation sheet for the organization including RE, water and CO_2 emission (3) Calculation of energy intensity of the organization (4) Historical trend of the energy intensity of the organization (5) Reasons of failure to achieve the target of energy intensity improvement (6) Compliance check with Evaluation Criteria	(1) EE&C investment plan and its effects (2) Difference between the existing plan and actual practice of the previous year of the whole organization

Table 9-9 Expected Contents of Periodical Report for Designated Site

EE&C Results Report	Middle-Term Plan Report
(1) Energy consumption calculation sheet for the site including RE, water and CO_2 emission (2) Energy consuming equipment list and operation status (3) Calculation of energy intensity of the site (4) Historical trend of energy intensity of the site (5) Reasons of failure to achieve the target of energy intensity improvement (6) Compliance check with Evaluation Criteria	(1) EE&C investment plan and its effects on the site (2) Difference between the existing plan and the actual practice of the previous year of the site

(b) Format of Periodical Report

In this section, the format details are discussed based on the individual contents of the report. Each category requires some changes from the general format (ex. Calculation method of energy intensity). The formats for each category with some note changes are proposed in Appendix 5.

The following (i) to (viii) shows the contents for each site and (ix) to (xiii) shows the ones for an organization/company. Items without notes mean that they were presented based on the Japanese version and accepted. In addition, the explanation for the items with the same concept for both the site and the organization has been omitted.

<For Sites>

(i) Energy consumption calculation sheet

(ii) List of equipment

(iii) Calculation of energy intensity
(iv) Trend of energy intensity
(v) Reasons of failure to achieve the target of energy intensity
(vi) Compliance check of Evaluation Criteria
(vii) Energy efficiency plan and its effects
(viii) Explanation of difference from previous year's plan

<For Organization>
(vii) Energy consumption calculation sheet
(viii) Calculation of energy intensity
(ix) Reasons behind the failure to achieve the energy intensity target
(x) Compliance check of Evaluation Criteria
(xi) List of designated sites
(xii) Energy efficiency plan and its effects
(xiii) Explanation of the difference from previous year's plan

(i) Energy Consumption Calculation Sheet
<General issues>

- Calculation of energy consumption consists of two sheets: one shows input and output and the other contains necessary convertors.
- Input items are the annual consumption of energy, fuels, heat including steam, electricity in the unit of t, m3, kWh and others, water usage amount, and provided amount of them. The amount of renewable energy consumption will be automatically calculated as the re-calculation.
- The output items are the annual consumption of the final energy (toe) and the primary energy (toe), CO2 emissions (tCO2), and the annual consumption of water.
- The conversion factors necessary for calculation shall be provided and announced by MOME.

<Issues which were discussed>
The following part describes the issues which were discussed and the reasons underlying the decisions.

Definition of Energy
(Conclusion):
The definition of energy shall follow the definition of the EU directive, "Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and the repealing Council Directive 93/76/EEC."
(Discussion and Reasons):
This is to maintain consistency with EU Directives, especially the above one.

Renewable Energy

(Conclusion):

In the Serbian EMS, energy consumption shall not discriminate between renewable energy or non-renewable energy, (in other words, renewable energy is counted as consumed energy). However, energy consumption of renewable energy will be automatically calculated.

(Discussion and Reasons):

The current definition of energy is limited compared to that EU's renewable energy. For example, a heat pump is defined as a form of renewable energy since it utilizes aero heat. However, the energy data which will be collected in the future EMS is not enough to calculate the contribution of aero heat. It requires additional data. Therefore, the re-calculation of renewable energy will only be for reference. However, MOME still requires such data.

Water Consumption

(Conclusion):

Annual water consumption shall be reported for reference.

(Discussion and Reasons):

Although water will not be defined as energy according to the law, the necessity of reporting was discussed and decided to be one of the reporting items in consideration of the following reasons; there must be a certain potential in water saving and as a society, water treatment consumes a large amount of energy. Thus, letting the sites report water consumption would have secondary effects to reduce its amount. In addition, it was confirmed that there would be no problems from a legal perspective.

Conversion Factors

(Conclusion):

Factors of specific heat, heat provided from others, electricity shall be prepared and announced by MOME. The necessary factors are the following three.

Table 9-10 Conversion Factors

Fuels	Specific heat (from original amount, tons, m3, to toe) The factors which are used in national energy statistics will be used. However, temporarily, the ones of IEA will be utilized.
Electricity	Factors from final energy to primary energy 1) Factor of EU (efficiency: 40%) will be used 2) Factor calculated from the data provided by EPS 2) will be chosen
Heat provided by others (Stem, hot and cold water etc.)	Factors from final energy to primary energy Factors will be calculated from the data provided by district heating and steam supply companies

(Discussion and Reasons):

Possible alternatives and recommendations for each item were presented, together with the cases of Japan, and discussed.

Fuels (Specific Heat)

There are two choices; 1) EU factor and 2) factor used in national energy statistics. It is possible to use the factors in the EU directive, but they are average values and it is better to use factors that reflect the domestic situation. Therefore, the conclusion was to use the factors used in the national energy statistics which must be defined somewhere in order to maintain consistency. However, those from the national energy statistics were not confirmed at this moment (as of December 2010), the factors used in IEA energy statistics were quoted. In Japan, the factors of the national energy statistics have been used.

Electricity (Factors from final energy to primar energy)

There are two choices; 1) EU factor and 2) calculated factors from the data provided by EPS. In order to reflect the Serbian situation, 2) is preferable. Thus, 2) was selected.

Heat Provided by Others (Steam, Hot and Cold water etc.)

These factors will not be grasped through national energy statistics. It requires an individual survey to determine these values.

(ii) Energy Consuming Equipment List and Operation Status

- The equipment list reports energy consuming equipment in the form of a list. It is required to cover more than 80 % of all the energy consumption by the reported equipment.
- It was proposed as a discussion point regarding how much percentage should be applied and the decision followed the case of Japan, namely 80 %.

(iii) Calculation of the Site's Energy Intensity

- Calculation of the energy intensity requires two values such as annual energy consumption and the value which should be a denominator.
- Annual energy consumption will be calculated in the "Energy Consumption Calculation Sheet." On the other hand, how to determine the value which should be a denominator was discussed separately.
- In the format of a Periodical Report, a value which should be a denominator should be filled in first. Then, the energy intensity of the fiscal year will be calculated automatically.
- In the beginning phase of the scheme operation, the target will be managed by the energy consumption amount, not by energy intensity.
- Regarding the particular categories (transformation sectors etc.) the energy intensity or energy consumption will have to be reported according to determined categories.

(iv) Historical Trend of the Energy Intensity of the Site

- The table shows the overall energy intensity for 5 years.
- When the values for 4 years were filled in the corresponding table, excluding the value which will be calculated in the (iii), improvement rates to each previous year and the average rate of 5 years will be shown automatically.
- Regarding the particular categories (transformation sectors etc.) will have another table which shows the historical trend of categorized intensities for reference.

(v) Reasons when the Numerical Target was not Achieved

- When the improvement rate of energy intensity which will be calculated in (iv) misses the target, e.g. 1 %, the reasons for the failure should be stated.
- The reasons should be described in case of the failure over the mid to long term, an average of 5 years, and in the case of failure to the previous year.

(vi) Compliance Check with Evaluation Criteria

- EMS scheme mandates the designated sites to set management standards for equipment complying with the Evaluation Criteria which will be announced. This section is for checking the following items.
  - Whether or not management standards are set
  - Whether or not the measurements and the recordings set in the management standards are conducted
  - Whether or not the maintenance and checks set in the management standards are conducted
  - Whether or not the measures complying with the Evaluation Criteria was adopted during the installation of new equipment

The following (vii) and (viii) relates the middle to long term plan. (In Japan, they are reported in the middle and long term plan not in the periodical report.)

(vii) EE&C Investment Plan and its Effects of the Site

- This section is required to report the plan for EE&C. The required contents are as follows;
  - Planned measures for EE&C will be reported regarding the equipment, contents, and estimated effects.
  - The measures which need investment and the ones via operational improvement should be described separately.
- In Japan, the description should be mainly the measures with investments, but it is possible to describe the measures via operational improvements. On the other hand, the potential via operational improvements in Serbia seems to be large. Therefore, both shall be described separately.
- Whether or not enough measures are planned in order to achieve the targets will be checked in

this section.

(viii) Difference between the Plan and the Actual Practice of the Previous Year of the Site

- When there is a difference between the existing plan and the actual practice, the contents and the reasons must be reported.

Below is the description of the Periodical Report Format for organization. The same items for the site (vii, ix, xii, xiii) have been omitted.

(ix) Energy Intensity Calculation Sheet

- The transformation sector is required to create an energy intensity table according to the determined categories
- A supplemental table which indicates the trends of energy intensity in the form of each category will be added for the transformation sector.

(x) Compliance Check with the Evaluation Criteria

- The Evaluation Criteria for organizations, not for sites will be applied.
- Except the above, all are the same for the sites.

(xi) List of Designated Sites

- Basic information (name, address, industrial classification etc.) and annual energy consumption should be shown.
- A column for calculating the summation of the energy consumption of the designated sites is added based on the request in order to grasp it for reference purposes.

(c) Indicator of Energy Intensity

The calculation method of the energy intensity has been basically represented by the following formula.

Energy Intensity=
Consumption of Target Energy / Strongly Relating Value with Product Volume or Service Volume

A definition of the "Consumption of Target Energy" has already been discussed in the previous section. In this section, the discussion point is how to best define the "Strongly Relating Value with Product Volume or Service Volume"

(i) Study Options

The following options were discussed in the definition of the "Strongly Relating Value with Product Volume or Service Volume".

Option 1: Selection of one value of preset options defined in the regulations

Option 2: Selection of one value of preset options recommended by MOME or a definition of the value of the organization itself if special conditions have to be considered.

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected. Option 2 states that a Designated Organization or Site can select the value from some preset options recommended by MOME or can select their original value which are self-defined. An important policy is that any value can be selected but the definition should not change after the adoption of the value.

The following column shows the samples of the calculation methods of the energy intensity in industry and building.

Energy Intensity = Energy Consumption (primary energy equivalent) /

Industry:

(i) Product Volume

(ii) Value which is strongly related to Energy Consumption

Commercial:

(iii) Total Floor Area

(iv) Value which is strongly related to Energy Consumption

- As samples of the above (ii), a methodology which represents one product equivalent by conversion of all products into one product or a methodology which represents "Added Value (=sales amount – material cost)" can be considered.
- As a sample of the above (iv), the product that operations hours is multiplied by floor area can be considered.

(d) Calculation of Energy Intensity of a Whole Organization

In this section, the calculation methods of the energy intensity of a whole organization were discussed. There are a few practical samples in the calculation of the energy intensity of a whole organization. In Japan, the calculation methods of the energy intensity of a whole organization have been introduced since 2010. The Japanese way has been introduced as follows.

In Japan, two calculation methods have bee introduced, separating the multi unit cases from single unit cases in the calculation of energy intensity.

(i) The Japanese Case for a Whole Organization

The following table shows that a single unit case cannot be used for the calculation because various types of business are included in the whole organization. Under such a case, the energy intensity of the whole organization is individually calculated by the weighted average of the energy intensity of the sub-sectors within the organization.

Table 9-11 Calculation Sample of Energy Intensity of a Whole Organization (in case that single unit cannot be adopted)

	Sub-Sector	Net Energy Consumption (a)	Energy Consumption Ratio (b)	Product Volume, etc. (c)	Energy Intensity of this Year (d)	Energy Intensity of Pre Year (e)	Improvement Ratio (f)=(d)/(e)	Weighted Improvement Ratio (g)=(b)x(f)
Group 1	Steal and iron products	18,943 toe	90.5 %	102,390 ton	0.1850	0.1871	98.9 %	89.5
Group 2	HQ Buildings for administration	1,854 toe	8.9 %	33,000 m2	0.05618	0.05721	98.2 %	8.7
Group 3	Other offices	122 toe	0.6 %	2,000 m2 x hrs	0.06100	0.06100	100%	0.6
Whole Company		20,919 toe						**98.8%**

The next table shows that a single unit case can be used. It is simpler to calculate because the energy intensity of the sub-sectors can be individually calculated utilizing the same unit.

Table 9-12 Calculation Sample of Energy Intensity of a Whole Organization (in case that single unit can be adopted)

	Sub-Sector	Net Energy Consumption (a)	Energy Consumption Ratio (b)	Added Value (Sales – Materials) (c)	Energy Intensity of this Year (d)	Energy Intensity of Pre Year (e)	Improvement Ratio (f)=(d)/(e)	Weighted Improvement Ratio (g)=(b)x(f)
Group 1	Retail shops for women's cloth	5,000 toe		2.8 million Euro				
Group 2	Retail shops for bags	2,500 toe		1.0 million Euro				
Group 3	Retail shops for men's cloth	500 toe		0.5 million Euro				
Whole Company		8,000 toe		4.3 million Euro	1,860	1,862	**99.9 %**	

(ii) Consultation Results

Through consultation with the Steering Committee, the following points have been confirmed.

- In a case where the energy intensity of a whole organization is evaluated, all the data of the whole organization must be collected.
- The Japanese calculation method for the energy intensity of a whole organization might be effective in Serbia as well.
- The data collection of a whole organization might lead to confusion in the beginning stages of the scheme of the Energy Management System because such a data collection system has yet to be established in many organizations. The process where the data collection within a site is established at the beginning stage of the scheme should be examined, and then transferred to the data collection of a whole organization.

(10) A-10: Introduction of Numerical Targets and their Status

(a) Necessity of Numerical Target

In this section, the introduction of numerical targets in the Energy Management System was discussed. Such numerical targets will be checked by Periodical Report.

Through consultation with the Steering Committee, the following items were selected for the numerical targets.

- Energy Intensity
- CO2 Emission

(b) Numerical Target of Serbian EMS

The numerical target of the Serbian EMS is discussed. The following preconditions have been considered for the discussion.

- The numerical target should be set up to confirm achievement of energy efficiency in the Designated Organizations.
- EU Directive (2006/32/EC) describes annually a 1 % reduction in final energy consumption (accumulated 9 % reduction in 9 years). In line with the directive, the Serbian EMS also plans to set up the same target for the national target by 2018.
- It is not necessary to completely adopt the same target between the national target and numerical target of the Serbian EMS. However, the numerical target of the Serbian EMS should set up a similar or substantially same target as the numerical target.
- The Serbian EMS plans to adopt primary energy for the calculation and evaluation (not final energy consumption).

In consideration of the above preconditions, the JICA Study Team proposed a realistic numerical target as follows. The Steering Committee agreed on it.

Numerical Target: Annually 1 % Reduction of Total Energy Consumption in Primary Energy

The JICA Study Team took note that (i) it is difficult for developing countries to maintain an annual 1 % reduction of energy consumption during the long-term period, (ii) the target “annually 1 % reduction” can be achieved if the target is set up in the short-term period (by 2018), (iii) 1 % reduction in final energy consumption and primary energy consumption is regarded as the same (under the conditions that a big change in the share of heat and electricity does not happen and the same amount of energy reduction in heat and electricity are achieved).

After 2018, the JICA Study Team proposes “annually 1.5 % improvement of energy intensity in primary energy”, that can achieve a 20 % improvement of energy intensity in 2030 from the base year 2015.

(11) A-11: Utilization of Obtained Data (Benchmark)

(a) Utilization for Benchmark

In this section, the utilization of data collected from the Energy Management System is discussed. The discussion point deals with the collected data utilized for benchmarking.

The disclosure of benchmark data is not included in this discussion point (that is the next step). However, it has been already confirmed that the individual data for Designated Organizations or Sites are not to be made public.

(i) Study Options

The benchmarking is a comparison method utilized to compare the efficiency level as a single indicator within each sub-sector and promote competition. Proper utilization of the benchmark was discussed from the following options,

Option 1: Results of benchmarking will be shared within the same sub-sector.

Option 2: Results of benchmarking are stocked within the MOME database of which there will be no feedback.

Option 3: Benchmarking is not conducted even in a MOME database.

(ii) Consultation Results

Through consultation with the Steering Committee, the Option 2 was selected due to the following reasons.

- Even under the same sub-sectors, each factory has their own products and their own processes. Under such cases, it has not been sufficiently verified at this moment whether the benchmark methodology will be effective and fair as a comparison tool.
- On the other hand, because worldwide trends move to adopt benchmark methodology, it has been judged that the data accumulation for benchmarking should begin within the Ministry.

As a result, at the beginning stage of the scheme, benchmark data will not be feedbacked to the Designated Organizations or Designated Sites and be stocked within the database of the MOME. In the future, when benchmarking methodology is established as an effective tool, the introduction of benchmark data feedback should be considered.

(b) Making Database

The MOME Database is a management tool for the efficient administration of the data accumulation collected from Designated Organizations or Sites. Under this section, a basic policy for database creation has been discussed.

Through consultation with the Steering Committee, the following policies have been confirmed. Based on the policies, the JICA Study Team proposes a concept design of the database in Chapter 13.

- The database should be integrated with the existing MOME database for GIS.
- The database should be able to efficiently sort out and compare the raw data for selection

or comparison.

(12) A-12: Assignment of Energy Manager and Energy Officer)

(a) Possibility of Outsourcing Energy Manager

Through consultation with the Steering Committee, it has already been confirmed that the Energy Manager is basically stationed on site (HQ office or site) and staff is selected from the HQ of that organization or site.

In this section, the discussion points will cover whether the Energy Manager for management of buildings including Municipality and Central Government buildings should be selected on site, or not. Because there are a few cases where the responsible person for building management exists on site, to deal with such cases, the possibility of outsourcing the Energy Manager to buildings is discussed.

Through consultation with the Steering Committee, in those cases where building organizations or sites are designated, an outsourcing Energy Manager is accepted when an Energy Officer who is a supporter for the outsourcing Energy Manager assigns and stations on site.

It has also been confirmed that an outsourcing Energy Manager can be assigned to two or more organizations or sites. However, in order to avoid a physically difficult assignment, MOME judges the appropriateness via an Energy Manager Application form.

(b) Assignment of Energy Officer

As mentioned above, in those cases where the building organization or site is designated, an outsourcing Energy Manager can be accepted when an Energy Officer assigns and stations on site. The status of the Energy Officer is also a national qualification. However, the tasks of Energy Officer are expected to be limited when it comes to creating Periodical Report. Under this context, it has been confirmed that the qualification methods for the Energy Officer should be a simple seminar focuses the proper creation of Periodical Report.

(c) Assignment of Energy Manager and Energy Officer

The Energy Management System for Serbia plans to monitor by a whole organization and/or site. In those cases where a whole organization is designated, the Energy Manager will have to be assigned to the HQ of the organization. However, in cases where the HQ and sites are within close proximity of each other, the Energy Manager of the HQ can be assigned for the Energy Manager of such sites when MOME approves.

As a result of the consultation with the Steering Committee, the assignment of the Energy Manager and Energy Officer was set up as shown in the following tables. One Energy Manager or Energy Officer is to be registered at both HQ and the accompanying site.

Table 9-13 Assignment of Energy Manager and Energy Officer (1/2)

	Factory Company (Category A-1)*1		Building Company (Category A-2)		Municipality HQ (Category B-1)
	Factory Company HQ	Factory Site*2	Building Company HQ	Building Site*2	
Energy Manager (on-site)	X	X	Option 1	Option 1	X (not less than 20,000 population)
Energy Manager (Outsourcing)			Option 2	Option 2	X (less 20,000 population)
Energy Officer (on-site)			Option 2	Option 2	

Table 9-14 Assignment of Energy Manager and Energy Officer (2/2)

	Municipality Control Facilities*1 (Category B-1)		Transformation Company (Category A-1)		Ministry (Category B-2)			
	Plant	Building	Transformation Company HQ	Transformation Plant*2	Ministry HQ	Ministry Control Buildings *2	GMO HQ	GMO Control Buildings *2
Energy Manager (on-site)	X	Option 1	X	X	Option 1	Option 1	Option 1	Option 1
Energy Manager (Outsourcing)		Option 2			Option 2	Option 2	Option 2	Option 2
Energy Officer (on-site)		Option 2				Option 2		Option 2

*1: Category is defined in the previous table (Table 9-1).
*2: In cases where the individual site exceeds the threshold, an Energy Manager or Energy Officer will be assigned.

9.2 Detailed Design of Priority B Design Item

9.2.1 Basic Approach

(1) Basic Approach

The design items of Priority B are selected as the expected duties and implementation methods etcetera. Selected items as the Priority B are as follows.

B-1 Status and Duties of Energy Manager
B-2 Status and Duties of Energy Officer
B-3 Status and Duties of Accredited Energy Auditor
B-4 Status and Duties of Inspector
B-5 Collection Method of Periodical Report
B-6 Evaluation Method for Periodical Report
B-7 Evaluation Method for External Energy Audit
B-8 Inspection Method and Evaluation
B-9 Penalties and Methods

In the process of discussing the above items, the results of the questionnaire survey, which were conducted at the second workshop held at the Serbian Chamber of Commerce on June 17th 2010, were incorporated into the design.

(2) Questionnaire Survey on Design Items regarding the EMS (2nd)

The questionnaire survey was conducted in order to reflect the opinions of energy related to the stakeholders on the design items of Priority B (mainly implementation methods) and Priority C (mainly the dissemination program). The JICA Study Team presented their own ideas regarding these topics and their answers to the questionnaire were collected at the workshop's conclusion.

(a) Basic Information on the Answers

The number of effective answers was 37. A breakdown of the answers is shown in the figure.

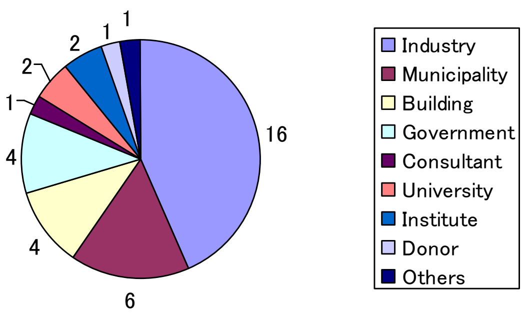


Figure 9-14 Breakdown of Respondents

(b) Need to submit the Data of the Whole Organization along with the Data of the Designated Sites

The majority considers it necessary that the data of a whole organization be submitted along with the Designated Sites.

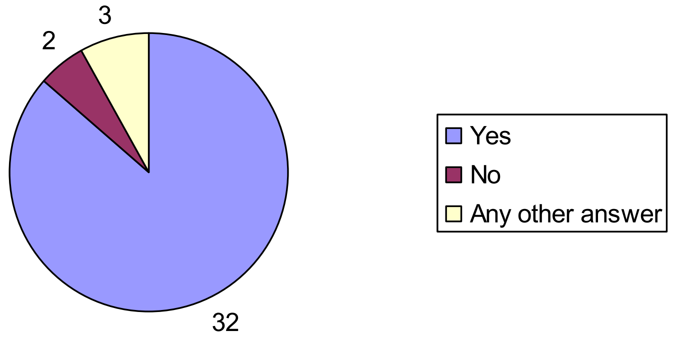


Figure 9-15 Need to Submit the Data of the Whole Organization

(c) Qualification of the HQ Energy Manager and Factory/Building Energy Manager should be the same or different

More than half of the respondents accept the same qualification system.

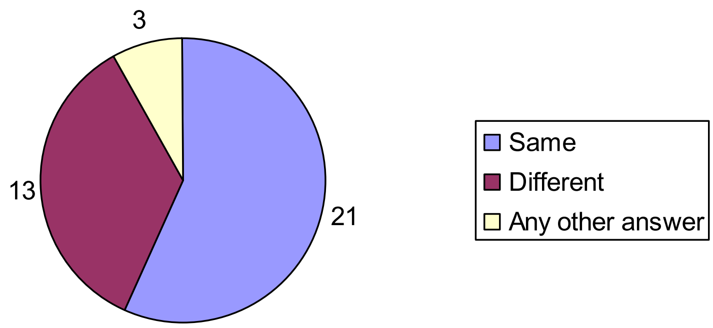


Figure 9-16 Qualification of HQ Energy Manager and Factory/Building Energy Manager

(d) Minimum Requirements for the Energy Manager (multiple answers allowed)

"Technical university graduate" and "energy management experience" are considered necessary by most respondents

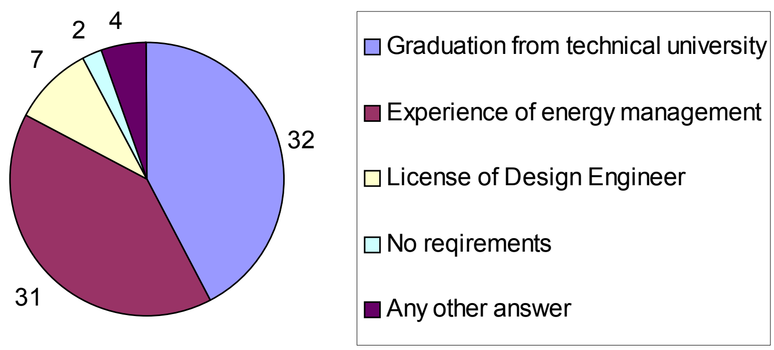


Figure 9-17 Minimum Requirements for the Energy Manager

(e) Contents of the Official Training Program of the Energy Manager (multiple answers allowed)

"Written Reporting Skill" and the "Calculation Skills of achieved effects under EE&C measures" are especially expected. All the contents are considered desirable by the majority.

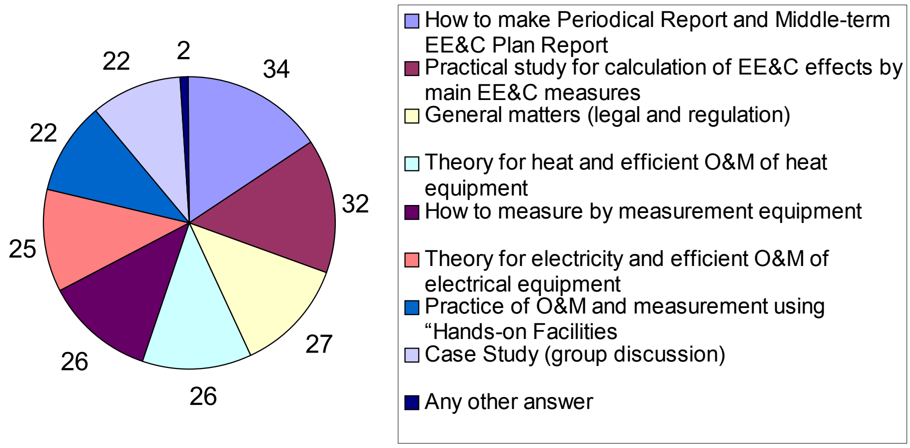


Figure 9-18 Contents of the Official Training Program of Energy Manager

(f) Appropriate Fee for the National Examination of the Energy Manager

Four third of the answers selected not more than 100 Euros.

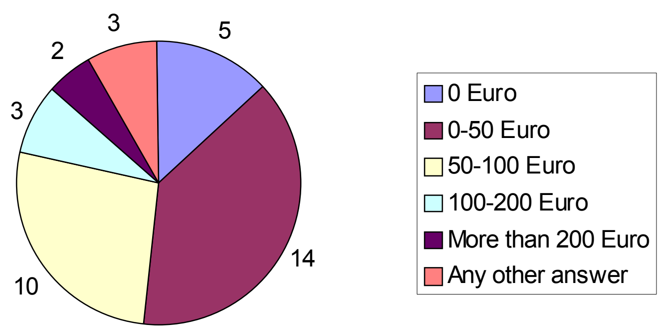


Figure 9-19 Appropriate Fee for National Examination of Energy Manager

(g) Appropriate Fee for the Official Training Program of the Energy Manager

The majority selected 300 or less Euros. Nearly half of the respondents selected 100 or less Euros.

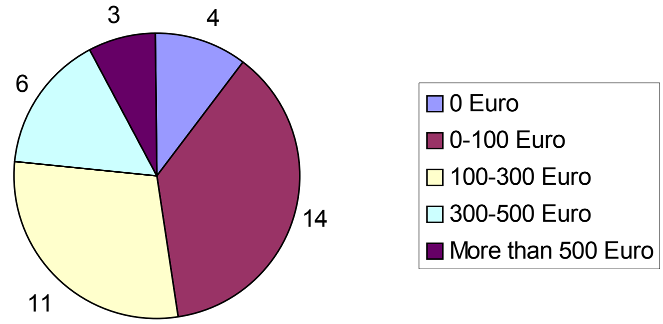


Figure 9-20 Appropriate fee for Official Training Program of Energy Manager

(h) Appropriate Method to Qualify Energy Managers

Most respondents consider the official training program more appropriate.

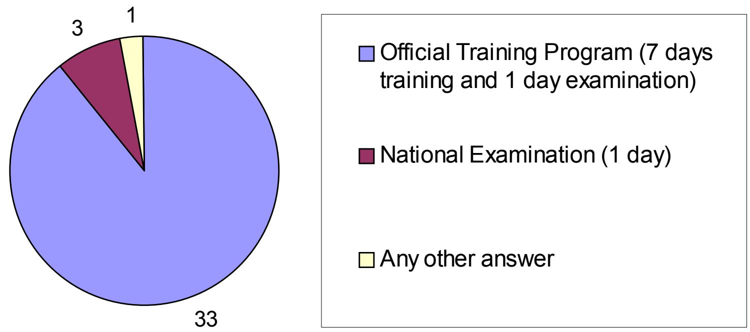


Figure 9-21 Appropriate Method to Qualify Energy Managers

(i) Services included in the Tasks of the Accredited Energy Auditor (multiple answers allowed)

"Evaluation of the performance of the Designated Organization" is to be the most expected. Other services are also considered favorable.

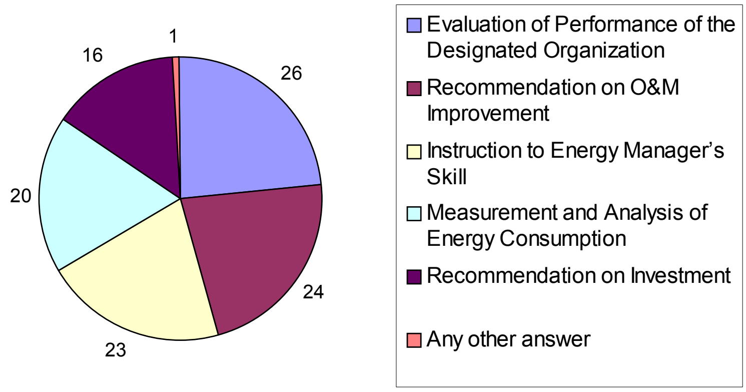


Figure 9-22 Services included in the Tasks of Accredited Energy Auditor

(j) Responsibilities to Pay the Costs for the External Energy Audit

"Both the Government and Designated Organizations" are in the majority.

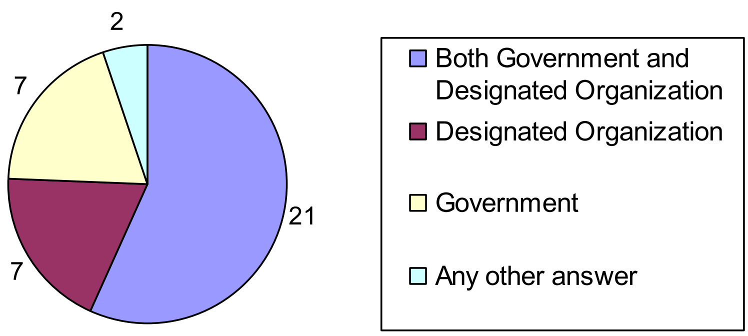


Figure 9-23 Responsibilities to Pay the Cost for External Energy Audit

(k) Contents covered by the Dissemination Programs (multiple answers allowed)

"Skill-up training program", "Issuing of periodical journals", "Good practice award" are almost to be equally expected. "Rental Service for Measurement equipment" is also considered favorable.

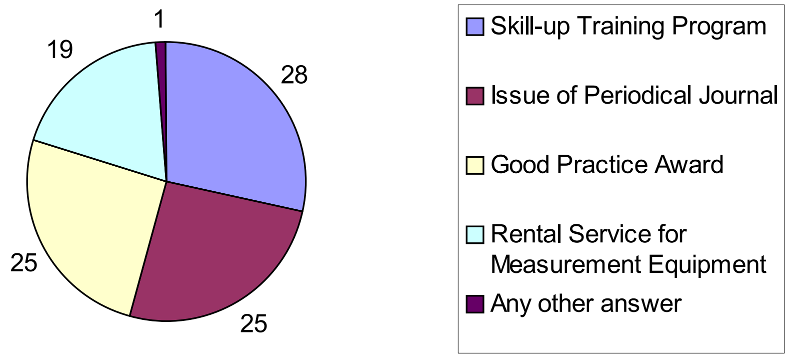


Figure 9-24 Contents Covered by the Dissemination Programs

(l) Annual Membership Fee to Implement the Dissemination Programs

The majority selected "less than 300 Euros" if the costs are borne by the Designated Organizations. Most respondents selected "less than 100 Euros" if the costs are borne by the energy managers.

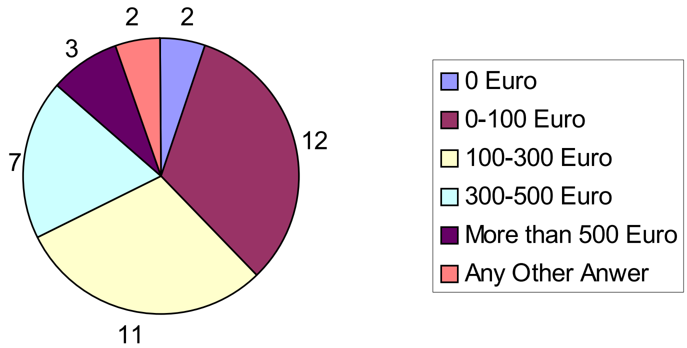


Figure 9-25 Annual Membership Fee (Designated Organizations)

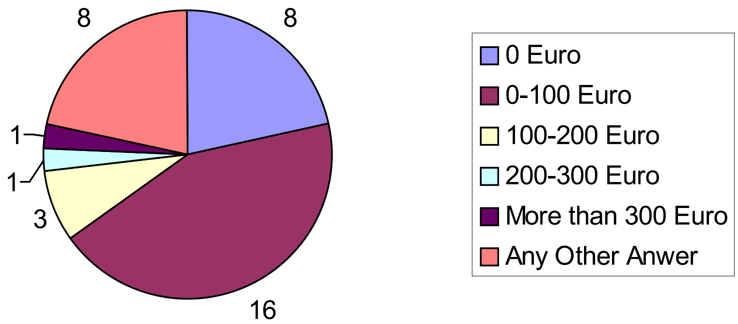


Figure 9-26 Annual Membership Fee (Energy Managers)

(m) Financial Incentive Schemes for Promotion of EE&C (multiple answers allowed)

"Loans with more favorable conditions for EE&C equipment and projects" are to be the most expected. "Subsidy" and "Tax Incentive" are also to be expected.

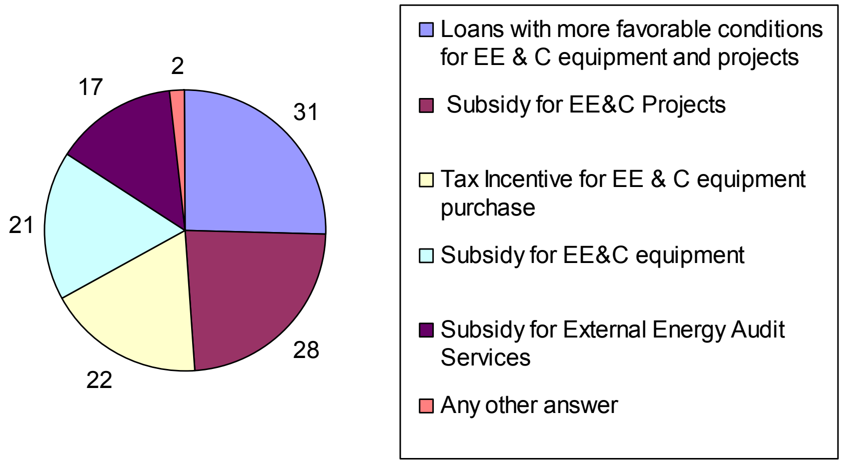


Figure 9-27 Financial Incentive Schemes for Promotion of EE&C

9.2.2 Study on Each Design Item

(1) B-1: Status and Duties of Energy Manager

(a) Status of Energy Manager

Through consultation with the Steering Committee, it was confirmed that Energy Managers would be appointed from the persons who:

- Has an Energy Manager license provided by MOME,
- Is appointed by a representative of the Designated Organization and submitted to MOME with an application form, and
- Is accepted by MOME

(b) Duties of Energy Manager

Through consultation with the Steering Committee, the duties of the Energy Manager included at least:

- Promotion of EE&C activities in the Designated Organization or Designated Site
- Having responsibility for creating a Periodical Report

Specific activities in Designated Organizations or Designated Sites are not regulated. However, the Evaluation Criteria which is a guideline for EE&C activities will be prepared by MOME and MOME will check the performance of the Designated Organization or Designated Sites in line with the Evaluation Criteria.

(2) B-2: Status and Duties of the Energy Officer

(a) Status of Energy Officer

Through consultation with the Steering Committee, it was confirmed that Energy Officers would be appointed from the persons who:

- Has a certificate of Energy Officer provided by SEEA,
- Is appointed by a representative of the Designated Organization and submitted to MOME with an application form, and
- Is accepted by MOME

The Energy Officer is adopted only in those cases where the Commercial Sector, Municipality Control Facilities and Central Government Control Facilities outsource an Energy Manager.

(b) Duties of Energy Officer

Through consultation with the Steering Committee, the duties of the Energy Officer included at least "Support for activities of the outsourced Energy Manager".

(c) Sample Case of the Appointment of the Energy Manager and Energy Officer

For a reference, the arrangement of an Energy Manager and an Energy Officer in an organization is illustrated as a sample case. The following figure shows the case of a company. The Energy Manager in HQ and Energy Manager on site are arranged into the following structure. When the outsourced Energy Manager is assigned, an Energy Officer must also be assigned. All of the Energy Managers and Energy Officers are appointed by a representative of the company (practically speaking, the General Manager of the site might recommend the Site Energy Manager to the representative).

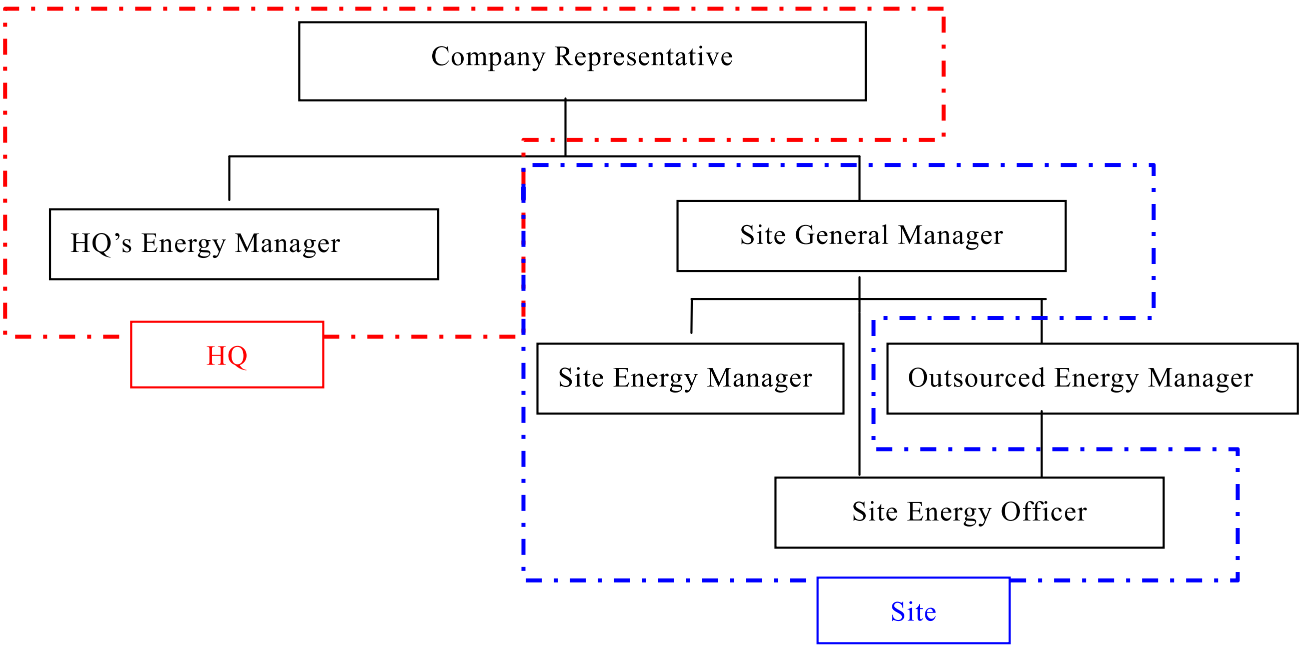
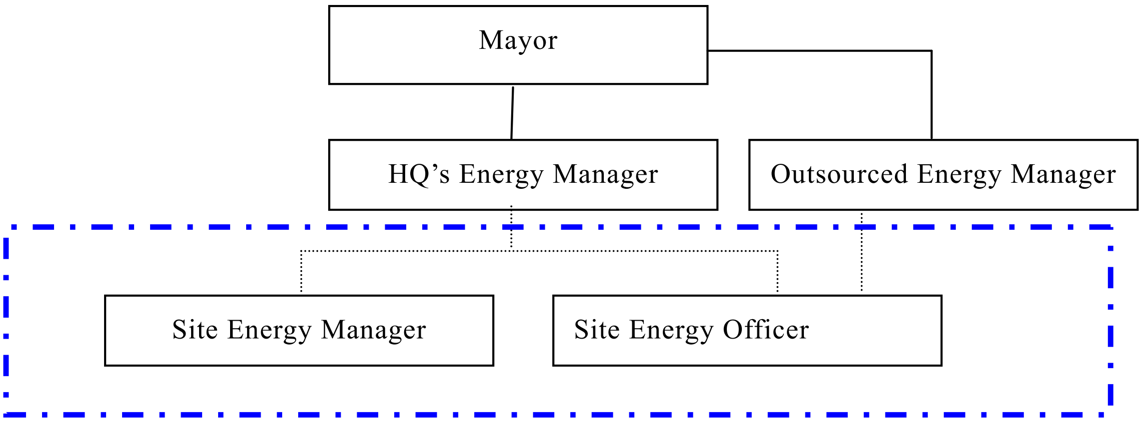


Figure 9-28 Sample Case of Appointment of Energy Manager and Energy Officer (Company)

The following figure shows the case of Municipality (Municipality buildings and Municipality control facilities).



