

**Ministry of Infrastructure and Energy of the Republic of Serbia**

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

**Summary**

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**Japan International Cooperation Agency (JICA)**

**Tokyo Electric Power Company (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 für 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 für 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

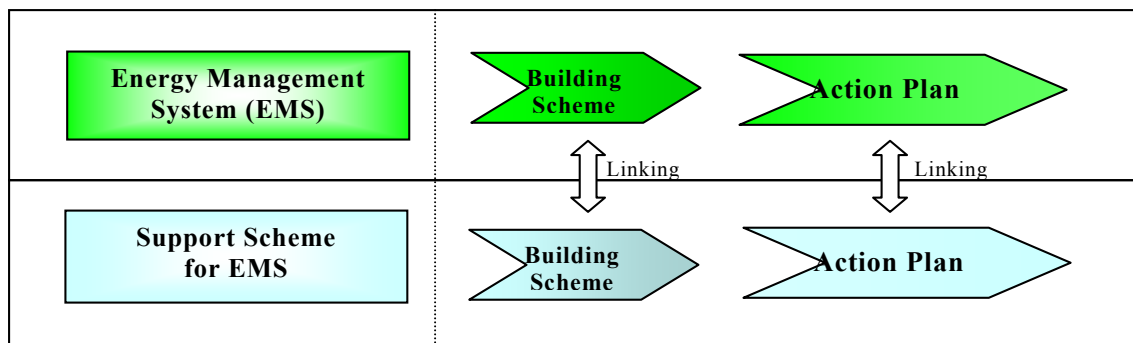
- Schematic Design (Implementation structure, roles and tasks, database, etc.)
- Energy Manager Qualification System
- Energy Manager Training System
- Required Law and Regulations

#### 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 Implementation Plan of the Study

### 1.4.1 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.