- Blue column is the case for the Designated Site (non-independent company) under the Municipality
- An independent company like DHC is in line with the company structure.

Figure 9-29 Sample Case of Appointment of Energy Manager and Energy Officer (Municipality)

(3) B-3: Status and Duties of the Accredited Energy Auditor

(a) Status of Accredited Energy Auditor

As mentioned previously, the implementation of the external energy audit and the selection of a consultant depend on the decision of the Designated Organization.

However, via consultation with the Steering Committee, the Accredited Energy Auditor should have a national qualified license due to the following reasons.

- There is high demand for a high quality energy auditor who can provide advice in line with the Energy Management System.
- The license is expected to contribute to the improvement of all the consultants in terms of skills and proposal capacity, because a distinction is made between the licensed person and other low quality consultants.

(b) Duties of Accredited Energy Auditor

An Accredited Energy Auditor will have one of the national qualificated licenses. However, the decision of whether or not to hire an Accredited Energy Auditor depends on the Designated Organization. In this context, it is not necessary to regulate the duties of the Accredited Energy Auditor.

It has been planned that when an incentive scheme prepared by MOME is utilized for an external energy audit, the applicant must select an Accredited Energy Auditor and the audit method must comply with prepared Audit Standards. As of November 2011, incentive schemes and budget resources have not been clear.

The Audit Standards described in Chapter 11 are made under the assumption that the Accredited Energy Auditor conducts an external energy audit in line with the Energy Management System.

(c) Proposal for External Energy Audit using Audit Standards

As mentioned above, it has been planned that the external energy audit using an incentive program prepared by MOME must use the Accredited Energy Auditor. The JICA Study Team proposes the workflow of the external energy audit using an Accredited Energy Auditor.

The following figure shows the workflow of an external energy audit using an Accredited Energy Auditor. The red column is an additional procedure when an incentive program is utilized. The additional procedure requires the submission of the summary report of the audit, and a subsidy (as an incentive program) is refunded after the audit is completed.

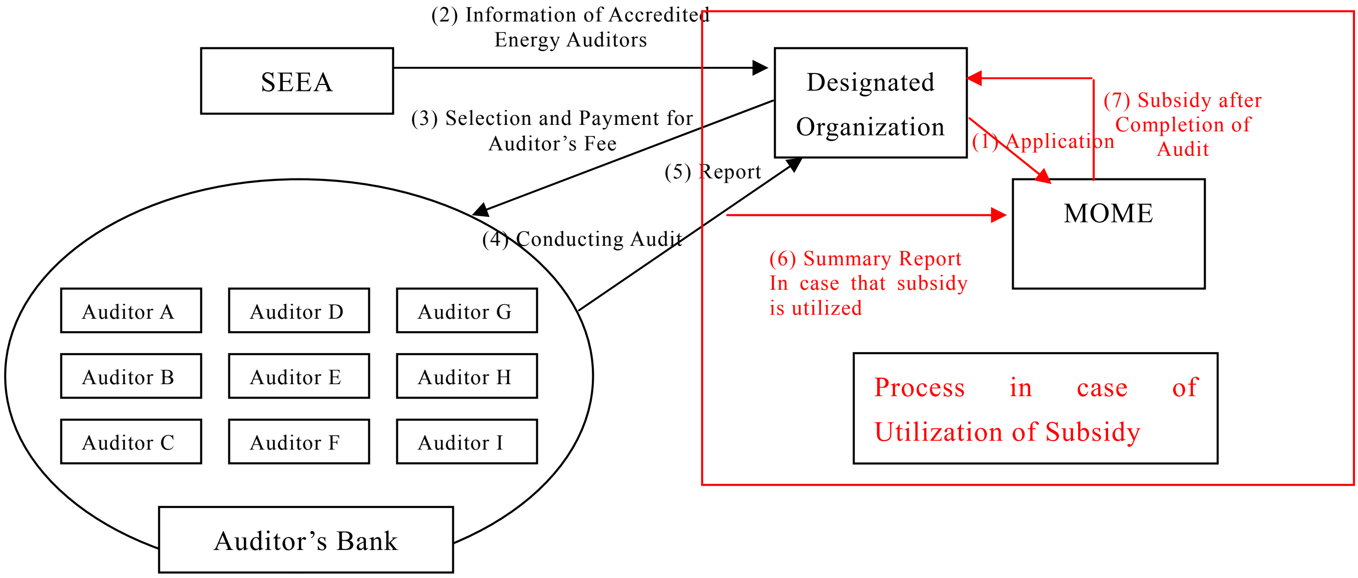


Figure 9-30 Workflow of External Energy Audit using Accredited Energy Auditor

In cases where the external energy audit is conducted utilizing an incentive program, the audit is recommended to be targeted at both the HQ of the Designated Organization and the Designated Site.

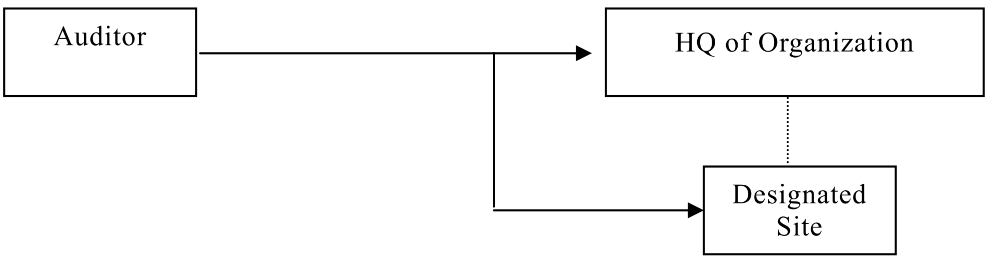


Figure 9-31 Sample Case for Target of Energy Audit using an Incentive Program

(4) B-4: Status and Duties of Inspector

(a) Workflow of Inspection

Through consultation with the Steering Committee, the following steps of the workflow were confirmed.

(i) First Step (in case that an energy audit was conducted by the Accredited Energy Auditor)

As the first step of the inspection workflow, a summary report created by the Accredited Energy Auditor is submitted to MOME and MOME examines the necessity for inspection (on-site survey) when it is judged as poor management of energy management.

As previously mentioned, the submission of the summary report in cases where the incentive program is utilized by a Designated Organization is now under planning (it has not been set up yet).

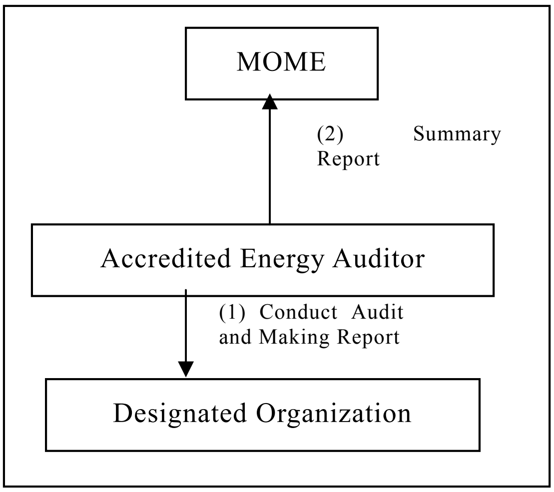


Figure 9-32 First Step (External Energy Audit and Examination of the Summary Report (Voluntary Actions))

(ii) Second Step

The second step includes actions from the selection of the inspected organization (including the site) to the correctional instruction judged by the results of the inspection.

An organization receiving correctional instruction has to submit a Rationalization Plan Report that is formatted. And then the organization must take actions based on the Rationalization Plan Report.

There are 2 methods for the selection of the inspected organization as shown below.

- At random selection by business type and regional area
- Selection by the results of the external energy audit or the contents of the Periodical Report if such results indicate poor management

The JICA Study Team recommended a combination of the above 2 methods. For example, an at random selection covers 80 % of total number of inspections and the selection of a poor management organization covers 20 %.

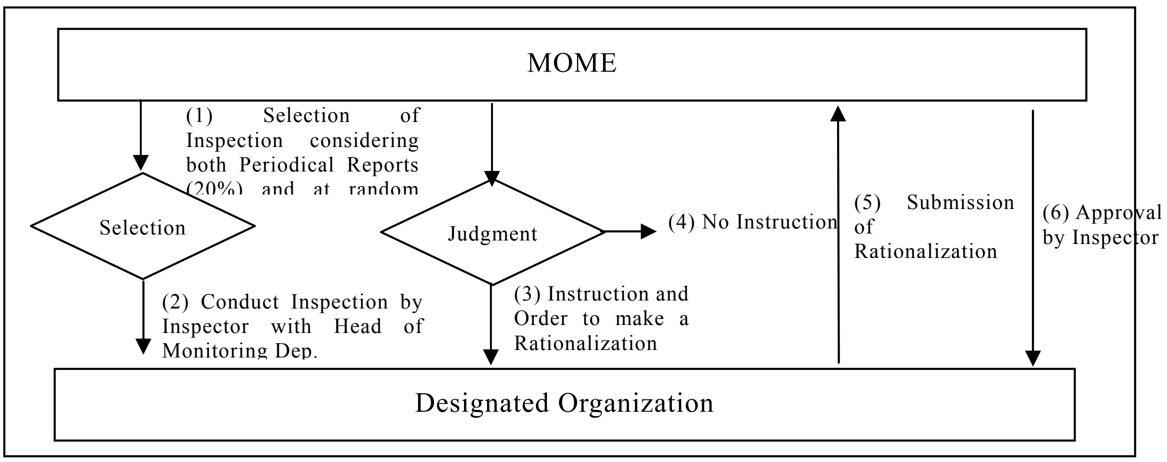


Figure 9-33 Second Step (Selection of Inspected Organization and Judgment of Poor Management)

(iii) Third Step

The third step is a procedure for follow-up activities after receiving the Rationalization Plan Report. MOME will dispatch the Inspector again to check the compliance with the contents of the Rationalization Plan Report 6-12 months later. When the Inspector judges that the performance is still not appropriate, MOME can penalize the organization.

The organization which has been subjected to a penalty has to submit a Rationalization Plan Report again. The same cycle is repeated after that. However, the second penalty for a repeated offense should be stricter than the first penalty (penalty types will be explained later).

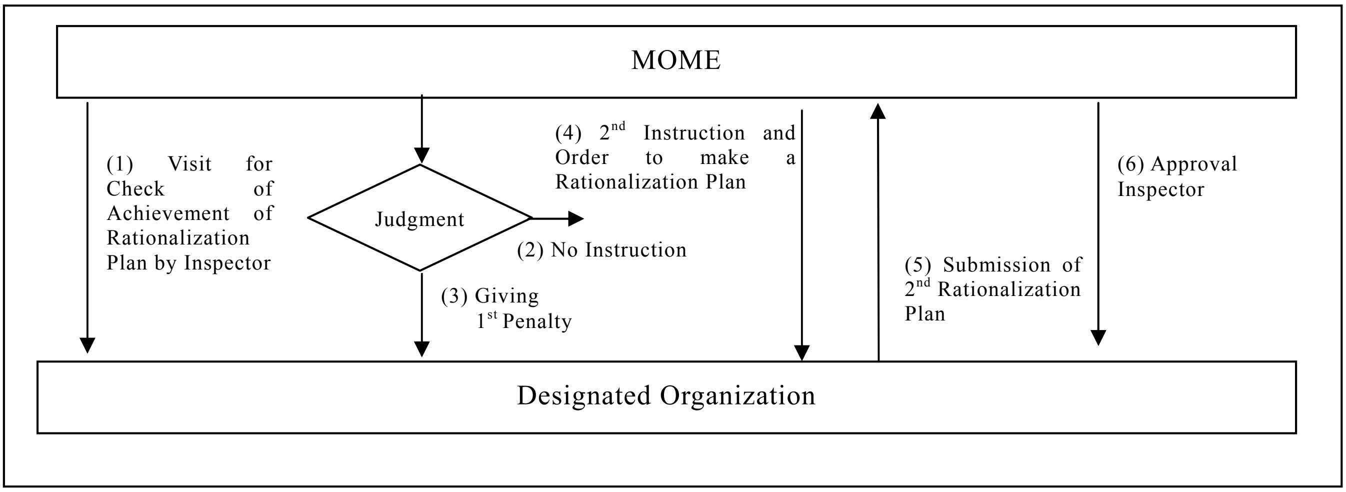


Figure 9-34 Third Step (Follow-up and Penalty (6-12 Months Later)

(b) Status of Inspector

Through consultation with the Steering Committee, the Inspector was regulated as a person who conducts an HQ or site survey and evaluates the performance in accordance with the Evaluation Criteria, etc.

The Inspector, who has the power to enter the HQ or site and order that certain necessary data and information be submitted, belongs to MOME.

(c) Duties of Inspector

Assuming that the above procedures (First – Third Steps) are implemented by the Inspector, the tasks of the Inspector have been regulated as follows.

- Inspecting and evaluating the performance level by Inspection Standards including a check list of Evaluation Criteria (the Standards to be explained in a later section).
- Providing advice leading to correctional instruction to a competent person of MOME when the inspection has revealed poor management practices.
- Examining and providing advice for the Rationalization Plan Report that is delivered via correctional instruction to a competent person of MOME.
- Conducting a follow-up survey for the organization which receives correctional instruction and evaluating the improvement situation in accordance with the submitted Rationalization

Plan Report.

- Providing further advice for improvement after the follow-up survey if poor management has not yet been improved yet. (In such case, the organization will be penalized under the name of a competent person of MOME.)

(5) B-5: Collection Method of Periodical Report

As for the collection method of the Periodical Report, the following options have been discussed.

- Submission by paper
- Submission by electronic file
- Simultaneous submission of both paper and electronic files
- Direct input to the Database from the Designated Organization via the Internet

Through consultation with the Steering Committee, the “Simultaneous Submission of both paper and electronic files” was selected. Paper submission can protect the unnecessary revision of data and electronic files can easily be transferred to the Database. The action of manually transferring the data from electronic files is expected to yield data errors.

The “Direct input to the Database from Designated Organization through Internet” is also judged as one option in the future.

The Periodical Report will be submitted from the HQ of the Designated Organization in both cases where the whole organization or individual site has been designated.

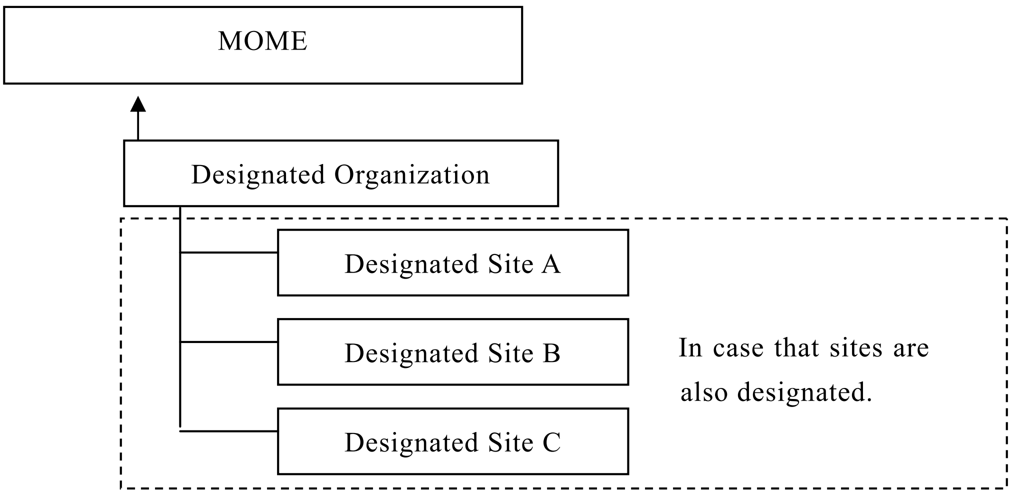


Figure 9-35 Flow of Submission of Periodical Report

(6) B-6: Evaluation Method for Periodical Report

Through consultation with the Steering Committee, it was confirmed that the procedure for checking and evaluating the Periodical Report would be illustrated as follows.

1st Step: Initial Check at the Submission

1. Checking the Appropriateness of the Registration
- Check of the registration number and their organization
- Check of the approval signature of representative of the Designated Organization
- Check of the registration of Energy Manager

2. Check of the Appropriateness of the Answers
- Check whether all the answers have been completely filled out.
- Check whether the unit and calculation method of "Energy Intensity" is the same as the previous one.

Acceptance → No → Re-Submission

Yes

2nd Step: Check and Clarification of Answers (after receiving the Report)

1. Check by Check List
(Energy Consumption Report)
- Is there any big difference from the previous year in the energy consumption data? (There may be a mistake)
- Is there any difference from the previous year in the equipment list? (If the equipment is different, the energy consumption and intensity should be carefully checked, "increase" or "decrease")
- Has the "Energy Intensity" of the Organization improved at 1% per year in the five years? (If the intensity is not improved, the reasons should be carefully checked whether the reasons are acceptable or not)
- Are the reasons (non-achievement of 1% improvement) clear and reasonable?
- Check of the "Compliance Check List" in the Reports.

(Middle-Term Plan Report)
- Does the "Middle –term Investment Plan" have a clear and concrete plan?
- Is the description the previous year's plan and its effects made clear?

2. Clarification
- The description of the above check items are not enough, the MOME staff must also clarify the contents by e-mail or telephone.
- The clarification will be completed by re-submitting the Reports with the revisions.

Judgment → Acceptance → No actions

Not enough

3rd Step: Feedback of Monitoring Results to the Organization is judged as Poor Management

3. Sending Warning Letter with Instruction
- If the improvement of energy intensity and compliance check list has been judged as poor, MOME can send a warning letter with instructions for next year's report.
- If the year after report is still NG, MOME can dispatch the Inspector apart from the "at random" inspection.

Figure 9-36 Monitoring Workflow for Periodical Report

The checking and evaluation procedures of the Periodical Report are summarized as follows.

- There are 3 checkpoints for checking the Periodical Report. The first checkpoint is the timing of the initial submission of the report, the second checkpoint is the timing after the completion of the clarification of the report, and the third checkpoint is the timing of the submission of next year's report when some inappropriate contents are identified and a warning letter with instructions are sent to the organization in the previous year.
- At the first checkpoint, registration data, completion of the filling report and aberrations that can be easily found at the reception of the initial submission are checked. In addition, a calculation method for energy intensity or total energy volume should be also checked to verify if it was calculated the same way as last year.
- At the second checkpoint, which is at the timing of the completion of the clarification of report, EE&C measures are taken and their effects and the appropriateness of EE&C plans should be checked. After that, these data will be inputted into the Database.
- At the third checkpoint, which is at the timing of the submission of next year's report, when a warning letter with instruction is sent in the former year, the situation's progress should be checked. If the situation has improved sufficiently, MOME can dispatch an Inspector to the organization.

(7) B-7: Evaluation Method for External Energy Audit

An external energy audit is conducted on a voluntary basis. However, for a Designated Organization utilizing an incentive program for the audit, it has been planned that a summary report based on the Audit Standards (refer to Chapter 11) conducted by an Accredited Energy Auditor will be submitted to MOME.

(8) B-8: Inspection Method and Evaluation

(a) Selection of Inspection Target

As for the selection of an organization to be inspected, the JICA Study Team proposed randomly making a selection based on the Periodical Report. The following table is an estimation of the inspection organization number from the at random selection assuming that 10 % of the total Designated Organizations have been selected by this method (about 36 organizations). Selections made based on the Periodical Report is made for about 10 organizations and a total of 46 organizations are to be inspected in a year. In other words, an inspection is to be conducted about 4 times a month

Table 9-15 Estimated Number of Inspection by At Random Selection

	Private Sector			Public Sector		
	Manufacturing, Mining and Transformation Sector	Commercial Sector	Transformation Sector	Central Government	Municipality	Heat Supply Utility
Estimated Number of Designated Organizations	110	30	EPS 11 NIS 2	About 10	About 140	About 45
Rate of At Random Selection	10%	10%	EPS 1 NIS 0.5	10%	10%	10%
Selected Number	11	3	2	1	14	5

(b) Inspection Method and Evaluation

Through consultation with the Steering Committee, the following methods were confirmed as an efficient way given the limited number of human resources and time constraints. The inspection Standards conducted by the Inspector are described in Chapter 11.

- A questionnaire, that indicates checkpoints at the inspection, is sent to an inspected organization beforehand.
- At the inspection, a check sheet is used for efficient work and rated by the checksheet results in order to confirm the accuracy of answers to the questionnaire and the performance of the organization in accordance with the Evaluation Criteria.
- The Inspector visits HQ of the organization and the Designated Site (if necessary) spending 1 day each.

(c) Implementation Structure of Inspection

The JICA Study Team proposed a 2-member team consisting of one MOME Inspector and one MOME monitoring staff. This is because a 2-member team can efficiently implement the inspection tasks and recommend the appropriate corrections to produce a quality Periodical Report.

(9) B-9: Penalties and Methods

(a) Type of Penalties

According to the questionnaire survey about penalties for organizations judged as poor energy management, conducted in the workshop held on November 4th 2009 in the Serbian Chamber of Commerce, the “fine” and “publication of the name” were selected as the majority answers from the prepared options (fine, public disclosure of the name, suspension of business and non-penalty).

Through consultation with the Steering Committee, it has been confirmed that the “fine” and “public disclosure of the name” were appropriate for such penalties.

(b) Methods of Penalties

There was a comment in the questionnaire survey in the workshop, that is, the penalty should be strict step by step. The JICA Study Team respected this comment and proposed the following methods for the penalties (1st penalty: Fine, 2nd or later penalty: Fine and Publication of the Name).

Table 9-16 Methods of Penalty

	Fine	Publication
1st Penalty		x
2nd Penalty even after the 1st Penalty	x	x
3rd Penalty even after the 1st Penalty	x	x

9.3 Detailed Design of Priority C Design Item

9.3.1 Basic Approach

The design items of Priority C have been selected as dissemination programs for the Energy Management System. The selected items as the Priority C are as follows.

C-1 Dissemination Programs and Expected Contents

C-2 Implementation Method for the Dissemination Programs

9.3.2 Study on Each Design Item

(1) C-1: Dissemination Programs and Expected Contents

(a) Proposal of Dissemination Programs

The JICA Study Team proposed the following 4 dissemination programs to smoothly promote the Energy Management System. All the programs are basically provided to the staff or organizations belonging to the Designated Organizations.

- Periodical Journals for Designated Organizations
- Good Practice Award utilizing a collection system of Energy Management System
- Skill-up Training Program for Voluntary Applicants
- Rental Service for Measurement Equipment

(b) Expected Contents of Each Program

(i) Periodical Journals

Periodical journals are periodically sent to the Designated Organizations and Accredited Energy Auditors with the following information.

- Information regarding contents of the scheme (announcement, revision, information on the examination and training program, etc.)
- Information regarding the promotion of EE&C (new technology, one-point lesson for EE&C, information on incentive programs, etc.)

Periodical journals will be distributed twice in a year and include the following contents.

1st Half of Year

(Permanent Contents)
- Results of Analysis of EMS Periodical Reports (macro data)
- Good Practice Award (selected by Periodical Reports and Site Survey)
- Results of Last Year's Examination and Official Training for Energy Manager
- Announcement and Application Form for Skill-up Training Program
- Advertisement of EE&C Equipment and Appliance
- EE&C Technology in the World

(Timely Contents)
- Announcement of Law and Regulation (when revised)
- Announcement of Violating Designated Company and Reasons
- EE&C Project Information and Donor's Assistance
- Event Information

2nd Half of Year

(Permanent Contents)
- Announcement and Application Form for Qualification of Energy Manager
- Announcement of Field of Examination for Energy Manager
- Support Scheme Information (Low Interest Loan for EE&C, Subsidy, Tariff, etc.)
- EE&C One Point Advice
- Advertisement of EE&C Equipment and Appliance
- EE&C Technology in the World
- Rental Service (Measurement Equipment)

(Timely Contents)
- Announcement of Law and Regulation (when revised)
- EE&C Project Information and Donor's Assistance
- Event Information

(ii) Good Practice Award

The Good Practice Award has been created to encourage EE&C activities done within Designated Organizations. Over a one year cycle, candidates of the Award are screened, surveyed and evaluated as good practice records and selected good practice projects are commended in the award ceremony. It has also been proposed that the Energy Management System can be utilized for the screening of candidate projects through the collection of Periodical Reports.

EE&C activities granted through this Award system are finally disclosed to the public to some extent. Prior consent from the selected organizations is necessary in order to participate in the Award system. To check the willingness to participate, a check box is put in the format of the Periodical Report. Projects from those organizations who check off "Yes" are initially screened as candidates projects.

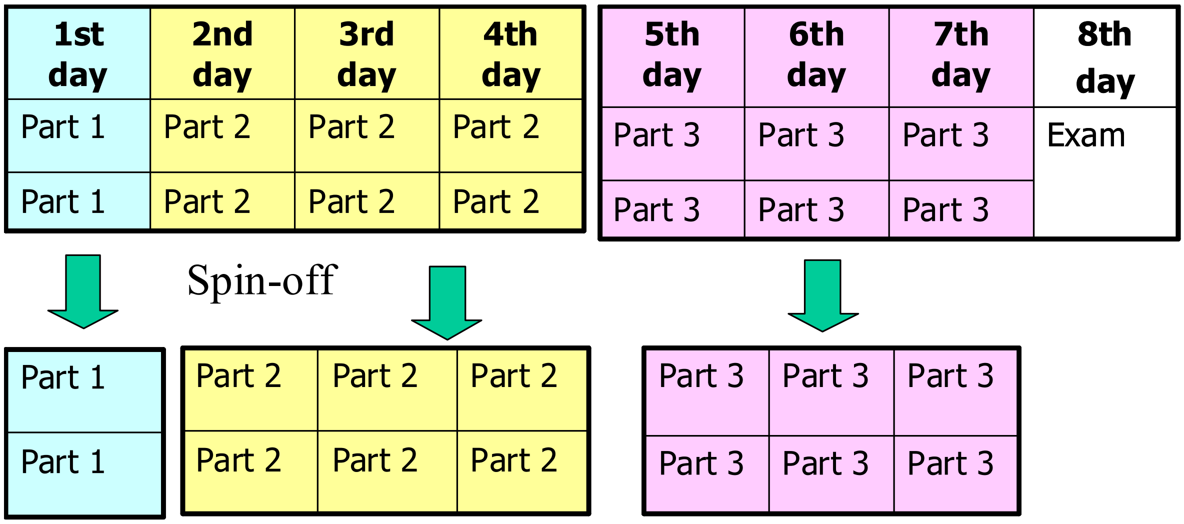
(iii) Skill-up Training Program

This program is not for qualifications but for skill enhancement training for general applicants who voluntarily want to improve their skills. The purposes of the Skill-up Training Program are as follows.

- The official training program developed for qualification for Energy Managers are utilized and divided for the Skill-up Training Program as short period programs.
- Present Energy Managers can also participate in the program to maintain their skills.
- All applicants who are involved in energy management can participate in the program if necessary.

The Skill-up Training Program is made by spinning off the official training program developed for the qualification for Energy Managers. The official training program for the qualification of Energy Managers is proposed in Chapter 10.

Official Training Program for Energy Manager



Skill-up Training Program (separating 3 parts)

Figure 9-37 Relationship between Official Training Program and Skill-up Training Program

The JICA Study Team recommended that the Skill-up Training Program be open to engineers in from other countries to increase the number of participants..

(iv) Rental Service for Measurement Equipment

Based on the experiences from the pilot implementation of the Energy Management System in A Factory and B Building, it was found that the costs and benefits should be clearly indicated in order to make a decision for EE&C investment. To assist such a clear indication for the benefit of EE&C, the JICA Study Team recommends a rental service for the measurement equipment. The service will be provided by SEEA for applicants (like Energy Managers or Accredited Energy Auditors) who want to use the equipment for the EE&C study.

Regarding the measurement equipment, the following 5 items have been recommended from the perspective of the wide use for energy-consuming machines. Lectures on how to use the measurement equipment are to be included in the Official Training Program for Energy Managers.

- Power Meter (Data Logger and Electric Current Sensor)
- Exhaust Gas Analyzer
- Ultrasonic Leak Detector
- Infrared Thermometer
- Pressure Sensor

Power Meter (Data Logger and Electric Current Sensor)

(Source: Website of Hioki, U_RD)

Exhaust Gas Analyzer

(Source: Website of Hodaka)

Ultrasonic Leak Detector

(Source: Website of CS Tech)

Infrared Thermometer

(Source: Website of Hioki)

Pressure Sensor

(Source: Website of Nagano Keiki)

Figure 9-38 Recommendation for Measurement Equipment

(2) C-2: Implementation Method for Dissemination Programs

(a) Implementation Formation of Each Program

(i) Periodical Journals

It has been proposed that periodical journals should be issued to provide important information regarding the scheme of Energy Management System from MOME. SEEA will compile and issue out the journals, and send them to the Designated Organizations and Accredited Energy Auditors. The workflow regarding the issue of the periodical journals is shown below.

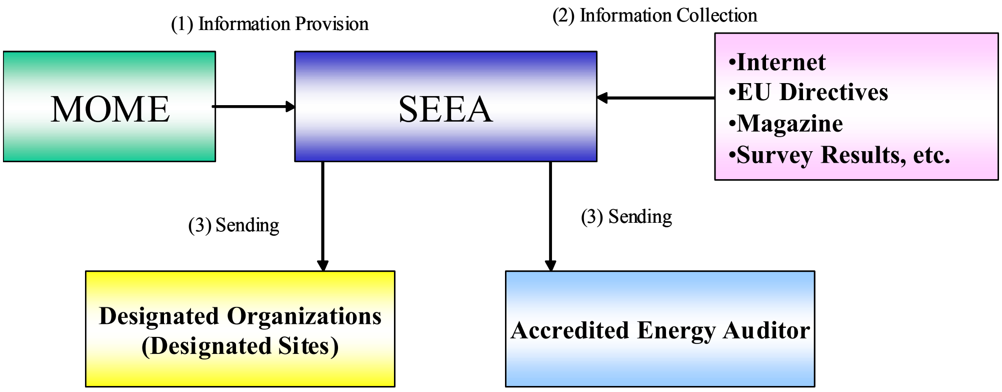


Figure 9-39 Workflow of Issue of Periodical Journals

(ii) Good Practice Award

The workflow of Good Practice Award is shown below.

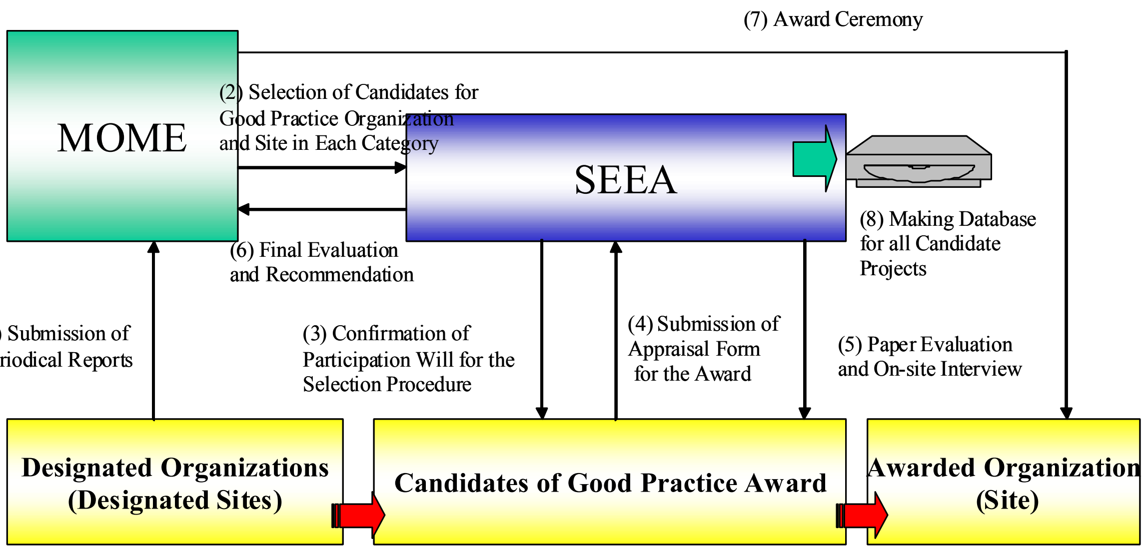


Figure 9-40 Workflow of Good Practice Award

Actions in the above workflow have been summarized as below.

- A willingness to participate in the Award has been confirmed by a checkbox in the Periodical Report.
- Based on the information from Periodical Reports, MOME initially screens candidate projects and reports the screening results to SEEA.

- SEEA reconfirms the willingness to participate to the organizations of the screened projects.
- Organizations who have a willingness to submit an application form with the project information for evaluation.
- Based on the application form, an evaluation is made after the interview survey on the site, if not necessary.
- SEEA creates a draft evaluation report and submits it to MOME.
- MOME creates a final decision for the awarded projects (a ceremony is arranged by SEEA).
- Good practice projects and candidates are registered into the SEEA database.

(iii) Skill-up Training Program

The Skill-up Training Program is made by a division of the Official Training Program for the Energy Manager. SEEA is expected to be a contact point for the Skill-up Training Program. However, in cases where persons from other countries wish to apply for the program, MOME might be an official counterpart for the reception.

The following figure indicates the workflows for the Skill-up Training Program and the Official Training Program for Energy Manager in parallel.

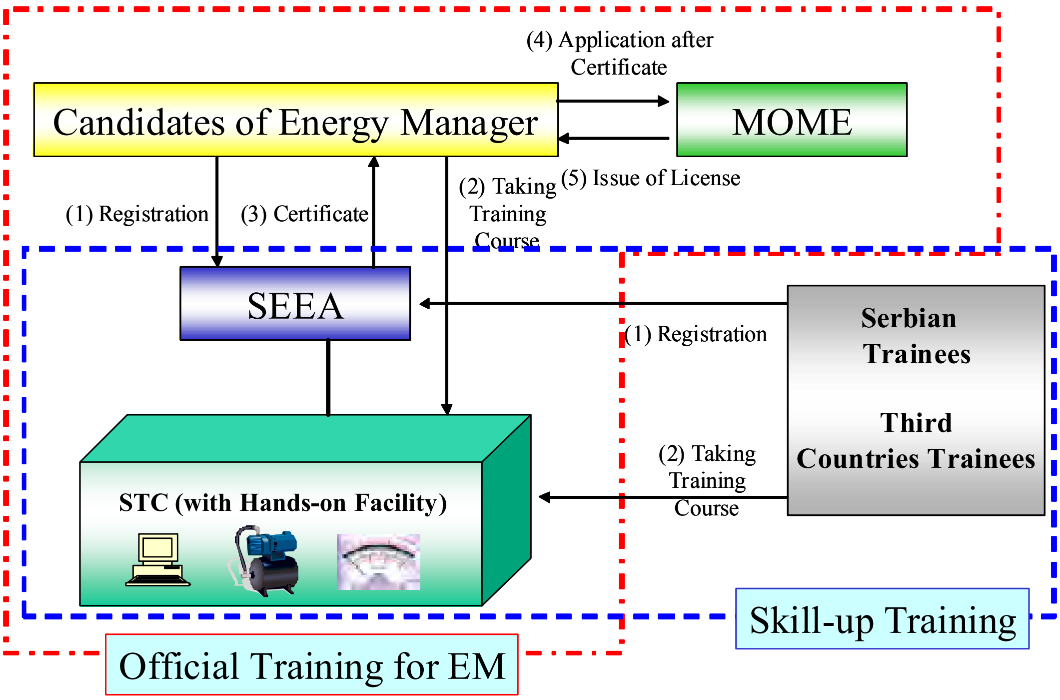


Figure 9-41 Workflow of Skill-up Training Program (Blue Column) and Official Training Program for Energy Manager (Red Column)

The main points in the above workflows are as follows.

- Training programs provided by SEEA are not only on-desk training but also a training using the Hands-on Facility.
- The Serbian Training Center (STC) has been established and the training programs are

basically conducted in the center. The STC is expected to use an existing organization's building (like university, institute, etc.).

- Properties of the training programs and the Hands-on Facility belong to SEEA. An O&M contract between SEEA and the STC is expected to be concluded to utilize such properties.

(iv) Rental Service for Measurement Equipment

The workflow of the rental service for measurement equipment is shown below. The Energy Managers or the Accredited Energy Auditors are assumed to be applicants for the rental service.

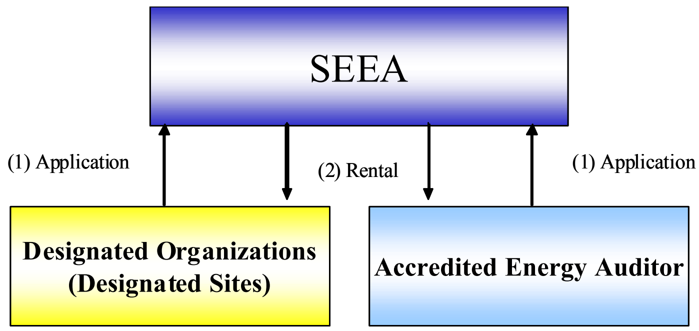


Figure 9-42 Workflow of Rental Service for Measurement Equipment

(b) Annual Schedule

Annual schedule for all the dissemination programs were proposed as follows.

Table 9-17 Annual Schedule for Dissemination Programs

	Jan	Feb	Mar	Apr	May	Jun
EMS (managed by MOME)	Registration and Submission of Periodical Reports			Clarification of Periodical Reports		Check of Periodical Reports
Exam and Training (managed by SEEA)						
Dissemination (managed by SEEA)		Issue Journal Award Ceremony		Skill-up Training		

	Jul	Aug	Sep	Oct	Nov	Dec
EMS (managed by MOME)	Check of Periodical Reports			Judgment	Inspection	Instruction
Exam and Training (managed by SEEA)				Exam		Official Training
Dissemination (managed by SEEA)	Skill-up Training	Issue Journal Announcement of Exam and Official Training				

Consideration points for the annual schedule are as follows.

- The schedule should be harmonized to the MOME's work schedule regarding the Energy Management System and the schedule of the official qualification system (national examination and official training) regarding the Energy Management System
- The Workload of SEEA should be levelized throughout the year.

(c) Budget Sources for Dissemination Programs

(i) Study Options

All applicants for the dissemination programs pay fees that go towards the administration budget. Assuming such budget resources are balanced to the expenditure for the dissemination programs, the collection method of fees was discussed with the Steering Committee.

Option 1: Periodic collection of fees from applicants
Option 2: Collection of membership fees (periodically) from all the Designated Organizations
Option 3: Collection of membership fees (periodically) from all the Energy Managers
Option 4: Collection of membership fees (periodically) from all the Accredited Energy Auditors

(ii) Consultation Results

Through consultation with the Steering Committee, Option 2 was selected from the following reasons.

- Periodical collection through membership fee is expected to be a stable resource.
- The beneficiary should be the whole organization and not "Individual Energy Manager".
- A higher fee is affordable for Designated Organizations

At the same time, the membership fee is not collected from the individual Energy Manager. This means that Energy Manager, who wants to have only a license, does not pay any membership fee. This will serve to motivate the Energy Manager to acquire a license.

9.4 Various Documents regarding Energy Management System

9.4.1 Guidebook for Energy Management System

To ensure the smooth introduction and operation of the EMS, it is necessary for each related party to deeply understand the regulations and operations of the system. The Study Team proposed a draft of the Guidebook introducing EMS. The contents of the guidebook are described below (A sample is attached to Appendix 6).

- Outline of the EE&C Law
- Definition of the Energy, the way of conversion of the energy amount
- Range of the designated companies and their activity
- Energy Management Flow, items to be checked
- Energy Manager, Energy Officer, Energy Auditor

- Evaluation Criteria, Management Standards
- Periodical Report
- Supporting Measures
- Others (Contact list, Technical Words)

9.4.2 Various Formats regarding the Energy Management System

The EMS requires many transactions of applications and permission between the Designated Organizations and MOME. Therefore, the JICA Study Team prepared and proposed various formats of applications for such processes. The contents of the formats are described below (Samples are attached to Appendix 7).

(1) Formats to be used by Designated Organizations for Applications to the Government

- Periodical Report
- Notification of the Energy Use Status
- Appointment / dischargement application for Energy Managers / Energy Management Officers
- Declaration of the revocation for designated factories / buildings

(2) Formats to be used by MOME for the notification to designated organizations

- Notification of the designation as a designated organization, factories, buildings
- Notification of the revocation as a designated organization, factories, buildings

Chapter 10 Official Qualification System

10.1 Qualification Programs for Energy Manager

10.1.1 National Examination

(1) Acquisition of the License

As previously mentioned, 2 qualification methods have been proposed for the issuing out of the Certificate for the Energy Manager; the "National Examination" and "Official Training Program for Energy Manager (with Certificate Examination)". The Certificate can be obtained by passing the examination or the official training program undertaken by SEEA. Applicants who have the Certificate submit the evidence of minimum requirements with the Certificate to MOME. MOME checks the documents and then issues out an Energy Manager license.

(2) Expected Contents of the National Examination

The National Examination completes a test (mark sheet method) in one day. Because the Energy Manager of a factory and an Energy Manager of a building require different fields and skills to some extent, it has been proposed that the optional subjects be introduced in the National Examination as follows. There is no difference in the status of Energy Manager if any optional subject is selected by the applicants.

Common Subject

- General Information on Energy Situation and Policy
- Environment
- General Theory on Energy
- Promotion of Energy Efficiency in Organization
- Law and Regulations on Energy Management System
- Periodical Reports and Evaluation Criteria, etc.

Optional Subject for Factory Energy Manager

- Basic Theory for Heat and Fuel, and Calculation Method of Combustion
- Basic Theory for Steam and Steam Trap Calculation Method of Heat Loss
- Basic Theory for Electricity and Electric Equipment (Transformer, Motor, Pump, Power Factor, etc.)
- Theory for Factory EE&C Measures in Heat and Electricity
- Factory EE&C Measures and Calculation Method of Effects

Optional Subject for Building Energy Manager

- Basic Theory for Heat and Fuel, and Calculation Method of Combustion
- Basic Theory for Electricity and Distribution Planning
- Basic Theory for Electricity and Electric Equipment (Transformer, Pump, Fan, AC, etc.)
- Theory for Building EE&C Measures in Heat and Electricity
- Building EE&C Measures and Calculation Method of Effects

Figure 10-1 Expected Contents of the National Examination for Energy Manager

(3) Pass Rate

The National Examination is a simple 1-day qualification method spending. The pass rate is set at a lower standard (ex. about 30 %).

(4) Examination Fee

The examination fee is collected from applicants of the National Examination. The fee will be a resource for SEEA's administration expenditure for the examination.

10.1.2 Official Training Program for the Energy Manager

(1) Training Curriculum

The Official Training Program for the Energy Manager consists of a 7-day training and a 1-day examination. Like the National Examination, the optional subjects for the factory Energy Manager or the building Energy Manager can be selected in the training curriculum. There is no difference in the status of the Energy Manager if any optional subject is selected by the applicants.

In the final day of the training program, a certificate examination is conducted to check comprehension and skill level. Applicants who pass the certificate examination can obtain the Certificate from SEEA.

Table 10-1 Training Curriculum for Energy Manager (Factory Course) 1/2

	Common: 1st	Factory: 2nd	Factory: 3rd	Factory: 4th
AM	**(General)** •Energy Situation of Serbia •General Explanation of the EMS Law and Regulation •HQ's Duties and Site's Duties •Organizing EE&C Team •Requirement in EMS	**(Basic Theory 1)** •Basic Theory for Heat and Fuel •Calculation Method of Combustion	**(Basic Theory 3)** •Basic Theory for Electricity •Basic Theory for Electric Equipment (Transformer, Motor, Power Factor, etc.)	**(Theory for O&M EE&C Electricity)** •EE&C for Compressor •EE&C for Pump and Fan •Others (Lighting, HP, Transformer, etc.)
PM	**(Periodical Reports)** •Energy Consumption Calculation •Energy Consuming Equipment List •Energy Intensity •Guideline for Heat and Electricity EE&C •Management Standards •Middle-term EE&C Plan, etc.	**(Basic Theory 2)** •Basic Theory for Steam and Steam Trap •Calculation Method of Heat Loss	**(Theory for O&M EE&C Heat)** •EE&C for Boiler •EE&C for Steam Trap •EE&C for Insulation and Heat Leakage	**(Case Study 1: Factory)** •Explanation of Conditions of the Case Study •Group Discussion •Presentation •Homework

Table 10-2 Training Curriculum for Energy Manager (Factory Course) 2/2

	Factory: 5th	Factory: 6th	Factory: 7th	Common: 8th
AM	**(Measurement)** •How to use Power Meter •How to use Exhaust Gas Meter •How to detect Heat Leakage •Other Equipment	**(Hands-on Facility 2)** •EE&C Operation of Compressor •Measurement Practice •Analysis and Evaluation Method	**(Application of EE&C Measures and Calculation of Effects 2)** •Efficient Operation of Compressor •Protection of Air Leakage •Pump and Fan Replacement •Transformer and Capacitor	**(Oral and Written Examination)**
PM	**(Hands-on Facility 1)** •EE&C Operation of Boiler and Steam Trap •Measurement Practice •Analysis and Evaluation Method	**(Application of EE&C Measures and Calculation of Effects 1)** •Boiler and Burner Replacement •Efficient Operation of Boiler •Insulation •Steam Trap Replacement •Protection of Heat Leakage	**(Case Study 2: Factory)** •Presentation •Comments	

Table 10-3 Training Curriculum for Energy Manager (Building Course) 1/2

	Common: 1st	Building: 2nd	Building: 3rd	Building: 4th
AM	**(General)** •Energy Situation of Serbia •General Explanation of the EMS Law and Regulation •HQ's Duties and Site's Duties •Organizing EE&C Team •Requirement in EMS	**(Basic Theory 1)** •Basic Theory for Heat and Fuel •Calculation Method of Combustion	**(Basic Theory 3)** •Basic Theory for Electric Equipment (Transformer, Motor, Power Factor, etc.)	**(Theory for O&M EE&C Heat)** •EE&C for Boiler •EE&C for Steam Trap •EE&C for Insulation and Heat Leakage
PM	**(Periodical Reports)** •Energy Consumption Calculation •Energy Consuming Equipment List •Energy Intensity •Guideline for Heat and Electricity EE&C •Management Standards •Middle-term EE&C Plan, etc.	**(Basic Theory 2)** •Basic Theory for Electricity •Distribution Planning in the Site	**(Theory for O&M EE&C Electricity)** •EE&C for Compressor •EE&C for Pump and Fan •Others (Lighting, HP, Transformer, etc.)	**(Case Study 1: Building)** •Explanation of Conditions of the Case Study •Group Discussion •Presentation •Homework

Table 10-4 Training Curriculum for Energy Manager (Building Course) 2/2

	Building: 5th	Building: 6th	Building: 7th	Common: 8th
AM	**(Measurement)** •How to use Power Meter •How to use Exhaust Gas Meter •How to detect Heat Leakage •Other Equipment	**(Hands-on Facility 2)** •EE&C Operation of Pump •Measurement Practice •Analysis and Evaluation Method	**(Application of EE&C Measures and Calculation of Effects 2)** •Pump and Fan Replacement •Lighting Replacement •Efficient Operation and Replacement of Air Conditioner	**(Oral and Written Examination)**
PM	**(Hands-on Facility 1)** •EE&C Operation of Boiler and Steam Trap •Measurement Practice •Analysis and Evaluation Method	**(Application of EE&C Measures and Calculation of Effects 1)** •Boiler and Burner Replacement •Efficient Operation of Boiler •Insulation •Steam Trap Replacement •Protection of Heat Leakage	**(Case Study 2: Building)** •Presentation •Comments	

(2) Pass Rate

The "Official Training Program for the Energy Manager" is a position for the persons who drop the 1-day examination. The pass rate of the official training program is set at a higher line (ex. about 70 %). Only applicants, who attend all curriculums in the 7 days before the examination, can take the certificate examination in the final day.

(3) Training Fee

The training fee is collected from the Official Training Program applicants. The fee will be a resource for SEEA's administration expenditure for the training program.

10.2 Qualification Programs for Accredited Energy Auditor and Energy Officer

10.2.1 Official Training Program for the Accredited Energy Auditor

(1) Acquisition of the License

To obtain the Certificate of the Accredited Energy Auditor, the "Official Training Program for the Accredited Energy Auditor (with Certificate Examination)" is proposed. The training program consists of 3 days training and 1 day practical examination. Applicants must submit evidence of having met the minimum requirements to SEEA before taking the training program.

The Certificate can be obtained by passing the Certificate Examination in the training program. Applicants who have the Certificate can request that MOME issue out the Accredited Energy Auditor license. After checking the Certificate, MOME will issue the license.

(2) Training Curriculum

(a) Required Knowledge for Accredited Energy Auditor

As mentioned previously, it has been planned that the external energy audit using an incentive program prepared by MOME must use the Accredited Energy Auditor who can conduct the audit in accordance with the Audit Standards prepared based on the concept of the Energy Management System. To fulfill the Audit Standards, minimum amount of knowledge listed below is required.

However, applicants who have the minimum requirements (ie. Certificate of Energy Manager and energy audit experience) for taking the official training program for Accredited Energy Auditor will be considered qualified. This means they already have rudimentary knowledge of theory and skills. Only the important knowledge and skills should be selected for the curriculum for the training program for the Accredited Energy Auditor. The following table shows the selection procedures for the curriculum.

Table 10-5 Training Curriculum for Accredited Energy Auditor

	Necessary Knowledge and Skills for Accredited Energy Auditor	Contents which can be confirmed by Minimum Requirement for Training	Priority of Training Contents for Accredited Energy Auditor
1	Energy Situation in Serbia, Environment, and General Topics in Energy	Yes	B
2	**Law and Regulations on Energy Management System**	**Yes**	**A**
3	**How to Make Periodical Report and Understanding for Evaluation Criteria**	**Yes**	**A**
4	Basic Theory for Heat and Electricity	Yes	C
5	Basic Theory for EE&C Measures in Heat and Electricity	Yes	C
6	**Audit Standards for EE&C Study**	**No**	**A**
7	**Skills for Finding Suitable EE&C Measures**	**No**	**A**
8	**Skills for Effect Estimate for EE&C Measures**	**No**	**A**
9	Skills for Cost Estimate for EE&C Measures	No	B
10	**Skills for Reporting and Presentation**	**No**	**A**

(b) Training Curriculum

From the above table, high priority contents are selected. The JICA Study Team proposed their breakdown as follows.

Common Subject: 0.5 Day

- Law and Regulations on Energy Management System
- Periodical Reports and Evaluation Criteria
- Overview of Audit Standards including Schedule, Minimum Required Work, Methodology, Reporting Format, etc. (prepared by the JICA Study Team)

Practical Subject for Energy Audit: 2.5 Days

- Factory EE&C Measures in Heat and Electricity
- Building EE&C Measures in Heat and Electricity
- Check Points to Find EE&C Potentials
- How to use Measurement Tools
- Calculation of Effects of EE&C Measures
- How to Estimate Costs of EE&C Measures
- Reporting Format and Presentation

On-Site Training: 1 Day

- At least 1 audit is conducted in accordance with the Audit Standards
- Certificate Examination

Figure 10-2 Training Curriculum for Accredited Energy Auditor

The “On-Site Training” mentioned in the above curriculum is a trial of the simple energy audit for a site SEEA selects. One team consisting of 2 trainees (different technical fields) visits the site and survey within a day. Passing the Certificate Examination is based on the results of the survey and the interview with SEEA. When SEEA acknowledges their skills to be at a satisfactory level, SEEA issues the Certificate of Accredited Energy Auditor.

(3) Pass Rate

No specific pass rate is considered.

(4) Training Fee

The training fee is collected from the applicants of the Official Training Program. The fee will be a resource for SEEA’s administration expenditure for the training program.

10.2.2 Official Training Program for the Energy Officer

(1) Acquisition of the Certificate

To obtain the Certificate of the Energy Officer, the “Official Training Program for the Energy Officer” is proposed. The training program spends 1 day on on-desk training. Applicants must submit evidence of having met minimum requirements to SEEA before taking the training program. The Certificate can be obtained by attending all of the curriculums. The person who has the Certificate for Energy Officer will be acknowledged as an official “Energy Officer”.

(2) Training Curriculum

The tasks of the Energy Officer are support for the activities of the outsourcing Energy Manager. The training curriculum focuses on the important tasks of the Energy Officer, that is how to make a Periodical Report.

Table 10-6 Training Curriculum for Energy Officer

	1st
AM	**(General)** •Energy Situation of Serbia •General Explanation of the EMS Law and Regulation •HQ’s Duties and Site’s Duties •Organizing EE&C Team •Requirement in EMS
PM	**(Periodical Reports)** •Energy Consumption Calculation •Energy Consuming Equipment List •Energy Intensity •Guideline for Heat and Electricity EE&C •Management Standards •Middle-term EE&C Plan, etc.

(3) Pass Rate

All applicants can obtain the Certificate from SEEA if they take all the curriculums in one day. For reference, in Japan there is a final examination in the Energy Officer Training Course. However, the pass rate of the Japanese case is set at almost 100 %.

(4) Training Fee

The training fee is collected from the applicants of the Official Training Program. The fee will be a resource for SEEA's administration expenditure for the training program.

10.3 Others

10.3.1 Skill-up Training Program

(1) Expected Applicants

The Skill-up Training Program is conducted as one of SEEA's dissemination programs. All applicants can voluntarily apply for the program. At this moment, expected applicants are engineers/technicians in energy management in Serbia as well as other countries.

(2) Courses of the Skill-up Training Programs

The courses of the Skill-up Training Program are made by parts of the official training programs for the Energy Manager or the Accredited Energy Auditor. Applicants select the courses according to their needs. It can contribute to a higher utilization of the SEEA training programs.

The expected courses of the Skill-up Training Programs are proposed as follows.

EE&C in Factory Course

- EE&C in Factory (Theory) 3 days
- EE&C Practice in Factory (Measurement, Hands-on Facility, Calculation of Effects) 3 days

EE&C in Building Course

- EE&C in Building (Theory) 3 days
- EE&C Practice in Building (Measurement, Hands-on Facility, Calculation of Effects) 3 days

Auditor's Skill-up Training Course (Practical Subject for Energy Audit)

- Theory and methodology for audit standards 2.5 days

10.3.2 Hands-on Facilities for the Training Programs

(1) Necessity of Hands-on Facilities

The effects of EE&C measures can be achieved by the actual practices of realizing the theories of such EE&C measures. However, Energy Managers or operators might have anxiety over something going wrong due to the adoption of (unusual) different operational methods or the installation of new equipment. Practical experience utilizing Hands-on Facilities can provide appropriate operational methods and prove effects in such ways. It can get rid of the anxiety that the Energy Managers or operators harbor.

In addition, the Energy Managers, who have the practical experience of Hands-on Facilities, can judge and explain the appropriate operation methods with judgment to responsible persons (such as the General Managers in the factories).

Engineers and operators should have an understanding of at least the following:

- Ability to make appropriate judgments during operations concerning pressure, power, temperature, unit number in operation, etc.
- Understanding of the checkpoints for each of the above items and practical skills for measurement to check
- Calculation skill of the effects when the operation methods or equipment is changed.

The above knowledge is at first learned during the on-desk training. After that, trainees try to operate, adjust and make measurements utilizing the Hands-on Facilities and then confirm the appropriateness and effects of the adjustment by calculation. A combination of theory and practice will drastically enhance their skills in energy management.

For the same reasons, Japan, Turkey, Iran, Poland etc. have such Hands-on Facilities in training programs that have been undertaken by governmental official agencies. In this context, it is has been recommended that Serbia should also have Hands-on Facilities to secure the quality of the scheme of the Energy Management System and improve the skills of the Energy Managers.

(2) Recommended Hands-on Facilities

(a) Priority Facilities

Hands-on Facilities have been proposed as listed below in consideration of equipment in high frequent use and large energy consuming equipment along with equipment whose energy consumption can be expected to be reduced due to operational improvements.

- Boiler and Burner Model Panel
- Compressor
- Pump
- Steam Trap
- Heatpump
- Lighting

(b) Training Idea Using Hands-on Facilities

(i) Boiler and Burner Model Panel

- Explanation of the structure of the boiler and burner
- Judgment of the appropriateness of the burner and its adjustment way
- Data acquisition for the calculation of the heat balance and its calculation
- Various operational methods for EE&C (load control, air ratio reduction) and measuring the effects
- Cleaning and estimate of its effects
- Effects of the oil temperature and mist on combustion conditions

Training for Boiler

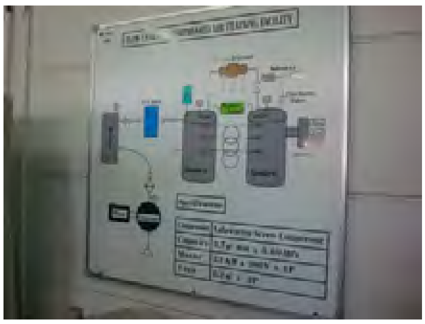
Burner Model Panel

Figure 10-3 Sample of Hands-on Facility (Boiler and Burner Model Panel)

(ii) Compressor

- Measurement of power, pressure and air-flow
- Measurement of the appropriate flow volume of each size of the pipe (pressure loss measurement)
- Various operational methods for EE&C (un/on load operation, inverter control) and measurement of the effects
- How to detect leakage points, measure leakage and the estimate effects of leakage protection

Training for Compressor



Compressor Flow Panel

Figure 10-4 Sample of Hands-on Facility (Compressor)

(iii) Pump (including Switch of Pipe Length)

- Measurement of the power, pressure and air-flow
- Measurement of the appropriate flow volume by each size of the pipe (pressure loss measurement)
- Theory of the pump efficiency curve and the calculation of the actual efficiency of the pump by measurement
- Various operational methods for EE&C (control of valve, inverter control) and measurement of these effects

Training for Pump

Hands-on facility of Pump

Figure 10-5 Sample of Hands-on Facility (Pump)

(iv) Steam Trap

- Explanation of the structure of the steam trap by various steam trap models
- Judgment of the appropriate actions of the steam trap
- Confirmation of the increase in drain volume on a rainy day and the protection methods for a rainy day
- Explanation of the proper selection of the steam trap type according to site characteristics

Training for Steam Trap

Hands-on Facility of Steam Trap

Figure 10-6 Sample of Hands-on Facility (Steam Trap)

(v) Heatpump

- Measurement of the power, temperature and humidity
- Various operational methods for EE&C (change of pre-set temperature, inverter controls, water-cooling of outdoor equipment) and the measurement of these effects

(vi) Lighting

- Illumination level of each type of lamp (including LED) and the comparison of power consumption
- Measurement of the effects of the inverter for the fluorescent lamp

Chapter 11 Audit Standards and Inspection Standards

11.1 Audit Standards

In some cases, it may be difficult to implement energy efficiency countermeasures at factories and buildings by themselves because of their limited human resources and technologies. Therefore, in order to promote energy efficiency at such sites, it is important that Accredited Energy Auditors who are specialists at energy conservation carry out the energy audits at the sites, and practical countermeasures be implemented based on the energy audit results.

In addition, Designated Organizations or Sites requires the effective implementation of energy efficiency in accordance with the purposes of the Energy Management System. The Accredited Energy Auditors can provide the appropriate advices for the said purposes.

The Audit Standards have been formulated under the assumption that Accredited Energy Auditors helps Designated Organizations who must prepare necessary energy data and energy efficiency plans in accordance with the Energy Management System. Therefore, such energy audits should be conducted by the Accredited Energy Auditor who has a nationally accredited and has a license.

The concept and outline of the energy audit standard are as follows. The details are shown in Appendix 8.

11.1.1 Scope of the Audit Standards

The Audit Standards applied to the energy audit carried out a site survey in one day (in case a 24 hours measurement is included, the site survey is in two days). Fundamentally, one of the purposes of the energy audit is to improve the quality of the Periodical Report, and it is also expected that the energy audit would contribute to the skill enhancement of the Energy Manager on site.

The Audit Standards includes the activities to grasp accurate energy consumption data using several kinds of easy measurements and to analyze the potentials of energy efficiency on site.

11.1.2 Overview of the Audit Standards

(1) Basic Concept of the Audit Standards

Basic concept of the Audit Standards has been summarized below.

- Basically the energy audit is carried out by two energy auditors responsible for heat and electricity respectively due to the following reasons.
  - ✓ It is required that both energy auditors have a working knowledge of heat and electricity respectively, therefore the themes of energy efficiency to be recommended are effectively found out.
  - ✓ Because the contents of the recommendations are confirmed by both energy auditors, false recommendations are avoided.

- The measurements of using instruments should be implemented in order to gather the correct data concerning the conditions of energy usage.
- The energy audit should be done according to the check sheets in which the check points, present conditions, recommendable countermeasures, etc. are described.
- At the field survey, persons in charge of the site should be accompanied in order not to give harmful influence on the operating facilities.

(2) Workflow of Energy Audit

The workflow of the energy audit by the Accredited Energy Auditor is as follows.

Submitting required documents and data from the audited site

↓

Implementing the energy audit

Note: In general energy audit is implemented in a day or two days considering the scale of site and measurement.

↓

Examining energy audit results

↓

Creating an energy audit report

↓

Reporting energy audit results to the site

Note: As a general rule, it should be reported to the site.

11.1.3 Format of Energy Audit Report

The following contents have been proposed as the report of the Audit Standards.

(1) Summary of energy audit results
- (a) Summary table of energy audit results (Each countermeasure of energy efficiency item, energy saving quantity, investment, payback period)
- (b) Summary table of energy saving potential (Total energy saving quantity and ratio)

(2) Conditions of energy consumption based on the related materials submitted from audited site

(3) Contents of energy audit
- (a) Date and name of energy auditor
- (b) Objective facilities to energy audit
- (c) Methods of energy audit

(4) Energy Audit Results
- (a) Filling out the energy audit results in the applicable columns of check sheets
- (b) Evaluating the situations of energy conservation in audited sites according to three ranks (A, B, C)

(5) Recommended energy efficiency countermeasures
- (a) Filling out the energy efficiency countermeasures in the applicable columns of check sheets
- (b) As for the recommended energy efficiency countermeasures, the detailed contents are described on another sheet with the following contents.
  - ① Present conditions
  - ② Recommended countermeasures
  - ③ Premised of calculation
  - ④ Calculation results of energy saving and energy cost saving
  - ⑤ Investment amounts
  - ⑥ Payback period

(6) Conclusion
- (a) General comments for energy efficiency in site
- (b) Others

11.1.4 Cost Estimation for the Energy Audit

The costs for the energy audit include spending one or two days are estimated under the following conditions. These costs might change according to the conditions of the audited site.

- Daily personnel expense for the Accredited Energy Auditor: 30 Euro/day
- Day trip to the audited site
- Transportation expense: 40 Euro/round trip/person
- On the assumption that Accredited Energy Auditors belong to consulting companies, the rate of the total administrative expense (company expense + technical fee) is assumed as 200 % of the personnel expense

Table 11-1 Cost Estimation for the Energy Audit by the Audit Standards (One Day Site Survey Case)

Items	Quantity	Unit cost	Amount	Remarks
(Personnel Expense)				
Preparation work	2 persons x 2dsys	30 Euro/day	120 Euro	
Energy audit at site	2 persons x 1day	30 Euro/day	60 Euro	
Examining energy audit results and making energy audit report	2 persons x 4 days	30 Euro/day	240 Euro	
Visiting to site for reporting	2 persons x 1day	30 Euro/day	60 Euro	
Subtotal			480 Euro	
(Direct Expense)				
Rental fee of instruments	-	-	100 Euro	Assumption: 1/25 of instruments purchase price
Transportation expense	2 round trips x 2 persons	40 Euro/round trip	160 Euro	
Subtotal			260 Euro	
(Total Administrative Expense)	200 % of Personnel Expense		960 Euro	
Grand Total			1,700 Euro	

Table 11-2 Cost Estimation for the Energy Audit by the Audit Standards (Two Days Site Survey Case)

Items	Quantity	Unit cost	Amount	Remarks
(Personnel Expense)				
Preparation work	2 persons x 3 days	30 Euro/day	180 Euro	
Energy audit at site	2 persons x 2days	30 Euro/day	120 Euro	
Examining energy audit results and making energy audit report	2 persons x 5days	30 Euro/day	300 Euro	
Visiting to site for reporting	2 persons x 1day	30 Euro/day	60 Euro	
Subtotal			660 Euro	
(Direct Expense)				
Rental fee of instruments	-	-	200 Euro	Assumption: 1/25 of instruments purchase price
Transportation expense	3 round trips x 2 persons	40 Euro/round trip	240 Euro	
Subtotal			440 Euro	
(Total Administrative Expense)	200 % of Personnel Expense		1,320 Euro	
Grand Total			2,420 Euro	

11.2 Inspection Standards

Designated Organizations, such as companies, organizations, Government bodies and Municipalities in the Energy Management System must put forth their best efforts on the following energy efficiency activities under the law.

- Posting Energy Manager
- Making a Periodical Report including the Middle & Long Term Plan and Submission of it to MOME
- Establishment of the Energy Management Standard (Evaluation Criteria) and its daily application and maintenance
- Promotion of energy efficiency activities through the improvement and renewal of energy consuming facilities

On the other hand, MOME is necessary to dispatch inspectors to the Designated Organizations at any time, in order to confirm the practical application of the issued plans, appropriateness of the Periodical Report and the promotion of energy efficiency. These Inspection Standards have been proposed to carry out the inspection activities smoothly.

11.2.1 Scope of the Inspection Standards

These Inspection Standards have been applied to the inspection activities of energy management performance for the selected Designated Organizations at any time.

The inspectors will make a one day visit to the organization after receiving the returned prepared questionnaires and report the inspection results to an appropriate representative of MOME. In the event of poor management practices, the inspectors have the right to order the organization to send an improvement plan (Rationalization Plan Report) to MOME, and if their efforts towards improvement are insufficient, the inspectors can recommend to an appropriate representative of MOME that penalties be levied.

11.2.2 Overview of the Inspection Standards

(1) Selection of the Organizations to be Inspected

Organizations are selected by the following conditions.

- Selecting them arbitrarily from each sector of industry, commercial municipality governments and the central government every year.
- Basing the selection on the Periodical Report and/or the energy audit report wherein the Accredited Energy Auditor has designated certain organizations as engaging in inappropriate management practices.

(2) Members of Inspectors

As a general rule, the inspection is performed by 2 (two) staff, one is the Inspector and the other is the MOME staff in charge of the monitoring of the Periodical Reports as the Inspector's supporter (refer to Figure 14-4).

(3) Inspection Questionnaire Sheet

The MOME sends a questionnaire sheet to the selected organization to be inspected one month before the inspection. The organization must fill in the prescribed form two weeks before the scheduled inspection day, and send it back to MOME. The inspector scrutinizes the returned questionnaire sheet and past 3-year Periodical Reports of the target organization, and grasps the checkpoints of the inspection in advance.

There are three different samples of the inspection sheet such as the Industrial sector, Commercial sector and the Municipality sector (Appendix 9).

(4) Inspection Schedule

The inspection at the target organization is performed one day, and the inspector examines the documents and questions the person in charge about their energy management activities at the head office in the morning and at the site in the afternoon along with conducting a site survey.

(5) Inspection Items and Evaluation

The inspection is performed as the check sheet system. The Inspector scores each item of the sheet based on the following judgment criteria. The check sheet is sent to the target organization and the person in charge of the organization must score it and send it back to MOME. The inspector utilizes the returned self-scored check sheet and scores the same items.

Evaluation: ○	The organization establishes their energy management items and executes management properly. In this case, the double point of the allotted point is scored.
Evaluation : △	The organization establishes their energy management items but its management is poor. In this case, the allotted point is scored.
Evaluation : ×	The organization does not establish their energy management items and does not execute management. In this case, no points are scored.

The scoring example of the check sheet is attached as Appendix 9. There are two types of check sheets, namely for the headquarters and site.

(6) Judgment of the Inspection Results and Treatment

The following criterion is to serve as the basis for judging the inspection results and its treatment.

80 points and over	Good (no instruction)
60 points and over to 79 points	The organization must prepare a Rationalization Plan Report for the inappropriate management items and send it to MOME. However, if it is confirmed that they have reached a satisfactory level of energy intensity or the gross energy consumption quantity, the Inspector will provide only aural guidance towards their improvements (no need to submit a Rationalization Plan Report).
Less than 59 points	The Inspector asks to submit the Rationalization Plan Report and strongly recommends that an energy audit be conducted by the Accredited Energy Auditor.

(7) Confirmation of the Execution Result of the Rationalization Plan

MOME dispatches the Inspector to the poor management organization 6 to 12 months after the submission of the Rationalization Plan Report, and certifies the execution results of the plan.

11.2.3 Format of Inspection Report

After the inspection, the inspectors fill in the prescribed report and report the inspection results to MOME. The format of the Inspection Report is attached as Appendix 9.

Chapter 12 Financial Support Scheme

This chapter describes the possibility of coordination with existing financial schemes by donors for energy efficiency promotion for private enterprises and planned energy efficiency funds with the energy management system, when the system is introduced and implemented.

12.1 Current Situation of the Energy Efficiency Fund

The Establishment of the Energy Efficiency Fund (EEF) was conceptualized originally in the report, "Program for Implementation of Energy Development Strategy of the Republic of Serbia: Module Fund for Energy Efficiency and Renewable Energy Sources" prepared with Norway's assistance in December of 2006.

As the official government plan of Serbia, the long-term plan " Energy Sector Development Strategy of the Republic of Serbia by 2015" drafted in year 2005 stated the establishment of an energy efficiency fund as an incentive with a view to providing financial support to promote energy efficiency and utilize renewable energy. The "Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012", the implementation plan of priority projects in the same long-term plan, describes the more specific content of EEF. Then, "The First Energy Efficiency Plan of the Republic of Serbia for the Period from 2010 to 2012" announced in July showed an action plan which suggests the implementation schedule with the date.

In the aspect of the law and regulation, the establishment of EEF is to be stipulated through the revision of the existing energy law. The law on the rational use of the energy is in the middle of drafting. This draft (as of November, 2010) states that the Serbian government provides financial incentives to promote energy efficiency and renewable energy from the fund stipulated by the special law.

■ *Energy Sector Development Strategy of the Republic of Serbia by 2015*

Among 5 prioritized programs in this strategy, energy efficiency is stated in the second. This program discussed the establishment of EEF from grants from foreign governments, finance from EU, and support from other financial and specialized institutions and the fund cofinances energy efficiency, new renewable energy, environmental protection, and other programs.

■ *Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012*

The amendment for the aforementioned program which was officially approved by the government in April in 2010 comprises 15 modules. Of these modules, the implementation plan of the EEF is presented in Module 14. The content of this plan is basically the same as the aforementioned report supported by the Norwegian government in 2006, mainly the indicators in the financial plan were updated.

The concept of EEF in Module 14 is described in the following. It specifically describes, as the financial source, 1 % of the electricity tariff and 0.5 % of the gas and liquid fuel energy consumption price were collected and utilized for the EEF. A part of donor's grant and loan fund will also be utilized for it. Although this paper does not indicate the collecting fee method, collection by new taxation is planned according to MOME which will result in an increased burden to energy consumers.

Table 12-1 Summary of Energy Efficiency Fund Concept

Fund Source	Purpose
■ 1 % of Electricity Tariff ■ 0.5 % of Gas and liquid fuel energy consumption price ■ A part of the donor's grant and loan funds	Targeting corporations or individuals, their energy efficiency improvements and renewable energy usage promotion of industrial and municipality systems, such as the below projects: ■ Support by financing the project and guarantee of finance, subsidies, and other grants funded, etc. ■ Education program for the professionals, training for local public officers with respect to energy balance sheet preparation and energy planning, and training entrepreneurs and machinery operators ■ Financial cooperation for research and development by the Ministry of Science and Environment[1]

（Source：Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012）

(Note 1) Original sentence in this paper refers to this name. As of November 2011, it is Ministry of Environment and Spatial Planning.

The envisaged revenue of the energy efficiency fund has been tentatively calculated as approximately 30 to 40 million EUR (approximately 3.38 to 4.5 billion yen) (refer to the chart in the below).

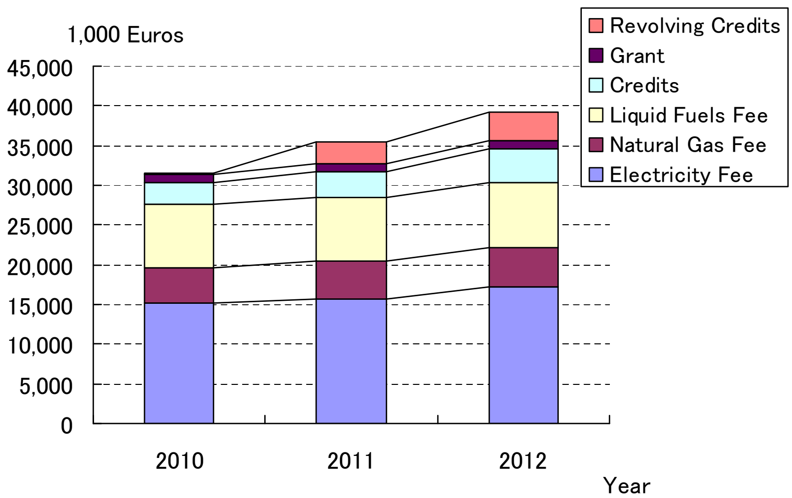


Figure 12-1 Projected Revenue of the Energy Efficiency Fund

（Source: Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012）

(Note) Draft amendment of the program implementation plan was prepared in 2009, thus the projection was made after 2010 although the energy efficiency fund has not actually been established yet.

Specific issues in the financial source items were summarized as follows:

- ✓ Revenues from energy tariffs occupies about 70 to 80 % as a major financial source, which account for 25 to 30 million EUR (approximately 2.8 to 3.38 billion yen) excluding unknown donor fund that will presently be obtained.
- ✓ The expected donor fund is about 12 to 15 % of the total. Module 14 implies the possibility of obtaining financing from EBRD, EU, and WB. It also refers to the use of the Global Environmental Facility (GEF).
- ✓ In order to finance for energy efficiency, a revolving fund is formed by the repayment of the credit to refinance the projects with the same objective.

The EEF is expected to utilize for finance or subsidy for the energy efficiency projects, energy efficiency education programs, and so on for all sectors such as industry, agriculture, housing, public and commercial services and transport. The plan for finance distribution by sector in 2012 is about 10 million EUR for the industrial and agricultural sector, 15 million for the housing sector, 12 million EUR for public and commercial services, and 4 million EUR for the transport sector.

It has been envisaged that 70 % of the total finance will be utilized for energy efficiency and the remaining 30% will be allocated to renewable energy projects.

■ *The First Energy Efficiency Plan of the Republic of Serbia for the Period from 2010 to 2012*

In principle, along with the "Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012", this plan contains the implementation schedule with a specific date. The plan shows the approval of a draft law concerning the rational use of energy by the end of year 2010 and the commencement of operating the EEF described in the program for implementation by the end of 2010.

■ *Law on Rational Use of Energy (Draft version as of October 2010)*

The draft law articulates the provision of grant funds and preferable condition loans through the energy efficiency fund established by special law as incentives for promoting energy efficiency projects and the use of energy efficiency equipment, technology, and so on, in Article 55 in "VI. Incentives for the Improvement of Energy Efficiency and for Realization of Projects for the Use of Energy Efficient Equipment, Materials, Devices, and Technologies".

In this article, the conditions for receiving financial support are to be stipulated in the ones and standard set by the Serbian government and are not described in the details. The draft law "V. Energy Audit and Energy Auditor Article 33, 34" describes the necessity of undergoing an energy audit in order to obtain subsidies and other financial incentives. The limit of financial support is that in the case of credit, it is up to the total energy efficiency investment cost and in the case of grants, it is 50 % less than the investment costs. In addition, according to the same Article, if the individual /company receive the subsidies and other support, they have to accept that they will undergo an energy audit within 12 months after project completion. If they cannot achieve 80 % or higher, they have to repay back the finance.

It should be noted that the aforementioned concept of EEF described in the "Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012" was just approved by the Government and at this phase it will be realized under concrete implementation policies and coordination with relevant ministries and agencies. Approval on the law concerning the Rational Use of Energy, however, has been rescheduled several times for a few years in the past and as of November in 2010 has not yet been approved. According to the present plan, it is supposed to be submitted by the end of 2010. Even if the law is approved in the future, for the establishment of EEF based on the program for implementation, it is necessary to deal with the below issues thereafter.

- <u>Securing the financial source for the energy tariff</u>
  - For the establishment of the energy tariff electricity, gas, and others which are major financial sources, it requires coordinating with relevant ministries and agencies such as the Ministry of Finance.
- <u>Analysis on current situation based on updated information (examining donor funds, reflecting the result of the existing financial schemes and others)</u>
  - The content of the program for implementation is based on the energy efficiency fund concept in year 2006 and refers to only the possibility of donor fund support. It should be realized through further negotiation, discussion, and coordination among stakeholders.
  - Moreover, there is a lack of analysis on most recent information of donors' assistance. For example, as for financing schemes for energy efficiency, there are schemes that some of the donors have already conducted. Regarding those financing schemes, it is necessary to conduct an overall evaluation on their results, such as those issues regarding to what extent those schemes cover the needs of borrowers and whether or not there are points for improvement in their schemes, and others. Then, it is desired that the evaluation result should be applied to the financing scheme utilizing the EEF.
  - Furthermore, the government already started to implement the increase in the electricity tariff by 10 % and more every year and the feed-in tariff system for renewable energy was introduced in the end of 2009. In consideration of this situation, it is necessary to examine the expectations concerning financial sources and financial support.
- <u>Drafting Special Law and Regulations on the Establishment of the EEF</u>
  - In the establishment of the EEF, with a special law referred to in the law on the rationed use of energy, a separate and detailed legal framework should be determined by the management of EEF including the aforementioned financial sources and its usage, namely, which agency is in charge and how they administrate the funds under what operational policies.

12.2 Lessons Learned and Issues to be Addressed from Existing Financial Scheme

In the current situation in Serbia, the existing financial support for energy efficiency depends on financial assistance from donors. The lending scheme, conditions, and availability of technical support differs per donor. There are some cases observed where financing targets such as small and medium enterprises and public facilities are the same among some donors.

12.2.1 Donor's Support for Energy Efficiency Investment

The Table below shows the range of targets of current donor projects and planned targets under the energy efficiency fund and Energy Management System at this moment. Donors' finance for energy efficient projects has preceded and has been envisaged that, for example, KfW's finance for small and medium enterprises will continue their support. In order to promote the implementation of the Energy Management System, it is important to have synergy effects by coordination and cooperation with these existing financial schemes or planned ones for energy efficiency projects.

Table 12-2 Targets under the Energy Management System, Energy Efficiency Fund Concept (Plan), and Major Donors' Support Energy Efficiency Investment (As of November, 2010)

	Industry			Building			Public Utility Service	
	Large	Medium	Small	Public	Commercial	Residencial	DHS	Electricity
EEF (Plan)	▪	▪	▪	▪	▪	▪	▪	
EMS (Plan)	▪	▪		▪	▪		▪	▪
(Loan)								
WB (IDA,IBRD)				●			●	
IFC		●	●					
EBRD		●	●					○
EIB		○	○	○				
KfW		●	●	○	●	●	●	○
Italia		○	○					
(Grant)								
GTZ				△				

✓:Target

●:Target projects have the objective of energy efficiency. As for EBRD loan, it is possible to finance indirectly to all targets through ESCO projects.

○:Target projects entail the energy efficiency as one of the project objectives.

△:A part of pilot projects contains the objective of energy efficiency.

DHS: District Heating System

In consideration of the range of targets by major donors in relation to the energy management system, the following points have been identified:

【Industry and Commercial Buildings】

- ✓ The current financial schemes by donors targeting small and medium enterprises, residences, and buildings. There are several parallel financial schemes by different donors, such as the one exclusively targeting projects related to energy efficiency and also the other targeting finance for medium and small enterprises in general which contain energy efficiency as one of the objectives. Under the energy management system suggested by this study, those enterprises have an obligation to conduct periodical reports based on the amount of energy consumption. On the other hand, medium to small enterprises under the financial scheme target are defined based on the size of capital, the number of employees, and so on. The target enterprises which have an obligation to the reporting of the energy management system are possibly included in the category of medium enterprises defined as targets of these financial schemes. However, it is mainly large enterprises that are included and therefore they are considerably outside of those targets of these existing financial supports especially in the area of efficiency investments.

【Public Building and Services】

- ✓ Targets under the energy management system suggested by this study are offices and facilities of the central government, the same municipalities (160 municipalities) which have 20 thousand and a larger population (energy loss is 2,500 toe and more in case of heat supply system). Facilities in some municipalities were already targets of WB and KfW financing projects; however, it seems that there are still many facilities remaining which have to take future countermeasures for energy efficiency. Thus, the possibility of coordination and cooperation with the energy management system is considered to be high in this sector.
- ✓ Taking into consideration the achievement of effectiveness by donors' projects for municipal facilities and the same capacity building for municipal government officers to the present, if some donors provide continuous support in these areas, it is necessary to take actions to coordinate them within the context of the energy management system.

【Overall】

- ✓ In the current situation, there are several projects presently being implemented. As for the financial support for private companies in particular, the ex-post evaluation concerning the effectiveness of these companies' energy efficiency enhancement measures has not been confirmed. Furthermore, these have not been sufficiently shared among government stakeholders and donors. In addition, it has not yet verified the total sector's needs clearly and there is no information-sharing regarding how much the existing financial support covers the needs of society and people.

12.2.2 Energy Efficiency Finance for Private Enterprises

Financial supports for EE & C projects by donors which are described in the Chapter 4 are those undergoing implementation or planning to be implemented in the future. Although it was difficult to obtain detailed information with respect to the overall evaluation and each project case, there was some information partly obtained about EBRD and KfW financial schemes through interviews conducted with donors, some private banks, technical assistant consultants for project formulation and other relevant personnel (Box 1 and 2).

After reviewing this information, upon promoting private companies' energy efficiency investments, it can be inferred that it is necessary to have the below conditions.

- **Environment which does not inhibit the energy efficiency investment**
  The electricity tariff in Serbia is at a very low price. Thus, it has been pointed out by donors that it should be necessary to double the tariff in year 2009 to recover the costs. In this situation, the incentives to reduce the energy consumption do not work for energy users. With a view to promoting the investment related to energy efficiency, it is necessary to increase the energy cost sharing for energy users up to a level where they become conscious of the necessity of controlling energy consumption. Moreover, it is indispensable to have an external environment such as a stabilized macro economic environment so that it is easy for private enterprises to judge the investment risks. At present, the electricity tariff is on an increasing trend and the macro-environment has been recovered and stabilized. Accordingly, it can be expected that the inhibiting factors for investment will be decreased gradually.

- **Strengthening the capacity to formulate the effective projects for energy efficiency**
  In the current situation in Serbia, conducting effective energy audits and providing the grants for consulting service for such audits are an incentive or trigger for energy efficiency investment. However, since engineers working in private enterprises do not have sufficient technical capacity to formulate an optimal energy efficiency investment project, there is a necessity to strengthen their capacity in this aspect. Besides, in Serbia, the number of such consultants who can conduct technical support is limited and there is no ESCO in a strict sense. For the moment and in the near future there is a necessity of technical support for energy audits and effective project proposals,

- **Preferences in lending conditions**
  In considering the weighted average interest rate for similar lending in data from the National Bank of Serbia which has been more or less 10 % from the late 2009 to early 2010, the energy efficiency investments supported by donors such as KfW is considered to have about a 1% interest rate preference. Thus, if there are no inhibiting investment factors from external conditions and adequate support for the project formulation, there will be a certain need to invest in energy efficiency projects such as the same already implemented. Furthermore, preferences in lending conditions are not always at low interest rates. For private enterprises, if the depreciation period of the invested facilities coincides with the repayment one, it would be a preferred condition. Thus, it can be assumed that there will be a need for longer term lending in accordance with the depreciation period of financing target facilities.

(BOX 1) EBRD: Case of Western Balkans Sustainable Energy Credit Line（WeBSECLF）

1. Lending Term

Maximum project cost: 5 million EUR

Lending amount: 10 thousand to 2 million EUR, equivalent amount of average foreign currency or dinar.

Interest Rate:EURIBOR 3M+5.75%～7.00% p.a. (EURIBOR=Euro Inter-bank Offered Rate)

Repayment Period:5 years（grace period up to 2 years）

2. Cases of Financing Projects

Project	Lending Terms and Expectation of Effectiveness in Energy Efficiency
Replacement of the construction material company's boiler	Lending Amount: 2.2 million EUR Interest Rate: EURIBOR 3M+5.75pa Repayment Period: 5 years (grace period: 1 year) *If the project achieved the CO2 reduction plan, the benefits of the pay back from the principle can be estimated tentatively in terms of interest conditions is approximately EURIBOR 3M + 0.50 % p.a
Introduction of a food processing company's 4 MW biomass boiler	Project Cost: 1.431 million EUR Lending Amount: 1.2 million EUR Interest rate and Lending period: N.A. IRR:29%、Payback:2.8 years
Introduction of a furniture manufacturing company's intelligent industrial lighting system	Project Cost: 1.65 million EUR Lending Amount: 1.62 万 EUR Interest rate and lending period: N.A. IRR:19%, Payback:3.5 years

3. Comments by relevant persons in charge of implementation

(Target enterprises and overview of the projects)

- There is the potential to target medium and small enterprises in the food, wood, leather, and agro-business sectors
- The insulator of the buildings and the replacement of the factory's boiler were actually implemented as targets of facility investment.
- Regarding financing in the renewable energy area, hydropower projects have the most potential. Furthermore, there is the possibility of financing wind power generation projects.
- Average energy efficiency improvements are 25 to 30 % among the financed projects. In Serbia, aged facilities that began operating 40 to 50 years ago are generally in use and the replacement of them can achieve 20 to 30% energy efficiency improvements. In the case of buildings, using double windows and replacing the air conditioners is expected to improve energy efficiency..
- In the disbursement record as of September in 2010, 70 % of the total are energy efficiency projects and the remaining 30% are renewable energy projects or the ones that fall under both issues.

(Progress of disbursement)

- Out of the 100 or more enterprises which have a potential for financing, 13 projects or more applied for finance by June 2010 and 12 projects were approved as of September 2010. The total financing amount was 1.2 million EUR. As of November 2010, it has been predicted that 2.2 million EUR will be financed. More than 30 projects will be expected to be financed by the year's end.

- On average, after submitting the initial application, it takes 1 to 8 months for enterprises to actually receive funds. This period differs depending on the company and project content. In general, it tends to require more time in case of small companies.

（Needs for financing conditions）

- The borrowers appreciate for the financing conditions.
- There are many enterprises applying for similar energy efficiency projects. On the enterprise side, they are waiting for the finance.
- Depending on the situation of the macro economy, from now on there will be a tendency for enterprises to increase energy efficiency investments. It is expected that such investments will be promoted via supporting energy management policy and regulations.

(Technical assistance for target projects)

- Experience of private banks in this area is limited. Therefore, for some time, it is necessary to provide technical assistance via technical appraisals.
- In the case of formulating energy efficiency improvement projects, there are those cases where the technical support consultant upon examination suggests a different proposal from the one received by the enterprise.

(Source: Documents provided by EBRD and interview to EBRD, Banka Intesa, and technical assistance consultant)

(BOX 2) KfW : Case of Stimulation of energy efficiency and renewable energy sources

1. Cases of the financing projects（As of February in 2010)

Examples of the projects	Lending conditions
(Bank A) ・ Replacement of the insulation and windows of the buildings and the roof ・ Purchase of the equipment which improves energy efficiency ・ Renewal of the heating system (Heat pump, biomass boiler, geothermal power utilization system and others) ・ Purchase of the tracks and cars which satisfy the CO2 reduction standard by EU	Maximum financing amount: 0.4 million EUR Interest rate: 7.5 % p.a.（Fixed. Effective interest rate is 8.38 %） Repayment period: 5 years (grace period 1 year）
(Bank B) ・ Purchase of the equipment which improves energy efficiency ・ Replacement of the production line ・ Utilization of renewable energy （solar power, mini hydro, biomass, geothermal power）	Maximum financing amount: 15 million RS Interest rate: 7 – 9 %（Fixed） Repayment period: 5 years

2. Comments by relevant persons in charge of financing,

（Progress of finance）

- As of November, 2009, 20 million EUR was disbursed out of a total of 4.5 million EUR to be financed by KfW. Furthermore, additional financing of 25 million EUR was approved. (As of September in 2010, another round of financing total 30 million EUR is in the middle of preparation.
- (Bank A) Since the agreement of 5 million EUR lending by KfW as of November, 2008, a total of 2 million for 30 projects was disbursed as of February 2010. At the time in 2008, the enterprises were not investment positive due to the impact from the financial crisis; however, from now on, it seems possible to disburse the remaining 3 million EUR. 20 % of the total is for the purchase of vehicles and the remaining 80% are for other purposes. 10 projects out of 30 are for the industry. 。
- (Bank B) Loan agreement with KfW in 2008, and the disbursement was started after September in 2009. As of February in 2010, there were 30 to 40 projects. 2 million EUR out of 15 million EUR was disbursed.

（Needs for financial conditions）

- (Bank A) Interest rate is better than the market rate. However, there are some points which seem to be better able to alleviate the conditions. For example, in the case of heat pumps, it is necessary to have a minimum repayment period of 7 years. Therefore, it would be better if the repayment period could be extended to 10 years. The conditions of similar financing from the European Investment Bank (EIB) are more preferential: interest rate is about EURIBOR 3 months + 4%, repayment period is 12 years (grace period is 3 years). Lending conditions are different contingent on the financial schemes, thus sometimes the bank appeals to the clients by combining these financial schemes.
- （Bank A & B） In future, it is expected to have financial needs for similar energy efficiency investments. The recovery of the macro-economy and an increase in the electricity tariff are promoting factors.

（Technical Assistance are for target projects）

- There are not that many consultants who are capable of conducting energy audits. The engineer staff of each enterprise lacks the capability of introducing energy efficient technologies.

(Source: Documents provided by KfW and interview to KfW and persons in charge in the private banks)

12.3 Cooperation between the Financial Support Scheme and Energy Management System

As a result of reviewing the current situation of the energy efficiency fund and the financial scheme for energy efficiency projects, the following approach is recommended as incentives to promote the Energy Management System.

12.3.1 Cooperation with the Existing Support Scheme (Short and Middle Term Visions)

It is expected that existing finance for energy efficiency projects for the private sector will be continued. Thus, through the cooperation that can be conducted relatively immediately in the below, it can be assumed that effectiveness will be enhanced via the introduction of the energy management system and to promote the implementation of the system.

As for following issues, upon receiving all donors' financial assistance for energy efficiency, the officer in charge of donor assistance, MOME and SEEA should share the information and it is supposed that they take initiatives and work together with the donors.

【Preparation Period of Energy Management System】

- **Understanding the financial needs of the enterprises better and reflecting them to the financial schemes**
  - Together with the total number of surveys on enterprises proposed by the action plan for the energy management system in this study, the information on the utilization of finance for energy efficiency to the present, its results, and future demand can be collected. Based on this survey, the financial needs can be analyzed in detail and shared among donors who provide financial support for energy efficiency. Since currently there are several financial schemes for energy efficiency; however, their results and the overall picture of their financial needs have not been clarified. Thus, at this timing, this information will be comprehensively grasped in one sitting.
  - In order to understand the needs of enterprises or organizations which attempt to incorporate energy efficiency measures, with the approval of energy management target enterprises, MOME and SEEA will analyze their periodical reports and they will hold the meeting to report the results of the analysis (in particular, the trends of the procurement of energy efficiency equipment etc.) to share the information with donors, private banks, and so on.

【Implementation Period of the Energy Management System (at any time from the beginning period)】

- **Provision of Information for Appraisal on Financing for Enterprises**
  - When the enterprises implement the projects proposed in the external audit by energy auditors qualified nationally and designated by MOME, they can have the appraisal process by the bank based on this report, enabling the simplification and acceleration

of its processes.

- In case they assign energy managers who create the energy saving plan the same as the above, it can also be considered that they will also be able to receive the preferential process in funding. More specifically, at the appraisal process of energy efficiency projects financed by each donor, periodical reports and medium and long-term plans are considered as appraisal documents. For example, those documents are utilized as evidences for judgment as being proactive in adopting energy efficiency countermeasures. Enterprises and organizations that submit periodical reports are considered to be those that take energy efficiency countermeasures eagerly. Thus, incentives can be provided in such a way that those enterprises are priority lending targets and have easier access to preferential loan conditions.

12.3.2 New Scheme for Energy Efficiency (Long Term Vision)

In examining the answers to the questionnaire submitted to participating enterprises, public entities, and consultants at the work shop of this study (refer to Table 9-27, in Chapter 9), the support scheme required by the majority of the respondents was a loan with preferential conditions and then subsidies for energy efficiency projects. At first, these schemes are examined. In fact, these schemes can be implemented in Serbia if the financial sources are secured via an energy efficiency fund and others in the future. In addition, although it is included in the top three schemes required by respondents, the support for an energy audit is considered to be necessary in order to complement the lack of capacity in being able to formulate an energy efficiency project. In the end, tax incentives are discussed, which was required by 60 % of all respondents next to the loans with preferential conditions and subsidies for energy efficiency projects.

(1) Support by the Energy Efficiency Fund

While the Serbian government has chronic fiscal deficit and is currently required to cut its budget per a recommendation from the IMF, it is currently very difficult to obtain a general governmental budget for low-interest rate loan and subsidy and also to introduce tax incentives. Regarding the plan of the Energy Efficiency Fund, on the premise that it can obtain presently planned financing, for example, the scale of the financial support scheme can be estimated as follows:

- ✓ <u>In the case of a low-interest rate loan:</u> if about 70 % of the fund can be a financial source for low-interest loans, it is between 2.2 to 2.7 million EUR. In reference to the EBRD loan amount: 0.1 to 2 million EUR per loan and KfW's maximum loan amount: 0.4 EUR, for example, the average size of the loan is estimated as 50 EUR. In this condition, the number of the loans for a year can be up to 45 to 54. In the case of the pilot project in this study, the investment costs which are relatively high are 0.1 EUR. If the support scheme targets this scale of the project, 220 to 270 loans can be disbursed yearly.
- ✓ <u>In the case of a subsidy:</u> If the detailed energy audit is assumed to be 20 thousand EUR on

the average per one case and a subsidy is provided for 10 thousand EUR for three years, it is possible to provide it for 140 private factories and buildings which are targets of the energy management system. Regarding the walk-through type energy audit, if it is subsidized for the total amount of 5,000 EUR, about 100 cased can be provided yearly. In addition, if the subsidy for the energy efficiency project is assumed to be 50 thousand EUR and distributed for 60 and more projects, the subsidy for the energy audit and energy efficiency projects is 3 to 3.8 million EUR yearly, which can be covered with about 10 % of the total revenue.

Table 12-3 Simulation of the Loan and Subsidy if the EEF as a Financial Source (Example)

(1,000EUR)

Year	Year 1	Year 2	Year 3
Revenue	31,614	35,396	39,155
Expenditure			
Loan 1)	22,130	24,777	27,409
Subsidies 2)	3,090	3,600	3,850
for Energy Audit 3)	90	100	100
for EE & RE project 4)	3,000	3,500	3,750

(Source : Revenue amount is from "Program for Implementation of Energy Sector Development Strategy for the Period from 2007 to 2012")
(Note 1) Based on the premise that estimated amount of 70 % of the revenue.
(Note 2) The subsidy for detailed energy audit is assumed as 10 thousand per case, Year 1&2=40 cases, Year 3 =50 cases, walk-through type energy audit 5 thousand EUR x 100 cases yearly.
(Note 3) The subsidy is assumed as 50 thousand EUR, Year 1=60 cases、Year 2=70 cases、Year 3=75 cases.

Upon designing each scheme feasibly based on information currently available, it is necessary to examine carefully the issues below.

■ Examining the Preferential Conditions for the Loan Specifically for Energy Efficiency Purposes

【Targeting】

- Since the existing donors' financial support is likely to continue on into the future, it is necessary to engage in analysis with those donors with respect to the results of those existing financing and financial needs for the future, and then coordinate with them in order to avoid duplication. The target of loans with preferential conditions supported by the government should be specified and then implemented.
- For example, target items should be focused on those that are expected to be highly effective in terms of energy efficiency and increasing needs, such as the insulators of the buildings, high energy efficiency boilers, and so on. Furthermore, target beneficiaries are considered as only those who have relative difficulty in funding (medium and small enterprises and are a part of designated enterprises or organizations under the energy management system).

【Considerations on the Implementation Scheme】

- In considering the implementation schemes for loans with preferential conditions, as shown in the issues for each scheme in the next table, the relevancy should be examined from the viewpoint of each stakeholder such as enterprises, private banks, and government entities. There are the issues to be considered such as the existence of sufficient investment incentives on the enterprise that assures the implementation structure of the government and provides enough incentives for the private banks to implement the loans, and so on.

Table 12-4 Issues to be Considered upon Implementing Low-Interest Loan per Different Schemes

Scheme			Loan with preferential conditions (revolving fund)	Interest Subsidy
Pro and Con Issues upon Implementation	Government (Fund manager)	Pro	• Not responsible for the direct credit risks of enterprises • Sustainability of the scheme by re-lending with repayment	• No credit risk • Relatively less administration cost • Support for Various financial institutions
		Con	• Necessity in establishing an adequate management system • Lending to selected financial institutions with implementation capacity	• Necessity in obtaining financial resources every year
	Private Financial Institutions	Pro	• Possibility to increase benefits depending on the conditions	• Almost no additional administration costs from implementation management costs
		Con	• Additional Management costs based on scheme • Must be responsible for credit risks • No that much incentives for lending	• Subject to credit risk • No additional profit by the scheme
	Enterprises	Pro	• Availability of a long-term loan	• Possible to support many enterprises at once
		Con	• Usually limited to enterprises which are under certain conditions through targeting financial institutions	• Minus certain conditions, a long-term loan is usually not available

- In considering the current situation in Serbia, while financial needs for energy efficient investment are expected continuously, it is required that detailed conditions be set, such as the extension of a repayment period and responding to the needs of each borrower (enterprises and organizations).
- As for the implementation structure, if sufficient structure and capacity are secured in the government entities, it is possible to manage the scheme directly and provide low-interest loans to enterprises and organizations. On the other hand, if it is difficult to establish an adequate structure or capacity in the government, the indirect support by means of an interest subsidy for the loans for designated projects is considered to be a realistic scheme. If the latter scheme is implemented with the same budget amount with the former scheme, it is expected to be effective in relatively saving

government administration costs.

- Furthermore, in order to promote low-interest loans from private banks, it would be effective to establish a guarantee system for the loan in order to reduce the credit risks for private banks. Currently, the loans for energy efficiency supported by donors are likely to target primarily those enterprises which already have a lending record and comparatively a higher credit rating. Accordingly, it can be predicted that financial needs for energy efficiency projects in the future will increase among enterprises with higher credit risks. Therefore, it has been considered that there will be an increase in the needs for the guarantee system to expand the low interest loans and possibly avoiding credit risks.

■ Subsidies

Depending on the financial resources which can be secured, more specific content will be determined; however, given the direction at this moment, subsidies in relation to the energy management system are to be expected as follows;

【Subsidy for Energy Audit】

- Relevant persons in charge of current energy efficiency projects by donors indicate the lack of capacity in formulating the projects on the enterprise side. In order to promote energy efficiency projects, it is indispensable to conceive of the necessary energy efficiency projects properly and therefore it is desired that priority be placed on those subsidies for energy audits so that more enterprises will conduct energy audits willingly.
- MOME has the intention to support the cost of energy efficiency audits conducted by the Accredited Energy Auditors designated by them. In order to promote designated organizations under the Energy Management System in the implementation of energy efficiency projects, it can be considered to support them to subsidize the cost of a detailed energy audit in the beginning of introducing the energy management system. Per the aforementioned, a detailed energy audit on average is estimated to be 20 thousand EUR. If the energy efficiency investment costs for the facilities are 2 million EUR, the energy audit costs will be 1 % of the investment cost. Thus, it is expected that there will be incentives for designated entities by subsidies.
- As for non-designated entities under the energy management system such as medium to small enterprises, it can be effective to subsidize a total or a part of a walk-through energy audit cost (about 1,500 to 2,000 EUR) in order to promote their energy efficiency projects. Furthermore, depending on the type of business, the subsidization of the detailed energy audit cost for them based on necessity can be considered.

【Subsidies for Energy Efficiency Projects】

- Regarding target equipment and projects subsidized by the energy efficiency fund, some specific equipment and facilities have been prioritized based on periodical reporting under the obligation of the energy management system and the result of the analysis conducted by energy auditors. For example, among measures suggested by the energy audit by pilot study sites, the target projects for subsidies can be considered for some measures which have certain effectiveness in the improvement of energy efficiency but they were out of further analysis because the pay back period was more than 5 years. One example is the replacement of fluorescent lamps to Hf lamps which are highly effective in improving energy efficiency.

- Regarding subsidies for projects, per the aforementioned case, in considering other target projects which are effective in improving energy efficiency, they are analyzed to verify whether the incentives for implementation are relatively low minus subsidies, for example, co-generation projects can be target projects, which are subsidized in Japan.

The table below shows the summary of the aforementioned issues regarding the priority for providing subsidies according to designated and non-designated enterprises or organizations at present. The provision of subsidies can be initiated from the perspective of "highly necessary" or "Necessary depending on the case" and then for subsidies for the projects. Othe points should be further examined later depending on the scale of the financial sources and specific target entities and equipment.

Table 12-5 Consideration on the Priority for Subsidy (As of November, 2011)

Target	Walk-through	Detailed Energy Audit	Energy Efficiency Projects	EE equipment purchase only
EMS Target	(To be considered)	Highly Necessary (Especially at initial stage)	Desired (Especially at initial stage)	(To be considered)
Non-EMS Target	Highly Necessary	Necessary depending on the case	Desired	(To be considered)

(2) Tax Incentives

The law on the Rational Use of Energy describes the reduction of the value added tax (VAT), custom tax, property tax, and income tax for investment in equipment in order to improve energy efficiency. Regarding the reduction of the VAT and custom tariff, it would be possible to have it implemented at an early phase if an agreement could be concluded with the Ministy of Finance (MOF) and other relevant organizations and there would be no procedural problems. However, in an interview with some relevant personnel, they pointed out that it was difficult to reach agreement with MOF in any tax reduction in the past. In any case, it is necessary to adhere to the legal procedures in revising the tax law, which will apparently take time to coordinate with MOF.

Furthermore, in the case of the reduction of income and property tax, it requires prudent consideration upon implementation. Operating under the premise that the reduction on those taxes will serve as an incentive to those enterprises, it is imperative that the financial management of the enterprises be properly implemented so that they can benefit from the tax reduction. Furthermore, as for the governmental side, it is required that the feasibility in terms of administration costs for implementation be consider, that is, whether or not the government has the system to check false applications and if it is possible to coordinate with other relevant organizations such as MOF. In examining the current situation in Serbia, IMF, they pointed out that there are no chronic weaknesses in the tax collection system (IMF (2010) "Fifth Review Under the Stand-By Arrangement, Request for Modification of End-September Performance Criterion, and Financing Assurances Review"). Therefore, it is possible to consider that there may be instances of tax evasion occurring among the enterprises. In this situation, tax incentives may not be effective measures. Thus, it is necessary to take supportive measures, for example, together with the implementation of tax reductions, a tax incentive campaign can be conducted for enterprises to promote their understanding on the merits of tax incentives and induce them to apply for these benefits properly.

Chapter 13 Database for Energy Management System

The Energy Management System (EMS) proposed by the JICA Study Team will be introduced to Serbia via the following procedures. At the first stage, the EMS will start covering Designated Sites (factories and buildings), and it is expected that the data collection system and a computer database for EMS be established during the first stage. The computer database for EMS is called for the EMS-database (EMS-DB). During the second stage, the EMS has to cover the whole organization designated (the whole organization over a threshold).

The basic design in this Chapter has been prepared for the first stage. However, the basic design has to be made so that it can be easily shifted to the second stage, even though the format of the Periodical Report during the first stage switches over to the one for the second stage.

13.1 Outline of the Database

13.1.1 Purpose of the Database

The following database concepts expected in the first and the second stage. The main purposes of the EMS-DB have to be a useful information system for MOME who maintains it and the Designated Organizations and sites who use the data. Additionally, it is necessary that the system security be kept at a high level, as the EMS-DB system is accessed through a public network system by the designated entities and sites.

- The EMS-DB has to be useful for the designated entities and sites.
- The EMS-DB has to analyze the EMS activities of the designated entities and sites.
- The EMS-DB has to make reports to the related authorities.
- The EMS-DB has to supply the suitable data to the academic persons interested in energy efficiency.

13.1.2 Functions of the Database

The required functions of the EMS-DB are as follows;

- EMS-DB has to be built for the targets to be able to analyze the periodical report and other required data.
- As the contents of the periodical report consist of energy consumption data, energy conservation activities, middle and long term plans and so on, the EMS-DB can manage many kinds of data and information.
- Based on the above data in the EMS-DB, MOME can create the maintenance of the periodical reports easily, at the same time, they can analyze for the time series data of the reports. In realizing the above activities, MOME has to maintain and manage the software and hardware for the EMS-DB and related computer systems.
- EMS-DB has two kinds of data files (In the relation database system such as the SQL

database, it is called “Table”), one is the “Master files” and the other is “Transaction files. The master files basically have to be maintained by MOME, and the transaction files must be updated and stockpiled with the annual periodical reports of the designated entities and sites.

- MOME has to judge the stockpiling years based on past periodical reports, the recent computer system has enough capacity to be able to stock the data over so many years (more than ten years).

13.1.3 System Structure

The system connection between the Designated Organizations and sites and the EMS-DB system has been depicted in the following figure.

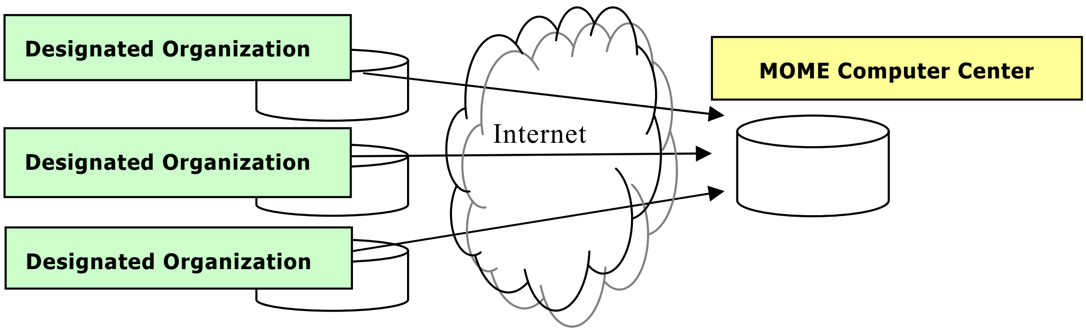


Figure 13-1 System Connection between the Designated Organizations (Sites) and EMS-DB

- The Designated Organizations and sites have to enter their Periodical Reports into EMS-DB through the internet system by themselves. However, given the concern that the beginning of EMS or any new incoming Designated Organizations are not familiar with how to use EMS-DB, such organizations and sites can send their Periodical Reports to MOME by mail or another electrical device. In this case, MOME must have their staff enter their Periodical Reports into the EMS-DB.
- The Designated Organizations and sites can see their Periodical Reports via the internet system. However, they cannot see the Periodical Report of other organizations and sites. Furthermore, MOME can prepare other kinds of analytical reports such as the distribution maps via the business categories, organizations and site positions based on the benchmarks and the targets.

- MOME has to prepare the following hardware systems in establishing the EMS-DB at MOME.

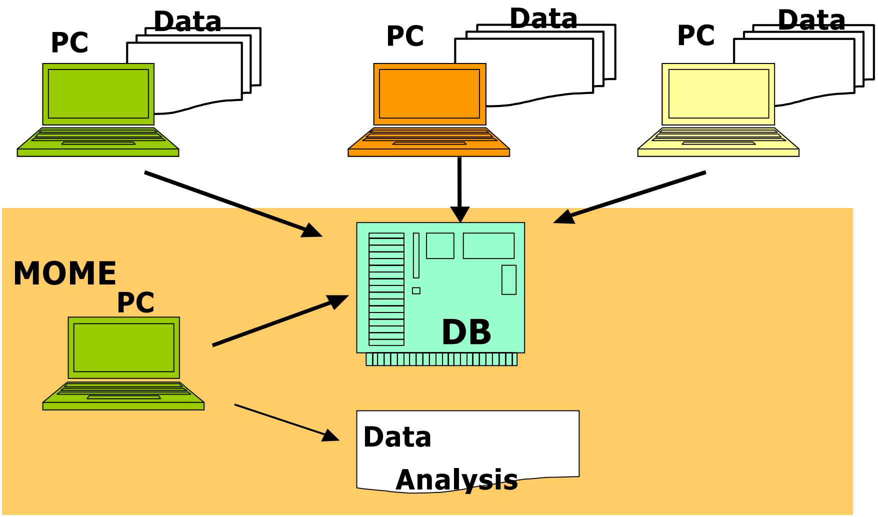


Figure 13-2 Hardware System for establishing EMS-DB

13.1.4 Basic Principle of Design for EMS-DB

The required documents needed for the development of the EMS-DB are the basic system design, the detailed system design and the programming and users and operations manual. Herein, the basic principle of design for the EMS-DB has been described. The contents of the principle are as follows;

- In the building and maintenance of the DB system, Input data (Periodical Report), EMS analysis items (Data analysis methods), Output formats (Information service) and DB maintenance manual (DB operation standards) should be prepared.
- In the project, the cost estimation of the DB system development and maintenance have been targeted. The design and contents of "Information service", "Data analysis methods" and "DB maintenance manual" should be prepared at the time of developing the system in the future.
- However, the cost estimation has to include the costs for all kinds of activities in development and maintenance.

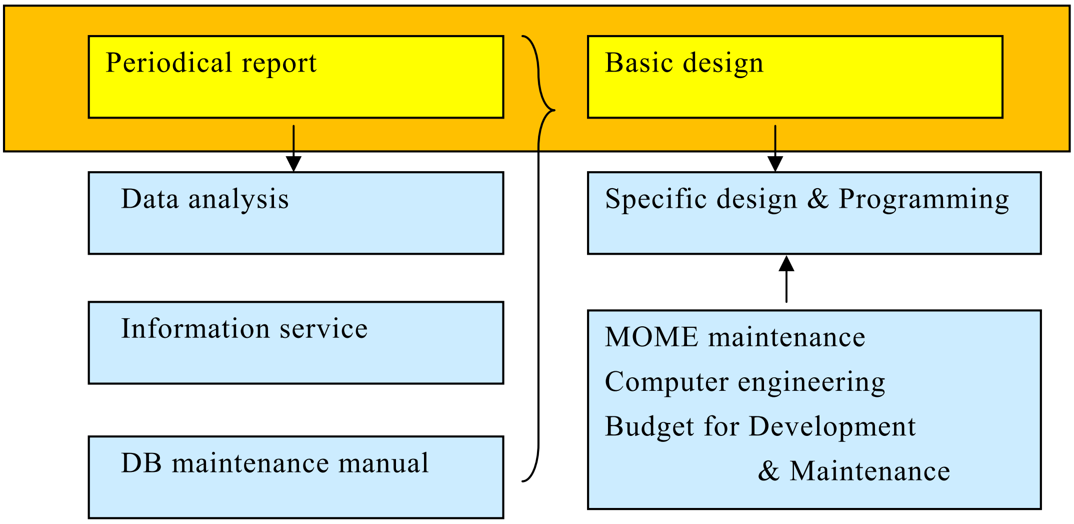


Figure 13-3 Flow of the System Development

- The EMS-DB has been designed under the Periodical Report at the first stage. However, the computer file format in EMS-DB has to be designed by including the data items of the Periodical Report at the second stage.
- Regarding information service contents, data analytical contents and DB maintenance standards that have to be designed at the time of specific design. In the basic design, the output formats of the only minimum necessary information contents have been designed.
- Regarding the DB maintenance and operation system of MOME, it should be considered at the time of system development or at the starting of the EMS.
- The utilization of the EMS-DB, Hardware structure and system logical structure are

according to the following figures.

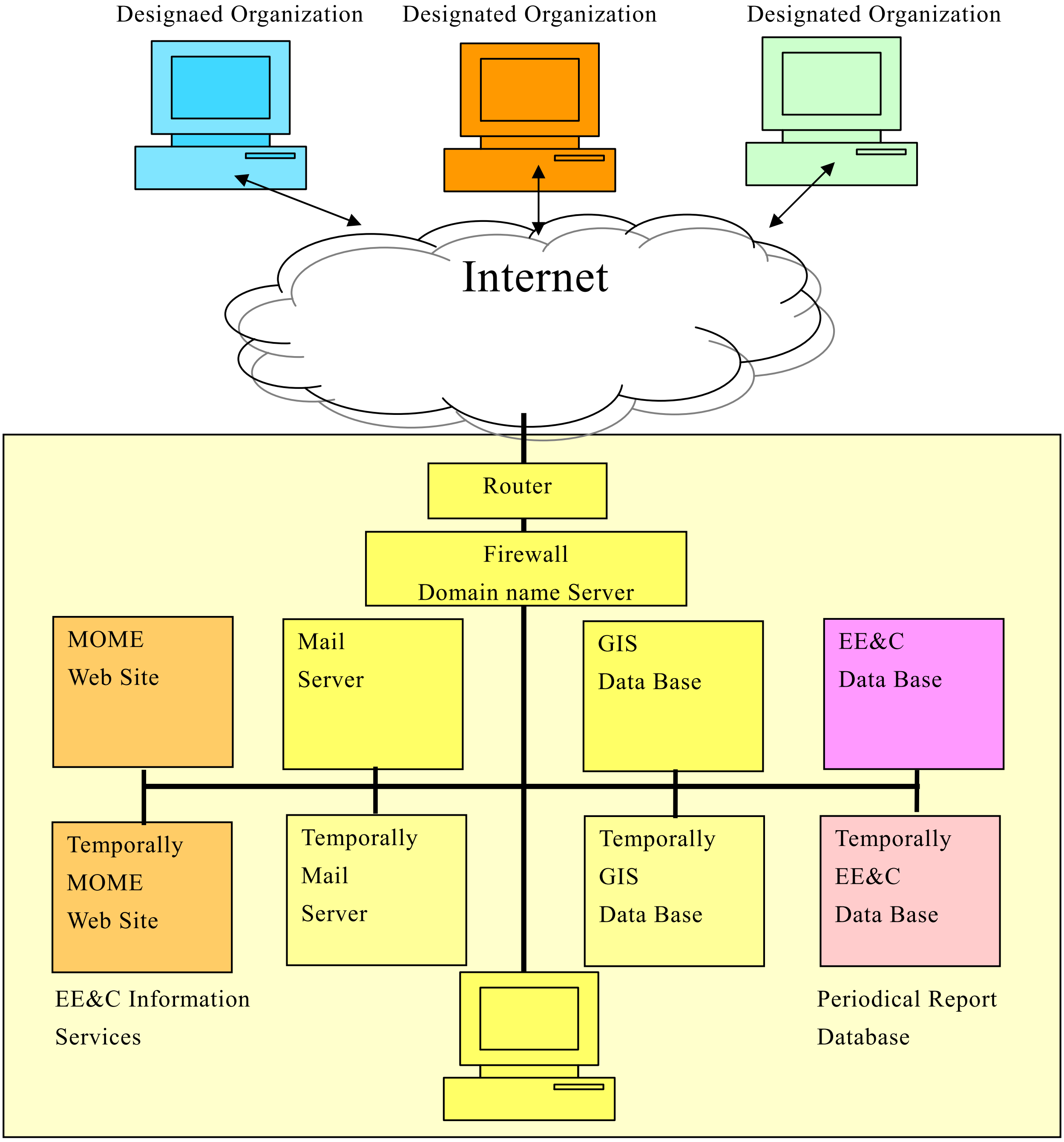


Figure 13- 4 Flow of Hardware and Logical Structures

13.2 Basic Design of the Database

The following figure shows input files to the EMS-DB, file names in the DB and outputs from the DB. The Periodical Report that it is the original data of the transaction file (Tables) is fulfilled by the Designated Organization and site. In the first stage, the Periodical Report has to be made in the units of the site.

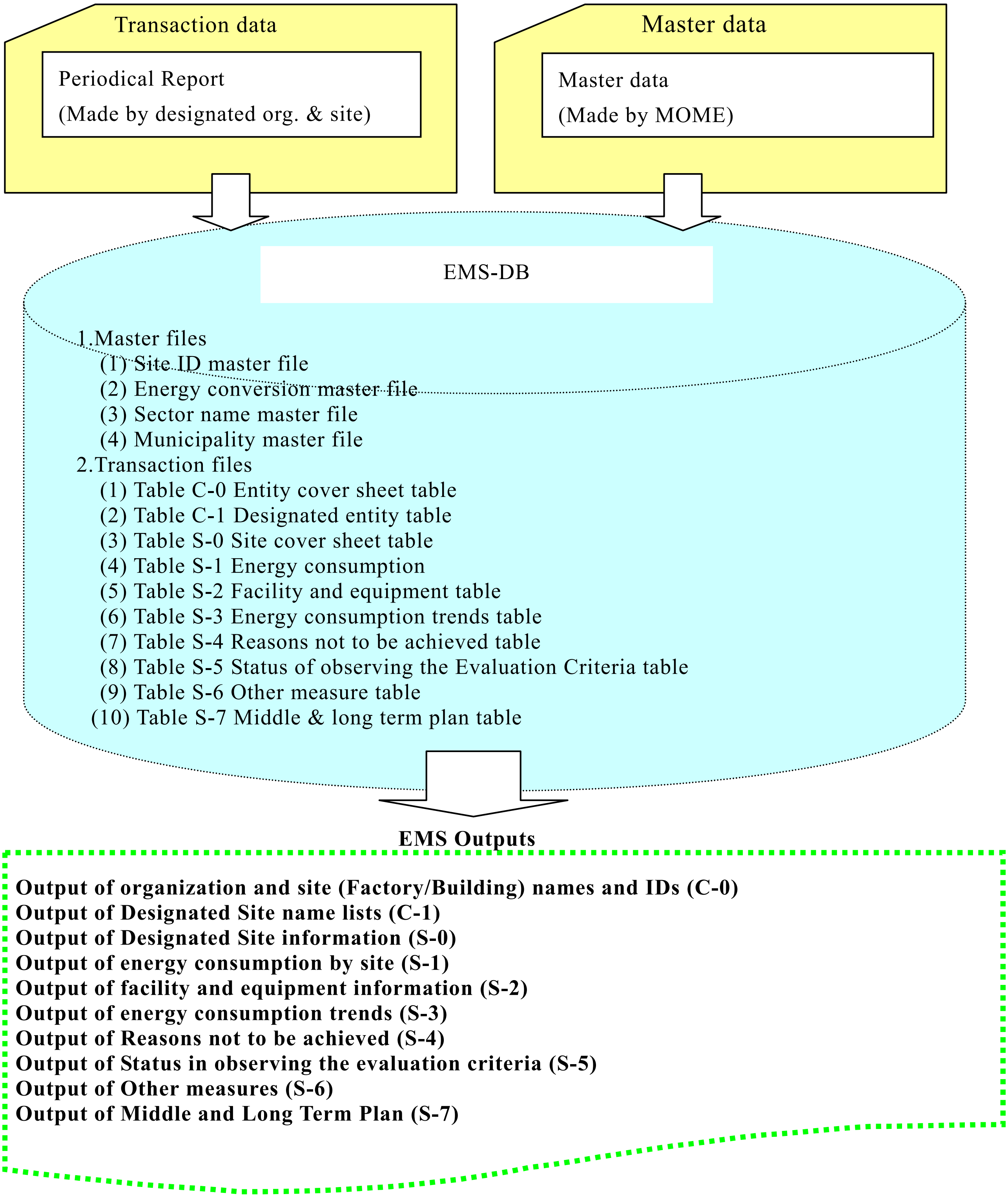


Figure 13-5 System Structures of EMS-DB

13.3 Data Structure of Master Files

13.3.1 Data Collection and Maintenance of Master Files

The following assumptions have been assumed for data collection and maintenance.

- There are four master files for the EMS-DB. The master files are the “Entity and Site ID” (herein after “Site ID”), “Energy conversion master file”, “Sector master file” and “Municipality master file”.
- The data for the master files have been collected by MOME and the master files are created and maintained by MOME.
- MOME can reduce their work load by MOME using the master files of the Municipal Energy Balance System as the master files for EMS-DB.
- MOME has to initially set the Site ID and Passwords of the Designated Organizations and sites when EMS-DB is maintained.
- MOME has to announce the Designated Organizations and sites when the master files are revised and it can be considered that the announcement has to be made through the MOME homepage, E-mail and special comments in the Periodical Report.

13.3.2 Site ID Master File

The Site ID master file has been created and maintained under the following functions and conditions.

- The registered numbers and IDs of organizations and sites have to be managed by MOME exclusively, and the registration and updating of new incoming organizations, sites, municipality facilities and commercial buildings are implemented by MOME.
- MOME has to announce the organization and site IDs and initial Passwords to the Designated Organizations and sites. Based on the organizations and sites using the ID and password, they can register, update and browse their data in the EMS-DB through the internet system.
- After MOME registers the Site ID and other required data in the master files in the EMS-DB, the Designated Organizations and sites can use the EMS-DB. It means that the required data area and records of the Designated Site in the EMS-DB are to be prepared by MOME.
- The Site ID in EMS-DB consists of the “Organization number”, “Site number” and “Password”.
- In the first stage, as one Designated Site has one Periodical Report, when an organization has more than two sites, a Periodical Report has to be submitted from each site. However in the second stage, two kinds of periodical reports, one is the whole organization Periodical Report and another is the site Periodical Report, both of which should be submitted from the Designated Organizations to MOME.

The following table shows the data structures of the Site ID master file.

Table 13-1 Site ID Master File

ID items	ID contents	Description ways
Receipt date	Receipt day	Year / Month / Day
	Update day	Year / Month / Day
Organization names (Company and Municipality names)	Organization name	Name
	Address	Code / Address
	Tel/Fax/E-mail	Phone / Fax /E-mail
	Business sector	Code / Sub-sector name
	Password	
Site names (Factory and Buildings)	Registered number	Number
	Organization name	Name
	Address	Code / Address
	Tel/Fax/E-mail	Phone / Fax
	Business sector	Code / Sub-sector name

13.3.3 Energy Conversion Master File

The energy conversion master file is created and maintained under the following functions and conditions.

- As energy conversion master tables, the data of heat values and CO2 emission coefficients are described, it is used when creating the Periodical Report.
- The targeted energies managed by the Periodical Report are Steam & Water, Coal, Oil, Gas, Renewable energies and Electricity. The kinds of collected data contained in the Periodical Report are energies and utilities.
- The contents of the conversion master file should be referred to in the following figures, it is desired that energy conversion master file be used with the same one as a Municipal Energy Balance System.
- Energy codes have to be arranged by each energy and utility in the conversion master file, and the energy and utility are handled within the codes in the EMS-DB.

Table 13-2 Data Structures of Energy Conversion Master File

Codes	Energies	Unit	to Final Energy (toe)	to Primary Energy (toe)	to Carbon Dioxide (kgCO2 to tCO2)	to Final Energy (kWh)	to Primary Energy (kWh)	to Carbon Dioxide (kWh to kgCO2)
10010	Lignite raw	t	0.309544	0.309544	0.000350	3,600	3,600	0.35
10020	Lignite dried	t	0.386930	0.386930	0.000350	4,500	4,500	0.35
10030	Brown Coal	t	0.429923	0.429923	0.000350	5,000	5,000	0.35
10040	Hard Coal	t	0.515907	0.515907	0.000350	6,000	6,000	0.35
10050	Heating oil	m3	0.979363	0.979363	0.000250	11,390	11,390	0.25
10060	Heavy fuel oil	t	0.945830	0.945830	0.000280	11,000	11,000	0.28
10070	Kerocine	m3	0.945830	0.945830	0.000250	11,000	11,000	0.25
10080	Propane-Butane	m3	0.945830	0.945830	0.000240	11,000	11,000	0.24
10090	Natural gas	m3	0.000796	0.000796	0.000200	9.26	9.26	0.20
10100	Biogas	m3	0.000774	0.000774	0.000200	9.00	9.00	0.20
10110	Coke	t	0.601892	0.601892	0.000350	7,000	7,000	0.35
10120	Wood	m3	0.144454	0.144454	0.000300	1,680	1,680	0.30
10130	Wood waste	t	0.386930	0.386930	0.000300	4,500	4,500	0.30
10140	Biomass	t	0.300946	0.300946	0.000300	3,500	3,500	0.30
10150	Steam	kWh	0.000086	0.000107	0.400000	1.00	1.25	0.40
10160	Hot water	kWh	0.000086	0.000107	0.400000	1.00	1.25	0.40
10170	Technical steam	kWh	0.000086	0.000107	0.400000	1.00	1.25	0.40
10180	Geothermal water	kWh	0.000086	0.000086	0.000000	1.00	1.00	0.00
20010	EPS	kWh	0.000086	0.000215	0.000800	1.00		0.80
30010	Solar energy	kWh	0.000086	0.000086	0.000000	1.00	1.00	0.00
30020	Wind Energy	kWh	0.000086	0.000086	0.000000	1.00	1.00	0.00

13.3.4 Sector Name Master File

The sector name master file is created and maintained under the following functions and conditions.

- Basically factories and buildings have been targeted in the first stage of EMS, mainly, the manufacturing sectors have factories and the commercial and service sector have large scale buildings.
- The sector classification names have to be registered in the master file, for example, sector classification names in manufacturing are selected from the SEEA database and commercial and service sector classification names have been quoted from large electricity consumers in EPS.

Table 13-3 Manufacturing Sector Classification Names

Code	Manufacturing sectors	Code	Sub-sectors
101	Non-Ferrous Metals	1011	Black Metallurgy
101		1012	Ores and products of Non-Ferrous Metals
103	Building Materials	1031	Stone, Gravel and Sand
103		1032	Building Materials
104	Chemical	1041	Basic Chemical Products
104		1042	Naphtha Derivates
105	Non-Metals	1051	Non-Metallic Minerals
106	Textile	1061	Textile Materials
106		1062	Final Textile Products
106		1063	Leather Shoes and Fur
107	Wood Industry	1071	Wood Timber / Lumber
107		1072	Final Wood Products
108	Food Industry	1081	Food and Tobacco Products
108		1082	Animal Food
108		1083	Beverages and Gum
109	Metal Industry	1091	Plants / Machines
109		1092	Traffic Vehicles
109		1093	Metals
109		1094	Electrical Machines and Devices
110	Pulp and Paper	1101	Production and Paper
111	Energy	1111	Coal and Coal products
111		1112	Oil Refinery and Oil products
111		1113	Natural gas and supply
111		1114	District heating supply
111		1115	Power generation and Supply
112	Other Industry	1121	Building of Ships
112		1122	Graphical/Printing Services
112		1124	Various Products

Table 13-4 Commercial & Service Sector Classification Names

Code	Commercial & Service sectors	Code	Sub-sectors
201	Government	2011	Central Government
201		2012	Municipal
202	Government Affiliated	2021	Education
202		2022	Institute
203	Public business	2031	Water Supply
203		2032	Gas network
203		2033	District Heating
203		2034	Public Transport
203		2035	Municipal Waste
203		2036	Public Transportation
203		2037	Public Greenery
203		2038	Road Maintenance
203		2039	Multifunction P.U.C.
204	Commercial	2041	Trade
204		2042	Whole sales
204		2043	Detail sales
205	Services	2051	Finance and Banks
205		2052	Media & IT
205		2053	Consulting
205		2054	Real estates
205		2055	Health and Hospitals

13.3.5 Municipality Master File

As the EMS has been implemented nationwide, district names and municipality names are described in the Periodical Report. The municipality master file is a registration file including the municipality names and the codes which are shown in the following table.

Table 13-5 Municipality Master File

NO	District	District -Codes	Municipal -code	Municipality
01	Grad Beograd	100	010	Barajevo
02			020	Čukarica
03			030	Grocka
04			040	Lazarevac
05			050	Mladenovac
06			060	Novi Beograd
07			070	Obrenovac
08			080	Palilula
09			090	Rakovica
10			100	Savski Venac
11			110	Sopot
12			120	Stari Grad
13			130	Surčin
14			140	Voždovac
15			150	Vračar
16			160	Zemun
17			170	Zvezdara
114	Zaječarski okrug	260	010	Boljevac
115			020	Knjaževac
116			030	Zaječar
117			040	Sokobanja
Master	Zlatiborski okrug	270	010	

(Source: Serbian Statistics Year Book)

13.3.6 Programs for Master files

MOME has to create initial Periodical Reports (report formats). It is the documentary forms of the periodical report that are fulfilled by the Designated Organizations and sites. In creating the initial Periodical Report, the following master files are required.

- Site master file（Organization & Site ID Master File）
- Energy conversion master file
- Sector master file
- Municipality master file

In the creation and maintenance of the above master files, the following programs are required. Regarding the required functions of the programs, the details have been described in Appendix 10 “Scope of Works for EMS-DB”.

Table 13-6 Programs for Creating and Maintenance of the Master Files

Programs	Functions
IMF Program	Initial set, update and browse for Site ID master files
CMF Program	Initial set, update and browse for Energy conversion master files
SMF Program	Initial set, update and browse for Sector name master files
MMF Program	Initial set, update and browse for Municipality master files

13.3.7 Maintenance of the Master Files

MOME has to maintain the four master files (Site ID master file, Energy conversion file, Sector file, Municipality file). It is essential for MOME that the master files be linked to other information systems such as the “MOME－Web”, ”MOME-Mail”, ”GIS system”, ”Municipal Energy Balance System” in MOME (The last one has been independent from the other systems as of 2010).

Under the current MOME information systems, the servers of MOME-Web and MOME-Mail are located in other buildings. Only the server of the GIS system is maintained in MOME’s office building.

It can be considered that a new computer server be required for EMS-DB, and it is desired that the staffs of the Municipal Energy Balance System, GIS system and EMS-DB system stay in the same building for the linkage and maintenance among the systems. By doing so, it can be considered that the convenience of the computer system maintenance be kept in MOME.

13.4 Periodical Report and Transaction Files

13.4.1 Initialization and Maintenance of Transaction Files

The following preconditions have been assumed for the initialization and maintenance of transaction files.

- The Periodical Reports are the major data sources for the EMS-DB transaction files. The maintenance system of the periodical reports is almost equal to the maintenance system of the EMS-DB. The periodical reports are revised once a year by the Designated Organizations and sites. The transaction tables are basically updated at that time.
- The amount of data storage years of the Periodical Reports in the EMS-DB is a discussion point that MOME is facing when developing the EMS-DB. The recent computer server has enough capacity to store data for ten years. The storage years of the Periodical Reports in EMS-DB can be judged at each aspect of the institutes of EMS minus computer capacity constraints.
- When the Designated Organizations and sites would like to change their Site IDs, MOME has to be maintained after the information has reached from the Designated Organizations or sites. The contents of the Site ID master file and the site ID in transaction files are maintained by MOME.
- The Designated Organizations and sites can revise the values and items of the transaction files by themselves through the internet system. However the Designated Organizations and sites cannot change the organization names, building names, municipality names and sector names. If the Designated Organizations and sites would like to change these items, they have to report it to MOME and the revised works should be conducted by MOME.
- MOME has to create the transaction files backup for security, the backup operation has to basically be implemented every day. Furthermore, MOME also has to take a backup when the master files are revised and/or updated.
- When the Designated Organizations and sites cannot technically enter their periodical report to the EMS-DB, MOME has to support their operations. Concretely, MOME has to enter the Periodical Reports into the EMS-DB instead of the Designated Organizations and sites.
- Before starting the EMS, the data entry procedures and technical knowledge are explained by MOME through the user’s manual and seminars held by MOME in the whole country.

13.4.2 Correspondence between Periodical Reports and Computer Files

The following shows the relation between the files (table) contents in the Periodical Report and the computer file (table) in the EMS-DB. Basically, all kinds of files (tables) in the Periodical Reports are entered into the files (tables) in the EMS-DB.

Table 13-7 Relational Tables between the Periodical Report and EMS-DB

Files (Tables) EMS-DB	Tables Periodical Report	Description
Table C-0	Organization cover sheet	Organization cover sheet and information
Table C-1	Table C-1	Site name list
	Table C-2	Award scheme application
Table S-0	Site cover sheet	Site cover sheet and information
Table S-1	Table S-1-1	Energy consumption to be fueled
	Table S-1-2	Recalculation of only renewable energies
	Table S-1-3	Utilization of water
Table S-2	Table S-2	Facilities and equipment
Table S-3	Table S-3	Energy consumption trends
Table S-4	Table S-4	Reasons not to be achieved
Table S-5	Table S-5	Compliance check with evaluation criteria
Table S-6	Table S-6	Other measures for EE&C
Table S-7	Table S-7	Middle and long term plan

13.4.3 Transaction Files and Programs

The followings are the preconditions of the transaction files (tables) and maintenance programs.

- Basically the contents of Periodical Report have been entered into the EMS-DB through the terminals of internet system in the Designated Organizations and Sites. Otherwise, it is entered through MS-EXCEL sheets to EMS-DB. Apart from the entry methods, the initial data entry to the Periodical Report has to be operated by the Organizations and Sites.
- Therefore, the programs for initializing and maintaining the transaction files (tables) have to be able to enter the data through the PC screen and MS-EXCEL sheets. Additionally, it is required that the programs can maintain the transaction files (tables).
- The transaction files (tables) of EMS-DB are relational table formats, (Assumed relational database like SQL). The programs for handling the transaction files (tables) are prepared for each transaction file (table).
- The following table shows the program names and the required functions. The details of the programs are referred to Appendix 10, “Scope of Works for EMS-DB”.

Table 13-8 Program Names for Initializing and Maintaining the Transaction Files

Program Names	Functions
TBL0 program	It enters and initializes the data of the organization and site cover sheet information in the Periodical Report to EMS-DB, and it maintains it and shows the data to system users.
TBL1 Program	It enters and initializes the data of energy consumption in the Periodical Report to the EMS-DB, and it maintains it and shows the data to system users.
TBL2 Program	It enters and initializes the data of facilities and equipment in the Periodical Report to EMS-DB, and it maintains it and shows the data to system users.
TBL3 Program	It enters and initializes the data of energy consumption trends in the Periodical Report to the EMS-DB, and it maintains it and shows the data to system users.
TBL4 Program	It enters and initializes the data based on reasons not to be achieved in the Periodical Report to the EMS-DB, and it maintains it and shows the data to system users.
TBL5 Program	It enters and initializes the data of compliance and the evaluation criteria in the Periodical Report to the EMS-DB, and it maintains and shows the data to system users.
TBL6 Program	It enters and initializes the data of other measures for the EE&C in the Periodical Report to EMS-DB, and it maintains and shows the data to system users.
TBL 7 Program	It enters and initializes the data of middle and long term plans in the Periodical Report to EMS-DB, and it maintains and shows the data to system users.

13.5 Output and Analysis Information of EMS-DB

13.5.1 Functions of the Outputs

The following are the output information and the functions. MOME needs the outputs in order to maintain the EMS-DB. Most of the outputs are done via PC, paper and electrical devices, the required outputs and programs are as follows.

- Basically the following table show programs for the reference of transaction files (tables) of the EMS-DB.
- More complicate analysis programs should be discussed when the detailed design including the analysis programs are implemented at the time of system development. Therefore, the discussions in analyzing the Periodical Reports with MOME are required.
- The detailed functions of the programs should be referred to in Appendix 10, "Scope of Works for EMS-DB".

Table 13-9 Output Programs on Transaction Files (Tables)

Program Names	Output Contents	Periodical Report Tables
OUP program	Output of organization names, Site names, Site IDs and Pass words	C-0
OEI program	Output of organization information	C-1, C-2
OSI program	Output of site information	S-0
OES program	Output of energy consumption	S-1-1, S-1-2, S-1-3
FRU program	Output of facility and equipment	S-2
ECT program	Output of energy consumption yearly trends	S-3
SOE program	Output of reasons not to be EE&C	S-4
CCE program	Output of compliance and evaluation of EE&C	S-5
OMT program	Output of other measures	S-6
MLP program	Middle and long term plan	S-7

13.5.2 Main Screen Menu for EMS-DB Administrators

(1) Main menu of the Screen for Administrators

By using the following main menu, the administrators can open and use the EMS-DB. The administrator can enter by using only an "Administrator ID".

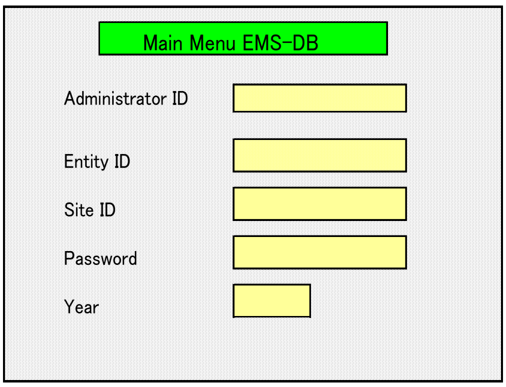


Figure 13-6 Main Screen Menu for the Administrators of EMS-DB

(2) Screen of the Administrator Menus

The followings are samples of the administrator menus on the screen

- In the following menu, when a "Selective Periodical Report" is selected, the pointer on the screen moves to a "Selective Periodical Report Menu" and the administrator can see the specific Periodical Report of the Designated Organizations and Sites.
- When a "Selective Table" is selected, the administrator can see the selected data and information in all Periodical Reports of the Designated Organizations and Sites.
- When "All Master Tables and Outputs" is selected, the administrator can update, output and see all kinds of master files (tables).
- When "All Periodical Report output" screen option is selected, the administrator can update, output and see data and information in all kinds of Periodical Reports of the Designated Organizations and Sites.

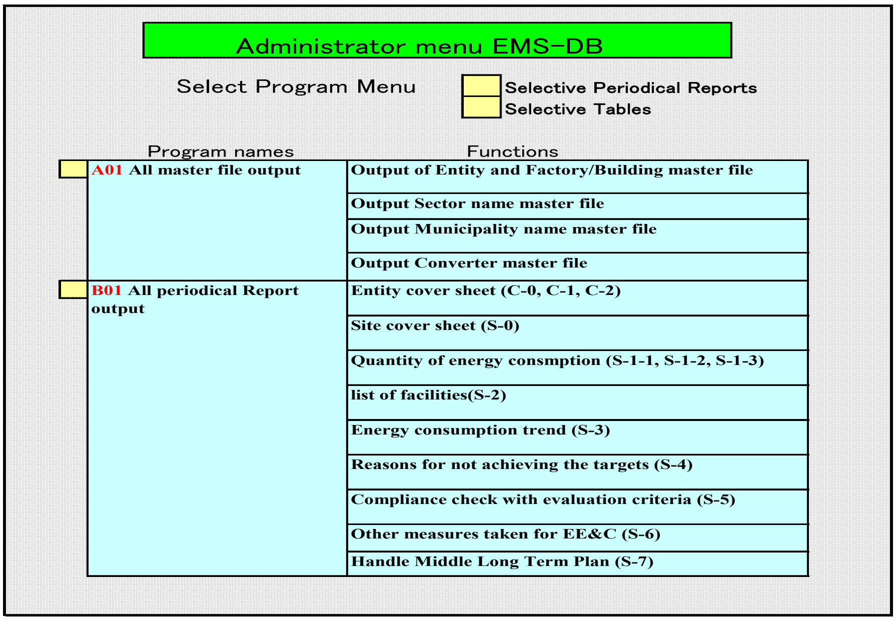


Figure 13-7 Output Screen for the Specific Periodical Report of a Designated Organization

(3) Update, Browse and Output of the Specific Designated Organization and Site

The administrators can update, browse and output the specific Periodical Report of the Designated Organizations and sites. By checking on the required button, the administrators can update, browse and output the tables of the Periodical Report required by the administrators.

The following image is an example of the screen display.

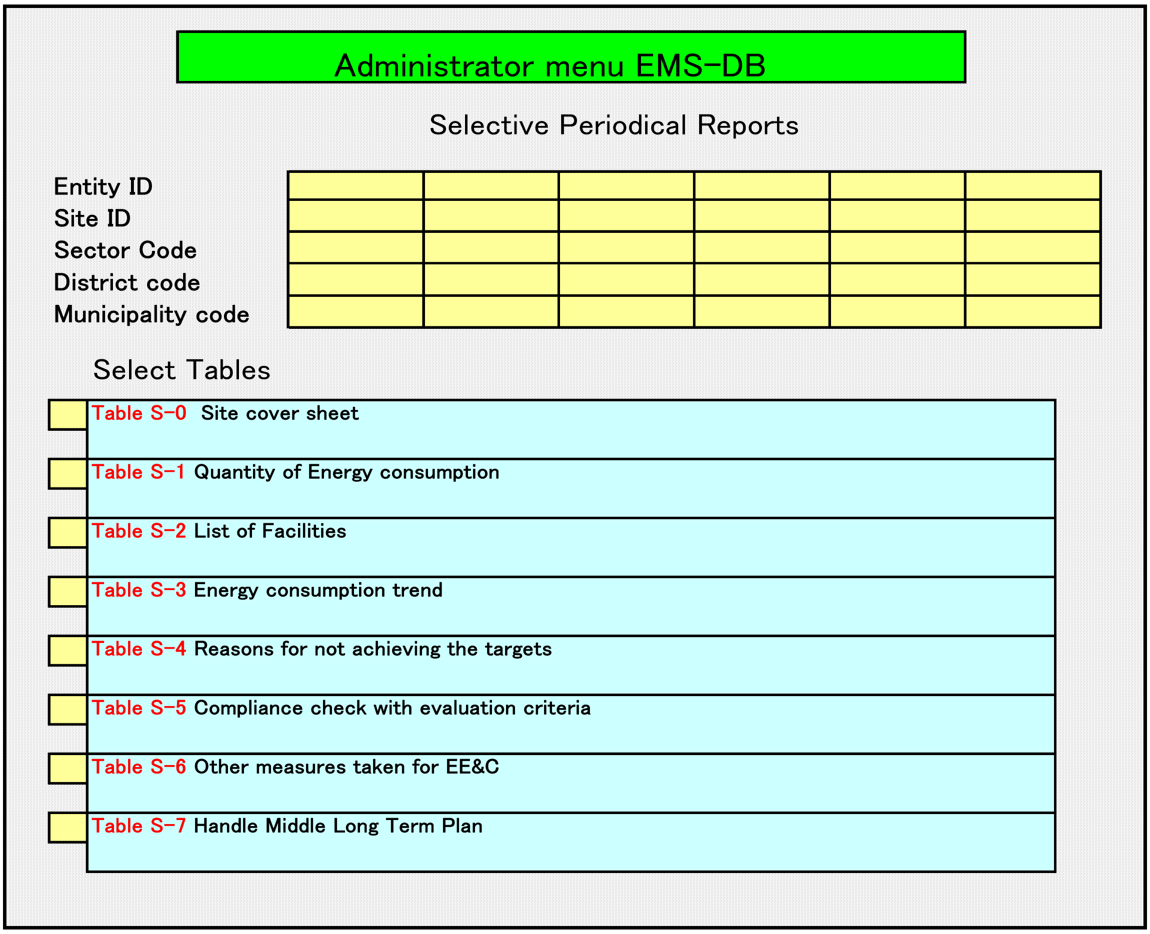


Figure 13-8 Example of Update, Browse and Output of the Specific Periodical Report

(4) Output Screen for the Data Update, Browse the Specific Periodical Report

The administrators can update, browse and output with the specific table formats.

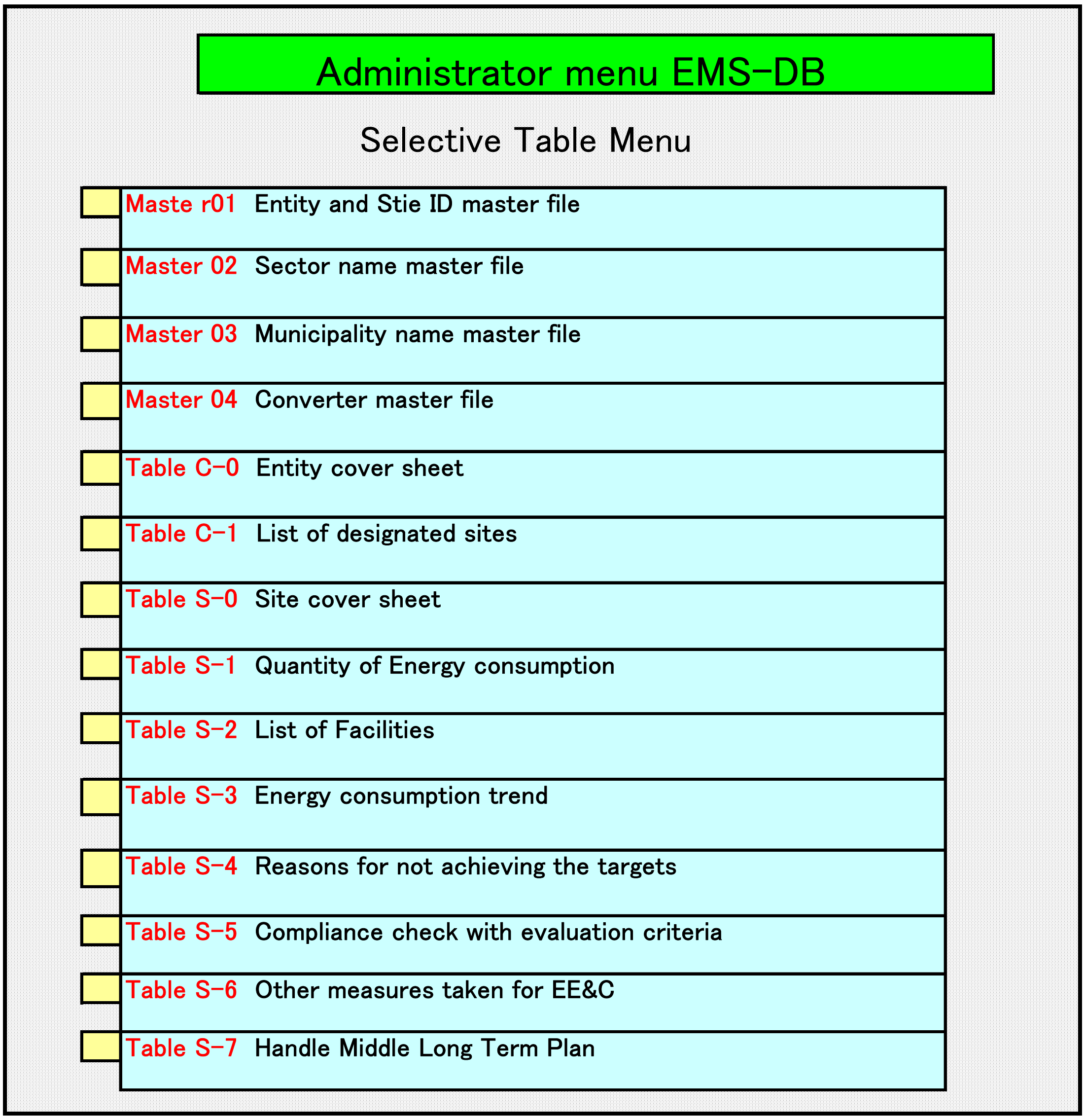


Figure 13-9 Screen Menu for Updating, Browsing and Creating Outputs

13.5.3 Main Menu Screen for System Users (Designated Organizations)

(1) Main Menu Screen Display

The Designated Organizations and sites can enter the EMS-DB system from the following menu.

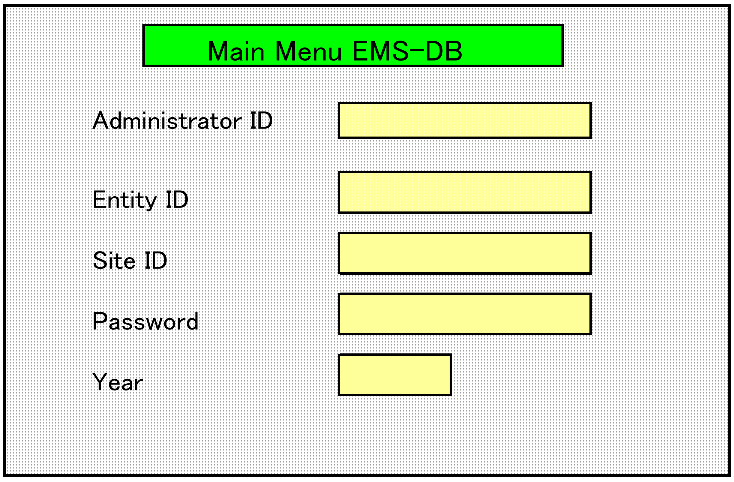


Figure 13-10 Main Menu Screen for the Designated Organizations

(2) Menu Screen for the Designated Organizations

The Designated Organizations can update, browse and output their Periodical Reports. When the system users select “All Tables in Periodical Report”, the Designated Organizations can update, browse and output all kinds of items in their Periodical Report. Concretely, by doing so, clicking on the following check boxes in the menu is required by the users.

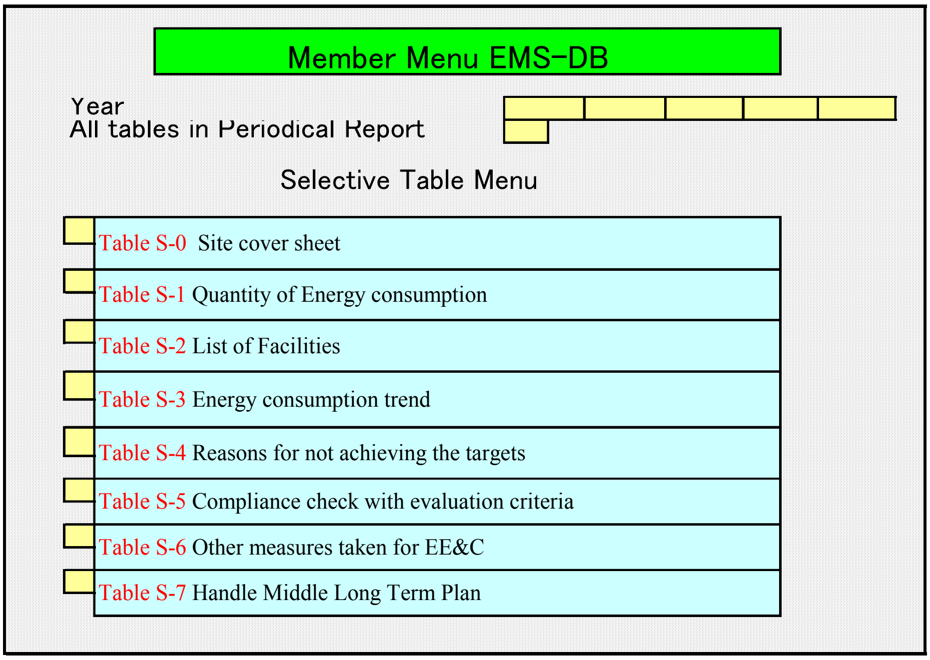


Figure 13-11 Updating, Browsing and Output of the Periodical Report by the Designated Organizations

13.5.4 Other Menu Screen

The EMS-DB requires so many screen menus in operation. However, only a minimum number of screen menus are shown in the basic design. It is required that the detailed screen menus are planned at the time of the detailed design. Furthermore, an “Error check” in the screen menus has to be considered at the detailed design.

13.6 Cost Estimation for EMS-DB Development and Maintenance

Based on the aforementioned basic design, EMS-DB development and maintenance costs were estimated as follows. The costs assume that the EMS-DB will be locally developed in Serbia (the unit prices are at 2010 prices).

Development Cost	60,720EUR	(7.3million yen)	1€= 120yen
Maintenance Cost	14,200EUR per year	(1.7million per year)	1€= 120yen

Table 13-10 Estimation of System Development and Maintenance Costs

1 €＝120yen

Cost items	Volume	Unit price	Amount EUR	Amount 1,000Yen
1.System development			**60,720**	**7,286**
(1) Wage cost				
Consultant fee	370 hours	32 € per hour	11,840	1,421
System engineering fee	460 hours	28 € per hour	12,880	1,546
Programmer fee	1,120 hours	25 € per hour	28,000	3,360
Sub-total			52,720	6,326
(2) Hard & Software cost				
Server cost	1 set	4,000 € per unit	4,000	480
Server soft cost	1 set	2,000 € per set	2,000	240
SQL soft cost	1 set	2,000 € per set	2,000	240
Sub-total			8,000	960
2. Maintenance per year			**14,200**	**1,704**
(1) Administration cost per year	1 year	4,800 € per year	4,800	576
(2) System maintenance cost per year	1 year	7,200 € per year	7,200	864
(3) Data entry cost per year	1 year	2,000 € per year	2,000	240
(4) Rental cost per year	1 year	200 € per year	200	24

Note: The above costs were estimated after having discussions with S/C members and the JICA Study Team.

Chapter 14 Action Plan for Implementation

14.1 Implementation Schedule

14.1.1 Overall Schedule

In considering the preparations of law and regulation by MOME, the JICA Study Team proposed the overall schedule as follows.

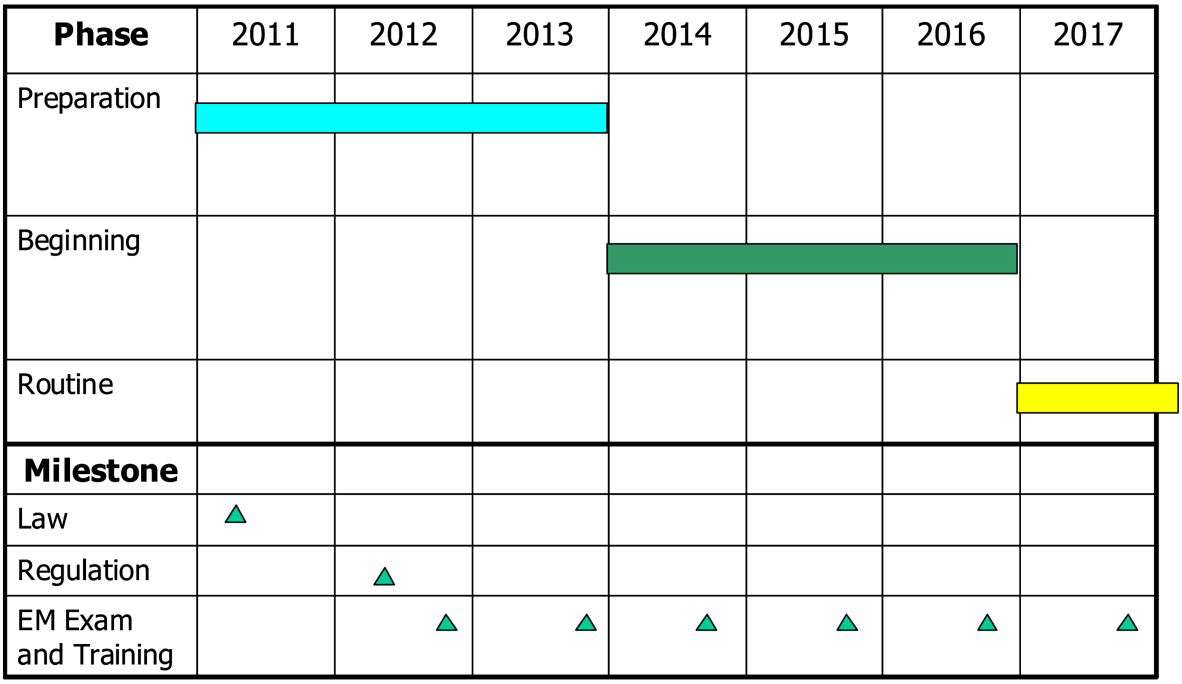


Figure 14-1 Overall Schedule for Implementation (tentative)

The following points were taken into consideration when the above schedule was devised.

- The overall schedule for implementation is divided into 3 phases, namely Preparation, Beginning and Routine Phases.
- The Energy Management System will start from 2014 in consideration of the preparation period.
- The Preparation Phase starts from 2011 and is expected to be completed in 2013. During the Preparation Phase, related laws and regulations will be prepared and established.
- Qualification system for Energy Manager, etc. should start from 2012 (before starting the Energy Management System) in order to secure enough numbers of qualified persons.

14.1.2 Two-step Implementation

The Serbian Energy Management System will cover the whole organization of the Designated Organization in the final stage. However, it seems difficult to collect all the data of the whole organization during the initial stages. As a result of a discussion with the Steering Committee, in the Beginning Phase, the Designated Organization which has a Designated Site (s) will be started.

After securing the data collection system within the Designated Sites, the reporting system will change to the whole organization including all the facilities. As for the timing of the change of the reporting system, the Routine Phase (2017) may be a good opportunity. However, the timing of change should be elaborately considered after it has been confirmed that the data collection system within the site effectively works. In this context, the timing does not stick to the change to the Routine Phase (2017).

14.1.3 Action Plan in Each Phase

(1) Expected Action Plan in Each Phase

The following action plan in each phase is proposed for MOME and SEEA. The Study conducted a scheme design of the Energy Management System. After the Study, the establishment of laws and regulations based on the scheme design, the preparation of operation manuals and the training curriculum (including Hands-on Facility) and the establishment of a database, etc. are expected and these tasks should be completed within the Preparation Period.

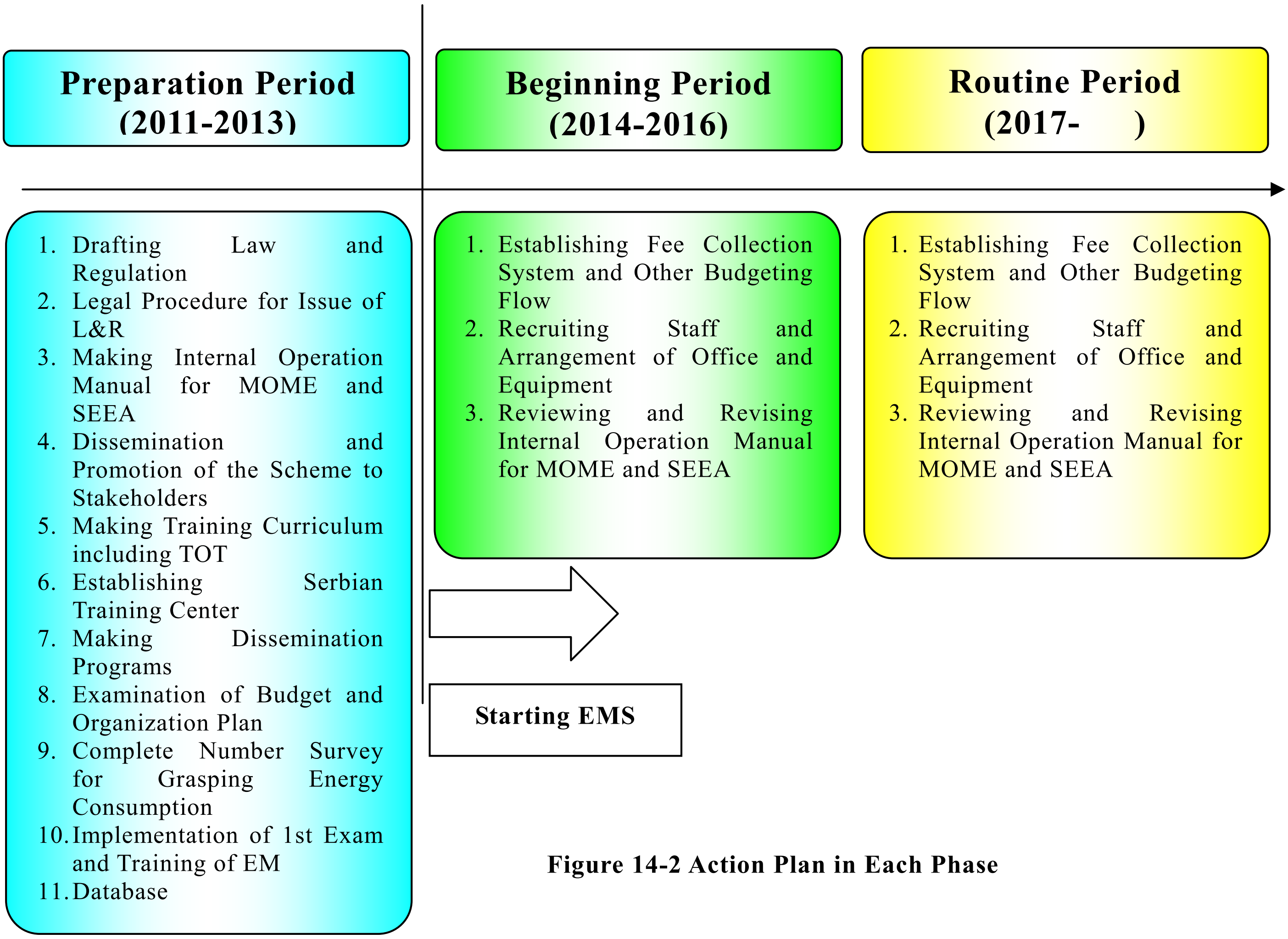


Figure 14-2 Action Plan in Each Phase

(2) Proposal of Further External Assistance in the Action Plan

The necessary actions of each phase have been proposed above. The following table shows the necessity of assistance from external organizations such as foreign donors in the Preparation Period, considering the achievement in the Study.

Table 14-1 Analysis of Necessity of External Assistance in the Preparation Period (2011-2013)

	Items	Executing Body	Achievement in the Study (result)	Further Assistance	
1	Drafting Law and Regulation	MOME	Scheme details are proposed.	C	Almost will be completed in the Study.
2	Legal Procedure for Issue of L&R	MOME	-	C	It is the exclusive tasks of MOME.
3	Making Internal Operation Manual for MOME and SEEA	MOME and SEEA	Some implementation methods are prepared.	B	More assistance might be necessary.
4	Dissemination of the Scheme to Stakeholders	MOME and SEEA	Workshops are held.	C	It can be done by MOME and SEEA.
5	Making Training Curriculum including TOT	SEEA	Concept is prepared.	A	Some budget is necessary for making EM, EO and AEA training.
6	Establishing Serbian Training Center	SEEA	Concept is prepared.	A	Some budget for hands-on facilities is necessary.
7	Making Dissemination Programs	SEEA	Concept is prepared.	B	More assistance might be necessary.
8	Examination of Budget and Organization Plan	MOF, MOME, SEEA	Rough estimation is prepared.	B	More assistance might be necessary.
9	Complete Number Survey for Grasping Energy Consumption	MOME	Concept is prepared.	A	Data collection and re-analysis is necessary.
10	Implementation of 1st Exam and Training of EM	SEEA, MOME	-	B	Some assistance might be necessary.
11	Database	MOME	Concept is prepared.	C	It can be done by MOME.

Note: A: High Necessity B: Partially Necessary C: Low Necessity

It seems difficult for MOME and SEEA (current staff) to prepare all the items mentioned in the above table, due to budget and human resource limitations. In this context, it is desirable that work items to be conducted by MOME's and SEEA's budget and human resource and work items requiring external assistance should be discriminated. The JICA Study Team raised three important items to be prepared by foreign consultants because these items are in fields where foreign consultants have enough knowledge and they can assist in these items effectively.

- Creating a Training Curriculum including the Training of Trainers (TOT)
- Establishing a Training Center having Hands-on Facilities
- Conducting a Complete Number of Surveys for Grasping Energy Consumption for Designated Organizations and Sites

The following tables are also the required actions and the necessity of assistance in the Beginning Period and Routine Period. Basically the necessity of external assistance seems limited compared to the Preparation Period.

Table 14-2 Analysis of Necessity of External Assistance in the Beginning Period (2014-2016)

	Items	Executing Body	Achievement in the Study (result)	Further Assistance	
1	Establishing Fee Collection System and Other Budgeting Flow	MOF, MOME and SEEA	Concept is prepared.	**B**	Some advice or analysis might be necessary
2	Recruiting Staff and Arrangement of Office and Equipment	MOME and SEEA	Rough estimation is prepared.	**C**	Such administration will be done by MOME and SEEA.
3	Reviewing and Revising Internal Operation Manual for MOME and SEEA	MOME and SEEA	-	**C**	Review and reflection will be done by MOME and SEEA.

Note: A: High Necessity B: Partially Necessary C: Low Necessity

Table 14-3 Analysis of Necessity of External Assistance in the Routine Period (2017-)

	Items	Executing Body	Achievement in the Study (result)	Further Assistance	
1	Reviewing Administration Cost and Revising Fee Collection System and Other Budgeting Flow, if necessary	MOF, MOME and SEEA	-	**C**	Review and reflection can be made by MOF, MOME and SEEA.
2	Reviewing Implementation Staff Formation	MOME and SEEA	-	**C**	Review will be done by MOME and SEEA.
3	Evaluation of 3 Years Implementation Results and Reviewing Contents of Law and Regulation	MOME	-	**B**	External evaluator is better for fair evaluation.
4	Reviewing and Revising Internal Operation Manual for MOME and SEEA	MOME and SEEA	-	**C**	Review and reflection can be made by MOME and SEEA.

Note: A: High Necessity B: Partially Necessary C: Low Necessity

(3) Detailed Action Plan during the Preparation Period

A detailed action plan during the Preparation Period is proposed. Each required item during the period (2011-2013) has been arranged assuming that the scheme will start in 2014

It has been assumed that the following items which are recommended as needing external assistance will start from the 2nd half of the year 2011.

- Creating the Training Curriculum including the Training of Trainers (TOT)
- Establishing a Training Center having Hands-on Facilities
- Conducting a Complete Number Survey for Grasping Energy Consumption for Designated Organizations and Sites

After 2011 the (completion of the Study), administration of the qualification system for Energy Managers and various important tasks such as the finalization of the scheme design, manual preparation, dissemination programs, etc. will be implemented during the Preparation Period. In order to smoothly start the Energy Management System in 2014, such tasks are also expected to be shared with external assistance such as foreign donors' assistance.

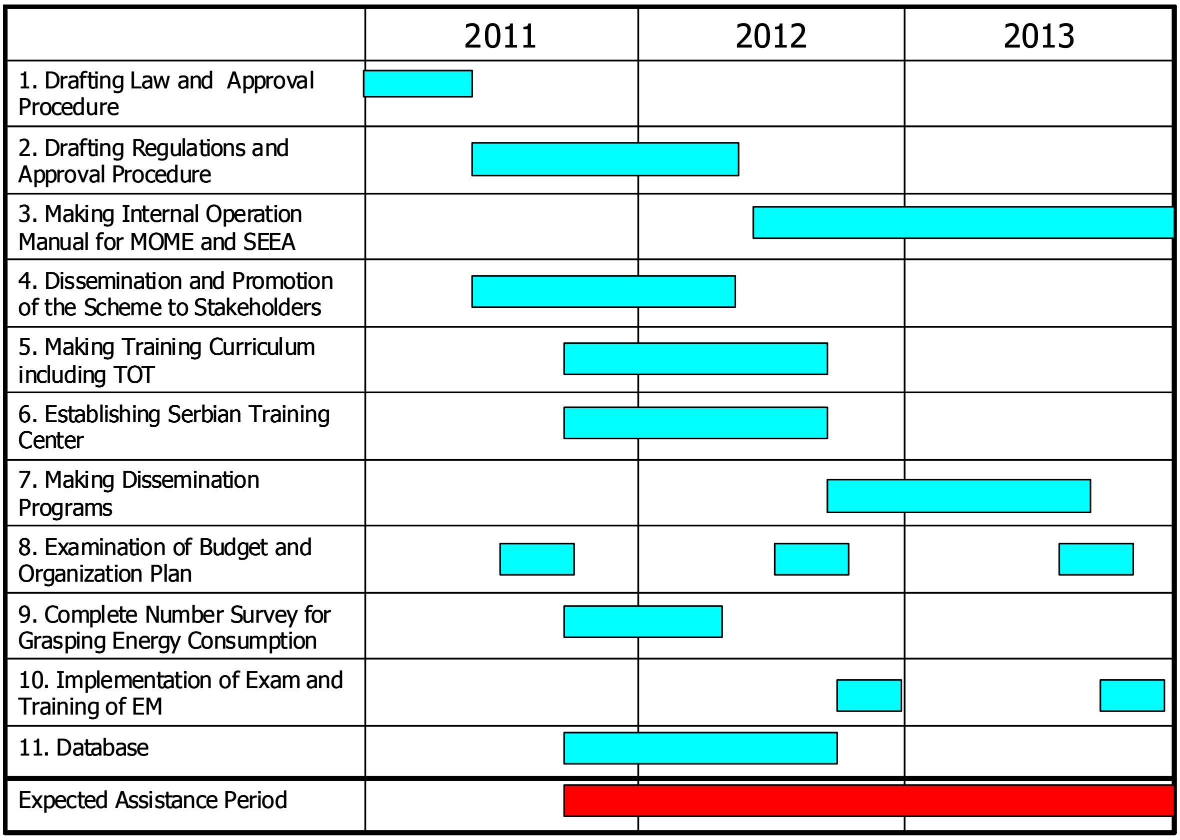


Figure 14-3 Schedule of Preparation Period and Expected External Assistance Period

14.2 Human Resource Plan

The human resource plan must take into consideration the additional staff for the administration of the Energy Management System in MOME and SEEA. The implementation structure of MOME and SEEA has been proposed below.

14.2.1 Implementation Structure of MOME

The JICA Study Team has proposed an additional 4 staff in MOME for the administration of the Energy Management System (number of Inspectors might increase according to the annual number of inspections). The tasks of the additional staff are as follows.

EMS Monitoring Office:

- ✓ Head and 2 monitoring staff (total 3 staff). Requesting Periodical Reports, receiving, clarification, data input to the database, examination of the Periodical Reports (About 300 Reports a year is expected).
- ✓ Documentation check for licenses for Energy Managers and Accredited Energy Auditors.
- ✓ Creating the database.

EMS Inspector:

- ✓ Conducting an inspection selected by “at random” or a poor management organization (about 46 inspections a year is expected).
- ✓ Site visit for the inspection is made by 2 staff (An inspector and the staff of an EMS Monitoring Office).

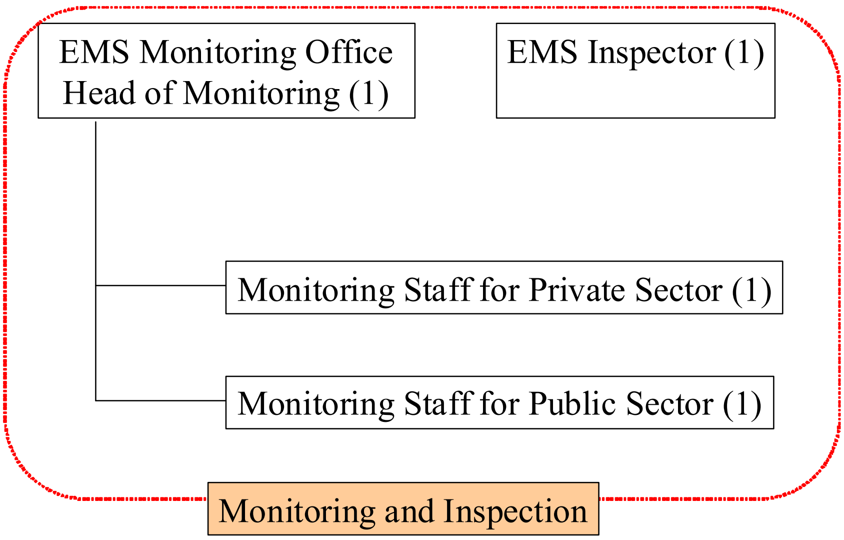


Figure 14-4 Implementation Structure of MOME

14.2.2 Implementation Structure of SEEA

The JICA Study Team proposes an additional 4 staff in SEEA for the administration of the official qualification system (examination and training programs) and dissemination programs. The tasks of the additional staff are as follows.

Exam. and Training for EM, EO and AEA:	✓ Staff for the official qualification system including tasks for reception, undertaking, creating a curriculum (outsourcing), arrangement of lecturers for the examination and training programs.
Journal:	✓ Staff for the Periodical Journals (a dissemination program) including tasks for issuing and sending to Designated Organizations and Accredited Energy Auditors twice a year.
Skill-up Training:	✓ Staff for Skill-up Training Program (a dissemination program) including tasks for the reception and undertaking the training programs.
Good Practice Award:	✓ Staff for the Good Practice Award (a dissemination program) including tasks for the collection of candidate projects from Periodical Reports, formulating and operating an evaluation committee, conducting a ceremony.

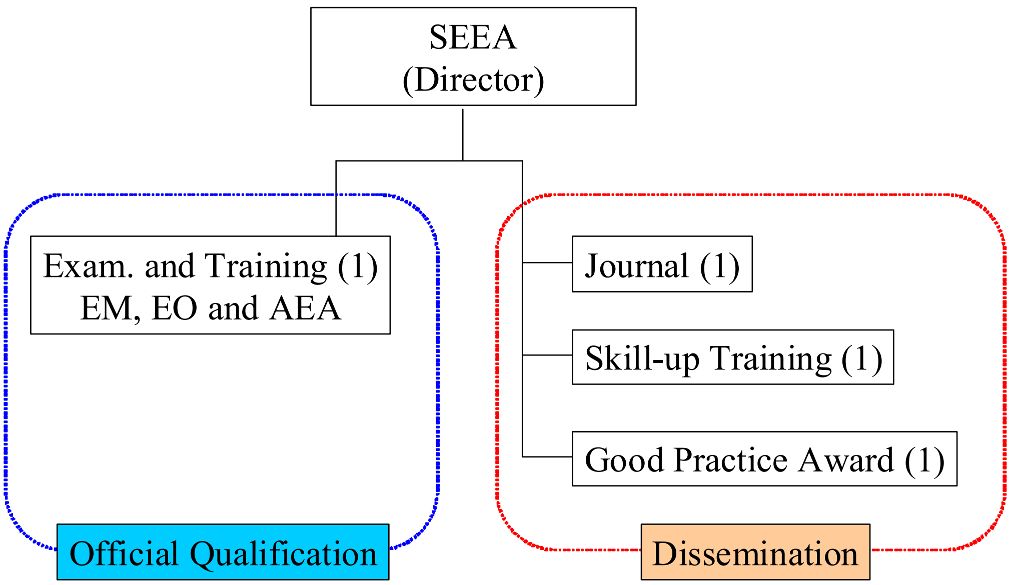


Figure 14-5 Implementation Structure of SEEA

14.3 Budgeting Plan

14.3.1 Preconditions for the Estimation of Expenditure

(1) Expenditure Items and Unit Prices

Expenditure items and unit prices for the introduction of the Energy management System are estimated. The estimation is made by each category as follows.

(a) Expenditure Items on the Official Qualification System (SEEA)

Expenditure items and unit prices towards the development and operations of the Official Qualification System for Energy Manager, Energy Officer and the Accredited Energy Auditor are summarized below. SEEA is the implementing agency for the tasks.

Table 14-4 Preconditions on Expenditure Items and Unit Prices regarding the Official Qualification System

Item	Price	Unit	Remarks
Hands-on Facilities (Investment)	1,000,000	Euro/ set	Boiler&Burner, Compressor, Pump and Steam Trap (Design, equipment, installation)
Hands-on Facilities (O&M Contract)	30,000	Euro/ year	3 % of Investment Cost (2 %: Maintenance, 1 %: Operation)
Measurement Equip	2.825	Euro/ set	Power meter, exhaust gas meter, thermometer, pressure sensor, leakage detector. Replace every 5 years.
Salary for Permanent Staff	830	Euro/ month	This includes salary and social cost. 1 person is assumed.
Entrusting Cost (Trainer and Test Maker)	355	Euro/ day	Trainer and test maker are entrusted outside. 8 days for training and 5 days for preparation of test making are accounted.
Development of New Text Books	17,700	Euro/ set	New books adjusting to EMS programs are necessary.
Miscellaneous Facilities	9,000	Euro/ set	Whiteboard and Projector = 5,000 Euro Computer = 2,000 Euro x 2 replacing every 5 years
Printing Text Books for EM's Course	70	Euro/ set	For Energy Manager's Course.
Rental Exam and Training Space (EM, EO, AEA)	0	Euro/ person -day	Public space (free charge) is expected.
Printing Text Books for EO and AEA's Course	20	Euro/ set	For Energy Officer and Accredited Energy Auditor's Course
Rental Space for Additional Permanent Staff	500 (=2,000/4)	Euro/ month /person	150 m2 for 4 persons including E&T staff (1) plus Dissemination staff (3). 1,600 Euro for office rental and 400 Euro for utility cost.
Administration Cost	249	Euro/ month	Permanent staff cost x 30%

(b) Expenditure Items on the Dissemination Programs (SEEA)

Four dissemination programs were proposed for the effective operation of the Energy Management System. Expenditure items and unit prices for the operation of the dissemination programs have been summarized below. SEEA is the implementing agency for the tasks.

Textbooks and Hands-on Facilities used in the Skill-up Training Program have been developed by the above "Expenditure Items on Official Qualification System". These costs have been neglected from the expenditure of dissemination programs.

Table 14-5 Preconditions on Expenditure Items and Unit Prices regarding the Dissemination Programs

Item	Price	Unit	Remarks
Car	15,000	Euro/ car	2 cars are requested. It runs at 10 km/litter.
Gasoline	1	Euro/ litter	2 cars runs total 10,000 km /year.
Salary for Permanent Staff	830	Euro/ month	This includes salary and social cost.
Entrusting Cost (Trainer)	355	Euro/ day	Trainer is entrusted outside.
Entrusting Cost (Proofreading)	10	Euro/ page	It's for complaining Periodical Journal.
Measurement Equip	2.825	Euro/ set	Power meter, exhaust gas meter, thermometer, pressure sensor, leakage detector. Replace every 5 years.
Computer	2,000	Euro/ set	3 computers are prepared for permanent staff and replaced every 5 years. Whiteboard and project are procured in E&T.
Printing Text Books for Skill-up Course	70	Euro/ set	For Skill-up Course
Rental Training Space	0	Euro/ person -day	Public space (free charge) is expected.
Printing and Mailing Cost for Periodical Journal	30	Euro/ set	Journal issues 2 times in a year.
Rental Space for Additional Permanent Staff	500	Euro/ month /perso n	Same as the expenditure of E&T.
Administration Cost	249	Euro/ month	Permanent staff cost x 30%
Award Ceremony Cost	5,000+3,000	Euro/ time	Ceremony cost and trophy cost. Once in a year.

(c) Expenditure Items on the Monitoring of Periodical Reports and Inspection (MOME)

Expenditure items and unit prices towards the operation of the monitoring of Periodical Reports and inspection work have been summarized below. MOME is the implementing agency for the tasks. The expenditure includes the development and maintenance of the database for Periodical Reports.

Table 14-6 Preconditions on Expenditure Items and Unit Prices regarding the Monitoring of Periodical Reports and Inspection

Item	Price	Unit	Remarks
Salary for Permanent Staff (Inspector and Head of Monitoring)	830	Euro/ month	This includes salary and social cost.
Salary for Permanent Staff (Data Input and Monitoring)	500	Euro/ person	This includes salary and social cost.
Transportation Cost	100	Euro/ time	The cost covers transportation for 2 persons.
Database (Investment)	60,720	Euro/ set	Database for Periodical Reports
Database (O&M)	14,200	Euro/ set	Database for Periodical Reports
Computer	2,000	Euro/ set	4 computers are prepared for permanent staff and replaced every 5 years.
Administration Cost (Inspector and Head of Monitoring)	249	Euro/ month	Permanent staff cost x 30%
Administration Cost (Data Input and Monitoring)	150	Euro/ month	Permanent staff cost x 30%

(2) Estimation of Quantity

Quantity of each expenditure item is estimated under the following preconditions.

(a) Preconditions for the Quantity Estimation on the Official Qualification System

The following table shows the preconditions for the quantity estimation on the Official Qualification System for Energy Manager, Energy Officer and Accredited Energy Auditor.

In this table, Industry, Commercial and Transformation sectors are categorized into the "Private Sector" and Central Government and Municipality sectors (including Heat Supply Utility (HSU) financed by Municipality) are categorized into the "Public Sector".

Table 14-7 Preconditions for Quantity Estimation on the Official Qualification System

	Private Sector			Public Sector		
	Industry	Building	TransF	Ministry	Mu	HSU
Number of Necessary Energy Managers	110	30	EPS 11 NIS 2	About 10	About 140	About 45
Retirement Rate of Energy Managers	3%	3%	3%	3%	3%	3%
Number of Membership	110	30	EPS 11 NIS 2	10	140	45
Natural Increase Rate of Designation Sites	1 %			0 %		
Number of Taking Examination	80 %			80 %		
Pass Rate	30 %			30 %		
Number of Taking Official Training	20 % + Dropped Persons in Exam			20 % + Dropped Persons in Exam		
Pass Rate	70 %			70 %		
Number of Energy Officer	0 %	50 %	0%	50 %	50 %	0 %
Number of Accredited Auditors	30 (Pass Rate: 70%)					

(b) Preconditions for the Quantity Estimation on the Dissemination Programs

The following table shows the preconditions for quantity estimation on the Dissemination Programs (4 programs).

Table 14-8 Preconditions for Quantity Estimation on the Dissemination Programs

	Private Sector			Public Sector		
	Industry	Building	TransF	Ministry	Mu	HSU
Number of Issue of Journal	110x2	30x2	EPS 11x2 NIS 2x2	About 10x2	About 140x2	About 45 x2
Natural Increase Rate of Designation Sites	1 %			0 %		
Best Practice and Good Practice Award	1	1	1	1	1	1
	5	2	2	2	5	2
Skill-up Training Domestic Third Countries	20 persons: Course 1 (Making Periodical Report) 10 persons for Factory of Domestic, 10 persons for Factory for Third Countries: Course 2 (Theory and Case Study) 10 persons for Factory of Domestic, 10 persons for Factory for Third Countries: : Course 3 (Hands-on and Measurement)					
	10 persons for Building of Domestic, 10 persons for Building for Third Countries: Course 2 (Theory and Case Study) 10 persons for Building of Domestic, 10 persons for Building for Third Countries: : Course 3 (Hands-on and Measurement)					
Number of Use of Rental Measurement Eq	10 times	3 times	5 times	1 time	10 times	5 times

(c) Preconditions for Quantity Estimation on Monitoring of Periodical Reports and Inspection

The following table shows the preconditions for quantity estimation on the monitoring of Periodical Reports and inspections.

Table 14-9 Preconditions for Quantity Estimation on Monitoring of Periodical Reports and Inspection

	Private Sector			Public Sector		
	Industry	Building	TransF	Ministry	Mu	HSU
Number of Designated Sites	110	30	EPS 11 NIS 2	About 10	About 140	About 45
Data Input and Monitoring Staff	1 person			1 person		
Head of Monitoring	1 person					
Database	1 set					
Random Inspection Rate	10 %	10 %	EPS 1 NIS 0.5	1	10 %	10 %
Instruction Rate (Rationalization Plan)	30 % of Random Inspection	50 % of Random Inspection	10 % of Random Inspection	50 % of Random Inspection	50 % of Random Inspection	30 % of Random Inspection
Penalty Rate (Not Improvement even after Instruction)	10 %	10 %	5 %	10 %	10 %	10 %

14.3.2 Preconditions for Estimation on Revenue for Budget Sources

(1) Expected Budget Sources

As a result of the discussion with the Steering Committee, it was confirmed that the following three items were expected to be budget sources for the administration of the Energy Management System.

- Fees for the Official Qualification System (Examination and Training Programs)
- Membership Fees from the Designated Organizations (mandatory payment every year)
- Government Ordinary Budget for MOME (including Energy Efficiency Fund)

It is stipulated that the membership fees are obligatorily collected from all the Designated Organizations every year. Instead of that, Designated Organizations can receive the services of the dissemination programs prepared by SEEA.

(2) Relationship between the Budget Sources and Expenditure

(a) Basic Principle on the Relationship between Budget Sources and Expenditure

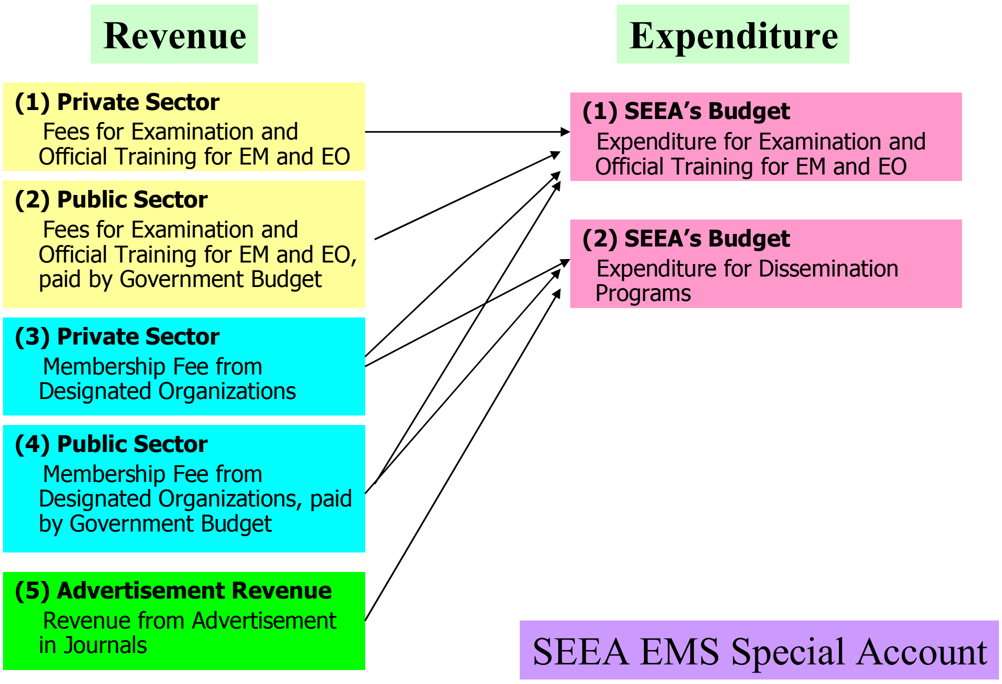
The JICA Study Team discussed the basic principle with the Steering Committee. As a result, the following principles were confirmed.

- Regarding the revenue from the fees for the Official Qualification System for Energy Manager and Energy Officer, it is forecasted that the revenue will decrease when license/certificate holders increase.
- On the other hand, the expenditure for examination or training programs in the Official Qualification System is not expected to drastically decrease. In order to fill the gap, a part of the revenue from the membership fees has been allocated to the deficit of budget sources for the Official Qualification System.
- Revenue from the membership fees are mainly used for the budget sources of the SEEA's dissemination programs. However, a part of the revenue is allocated to the deficit of budget sources for the Official Qualification System.
- Both the Official Qualification System and the dissemination programs are managed by SEEA. Revenue from the fees for the Official Qualification System and membership fees are merged into one budget titled the "SEEA EMS Special Account".
- The Accredited Energy Auditor gets the license based on his/her voluntary will. The budget sources for the administration of the Official Training Program for the Accredited Energy Auditor should be separated from the revenue by the fees for Official Qualification System for Energy Manager and Energy Officer and the membership fees collected from the Designated Organizations. In this context, fees for the Official Training Program for the Accredited Energy Auditor are used for only the expenditures of this training program. Revenue by fees collected from the applicants for the Accredited Energy Auditor formulates another special account titled the "AEA Training Special Account".
- The budget sources for the monitoring of the Periodical Reports and inspections comes from the Government Ordinary Budget for MOME (including the Energy Efficiency Fund).

(a) SEEA EMS Special Account

As mentioned above, the Official Training Programs for the Energy Manager and Energy Officer and the dissemination programs are operated with the revenue from fees for the examination and training program and membership fees. In addition, advertisement revenue in the periodical journals is also funneled into the budget sources for the SEEA EMS Special Account.

The relationship between revenues and expenditures in the SEEA EMS Special Account is shown below.



Private Sector: Industry, Commercial and Transformation Sectors
Public Sector: Central Government, Municipality, and Heat Supply Utility (HSU) financed by Municipality

Figure 14-6 Relationship between Revenue and Expenditure in the SEEA EMS Special Account

It has been proposed that all Public Sector fees be paid from the Central Government Ordinary Budget and not the individual budget of each organization. Thus, the payment from the Public Sector will be secured.

(b) AEA (Accredited Energy Auditor) Training Special Account

Revenue from fees collected from applicants for the Accredited Energy Auditor formulates another special account titled the “AEA Training Special Account”.

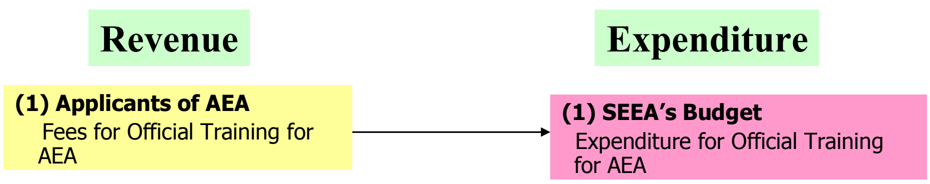


Figure 14-7 Relationship between Revenue and Expenditure in the AEA Training Special Account

(c) Monitoring of Periodical Reports and Inspection

MOME is responsible for the monitoring of Periodical Reports and inspections. The budget for necessary additional staff and database, etc. is allocated from the Government's Ordinary Budget.

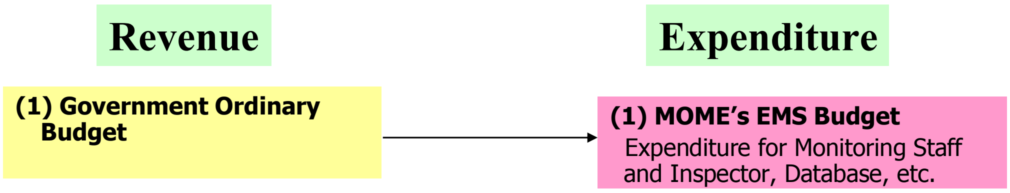


Figure 14-8 Monitoring of Periodical Reports and Inspection (MOME)

14.3.3 Simulation of Expenditure and Revenue

(1) SEEA EMS Special Account

Simulation results for the SEEA EMS Special Account are described below.

(a) Expenditure Forecasts

Expenditure forecasts of the SEEA EMS Special Account are shown below. The calculation is made based on the preconditions described above.

Table 14-10 Forecasts of Expenditure 1 (Official Qualification System for EM and EO)

1. Examination and Official Training for Energy Manager

Assumption

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of Designation (Private)			153	155	157	159	161	163	165	167	169	171	173	175	177	179	181	183	185	187	189	191	193
Number of Designation (Public)			195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195
Sub-total			348	350	352	354	356	358	360	362	364	366	368	370	372	374	376	378	380	382	384	386	388
Number of Necessary EM (Private)			153	155	157	159	161	163	165	167	169	171	173	175	177	179	181	183	185	187	189	191	193
Number of Necessary EM (Public)			195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195
Sub-total			348	350	352	354	356	358	360	362	364	366	368	370	372	374	376	378	380	382	384	386	388
Un-Licensed EM at the Beginning of the Year			348	87	25	9	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Incremental EM by Natural Increase				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Replacement of EM by Retirement				11	11	11	11	11	11	11	11	11	11	12	12	12	12	12	12	12	12	12	12
Sub-total			348	100	38	22	18	17	17	17	17	17	17	18	18	18	18	18	18	18	18	18	18
Applicants for Examination			279	80	31	18	15	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	15
Passed Applicants			56	16	7	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Dropped Applicants			223	64	24	14	12	11	11	11	11	11	11	12	12	12	12	12	12	12	12	12	12
Applicants for Official Training			292	84	30	18	15	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	15
Passed Applicants			205	59	22	13	11	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11
Dropped Applicants			87	25	9	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Number of Dropped Applicants at the Year			87	25	9	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Number of Holding Official Training			3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Expenditure

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Human Resources																							
One Permanent Staff for E&T			3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960	3,960
Administration Cost for the Staff			2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Office Space for the Staff			8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
Sub-total			13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960	13,960
2 Facility Cost																							
Hands-on Facilities (Investment)	500,000	500,000																					
Hands-on Facilities (O&M)			30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Measurement Equipment			5,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825	2,825
Development of New Text Books		17,700																					
Miscellaneous			6,000					9,000					9,000					9,000					
Sub-total	500,000	517,700	41,825	32,825	32,825	32,825	32,825	41,825	32,825	32,825	32,825	32,825	41,825	32,825	32,825	32,825	32,825	41,825	32,825	32,825	32,825	32,825	32,825
3 Administration Cost																							
Entrusting Trainer for Training (Factory+Building)			19,910	9,940	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970
Entrusting Making Test Paper			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Printing Cost (EM Training Course)			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rental Exam and Training Space			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sub-total			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	500,000	517,700	97,910	89,330	60,700	59,790	59,580	68,510	59,510	59,510	59,510	59,510	68,510	59,580	59,580	59,580	59,580	68,580	59,580	59,580	59,580	59,580	59,580
Total - Hands-on Facility Cost	0	0	56,035	36,555	27,875	26,965	26,755	26,685	26,685	26,685	26,685	26,685	26,685	26,755	26,755	26,755	26,755	26,755	26,755	26,755	26,755	26,755	26,755

2. Official Training for Energy Officer

Assumption

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of Necessary Energy Officer																							
Building			15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Municipality			70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
Ministry			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sub-total			90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
Incremental EO by Natural Increase				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Replacement of EO by Retirement				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sub-total				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Applicants for Training			0	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Expenditure

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
All cost is covered by EM Course Expenditure			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 14-11 Forecasts of Expenditure 2 (SEEA'S Dissemination Programs)

3. Dissemination Programs

Assumption

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of Designation (Private)			153	155	157	159	161	163	165	167	169	171	173	175	177	179	181	183	185	187	189	191	193
Number of Designation (Public)			195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195	195
Sub-total			348	350	352	354	356	358	360	362	364	366	368	370	372	374	376	378	380	382	384	386	388
Number of Issue of Journal (twice a year)			696	700	704	708	712	716	720	724	728	732	736	740	744	748	752	756	760	764	768	772	776
Extra Issue (30% of Necessary Number)			209	210	212	213	214	215	216	218	219	220	221	222	224	225	226	227	228	230	231	232	233
Sub-total			905	910	916	921	926	931	936	942	947	952	957	962	968	973	978	983	988	994	999	1,004	1,009
Ceremony of Good Practice Award			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Skill-up Course 1 (Making Periodical Report)			20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Skill-up Course 2 (Theory and Case Study) F+B			40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Skill-up Course 3 (Hands-on and Measurement) F+B			40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Number of Use of Measurement Equipment			34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34

Expenditure

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Human Resources																							
3 Permanent Staff for DE			29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880	29,880
Administration Cost for the Staff			9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Office Space for the Staff			18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Sub-total			56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880	56,880
2. Facility Cost																							
Measurement Equipment			11,300					11,300					11,300					11,300					
Computers			6,000					6,000					6,000					6,000					
2 Cars			30,000										30,000										
Gasoline (1,000 L/year)			1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Sub-total			48,300	1,000	1,000	1,000	1,000	18,300	1,000	1,000	1,000	1,000	48,300	1,000	1,000	1,000	1,000	18,300	1,000	1,000	1,000	1,000	1,000
3. Administration Cost																							
Printing and Mailing Cost for Journal			27,150	27,300	27,480	27,630	27,780	27,930	28,080	28,260	28,410	28,560	28,710	28,860	29,040	29,190	29,340	29,490	29,640	29,820	29,970	30,120	30,270
Entrusting Cost (Proofreading of Journal)			2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Printing Cost (Skill-up course)			2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
Rental Training Space			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entrusting Cost (Trainer)			4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615
Sub-total			36,565	36,715	36,895	37,045	37,195	37,345	37,495	37,675	37,825	37,975	38,125	38,275	38,455	38,605	38,755	38,905	39,055	39,235	39,385	39,535	39,685
Total	0	0	141,745	94,595	94,775	94,925	95,075	112,525	95,375	95,555	95,705	95,855	143,305	96,155	96,335	96,485	96,635	114,085	96,935	97,115	97,265	97,415	97,565
Total - Cars Cost	0	0	110,745	93,595	93,775	93,925	94,075	111,525	94,375	94,555	94,705	94,855	112,305	95,155	95,335	95,485	95,635	113,085	95,935	96,115	96,265	96,415	96,565

(b) Setting of Fee Prices (Base Case)

Fee prices that are the budget sources for the account are proposed based on the answers to the questionnaires conducted in the Workshop. The following prices are used for the Base Case.

Table 14-12 Fee Prices in Base Case

Fee for National Examination for Energy Manager	Fee for Official Training Program for Energy Manager	Membership Fee for Designated Organization	Fee for Official Training Program for Energy Officer	Income from the Advertisement of Periodical Journals
100 Euro	300 Euro	300 Euro/year	100 Euro	5,000 Euro/year

(c) Simulation Results of Revenues and Expenditures

Revenues (fee collection by the Base Case) and expenditures are simulated as follows. The strongest impact factor on revenue is the membership fees. If the membership fee is set at "300 Euro/year", the initial investment cost for Hands-on Facilities and the development of textbooks for the Energy Manager in the Preparation Period cannot be covered by the revenue. In addition, even after starting the scheme, the annual balance still shows a deficit every year (total deficit by 2030 is estimated at 1,782 thousand Euro).

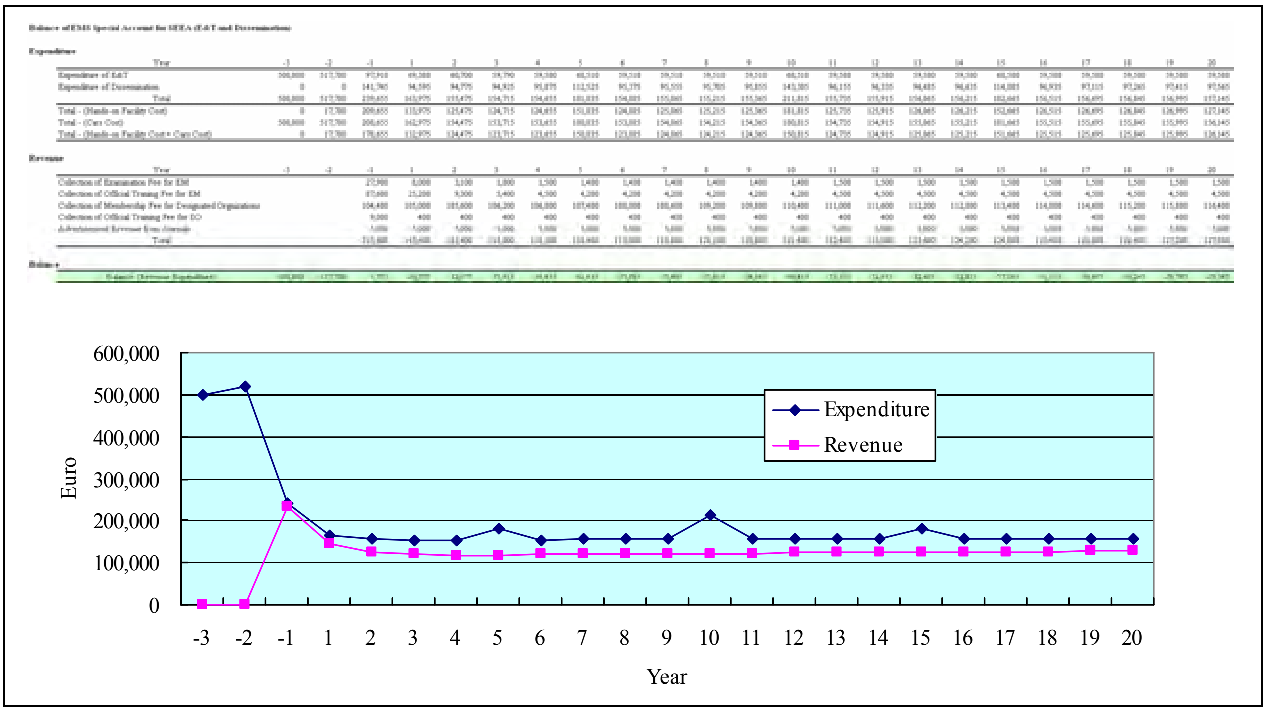


Figure 14-9 Simulation Results of Revenue (Base Case Fee Prices) and Expenditure

(d) Sensitivity Study

In case the price of the membership fee is set at "400 Euro/year", after starting the scheme, the annual balance will be almost equal in the operational period. However, even in this case, the initial investment cost cannot be recovered (total deficit by 2030 is estimated at 1,009 thousand Euro).

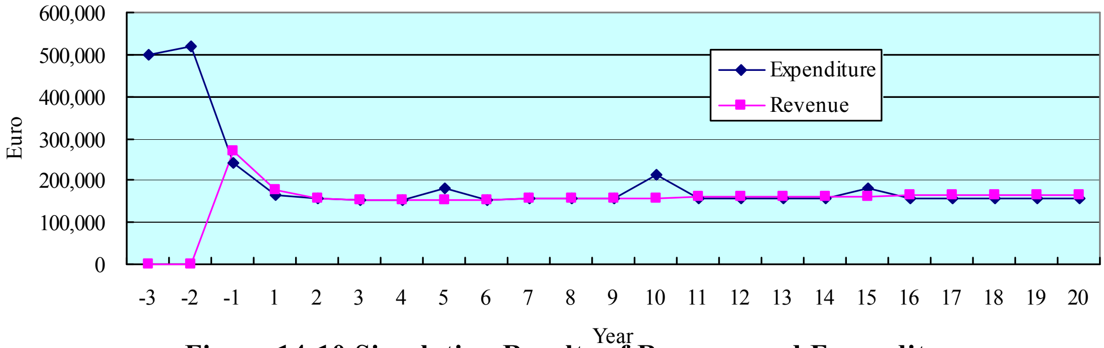


Figure 14-10 Simulation Results of Revenue and Expenditure

(In the case of 400 Euro/year for the Membership Fee)

In cases where the price of the membership fee is set at "500 Euro/year", the total balance of revenues and expenditures including the initial investment cost through 2030 will be almost equal (total deficit by 2030 is estimated at 236 thousand Euro).

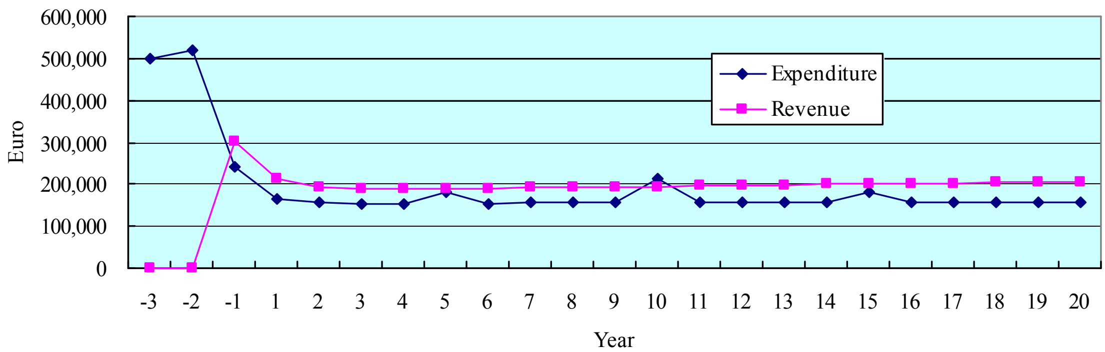


Figure 14-11 Simulation Results of Revenue and Expenditure
(In the case of 500 Euro/year for the Membership Fee)

(e) Final Proposal on the Price of the Membership Fee

As mentioned above, the "300 Euro/year", as the membership fee suggested from the answers to the questionnaire in the Workshop, is not enough to cover all of the SEEA EMS Special Account. The JICA Study Team proposed a "Step-up Price" membership fee to fill the gap. The membership fee raises the price by energy consumption volume as follows.

2,500 toe - 5,000 toe	Basic Price
5,000 toe - 10,000 toe	Basic Price x 2 times
More than 10,000 toe	Basic Price x 3 times

In cases where the Step-up Price Fee is adopted, the impact on the revenue is 1.2 times. In other words, if 300 Euro/year is adopted for the basic price, the average price is equivalent to 360 Euro/year and if 400 Euro/year is adopted for the basic price, the average price is equivalent to 480 Euro/year

The following figure shows the simulation results that the Step-up Price Fee (Basic Fee: 300 Euro/year) is adopted. The figure indicates that the overall balance in the project period is almost equal if the initial investment cost (Hands-on Facilities and development of textbooks) is covered by a grant scheme from foreign donors.

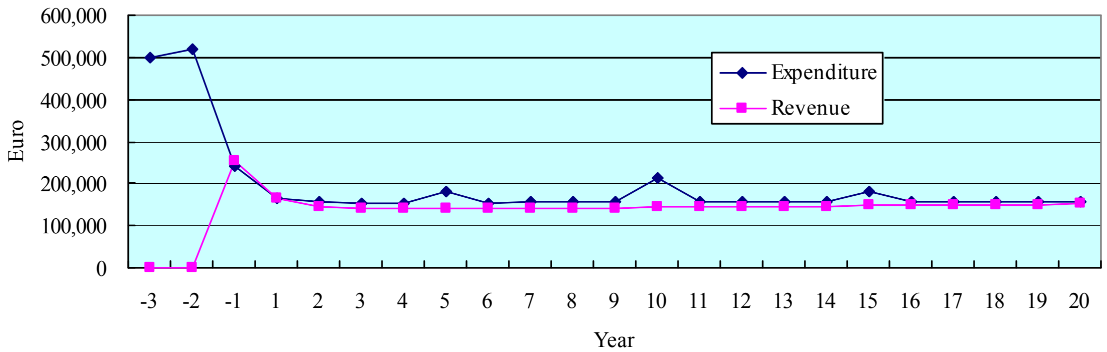


Figure 14-12 Simulation Results of Revenue and Expenditure
(In the case of the Step-up Price Fee (Basic Price: 300 Euro/year))

(2) AEA Training Special Account

Assuming that the training fee for the Accredited Energy Auditor is set at 300 Euro, the simulation results of the revenue and expenditure in the training program are calculated. In this case, the revenue exceeds the expenditure of the training program.

Table 14-13 Simulation Results of Revenue and Expenditure on the AEA Training Special Account

Balance of AEA Special Account (Training for AEA)

Assumptions

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Number of Necessary Accredited Energy Auditor																				
Electrical	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mechanical	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sub-total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Replacement of AEA by Retirement																				
Electrical		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mechanical		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Voluntary Applicants	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sub-total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Applicants for Training	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Passed Applicants	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dropped Applicants	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Expenditure

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Estimating Trainer for Training	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065	1,065

Revenue

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Collection of Training Fee	12,000	7,200	5,700	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100

(3) Expenditure of Monitoring of Periodical Reports and Inspection

The monitoring of Periodical Reports and inspection are implemented by MOME with expenditures being covered by the Government's Ordinary Budget. The following table lists the simulation results of expenditure for the works concerning the monitoring of Periodical Reports and inspection.

Table 14-14 Expenditure of Monitoring of Periodical Reports and Inspection

Expenditure of MOME

Expenditure

Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1 Human Resources																							
2 Permanent Staff for Monitoring Head and Inspector				19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920	19,920
2 Permanent Staff for Data Input and Monitoring				12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Administration Cost for the Staff				9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Sub-total				41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520	41,520
2 Facility Cost																							
Database (Investment)	70,300	35,300																					
Database (O&M)				14,200	14,200																		
4Computers			8,000					8,000					8,000					8,000					
Sub-total				14,200	14,200	0	0	8,000	0	0	0	0	8,000	0	0	0	0	8,000	0	0	0	0	0
3 Administration Cost																							
Transportation to Inspection Site				4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600
Sub-total				4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600
Total	0	0	0	60,120	60,120	46,120	46,120	54,120	46,120	46,120	46,120	46,120	54,120	46,120	46,120	46,120	46,120	54,120	46,120	46,120	46,120	46,120	46,120

Chapter 15 Economic Evaluation

15.1 Methodology of the Evaluation

15.1.1 Outline of the Methodology

As the evaluation method for introducing the Energy Management System (EMS), the building of a suitable energy forecasting model and comparing forecasted energy demand, analyzing national wide cost/ benefits and reducing CO2 emission when compared between "With EMS" and "Without EMS" can be considered. The details of the methodologies are as follows;

- Regarding electric power and final energy demand and primary energy demand, the energy demands should be calculated in cases of "With EMS" and "Without EMS".
- National wide costs and benefits after introducing the EMS and a government budget for affordable capital investment to EMS should be calculated.
- CO2 reduction after introducing EMS should be estimated.

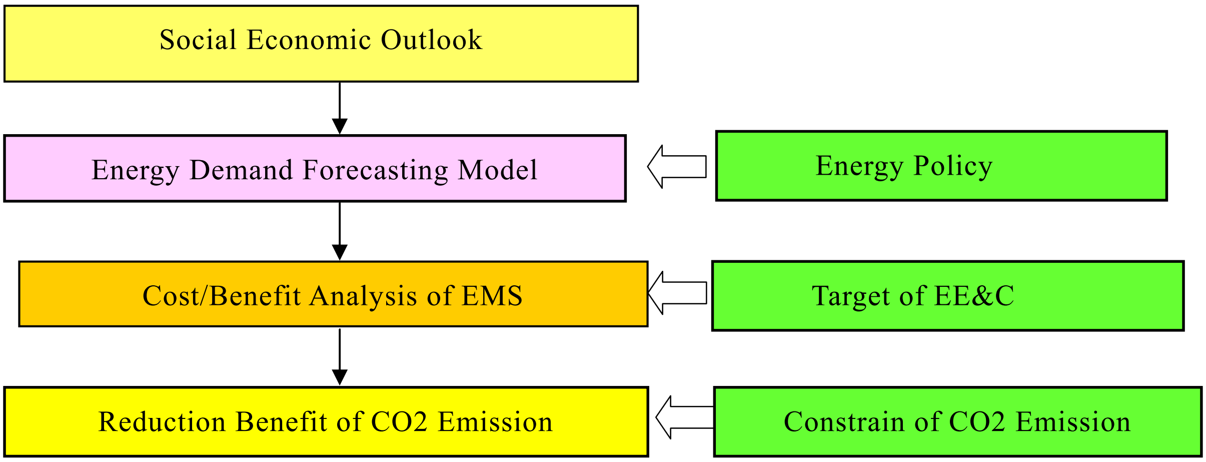


Figure 15-1 Evaluation Methods of EMS

15.1.2 Concepts of Energy Demand Forecasting

(1) Required Functions of Energy Demand Forecasting

In forecasting future energy demand in Serbia, it is necessary to analyze the current energy consumption structures and clarify the important factors necessary to give impacts to the demands. The energy demand trends are the same trends as the Serbian economy. It can be considered that the changes in energy demand in the future are equal to the changes of social and economic development structures. Therefore, the analysis of future Serbian social and economic activities is required. Under the above concepts, the energy demand forecasting model should be designed

The following functions are required by the energy demand forecasting model in the project.

- The model has to link social economic activities.
- The model has to be affected by the changes of energy intensities.
- The model has to be applied to EMS in the industry, commercial and public sectors.
- The model has to include the effects of energy efficiency from entities exceeding the threshold.
- The model has to analyze the EMS effects to power, final energy can and primary energy demands.
- The model has to calculate the reduction of primary energy consumption and nationwide costs and benefits.
- The model has to estimate the effects of CO2 emission reduction.

(2) Structure of the Energy Demand Forecasting Model

The energy demand forecasting model calculates sectoral power demand, power generation, energy resources for the power sector, final energy demand, primary energy, and after that, CO2 emissions are calculated. Econometric theory and model building technologies are used for analyzing and estimating the mentioned items. The following is a figure of an energy demand forecasting model structure. The model consists of two blocks, one is the "Macro Economic Block" and the other is the "Energy Demand Forecasting Block".

Macro Economic Block

(1)Indicators social and economy
- Population
- Number of labor
- Domestic expenditure
- Price and exchange

(2) Production activities
- Sectoral GDP
- Labor productivity

(3) Energy prices
- Crude oil price
- Electric tariffs
- Fuel prices

(4) Energy consumption indicators
- Power ratio
- Energy efficiency
- Energy conversion of generation
- Heat values

(5) Power Development plan
- Thermal
- Hydro
- Renewable
- Power import and export

Energy Demand Forecasting Block

(1) Sectoral final energy demand
- Agriculture
- Manufacturing
- Commercial & Publics
- Transportation & Communication
- Residential use

(2) Own use and T/D loss

(3) Power supply
- EPS
- Power foreign trade
- CHP/Renewable energy

(4) Fuel consumption for power
- Coal
- Gas
- Oil
- Others

(5) Heat supply
- Oil
- Coal
- Bio

(6) Energy demand by energy

(7) CO2 emission

Figure 15-2 Outline of Energy Demand Model

(3) Procedures of Energy Demand Forecasts

The targeted sectors are power, manufacturing, commercial, public, transportation and the residential sectors. The procedures are as follows;

- The energy demands of the sectors are estimated with future energy intensities per sectoral GDP (for the residential sector, energy consumption per population is used) extended from the past trends.
- Power and fossil energies are estimated based on the sectoral GDP, the electricity ratio, energy price elasticity, energy conversion policy and the introduction of EMS.
- The primary energies for the power sector have been estimated under EPS's power development plan.
- Finally, sectoral final energy demand and power demand, primary energy and energy intensities after implementing EMS are forecasted.

(4) Calculation of CO2 Emissions

CO2 emissions are calculated from sectoral energy demand and fuel consumption from both the power sector and the transportation sector. The CO2 emission factors from the Municipal Energy Balance System managed by MOME are used in the calculation of CO2 emissions. Furthermore, the sectoral energy demand and fuel consumption of the power sector are used for CO2 emissions. In this model, gasoline and the diesel consumption of the transportation sector are calculated based on the elasticity to GDP. (Renewable energies are neutral to CO2 emissions calculations).

15.1.3 Preconditions and Case Setting

(1) Social Economic Outlook

The following are the social economic preconditions.

(a) Population Growth Rate

The population increased from 7.44 million in 2005 to 7.50 million in 2010 .However, it is predicted to decrease by - 0.3 % per year.

(b) GDP

Serbian GDP increased by around 5 % in 2007 and 2008. However, due to the world financial crisis, it decreased to 3 % in 2009. Between 2012 and 2015, estimates are that the average GDP growth rate will reach 5 %. However, the long term GDP growth rate between 2016 and 2030 will stabilize at around 2.0 % to 2.5% as well as the growth rate of the current EU.

(c) Foreign Exchange Rate

The fluctuation of the foreign exchange rate impacts domestic investments and the inflation rate. It cannot be considered that the Serbian Dinar (SDR) has been deeply devaluated to EUR and USD when looking at the current situation of EUR and USD. It is difficult to forecast the exchange rate over the long term. It has been predicted that the current 80- 90 SDR per USD will experience a slight increase in the near future, and after 2012, will become 70 SDR to USD.

(d) Inflation Rate

The inflation rate is strongly related to the foreign exchange rate and the GDP growth rate. Under the stable inflation rate (2 % to 3 %), generally investments and equipment are activated by increasing money saving. However, under hyper-inflation, normal and suitable GDP growth cannot be desired. Serbia is going to prepare the environment to carry out their economic development in line with the EU recommendation that the Serbian government depresses the inflation rate under 3 % per year. In the future, the inflation rate of Serbia is set at 3 %, instead of the current 5 % inflation rate.

(e) Crude Oil Price

The current WTI (West Texas Intermediates) in the New York crude oil market is carried on around \$80/ bbl, and the Saudi Arabian government has announced that they would like to increase the crude oil price to as much as the US inflation rate. The inflation rate of the USA is predicted to be 2.0 % to 2.5 % per year. It is predicted that the crude oil price will increase with the same rate per USA inflation. In 2030, crude oil price reached \$130 / bbl when increasing in line with the mentioned growth rate.

(f) Summary of the Preconditions

The summary of the above items is as follows;

Table 15-1 Social Economic Outlook (Preconditions)

	2010-15	2016-20	2021-25	2026-30
Population	-0.3%	-0.3%	-0.3%	-0.3%
GDP	2010=1.5% 2011=3.0% 2012=5.0% 2013=5.0% 2014=5.0% 2015=5.0%	4.0%/year	3.0%/year	2.5%/year
Exchange rate	2010=70 Dir/\$ 2011=80 Dir/\$ 2012=70 Dir/\$	70 Dir/\$	70 Dir/\$	70 Dir/\$
Inflation rate	5 %	5 %	3 %	3 %
Crude oil price (WTI)	2010=\$80/bbl	2015=\$91/bbl	2020=\$102/bbl	2030=\$131/bbl

(2) Energy Policy

In Serbia, the long term economic and energy plans have not been prepared by the Government, the rehabilitation plan of the power sector have been prepared along with the energy efficiency plan and the renewable energy plan. When picking up plans and EE&C policies regarding energies from the above plans, the following items were arranged.

- Rehabilitation of hydro power plants
- Changes of the electric power tariff system
- Introducing high performance thermal power plants
- Introducing CHP and CCGT
- Reduction of distribution loss
- Natural gas utilization of the industrial and residential sectors
- Introducing bio gas and bio oil
- Utilization of renewable energy such as wind power, small hydro
- Bio gas utilization in the agriculture sector, and bio fuel in heat supply factories
- Reduction of CO2 emissions by improving energy efficiency

(3) Scenario Setting

The Base Case includes the current energy policies prepared by the Serbian government. In the other three scenarios, the EMS effects have been added to the Base Case.

The targets of the EMS are the industrial and commercial organizations over each threshold, and the public facilities in the municipalities. (Industrial threshold: 2,500 toe per year, Commercial threshold: 1,000 toe per year and the Public sector threshold: municipalities with over 20,000 populations). It is assumed that EMS starts from 2014. Their effectiveness becomes available from 2015. The calculation period is 15 years between 2015 and 2030. The effects of EMS are as follows.

Table 15-2 Case Setting for EMS

Case Setting	EEE&C Achieving Scenarios
Base Case	Base Cases are scenarios where existing energy policies are implemented and the targets are achieved as much as the planned level. However, the EMS is not considered.
EE&C Not Enough Case	The energy intensities in the case are improved with 15% to the Base case. The improvement is implemented between 2015 and 2030 in the Industrial, Commercial and Public sectors. The average improvement rate of the energy intensities is 1 % per year.
EE&C Reference Case	The energy intensities in the case are improved by 20 % between 2015 and 2030. The average improvement rate of the energy intensities in the case is 1.3 % per year.
EE&C Possibility Case	The energy intensities in the case are improved by 30 % between 2015 and 2030. The average improvement rate of the energy intensities in the case is 2.0 % per year.

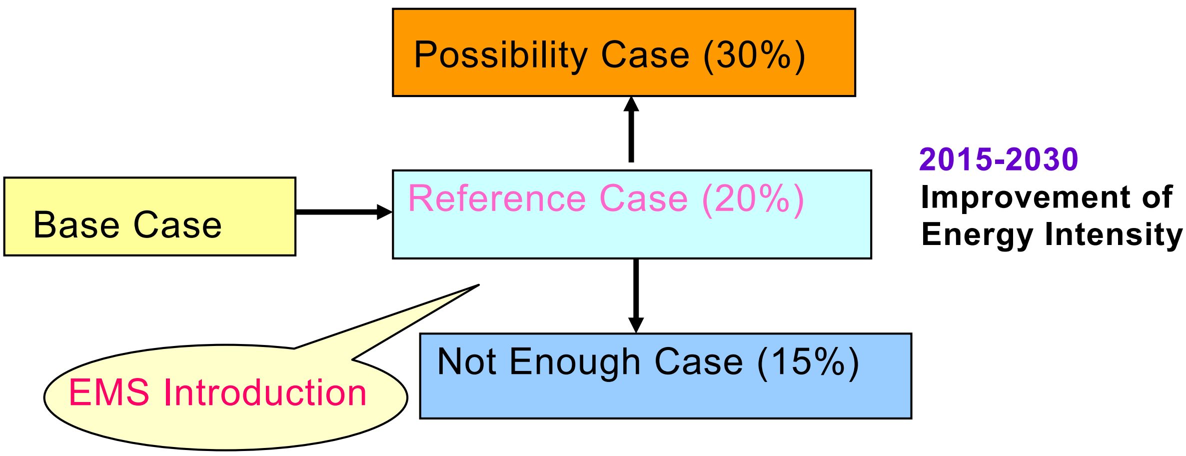


Figure 15-3 Improvement Rate of Energy Intensities in Base and Each EMS Introduction Cases

Table 15-3 Improvement of Annual Average Energy Intensities by Case

Cases	2015-2030 Annual Improvement Rate
Base Case	0.0 %/year
EE&C Not Enough Case	1.0 %/year
EE&C Reference Case	1.3 %/year
EE&C Possibility Case	2.0 %/year

(4) Cover Ratio

The thresholds of the EMS targets with the organizations of 2,500 toe per year in the industrial sector, with 1,000 toe per year in the commercial sector and with more than 20,000 of the population of municipalities being introduced.

The energy cover ratio of energy consumption in the industrial sector was around 75 % in 2010, it will reach 81 % in 2030. (It is estimated based on the elasticity between GDP and energy consumption in industrial sector). Meanwhile, it was 15% in the commercial sector in 2010 and it will increase to 21 % in 2030.

Table 15-4 Thresholds and Cover Ratio (Energy Consumption Ratio)

Items	Industry	Commercial	Publics	Total
Thresholds	2,500 toe	1,000toe	Pop: more 20,000	
Energy cover ratio more than the threshold	2010=75% 2020=78% 2030=81%	2010=15% 2020=18% 2030=21%	Around 100%	64% 66% 69%
Number of organizations more than the thresholds (Not number of sites)	2010=110 2020=150 2030=180	2010=30 2020=35 2030=40	2010=160 2020=160 2030=160	300 345 380

Note: Percentage in total is the shares of energy consumption of the entities more than the thresholds to the total energy consumption in the sectors.

The sectoral cover ratios by EMS are between 75 % - 81 % in the industrial sector, 15 % - 21 % in the commercial sector and 100 % in the public sector.

The targeted organizations (Designated Organizations) covered by the EMS are promoted to improve their energy efficiency. Per the results, power demand, final energy demand, primary energy demand, national benefits (reduction of fuel import and increase of corporate tax) and CO2 emissions reductions have changed.

The evaluation of introducing the EMS is carried out via a comparison between the case with improvement of the energy intensities and the case not to be improved.

15.2 Power and Energy Demand Forecasting

15.2.1 Power Demand Forecasting

(1) Power Demand in Base Case

The following table lists the results of the power demand foresting in the Base Case.

Table 15-5 Power Demand in Base Case

Power demand in final use	Unit	2010	2015	2020	2025	2030	30/15	30/10
Total	GWh	28,000	31,800	35,200	38,400	41,400	1.8	2.0
Industry	GWh	6,800	8,100	9,500	10,900	12,400	2.9	3.0
Commercial & Service	GWh	5,500	6,300	7,200	8,000	8,900	2.3	2.4
Residentials	GWh	15,300	16,900	17,900	18,700	19,400	0.9	1.2
Total	%	100	100	100	100	100	0.6	0.6
Industry	%	24	25	27	28	30	0.9	0.9
Commercial & Service	%	20	20	20	21	21	0.7	0.7
Residentials	%	55	53	51	49	47	0.3	0.3

Note: The red values in the lower lines in the table are elasticity between power demand and GDP.

- The annual growth rate of the domestic power demand in the Base Case will be 2.0 % per year between 2010 and 2030. The industrial sector (excluding the power and heat supply sectors) is 3.0 % per year, and the commercial sector is 2.4 % per year. The growth rates of the two sectors are higher than the average growth rate.
- During the term, the GDP growth rate is 3.5 % per year, the elasticity between the total power demand and GDP is 0.6, the elasticity to the industry is 0.6 and the elasticity to the commercial sector is 0.7.

(2) Reference Case

The following table lists the results of power demand foresting in the Reference Case.

Table 15-6 Power Demand in Reference Case

Power demand in final use	Unit	2010	2015	2020	2025	2030	30/15	30/10
Total	GWh	28,000	31,700	34,600	37,100	39,200	1.4	1.7
Industry	GWh	6,800	8,100	9,000	9,900	10,700	1.9	2.3
Commercial & Service	GWh	5,500	6,200	7,100	7,700	8,300	2.0	2.1
Residentials	GWh	15,300	16,900	17,900	18,700	19,400	0.9	1.2
Total	%	100	100	100	100	100	0.5	0.5
Industry	%	24	26	26	27	27	0.6	0.7
Commercial & Service	%	20	20	21	21	21	0.6	0.6
Residentials	%	55	53	52	50	49	0.3	0.3

- When industrial and commercial sectors realize a 20% energy efficiency improvement between 2015 and 2030, the annual growth rate of the power demand in the industrial sector will become 2.3 % per year. Meanwhile, the annual growth rate of the commercial sector is 2.1 % per year.

- Power demand in the industrial sector will reach 10.7TWh (Base Case: 12.4TWh) and the commercial sector will be 8.3 TWh (Base Case: 8.9 TWh). The power demand in the Reference Case decreases to 13.7 % in the industrial sector and 6.7 % in the commercial sector respectively when compared to the Base Case in 2030.
- When comparing 2030 power demand to 2015, the increase ratio of the industrial sector in the Base Case from 2015 to 2030 is 52 %, and the increase ratio in the Reference Case is 32 %. The ratio in the 2030 Reference Case in 2030 is 20% lower than the Base Case in the industrial sector. In the case of the commercial sector, the difference of the ratio between the Base Case and the Reference Case between 2015 and 2030 is 7 %. It shows that the Reference Case is lower than the Base Case.

(3) Power Demand Comparison by Case

The comparison results of the power demand in each case are shown in the following table.

Table 15-7 Power Demand Growth Rate by Case and by Sector

Cases	Industry 2015-2030	Commercial 2015-2030	Residential 2015-2030	Total 2015-2030
Base Case	2.8%	2.3%	1.0%	1.8%
Not Enough Case (15% improvement)	2.1%	2.0%	1.0%	1.5%
Reference Case (20% improvement)	1.9%	2.0%	1.0%	1.4%
Possibility Case (30% improvement)	1.4%	1.8%	1.0%	1.3%

Note: The total column contains agriculture and transportation sectors.

- EMS is targeting energy efficiency improvements in the industrial, commercial and public sectors and there have been changes in the power demand growth rate that have occurred in the Industry and Commercial sectors.
- As outstanding points, the Serbian Government has plans to reduce energy consumption in the future. However, the power demands in all cases have been increased in the above table. It is the reasons why the GDP growth rate and the electricity ratio are higher than the reduction of energy intensities in the Industrial and Commercial sectors.
- The average growth rate of power demand between 2015 and 2030 (during 15 years) will be from 1.3 % to 1.8 % per year, and the growth rates will be rather lower than other middle developed countries when comparing it.

The following table is a comparison of the increase rates of the power demand by case and by sector in 2020 and 2030 to the years of 2008 and 2015.

Table 15-8 Effects of EMS in Aspect of Power Demand Increase Rates by Case based on 2008 and 2015

	Cases	Industry 2020 2030	Commercial& Services 2020 2030	Residential 2020 2030	Total 2020 2030
Based on 2015 Upper 2020/2015 Lower 2030/2015	Base	+16.6% +52.0%	+15.3% +41.3%	+6.3% +15.4%	+10.8% +30.2%
	Not enough (15% improved)	+12.9% +37.0%	+13.8% +35.5%	+6.3% +15.4%	+9.5% +25.2%
	Reference (20% improved)	+11.7% +32.4%	+13.3% +33.6%	+6.3% +15.4%	+9.1% +23.6%
	Possibility (30% improved)	+9.3% +23.7%	+12.3% +29.9%	+6.3% +15.4%	+8.3% +20.7%
	Difference between Base and Reference	▲4.9% ▲19.6%	▲2.0% ▲7.7%	▲0% ▲0%	▲1.7% ▲9.5%
Based on 2008 Upper 2020/2008 Lower 2030/2008	Base	+33.0% +73.3%	+29.3% +58.6%	+23.3% +33.8%	+27.2% +49.5%
	Not enough (15% improved)	+28.0% +55.3%	+27.3% +51.7%	+23.3% +33.8%	+25.5% +43.4%
	Reference (20% improved)	+26.3% +49.8%	+26.7% +49.4%	+23.3% +33.8%	+25.0% +41.6%
	Possibility (30% improved)	+23.1% +39.3%	+25.4% +45.1%	+23.3% +33.8%	+23.9% +38.0%
	Difference between Base and Reference	▲6.7% ▲23.5%	▲2.6% ▲9.2%	▲0% ▲0%	▲2.2% ▲7.9%

Note1: Total includes agriculture and transportation sectors
Note2: Growth rate = (Annual power demand) / (Power demand in 2008 or 2015)

- When comparing power demand in the Reference Case and the Base Case from 2015, the power demand in the industrial sector in the Reference Case will be 4.9 % lower in 2020 and 19.6 % lower in 2030 respectively to the Base Case. Otherwise, the power demand in commercial sector in Reference Case will be 2.0 % lower in 2020 and 7.7 % lower in 2030 to the Base Case.
- When comparing from 2008, the power demand in the industrial sector in the Reference Case will be 6.7 % lower in 2020 and 23.5 % lower in 2030 respectively to the Base Case. The power demand in the commercial sector in the Reference Case is 2.6 % lower in 2020 and 9.2 % lower in 2030 to the Base Case.

15.2.2 Final Energy Demand

(1) Final Energy Demand in Base Case

The following table lists the results of the final energy demand forecasting in the Base Case.

Table 15-9 Final Energy Demand in Base Case

Final Energy Demand	Unit	2010	2015	2020	2025	2030	30/15	30/10
Total	KTOE	9,920	11,150	12,340	13,340	14,190	1.6	1.8
Agriculture.Fishery	KTOE	320	410	470	530	570	2.2	2.9
Industry	KTOE	3,440	4,000	4,540	5,060	5,530	2.2	2.4
Commercial & Service	KTOE	850	960	1,100	1,210	1,320	2.1	2.2
Transportation	KTOE	1,740	1,970	2,270	2,500	2,690	2.1	2.2
Residentials	KTOE	3,570	3,830	3,970	4,040	4,090	0.4	0.7
Total	%	100	100	100	100	100	0.5	0.5
Agriculture.Fishery	%	3	4	4	4	4	0.7	0.8
Industry	%	35	36	37	38	39	0.7	0.7
Commercial & Service	%	9	9	9	9	9	0.7	0.6
Transportation	%	18	18	18	19	19	0.7	0.6
Residentials	%	36	34	32	30	29	0.1	0.2

- The average growth rate of the final energy demand in the Base Case from 2010 to 2030 is 1.8 % per year (power demand: 2.0 %), the industrial sector is 2.4 % per year (power demand: 3.0 %), and the commercial sector is 2.2 % per year (power demand: 2.4 %). The growth rates of the two sectors are higher than the total growth rate from 2010 to 2030.
- The elasticity of the final energy demand to the GDP is 0.5 (power demand: 0.6), the industrial sector is 0.7 (power sector: 0.9), the commercial sector is 0.6 (power demand: 0.7). The difference between the power and final energy demand is caused by an electricity ratio increase in the sectors.
- In the agriculture sector, the elasticity with 0.8 is a little bit higher than other sectors. It is the reason that the sector will use bio fuels in future. In past days, the sector used to use agricultural residual fuels, however the fuels were not counted in the national statistics. In the future, the fuels are counted in energy statistics as bio fuels.

(2) Final Energy Demand in Reference Case

The following table lists the results of final energy demand forecasting in the Reference Case.

Table 15-10 Final Energy Demand in Reference Case

Final Energy Demand	Unit	2010	2015	2020	2025	2030	30/15	30/10
Total	KTOE	9,920	11,110	12,060	12,750	13,260	1.2	1.5
Agriculture.Fishery	KTOE	320	410	470	530	570	2.2	2.9
Industry	KTOE	3,440	3,960	4,270	4,520	4,680	1.1	1.6
Commercial & Service	KTOE	850	950	1,080	1,150	1,220	1.7	1.8
Transportation	KTOE	1,740	1,970	2,270	2,500	2,690	2.1	2.2
Residentials	KTOE	3,570	3,830	3,970	4,040	4,090	0.4	0.7
Total	%	100	100	100	100	100	0.4	0.4
Agriculture.Fishery	%	3	4	4	4	4	0.7	0.8
Industry	%	35	36	35	35	35	0.4	0.4
Commercial & Service	%	9	9	9	9	9	0.5	0.5
Transportation	%	18	18	19	20	20	0.7	0.6
Residentials	%	36	34	33	32	31	0.1	0.2

- When energy intensities in the industrial and commercial sectors are improved by 20 % between 2015 and 2030, the annual growth rate of final energy demand in all sectors will be 1.5 % per year (Base Case: 1.8 %). The difference between the Base Case and the Reference Case is not so big.
- The final energy demand including power in the industry sector from 2010 to 2030 is the growth rate of 1.6 % per year. (Base Case 2.4 %), the commercial sector is the growth rate of 1.8 % per year. (Base Case: 2.2 %). It can be considered that the difference between the Base Case and the Reference Case has significance in the two sectors.
- The final energy demand in the industrial sector in 2030 is 4,680 ktoe (Base: 5,530 ktoe), the commercial sector is 1,220 ktoe (Base: 1,320 ktoe). The demand in the Reference Case is 18 % in the industry and the 8 % in the commercial sector is lower than the Base Case in 2030.

(3) Final Energy Comparison

The following table is the annual growth rates of the final energy demand by sector and by case from 2015 to 2030.

Table 15-11 Annual Growth Rate of Final Energy Demand by Sector and by Case (2015-2030)

Case	Industry	Commercial	Transportation	Residential	Total
Base	2.0%	2.1%	2.1%	0.5%	1.6%
Not Enough (15% improvement)	1.4%	1.8%	2.1%	0.5%	1.3%
Reference (20% improvement)	1.1%	1.6%	2.1%	0.5%	1.2%
Possibility (30% improvement)	0.6%	1.4%	2.1%	0.5%	1.0%

Note: Total includes agriculture sector.

- The target sectors of the EMS are mainly industry and commercial sectors. Therefore, the changes of the total growth rate happen in the two sectors.
- As outstanding points, the final energy demand as well as power demand increases in all sectors. In the industrial and commercial sectors, GDP growth has a stronger impact to demand than the improvement of energy intensities of the sector. (GDP growth rate: 3.5 % per year up, the industry sector: 1.1 % per year up and the commercial sector: 1.6 % per year up)
- In the transportation sector, the energy intensities of 1 % per year after 2020 are set due to transportation facility and system improvements.
- In residential use, energy consumption per population is set as the precondition to increase by 1 % per year between 2015 and 2020, and by 0.5 % per year after 2021.

The following table shows the calculation results of the final energy demand by case and by sector. The calculation years are 2020 and 2030 when it is compared to the year of 2015. The values in the table change in 2020 and between 2030 and 2015.

Table 15-12 Effects of EMS to Final Energy Demand in 2020 and 2030 to 2015

	Case	Industry 2020 2030	Commercial Service 2020 2030	Transport 2020 2030	Residential 2020 2030	Total 2020 2030
Based on 2015	Base	+14% +38%	+14% +36%	+16% +37%	+4% +7%	+11% +27%
	Not Enough (15% improvement)	+9% +23%	+13% +30%	+16% +37%	+4% +7%	+9% +21%
Upper 2020/2015 Lower 2030/2015	Reference (20% improvement)	+8% +18%	+12% +28%	+16% +37%	+4% +7%	+8% +19%
	Possibility (30% improvement)	+5% +9%	+11% +24%	+16% +37%	+4% +7%	+7% +16%
	Difference between Base and Reference	▲6% ▲20%	▲2% ▲8%	▲0% ▲0%	▲0% ▲0%	▲3% ▲8%

Note: Total includes the agriculture sector.

- The increase ratio of the final energy demand in the Reference Case is 3 % in 2020 and 8 % in 2030 lower than the Base Case. The increase ratios are compared to the final energy consumption in 2015.
- The increase ratio of the final energy demand in the industrial sector in the Reference Case is 6 % in 2020 and 20 % in 2030 lower than the Base Case. Otherwise, the ratio of the commercial sector in the Reference Case will be 2 % in 2020 and 18 % in 2030. The ratio is calculated from the year of 2015.

15.2.3 Primary Energy Demand

(1) Primary Energy Demand in the Base Case

The following table shows the primary energy demand forecasting in the Base Case.

Table 15-13 Primary Energy Demand in Base Case

Primary Energy Demand		2010	2015	2020	2025	2030	30/15	30/10
Total	ktoe	16,080	18,080	17,730	18,000	18,810	0.3	0.8
Coal	ktoe	8,980	9,540	8,380	7,920	7,870	-1.3	-0.7
Coke	ktoe	600	690	780	870	940	2.1	2.3
Natural Gas	ktoe	1,970	2,580	2,470	2,590	3,040	1.1	2.2
Power from Hydro	ktoe	580	580	690	760	760	1.8	1.4
Power from Wind & PV	ktoe	30	60	90	120	150	6.3	8.4
Bio mass	ktoe	1,130	1,690	2,200	2,410	2,540	2.8	4.1
(Oil products)	ktoe	2,790	2,960	3,170	3,410	3,600	1.3	1.3
Crude oil	ktoe	2,890	3,090	3,320	3,600	3,810	1.4	1.4
Total	%	100	100	100	100	100	0.1	0.2
Coal	%	56	53	47	44	42	-0.4	-0.2
Natural Gas	%	12	14	14	14	16	0.8	0.7
Power from Hydro	%	4	3	4	4	4	0.3	0.6
Power from Bio, Wind & PV	%	0	0	1	1	1	0.6	0.4
Bio mass	%	0	0	1	1	1	2.0	2.4
(Oil products)	%	17	16	18	19	19	0.9	1.2

- The average growth rate of the primary energy demand in the Base Case between 2010 and 2030 is 0.8 % per year (final energy demand 1.8 %). As preconditions, there are energy efficiency improvements in the heat supply and power sectors. The activities reduce the primary energy consumption in the future.
- Coal demand is - 0.7 % per year between 2010 and 2030, due to that it is substituted by bio and renewable energies, natural gas and hydro power (include small hydro).
- The elasticity of bio and renewable energies in the primary energies has become bigger than the current situation of the Government policies. However the elasticity of oil products keeps a high value with 1.2 due to be used in the transportation sector. The elasticity of the total primary energy is 0.2, it is rather small (final energy demand: 0.4). It shows the Government policies to reduce primary energy consumption.
- The contribution of the primary energy in Serbia is coal 42 % (56 % in 2010), oil products 19 % (17 % in 2010), crude oil 20 % (18 % in 2010), natural gas 16 % (12 % in 2010) and hydro power 4 % (4 % in 2010). When looking at the changes of the contribution, coal is decreased and oil products and natural gas are increased.
- The growth rates of primary energy demand from 2010 to 2030 and 2015 to 2030, the primary energy is the growth rate of 0.8 % per year between 2010 and 2030 and 0.3 % per year between 2015 and 2030. The growth rate of primary energy after 2016 is lower than before 2015, due that the GDP growth rate is 5 % before 2015. However, the GDP growth rate after 2016 has become lower compared to previous years.

(2) Primary Energy Demand in Reference Case

The following shows the results of the primary energy demand forecasting in the Reference Case.

Table 15-14 Primary Energy Demand in Reference Case

Primary Energy Demand		2010	2015	2020	2025	2030	30/15	30/10
Total	ktoe	16,080	17,980	17,160	16,950	17,230	-0.3	0.3
Coal	ktoe	8,980	9,480	8,050	7,330	7,030	-2.0	-1.2
Coke	ktoe	600	690	740	770	790	0.9	1.4
Natural Gas	ktoe	1,970	2,560	2,350	2,360	2,660	0.3	1.5
Power from Hydro	ktoe	580	580	690	760	760	1.8	1.4
Power from Wind & PV	ktoe	30	60	90	120	150	6.3	8.4
Bio mass	ktoe	1,130	1,690	2,190	2,370	2,480	2.6	4.0
(Oil products)	ktoe	2,790	2,950	3,110	3,300	3,440	1.0	1.1
Crude oil	ktoe	2,890	3,080	3,260	3,480	3,630	1.1	1.1
		14,440	15,810	14,400	13,940	14,110	-0.1	0.1
Total	%	100	100	100	100	100	-0.1	0.1
Coal	%	56	53	47	43	41	-0.6	-0.3
Natural Gas	%	12	14	14	14	15	0.5	0.6
Power from Hydro	%	4	3	4	4	4	0.1	0.4
Power from Bio, Wind & PV	%	0	0	1	1	1	0.6	0.4
Bio mass	%	0	0	1	1	1	2.0	2.4
(Oil products)	%	17	16	18	19	20	0.8	1.1

- The average growth rate of the primary energy demand in the Reference Case from 2010 to 2030 is 0.3 % per year (Base: 0.8 %). However, the primary energy demand decreases by -0.3 % per year between 2015 and 2030 (Base: 0.3 %). The difference between the two shows the effects of the EMS.
- Regarding coal, the growth rate in the Reference case is -1.2 % per year between 2010 and 2030 (Base: -0.7 %). Otherwise, the growth rate between 2015 and 2030 is -2.0 % per year. Therefore, the effect of the EMS is -0.8 % per year for coal demand.
- The elasticity of the oil products in the Reference Case is 1.1 (Base: 1.2) between 2010 and 2030, and the value is higher than other energies. However, the difference between the Reference and Base Cases is rather small. It is the reason why oil products are mainly used in the Transportation sector.
- The contributions of primary energies in the Reference Case in 2030 are coal 41 % (Base: 42 %), oil products 20 % (Base: 19 %), crude oil 21 % (Base: 20 %), natural gas 15 % (Base: 16 %) and hydro power 4 % (Base: 4 %). The changes in the contributions between the Reference and Base Cases that coal and natural gas decrease and oil products increase. It is the reason that energy efficiency is not promoted when comparing to other sectors.
- Coal demand decreased from 20 million tons in 2010 and will increase to 16 million tons in 2030 (heat value 4,500 kcal / kg assumed), crude oil increases from 3.4 million kl in 2010 to 4.3 million kl in 2030 and natural gas increases from 2.3 million m^3 (79 million cf) in 2010 to 3.0 million tons (106 million cf) in 2030 (1 toe = 40 MMBtu, 1 MMBtu = 1,000 cf, 1 m^3 = 35 cf).

(3) Comparison of Primary Energy Demand

The following table shows the growth rates of primary energy demand by sector and by case.

Table 15-15 Growth Rates of Primary Energy Demand by Energy and by Case (2015-2030)

Cases	Coal	Natural gas	Crude Oil	Bio gas	Wind PV	Total
Base	-1.3 %	1.1%	1.4 %	2.8 %	6.3%	0.3 %
Not Enough (15% improvement)	-1.8 %	0.5 %	1.2 %	2.6 %	6.3%	-0.2 %
Reference (20% improvement)	-2.0 %	0.3 %	1.1 %	2.6 %	6.3%	-0.3%
Possibility (30% improvement)	-2.3 %	-0.2 %	1.0 %	2.5 %	6.3 %	-0.5 %

Note: Total includes all kinds of primary energies.

- The target sectors of EMS are mainly industry and commercial sectors. When comparing between each case and the Base Case, the EMS is effective for the demand of coal and natural gas, because the much energies are used in the power sector.
- As for the outstanding changes after implementing the EMS, it is to decrease coal demand and to decrease the growth rate of natural gas. Other hand, crude oil demand is not changed by the EMS, and renewable energies are increased by the Government policies.

The following table shows the change rates of primary energy in 2020 and 2030 when compared to 2015.

Table 15-16 EMS Effects to Fossil Primary Energy Demand based on 2105 (Unit: %)

	Cases	Coal 2020 2030	Natural gas 2020 2030	Crude oil 2020 2030	Total 2020 2030
Based on 2015	Base	▲12 ▲18	▲4 +18	+7 +23	▲6 ▲2
Upper 2020/2015 Lower 2030/2015	Not Enough (15% improvement)	▲14 ▲24	▲8 +7	+6 +19	▲8 ▲9
	Reference (20% improvement)	▲15 ▲26	▲8 +4	+6 +18	▲9 ▲11
	Possibility (30% improvement)				
	Difference between Base and Reference	▲3 ▲8	▲4 ▲14	▲1 ▲5	▲3 ▲9

Note: Total includes all kinds of primary energies.

- When comparing primary energy demand to 2015 between the Reference and Base Cases, the demand of fossil primary energy in the Reference Case is -2.9 % per year lower than the Base Case in 2020 and also -9.2 % per year lower in 2030.
- The increase ratio of coal demand in the Reference Case is lower than the Base case. The ratios are -3.4 % per year in 2020 and -9.9 % in 2030. Natural gas will be -10.2 % in 2020 and -2.3 % in 2030 lower than Base Case. Crude oil is -1.6 % in 2020 and -5.5 % in 2030.

15.3 Economic Evaluation of Energy Management System

15.3.1 Reduction of Primary Energy Consumption by the Energy Management System

(1) Monetary Benefit by the Reduction of Primary Energy Consumption

The following table shows the values of primary energy consumption in each case. The primary energies are evaluated by the energy prices. The energy prices are estimated in the model.

Table 15-17 Monetary Values of Primary Energy Consumption by Case

(Million Euro)

		2010	2015	2020	2025	2030
Base	Coal+Coke	754	916	943	1,035	1,184
	Crude oil	1,468	1,762	2,132	2,597	3,102
	Natural Gas	173	523	779	1,047	1,513
	Total	2,395	3,201	3,855	4,679	5,798
Not Enough	Coal+Coke	754	911	913	972	1,078
	Crude oil	1,468	1,758	2,106	2,537	2,997
	Natural Gas	173	520	751	978	1,369
	Total	2,395	3,190	3,769	4,486	5,444
Reference	Coal+Coke	754	909	903	952	1,046
	Crude oil	1,468	1,757	2,097	2,518	2,965
	Natural Gas	173	519	742	956	1,325
	Total	2,395	3,186	3,742	4,426	5,335
Possibility	Coal+Coke	754	906	884	914	987
	Crude oil	1,468	1,755	2,080	2,481	2,904
	Natural Gas	173	517	725	915	1,243
	Total	2,395	3,178	3,688	4,310	5,133

The energy prices used for the evaluation are forecasted by the WTI crude oil indicator. The escalation rate of the energy prices is 2.5 % per year. The rate is the same as the escalation factor of future crude oil prices.

Table 15-18 Primary Energy Prices (Discount rate considers 2.5 % per year)

	Unit	2010	2015	2020	2025	2030
Crude oil	$/bbl	80	90	100	115	130
Crude oil	€/bbl	59	67	76	86	97
Natural gas	€/MMBtu	2.2	5.1	8.0	10.3	12.6
Cola	€/ton	44	50	57	64	73

(2) Economic Benefits from Introducing the EMS

The economic benefits are indicated by the saved energy value between the Base Case and the Reference Case. The following table shows the energy saved values in each EMS promotion case. The energy-saved values are regarded as the economic benefits per EMS implementation.

Table 15- 19 Energy Saved Values between Each EMS Promotion Case and Base Case

(Million Euro)

		2010	2015	2020	2025	2030
Base	Coal+Coke	0	0	0	0	0
	Crude oil	0	0	0	0	0
	Natural Gas	0	0	0	0	0
	Total	0	0	0	0	0
Not Enough	Coal+Coke	0	5	31	64	106
	Crude oil	0	4	27	60	105
	Natural Gas	0	3	27	69	144
	Total	0	11	85	193	355
Reference	Coal+Coke	0	6	41	83	138
	Crude oil	0	5	36	79	137
	Natural Gas	0	4	36	90	188
	Total	0	15	113	253	463
Possibility	Coal+Coke	0	9	60	121	197
	Crude oil	0	8	53	116	198
	Natural Gas	0	6	54	132	270
	Total	0	23	166	369	665

(3) Present Values of the EMS Effects

The present values (at 2010 price) of primary energy values in the Base Case and the Reference Case are as the following table. The energy prices are discounted by 2.5 % per year. The total value from 2010 to 2030 is 63.3 billion Euro in the Base case and 61.1 billion Euro in the Reference Case. The difference is 2.2 billion Euro. This is the “Effects of EMS” or the “Benefit of EMS”.

Table 15-20 Present Values of EMS Effects (at 2010 price)

			2010	2015	2020	2025	2030
Base	Primary energy value	Million €	2,395	2,829	3,011	3,231	3,539
	Total	Million €	63,324				
Reference	Primary energy value	Million €	2,395	2,816	2,923	3,056	3,256
	Total	Million €	61,130				
Benefit	Primary energy value	Million €	0	13	88	175	283
	Difference	Million €	2,194				

15.3.2 Effects on Increase of Corporate Tax Revenue of the Government

The energy cost of the private companies is reduced by the introduction of EMS. As a result, it is expected that the Government will be able to implement corporate tax income increases. The Government income as corporate tax is estimated by the following procedures.

- It has been assumed that the EMS will be started in 2014 and the effects of EMS are reflected from 2015. Given that the Pay Back Period (PBP) per rationalization investment (include EE&C investment) is within five years, Government revenue as corporate tax increases within the period (from 2015 to 2019) is not expected. Because it is the reason why most of the profit from EMS is applied to depreciation and payable interest and the profit on corporate financial accounts does not increase from 2015 to 2019. After the PBP period, the income targeted corporate tax has increased, and the Government income also increases in line with corporate tax system. Under the analysis, the corporate tax rate is assumed to be 15 % after 2020. Under these assumptions, the total government tax revenue increases to 220 million EUR (2,200 million EUR * 10 / 15 *0.15) from 2020 to 2030. The incremental revenue of the Government can be used as capital sources for promoting EMS.

- The incremental revenue of the Government from EMS is as the following table. As it is assumed that the incremental revenue is merged into the general budget of the Government, it is desired that the revenue is used for manpower fee, making policies and improving energy efficiency of the Government buildings.

Table 15-21 Incremental Revenue of the Governmental from EMS (estimation)

	Unit	2015	2020	2025	2030
Incremental Revenue (at 2010price)	Million EUR	1	9	18	28

Note: The primary energy values are discounted by 2.5 % discount rate.

15.4 Effects on CO2 Emission Reduction

15.4.1 Calculation Method of CO2 Emissions

In the session, CO2 emissions are calculated from fossil energy consumption by 2030. The CO2 emissions are calculated for the Base Case and the Reference Case. Most of the energies are used in the power, heat supply, manufacturing, transportation and residential sectors, and fossil energies used in the sectors are coal (including coke), natural gas and oil products. Bio mass, woods and charcoal are not included in the CO2 calculation due to the fact that the renewable energies are neutral to CO2 emissions according to the Kyoto protocol definition.

(1) CO2 Emission Factors

In calculating CO2 emissions, CO2 emission factors are used in the calculation expressions. The following CO2 emission factors have been quoted from the “Municipality Energy Balance System” managed by MOME (Emission factor of gasoline is quoted from the Japanese CO2 emission factor).

Table 15-22 CO2 Emission Factors for Serbia

Energy	Unit	kWh/unit	CO2 kg/kWh	CO2-kg/unit	CO2 ton/unit	Kcal/kg	CO2 ton/toe
Lignite raw	t	3,600	0.35	1260	1.2600	3,096	4.07
lignite dried	t	4,500	0.35	1575	1.5750	3,870	4.07
Brown coal	t	5,000	0.35	1750	1.7500	4,300	4.07
Hard coal	t	6,000	0.35	2100	2.1000	5,160	4.07
Coke	t	7,000	0.35	2450	2.4500	6,020	4.07
Wood waste	t	4,500	0.30	1350	1.3500	3,870	3.49
Biomass	t	3,500	0.30	1050	1.0500	3,010	3.49
Gasoline	t	9,700	0.24	2347.4	2.3474	8,342	2.81
Heavy fuel oil	t	11,000	0.28	3080	3.0800	9,460	3.26
Kerosene	m3	11,000	0.25	2750	2.7500	10,750	2.56
LPG	m3	11,000	0.24	2640	2.6400	12,613	2.09
Natural gas	m3	9.26	0.20	1.852	0.0019	13,273	2.10

(Source: Municipality Energy Balance System)

(2) Calculation Method of CO_2 Emission

The estimation of CO_2 emissions from energy combustion is based on the energy demand forecasted in the energy demand forecasting model. The expression of emissions are as follows.

CO_2 Emission = Fossil Energy Consumption (toe) * CO_2 Emission Factor

(Note) The calculation expression of IPCC consists of the carbon emission factor (Ton-C/TJ) and CO_2 fraction factors. When using IEA data for CO_2 emission calculation in line with the IPCC expression, the Joule unit has to be converted to the ktoe unit used in the IEA database. The following expression is the IPCC expression for CO_2 emissions calculation. The value of the 41.868 is a conversion coefficient from ktoe to Joule and the value of 3.667 is a conversion coefficient from carbon emissions to CO_2 emissions.

CO_2 Emission = Fossil Energy Consumption *(41.868/1000)* (Ton-C/TJ*3.667)* Fraction CO_2

15.4.2 Calculation Results of CO_2 Emissions

(1) CO_2 Emission in the Base Case

The CO_2 calculation results for the Base Case are as follows.

Table 15-23 CO_2 Emission in Base Case

Items	Sector	Unit	2008	2009	2010	2015	2020	2025	2030	30/08
CO_2 emission	Power	CO_2 million ton	30.8	31.6	32.0	35.4	30.3	28.2	28.5	-0.4
(Million CO_2 t)	Heat supply	CO_2 million ton	3.0	2.9	2.9	2.3	1.7	1.9	2.1	-1.7
	Agriculture	CO_2 million ton	1.1	1.1	1.2	1.4	1.5	1.6	1.6	1.9
	Industry	CO_2 million ton	7.5	7.0	6.9	8.0	9.0	10.0	10.8	1.7
	Comm & Public	CO_2 million ton	1.1	1.0	1.0	1.1	1.3	1.4	1.4	1.4
	Transportation	CO_2 million ton	5.4	5.0	4.9	5.4	6.1	6.5	6.9	1.1
	Residential	CO_2 million ton	2.8	2.9	3.0	2.8	2.5	2.2	2.2	-1.1
	Total	CO_2 million ton	51.6	51.6	51.9	56.4	52.4	51.8	53.6	3.0
Contribution	Power	%	60	61	62	63	58	54	53	-0.5
(%)	Heat supply	%	6	6	6	4	3	4	4	-1.9
	Agriculture	%	2	2	2	3	3	3	3	1.8
	Industry	%	14	14	13	14	17	19	20	1.5
	Comm & Public	%	2	2	2	2	2	3	3	1.2
	Transportation	%	10	10	9	10	12	13	13	0.9
	Residential	%	5	6	6	5	5	4	4	-1.2
	Total	%	100	100	100	100	100	100	100	

- 3.0 % CO_2 emission increases per year from 2008 to 2030. It is a reason to increase energy consumption in the each sector (agriculture, industry and commercial sectors) except power and the heat supply sectors.
- CO_2 emissions decreased to -0.4 % per year in the power sector, and decreased to -1.7 % per year in the heat supply sector. This has caused the power sector to introduce renewable energies and gas fired thermal power plants, and the heat supply sector to use bio energies.
- CO_2 emissions decreased -1.1 % per year from 2008 to 2030 in the residential sector, due to the predicted decrease of the Serbian population in the future.
- The contribution of CO_2 emissions per sector in 2030 is 53% for the power sector (60 % in 2010), 4 % for the heat supply sector 4 % (6 % in 2010), 20% for the industrial sector 20 % (14 % in 2010) and 13 % for the transportation sector (10 % in 2010). It is forecasted that the CO_2 emissions of the power sector and the heat supply sector will decrease from 2010

to 2030.

(2) CO2 Emissions in the Reference Case

The CO2 calculation results for the Reference Case are as follows.

Table 15-24 CO2 Emission in Reference Case

			2008	2009	2010	2015	2020	2025	2030	30/08
CO2 emission	Power	CO2 million ton	30.8	31.6	32.0	35.2	29.0	26.0	25.2	-0.9
(Milion CO2 t)	Heat supply	CO2 million ton	3.0	2.9	2.9	2.3	1.6	1.7	1.7	-2.5
	Agriculture	CO2 million ton	1.1	1.1	1.2	1.4	1.5	1.6	1.6	1.9
	Industry	CO2 million ton	7.5	7.0	6.9	7.9	8.5	8.9	9.1	0.9
	Comm & Public	CO2 million ton	1.1	1.0	1.0	1.1	1.2	1.3	1.3	1.0
	Transportation	CO2 million ton	5.4	5.0	4.9	5.4	6.1	6.5	6.9	1.1
	Residential	CO2 million ton	2.8	2.9	3.0	2.8	2.5	2.2	2.2	-1.1
	Total	CO2 million ton	51.6	51.6	51.9	56.1	50.4	48.2	48.2	-0.3
Contribution	Power	%	60	61	62	63	58	54	52	-0.6
(%)	Heat supply	%	6	6	6	4	3	4	4	-2.2
	Agriculture	%	2	2	2	3	3	3	3	2.3
	Industry	%	14	14	13	14	17	18	19	1.2
	Comm & Public	%	2	2	2	2	2	3	3	1.4
	Transportation	%	10	10	9	10	12	14	14	1.4
	Residential	%	5	6	6	5	5	5	5	-0.8
	Total	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

- CO2 emissions will decrease by -0.3 % per year between 2008 and 2030 (3.0 % per year in Base Case). The CO2 emissions in the Reference Case have declined drastically compared to the Base Case. Estimated CO2 emissions from energy utilization was 52 million tons-CO2 (80 million tons-CO2 in the whole country in 2008) in 2010, 56 million tons-CO2 in 2015, 50 million tons-CO2 in 2020, 48 million tons-CO2 in 2025 and 48 million tons-CO2 in 2030.
- When CO2 emissions are compared to 2015, it appears that will decrease to -10 % in 2020, -14 % in 2025 and -14 % in 2030.
- The contribution of CO2 emissions by sector in 2030 is 52% for the Power sector (53 % in Base Case), 4% for the heat supply sector (4 % in Base Case), 19% of the Industrial sector (20 % in Base Case) and 14% for the Transportation sector (13 % in Base Case). Contributions to the Transportation sector have increased due to the fact that there haven't been any additional energy efficiency policies taken up in the sector.

(3) CO2 Reduction per EMS Introduction

The following table lists the trial results of CO2 reduction from the Base Case to each EMS promotion case. The values in the table are indicators to “1.00” in 2015. There is an assumption that the EMS effects are expressed from 2015 to 2030. The EMS effects (called “benefits”) are defined by the difference of CO2 emissions between the Base Case and the Reference Case. The CO2 emission reduction rate to 2015 in the Reference Case is decreased by -3 % in 2020, -6 % in 2025 and -9 % in 2030.

Table 15-25 CO2 Emission Reduction in Each Case (2015=1.00)

	2015	2020	2025	2030
Base	1.00	0.93	0.92	0.95
		▲7%	▲8%	▲5%
Not Enough	1.00	0.91	0.87	0.88
		▲9%	▲13%	▲12%
Reference	1.00	0.90	0.86	0.86
		▲10%	▲14%	▲14%
Possibility	1.00	0.88	0.83	0.82
		▲12%	▲17%	▲18%
EMS Effects		▲3%	▲6%	▲9%

Note: EMS effects are defined as the difference between Base Case and Reference Case.

15.4.3 International Comparison of CO2 Emissions

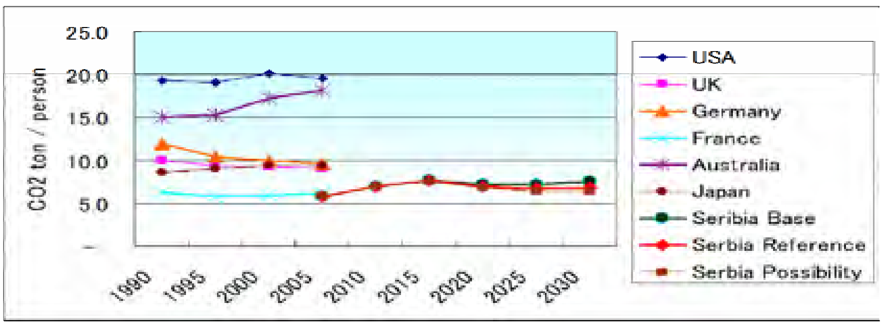
There is the idea that CO2 emissions have to be discussed under the assumption of emissions per population and/or per GDP, then it should not be discussed under total emissions volume in each country. The idea is that one of the intentional policies of energy efficiency should be strongly requested to lower energy efficient countries, and it especially may become an important evaluation method in the next climate change measures after Kyoto protocol. Herein, CO2 emissions per population and the GDP of Serbia are compared to other countries.

(1) CO2 Emissions per Population

The Serbian population was 7.7 million in 2010. It is estimated that it will decrease to 7.1 million in 2030. Meanwhile the CO2 emissions per population in Serbia are 6.9 tons-CO2 in 2010.

Table 15-26 CO2 Emission per Capita (ton-CO2 per person)

	1990	1995	2000	2005	2010	2015	2020	2025	2030
USA	19.3	19.1	20.1	19.6					
UK	9.9	9.4	9.3	9.0					
Germany	11.9	10.4	9.9	9.7					
France	6.3	5.8	5.9	6.2					
Australia	15.1	15.3	17.3	18.2					
Japan	8.6	9.1	9.3	9.4					
Seribia Base				5.8	6.9	7.6	7.2	7.2	7.5
Serbia Reference				5.8	6.9	7.6	6.9	6.7	6.8
Serbia Possibility				5.8	6.9	7.5	6.8	6.4	6.4



(Source: Energy Economic Statistics 2010)

Figure 15-4 CO2 Emission per Capita in the Main Counties & Serbia (CO2-ton per person)

(2) CO2 Eission per GDP

The following table is the CO2 emissions per GDP in the main countries and Serbia. In 2010, CO2 emissions per GDP in Serbia was 970s ton-CO2 per GDP (million USD), and the value of Serbia in 2010 was 2 or 3 folds when compared to EU, USA and Japan in 2005. However, the CO2 emissions per GDP in Serbia drastically declined after the EMS introduction in 2014.

Table 15-27 CO2 Emission per GDP (ton-CO2 per million USD, at 2000 price)

	1990	1995	2000	2005	2010	2015	2020	2025	2030
USA	684	639	582	530					
UK	498	440	376	331					
Germany	610	493	428	407					
France	329	290	262	260					
Australia	955	911	885	851					
Japan	257	256	253	242					
Seribia Base				924	970	841	642	548	500
Serbia Reference				924	970	836	617	509	450
Serbia Possibility					970	833	606	492	428

(Source: Energy Economic Statistics 2010)

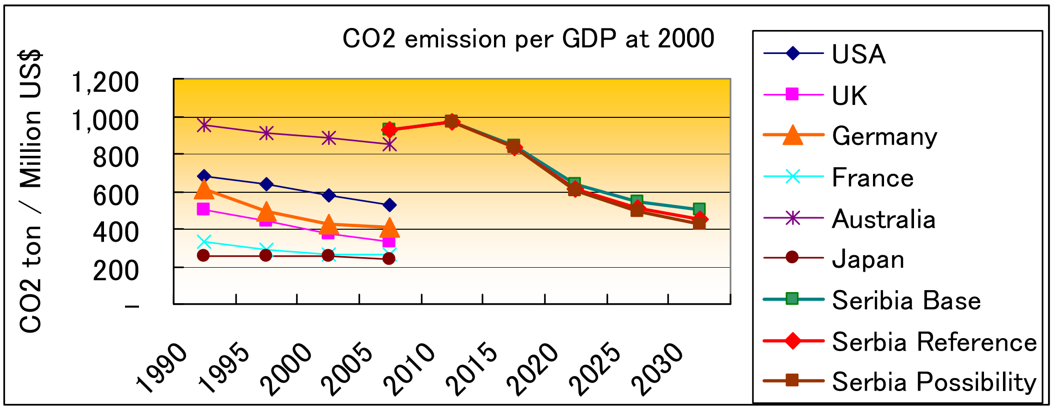


Figure 15-5 CO2 Emission per GDP (CO2ton per million USD, at 2000 price)

15.5 Analysis on National Economic Cost and Benefit

In the session, capital investment (national economic cost) for implementing EMS and the saved energy value (national economic benefit) from EMS are estimated and compared to know the justification of EMS in the nation wide economy.

15.5.1 National Economic Benefit

The following table indicates the amount of energies saved by EMS for the Base and Reference Cases. The energy prices used for calculating the values increased by 2.5 % per year, the amount of the saved energy becomes bigger in a company with increased energy prices, and benefits (National economic benefit) also increase. The amount difference between the Base and Reference Cases is an important benefit from the introduction of EMS into Serbia.

Table 15-28 Economic Benefit by EMS (Difference between Base and Reference Cases)

	Unit	2010	2015	2020	2025	2030
Base Case	million EUR	2,395	3,201	3,855	4,679	5,798
Reference Case	million EUR	2,395	3,186	3,742	4,426	5,335
Benefit	million EUR	0	15	113	253	463

15.5.2 National Economic Cost

The Designated Organizations (factories, commercial buildings and Governmental office buildings, etc.) have to invest some incremental costs (= value added cost for EE&C) in order to achieve the numerical target of EMS. The total cost for such incremental investment can be considered as one of the national costs calculated in the following table.

Table 15-29 Incremental Investment Cost to Achieve EMS Numerical Target

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Investment (million EUR)	100	104	109	113	118	122	127	131	135
	2023	2024	2025	2026	2027	2028	2029	2030	Total
Investment (million EUR)	139	143	147	151	155	159	163	167	2,282

Note1) Fixed capital formation = GDP * 20 %.
Private investment and equipment = Fixed capital formation * 50 %
Note2) Investment for Machines = Private investment and equipment * 50 %
Designated investment for machines = Investment for Machines * 70 %
Note3) Investment for EMS = Designated investment for machines * 10 %
Note4) As Japanese experience, the annual investment share of EMS from 1985 to 1992 is 7 % to the total investment and equipment of large scale private companies. By the investment, annual energy conservation rate of the companies have been 1.2 % per year.

15.5.3 Comparison of National Economic Cost and Benefit

The comparison results between the cost and benefits of EMS from the viewpoint of the national economy are as follows.

- It can be said that EMS introduction makes significant sense if the cost (incremental investment for EE&C) doesn't exceed the benefits (amount of the saved energies).
- When looking at annual costs and the benefit balance in the following table, the benefit is over the cost after 2021.
- The Internal Rate of Return (IRR) for EMS in the country is 12 % from 2014 to 2030 under the assumption that EMS is introduced from 2014.

Table 15-30 Comparison of Cost and Benefit

Year	Incremental Investment Cost for EMS in the Target Secto Million EUR	Energy Cost Reference Case (1) Million EUR	Energy Cost Base Case (2) Million EUR	Benefit bu EMS (3)=(2)-(1) Million EUR	Discount Rate	Present Value Incremental Investment Cost Million EUR	Presente Value Benefit Million EUR
2010		2,395	2,395		0.12		
2011		2,476	2,476				
2012		2,738	2,738				
2013		2,846	2,846				
2014	100	3,028	3,028		1.00	100	0
2015	104	3,186	3,201	15	1.12	94	13
2016	109	3,335	3,367	32	1.24	87	26
2017	113	3,408	3,457	49	1.39	82	35
2018	118	3,553	3,623	70	1.55	76	45
2019	122	3,650	3,739	89	1.72	71	52
2020	127	3,742	3,855	113	1.92	66	59
2021	131	3,847	3,982	135	2.14	61	63
2022	135	4,014	4,177	163	2.39	56	68
2023	139	4,134	4,323	189	2.66	52	71
2024	143	4,316	4,538	222	2.97	48	75
2025	147	4,426	4,679	253	3.31	44	76
2026	151	4,667	4,964	297	3.69	41	80
2027	155	4,795	5,126	331	4.12	38	80
2028	159	4,996	5,372	376	4.59	35	82
2029	163	5,158	5,576	418	5.12	32	82
2030	167	5,335	5,798	947	5.71	29	166
Total	2,282	72,436	75,651	3,699	47	1,012	1,074

As mentioned above, the introduction of the EMS into Serbia is important and beneficial in its improvement of energy efficiency as well as the Serbian economy in the future.

15.6 Summary of Economic Evaluation

The effects of EMS introduction have been analyzed from 4 viewpoints, “Reduction of Energy Demand”, “Increase of Corporate Tax of the Government”, “Reduction of CO2 Emission”, and “National Economic Benefit and Cost”. This section summarizes the results of such analysis as follows.

15.6.1 Reduction of Energy Demand

The benefits after implementing EMS are the reduction of power consumption, final energy consumption and primary energy consumption. The energy consumption reductions are shown in the following table.

Table 15-31 Effects on Energy Consumption Reduction by Introduction of EMS

	Case	Unit	2010	2015	2020	2025	2030	30/10
Power Demand	Base	TWh	28.0	31.8	35.2	38.4	41.4	2.0%
	Reference	TWh	28.0	31.7	34.6	37.1	39.2	1.4%
	Effects	TWh	0	0.1	0.6	1.3	2.2	
Final Energy Demand	Base	Mil toe	9.9	11.2	12.3	13.3	14.2	1.8%
	Reference	Mil toe	9.9	11.1	12.1	12.8	13.3	1.5%
	Effects	Mil toe	0	0.1	0.2	0.5	0.9	
Primary Energy Demand	Base	Mil toe	16.1	18.1	18.3	18.6	19.4	1.0%
	Reference	Mil toe	16.1	18.0	17.8	17.6	17.8	0.5%
	Effects	Mil toe	0	0.1	0.5	1.0	1.6	

Note: The primary energies include power foreign trade balance.

15.6.2 Increase of Corporate Tax of the Government

It has been estimated that the increase of the Government tax revenue will be 220 million EUR between 2015 and 2030 with the EMS. For the estimation, there is an assumption that the designated companies have to pay a suitable corporate tax. According to the trial calculation, as the PBP is set at a maximum 5 years, the corporate tax will be covered by more profitable companies, even though there are unprofitable companies unable to pay the corporate tax. Furthermore, it is expected that incremental corporate tax revenue can be used for the wages of EMS staff, capital sources of EMS promotion and the energy efficiency improvements of governmental buildings.

Table 15-32 Effects on Increase of Corporate Tax of the Government

	Unit	2015	2020	2025	2030
Incremental Tax Revenue (at 2010 price)	Million EUR	1	9	18	28

Note: The primary energy values are discounted with 2.5 % discount rate to at 2010 price.

15.6.3 Reduction of CO2 Emissions

CO2 emissions reduction is one of international promises nowadays. Furthermore, it also is one of those hurdles that Serbia must overcome in order to be eligible to join the EU regime. According to the trial calculations, EMS can realize a 9 % decrease of CO2 emissions in 2030 when compared to the Base case as "Without EMS".

Table 15-33 Comparison of CO2 Emission (2015=1.00)

	2015	2020	2025	2030
Base Case	1.00	0.93	0.92	0.95
		▲7%	▲ 8%	▲ 5%
Reference Case	1.00	0.90	0.86	0.86
		▲10%	▲14%	▲14%
EMS Effects		▲ 3%	▲ 6%	▲ 9%

15.6.4 National Economic Benefit and Cost

Based on the assumption that the EMS is introduced from 2014, the benefits (amount of saved energy) is over the costs (incremental investment cost) after 2021. Furthermore, the IRR (Internal Rate of Return) is calculated at 12 % between 2014 and 2030 in the national economic analysis. In private companies, generally, final energy consumption is reduced via the EMS instead of primary energies. As the prices of the final energies usually are higher than primary energies, the IRR of the private companies from the EMS is higher than the IRR mentioned in the session.

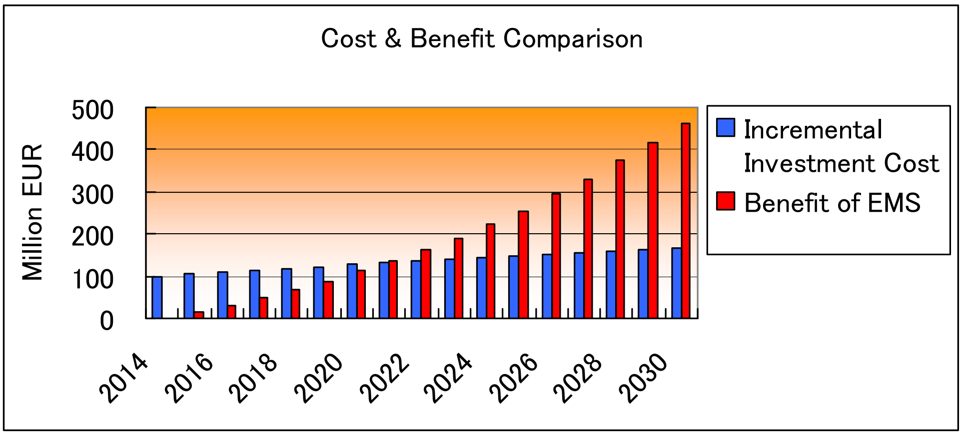


Figure 15-6 Cost and Benefit Trends

Chapter 16 Conclusion

This chapter describes the conclusion of the Study, focusing on the scheme design of Serbian the Energy Management System, economic evaluation and the action plan for implementation.

16.1 Overview of the Scheme

16.1.1 Implementation Structure

The following structure was proposed for the Serbian Energy Management System.

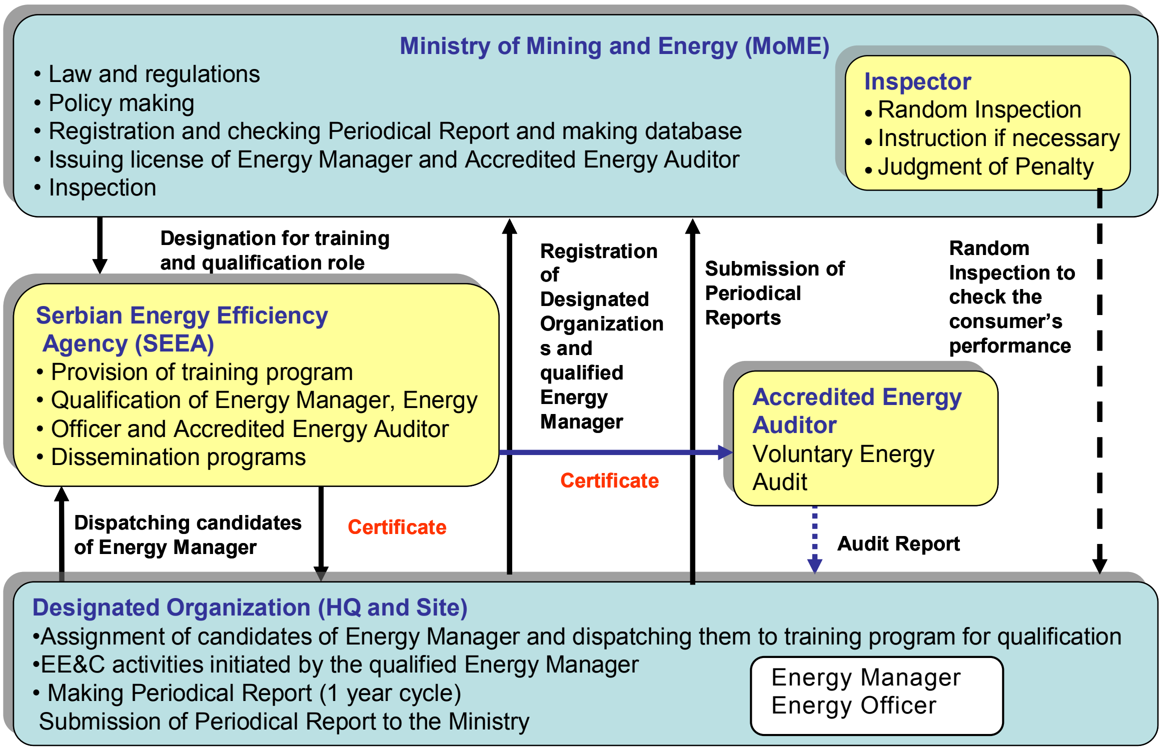


Figure 16-1 Implementation Structure of Serbian EMS

Roles of each player in the above structure are summarized as follows.

- MOME is responsible for law and regulations, monitoring of Periodical Reports including the database, inspection and issuing out the licenses for the Energy Manager and the Accredited Energy Auditor. An inspection is made by the MOME's Inspector.
- SEEA implements a National Examination or various Official Training Programs for the qualifications of Energy Manager, Energy Officer and Accredited Energy Auditor. Applicants who pass such a qualification system can obtain the Certificate from SEEA. SEEA is also a main player in the execution of dissemination programs to smoothly implement the Energy Management System.
- National license, Accredited Energy Auditor, can implement an appropriate energy audit in accordance with the purposes of the Energy Management System. An external energy

audit is conducted based on the self-judgment of the Designated Organization. Therefore, the Designated Organization can freely select a consultant from among Accredited Energy Auditors or non Accredited Energy Auditors. However, it is planned that clients must utilize the Accredited Energy Auditor when they use some incentive schemes prepared by the Government.

- A designated Organization must appoint a licensed Energy Manager and register with MOME. A registered Energy Manager is responsible to promote EE&C activities in the whole organization or site and to create a Periodical Report of the whole organization or site. All Periodical Reports are submitted from the HQ of the Designated Organization/Sites once a year to MOME.

16.1.2 Monitoring the Targets of the Energy Management System (Designated Organizations)

The monitoring targets of the Energy Management System are shown in the following table. Categories A-1 and A-2 are designated by both the threshold for the whole organization and a threshold for the site. The former calls the Designated Organization and the latter calls the Designated Site. All categories of B-1 and B-2 are designated minus any thresholds.

Table 16-1 Monitoring Targets of the Energy Management System

Category	Target Sectors	Threshold (Annual Energy Consumption)	Expected Facility or Business in the Category
A-1	Manufacturing and Mining Sector	2,500 toe	Factory, mining site, etc.
	Transformation Sector	2,500 toe	Plant of power, heat supply and oil refinery
A-2	Commercial Sector	1,000 toe	Office, commercial buildings, hospital, department store, etc. (other then Government or Municipality)
B-1	Municipality Buildings	All the Facilities (Not less than 20,000 residents)	Municipality offices
	Municipality Control Facilities *1		Municipality Control Facilities such as school, public facilities, district heat supply facilities public lighting, etc.
B-2	Central Government Buildings *1	All the Facilities	Central Government Buildings
	Central Government Control Facilities *1		Central Government Control Facilities such as hospital, school, etc.

*1: In case that a facility belonging to Municipality or Central Government has a certain amount of energy consumption, the facility takes the same methodology with A-1 or A-2 in energy management even in Municipality or Central Government Sector.

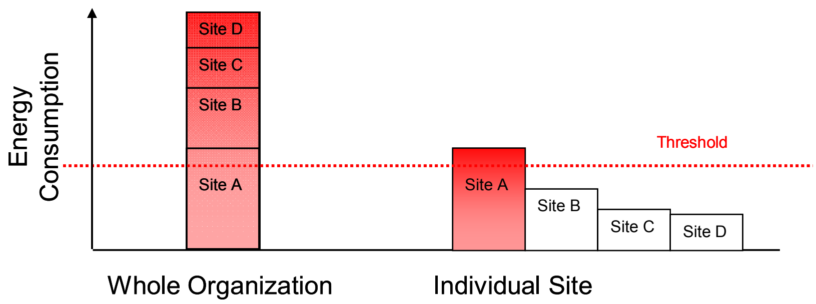


Figure 16-2 Image of Designation for Organizations and Sites (Red is Designated)

16.1.3 Roles of Qualified Persons

(1) Roles of Qualified Persons

Roles of qualified persons are summarized as follows.

Table 16-2 Roles of Qualified Persons

Status	Category	Roles
Energy Manager	HQ Energy Manager	- Promotion of EE&C activities in the whole organization (Designated Organization) - Having responsibility for creating the Periodical Report of the whole organization including sites
	Factory Energy Manager / Building Energy Manager	- Promotion of EE&C activities in the Designated Site - Having the responsibility for creating a Periodical Report of the site
Energy Officer	Energy Officer	- Support the activities for the outsourcing of the Energy Manager
Accredited Energy Auditor	Accredited Energy Auditor	- Conducting an Energy Audit based on the Audit Standards

(2) Assignment of Qualified Persons

The Energy Management System requires the following qualified persons. In the case that the Energy Manager is outsourced, an Energy Officer must assign and station in the organization or site.

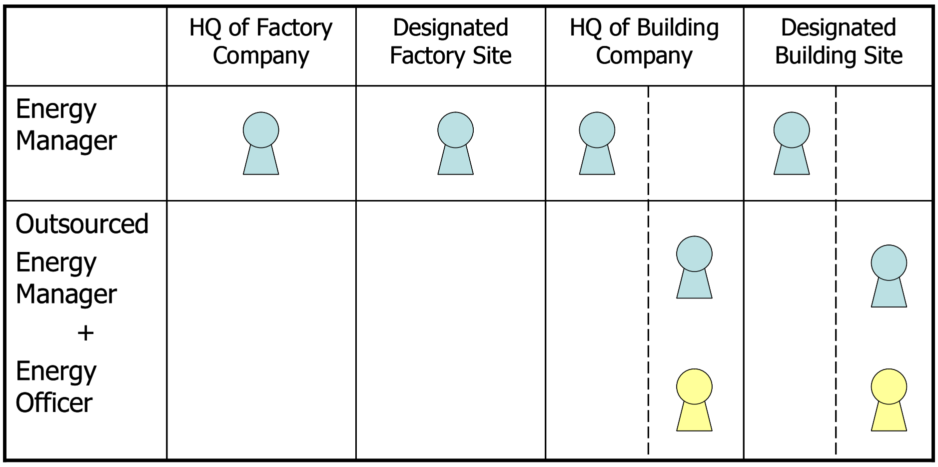
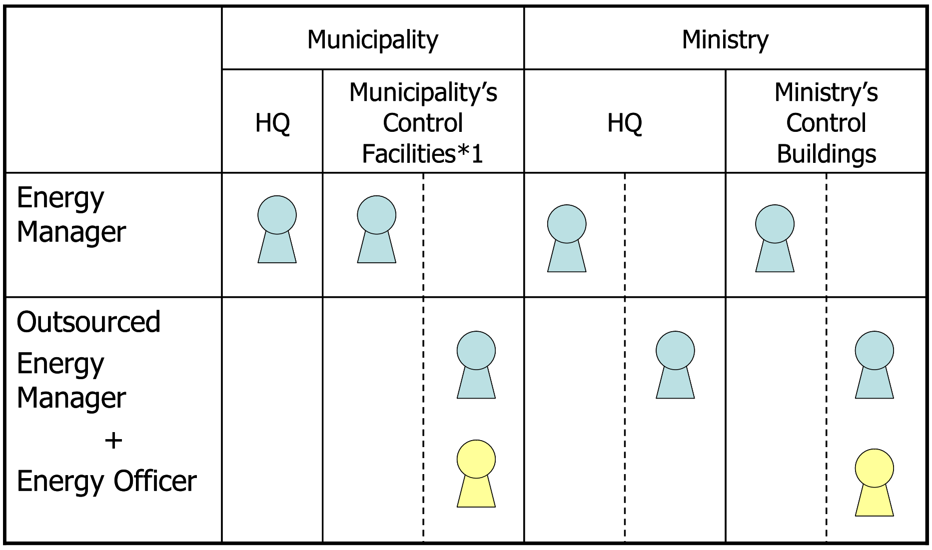


Figure 16-3 Assignment of Qualified Persons (1/2)



*1: Heat supply plant under the control of Municipality is categorized into Factory.

Figure 16-4 Assignment of Qualified Persons (2/2)

16.1.4 Official Qualification System

The following figure is an overview of the Official Qualification System for Energy Manager, Accredited Energy Auditor and Energy Officer.

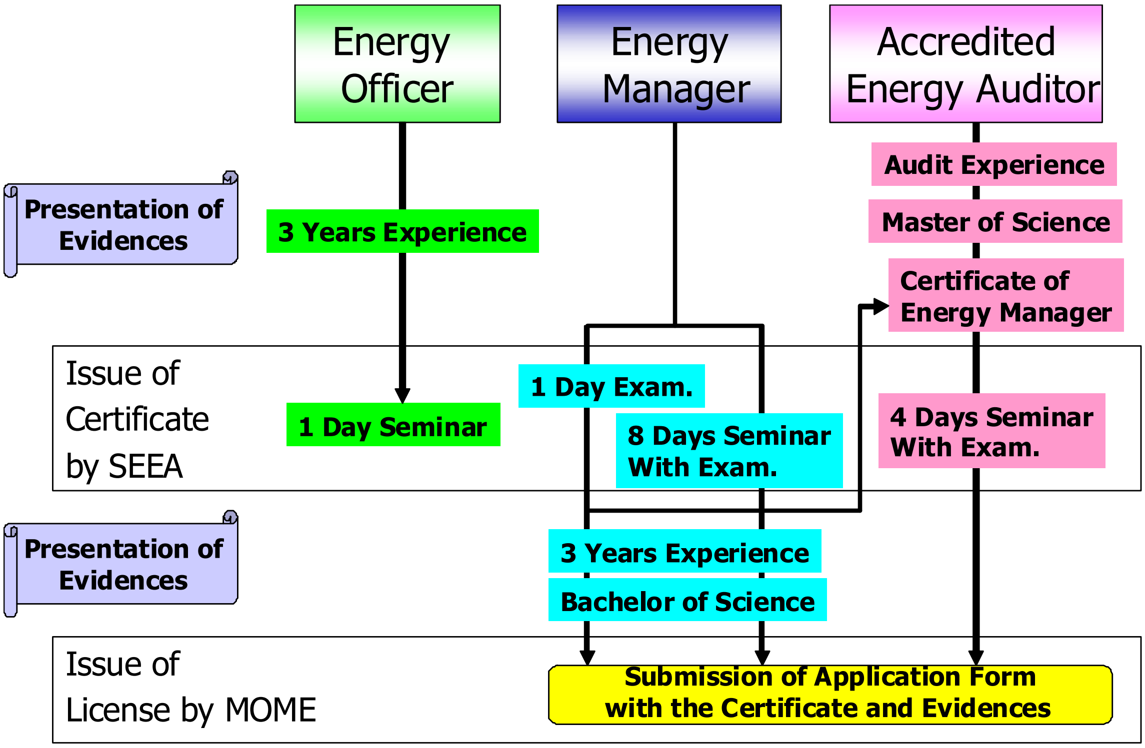


Figure 16-5 Overview of the Official Qualification System

- Qualification for qualified persons is jointly conducted by MOME and SEEA. SEEA conducts the National Examination and Official Training Programs and issues out the Certificates for the persons who pass the National Examination or Official Training Programs.
- Applicants who have the Certificate can apply to request the issuing out of a license to MOME. MOME issues the license after confirming the veracity of the document.
- Only the licenses for the Energy Manager and the Accredited Energy Auditor are issued out. An Energy Officer who has the Certificate is regarded as on official status (he or she does not need to apply for the license).
- Other than the Certificate, a Minimum Requirement is also necessary to check the eligibility for Energy Manager, Accredited Energy Auditor and Energy Officer. An accredited Energy Auditor and Energy Officer require the Minimum Requirement before taking the National Examination / Official Training Programs. However, only the Energy Manager presents evidence of the Minimum Requirement at the same time that applicants apply for the license to MOME.

16.2 Economic Evaluation

It is assumed that the Energy Management System (EMS) will start from 2014 and its effectiveness becomes available from 2015. The Study adopts the moderate scenario with the introduction of the EMS, that is the "Reference Case", The Reference Case expects to achieve a 20 % improvement of energy intensity (energy per GDP) from 2015 to 2030 together with the EMS and other "business as usual" measures.

The effects of the Energy Management System are defined as the difference in values between the Reference Case (With EMS)" and the Base Case (Without EMS)." The Study evaluates the following viewpoints, "Reduction of Energy Demand", "Increase of Corporate Tax of the Government", "Reduction of CO2 Emissions", and "National Economic Benefit and Cost". All the viewpoints indicate that the effects of the EMS bring considerably high benefits in terms of the economy and environment in Serbia.

Effects on Reduction of Energy Demand

- 2.2 TWh (5.3 %) can be reduced by 2030 in the power resources from the Base Case
- 1.6 million toe (8.4 %) can be reduced by 2030 in the primary energy from the Base Case
- If these reduction effects changes to the monetary values in 2010 (present value), it is equivalent to 2,194 million Euro.

Effects on Increase of Corporate Tax of the Government

- Private companies increase their benefits via the cost reduction of energy. It brings an increase of Corporate Tax levied by the Government. The effects of the tax increase are estimated to be at about 9 million Euro by 2020 and 28 million Euro by 2030.

Effects on Reduction of CO2 Emission

- When the emission volume of 2015 represents "1.00", the emission volume in 2030 will be "0.95" in the Base Case and "0.86" in the Reference Case. The effects on the reduction of CO2 by the EMS are equivalent to 9 % compared with the volume of 2015.

Effects on National Economic Benefits and Costs

- National economic cost is defined as an incremental investment cost paid by consumers for EE&C to achieve the Reference Case. On the other hand, the national economic benefit is defined as national energy saving values.
- When the EMS starts from 2014 (effective from 2015) and considers the project period by 2030, the Internal Rate of Return (IRR) of the national economy is indicated at 12 %.
- Energy saving values has accumulated from 2015. The monetary effects of energy saving (differential monetary values between the Reference Case and the Base Case) are estimated to exceed the incremental investment cost for EE&C in 2011.

16.3 Overall Schedule and Action Plan

16.3.1 Overall Schedule

In considering a period of preparation for the law and regulations by MOME, the JICA Study Team proposed the overall schedule as follows.

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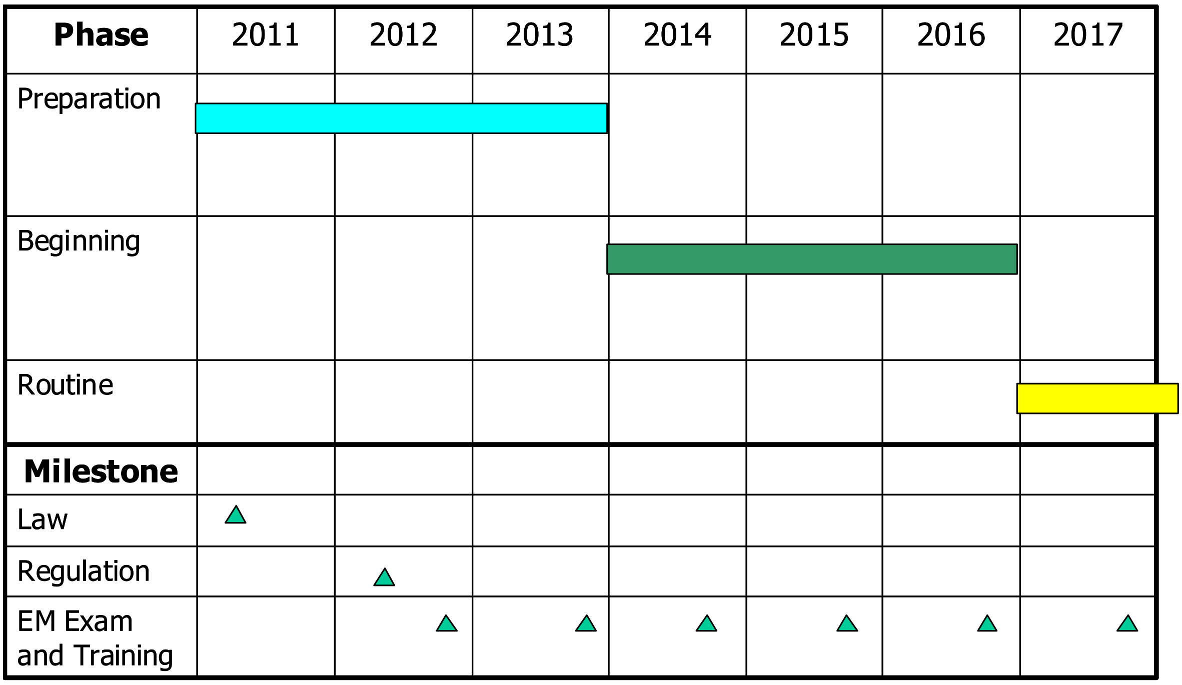

Figure 16-6 Overall Schedule (tentative)

The Serbian Energy Management System will cover the whole organization in the Designated Organization in the final stages. However, it seems difficult to collect all the data of the whole organization from the first. It has been proposed that the Beginning Period “Energy Management within Designated Site” will be started to a establish data collection system from within the site. Even in this case, a Periodical Report (compiling the data of Designated Site) has been submitted from the HQ of the organization.

16.3.2 Action Plan

The following action plan in each phase is proposed for MOME and SEEA. The Study conducted the scheme design of the Energy Management System. After the Study, the establishment of the law and regulations based on the scheme design, preparation of the operation manual, preparation of the training curriculum (including Hands-on Facility), establishment of the database, etc. are expected and these tasks should be completed within the Preparation Period.

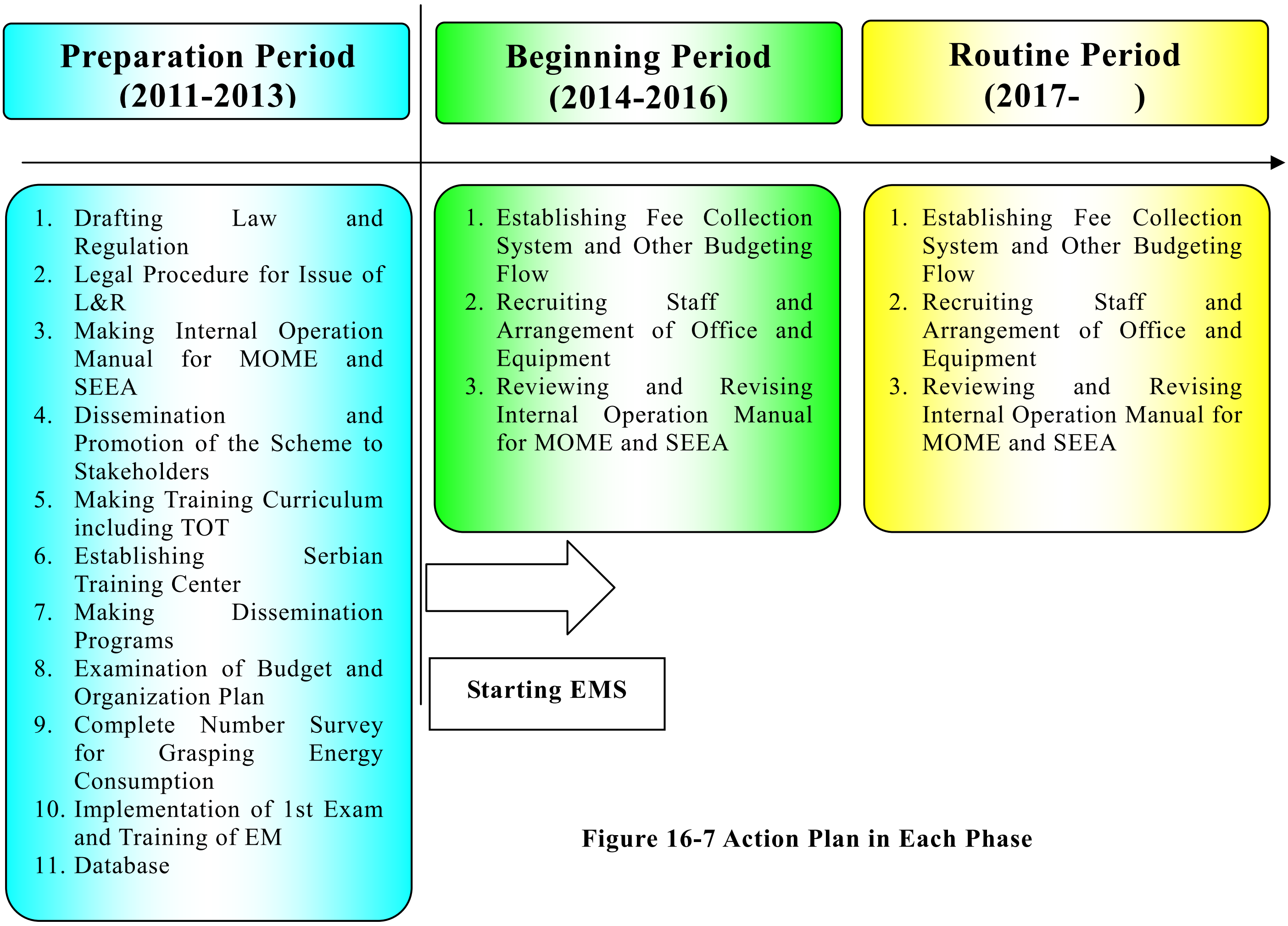

Figure 16-7 Action Plan in Each Phase

16.3.3 Direction for Foreign Assistance

The Preparation Period (2011-2013) is set before starting the Energy Management System. However, it seems difficult for MOME and SEEA (current staff) to prepare all the necessary items, due to budget and human resource limitations.

The JICA Study Team raised three important items to be prepared by foreign consultants through external assistance such as foreign donors' assistance because these items are those fields where foreign consultants have enough knowledge and they can assist in these items effectively.

- Creating a Training Curriculum including the Training of Trainers (TOT)
- Establishing a Training Center having Hands-on Facilities
- Conducting a Complete Number Survey for Grasping Energy Consumption for Designated Organization and Sites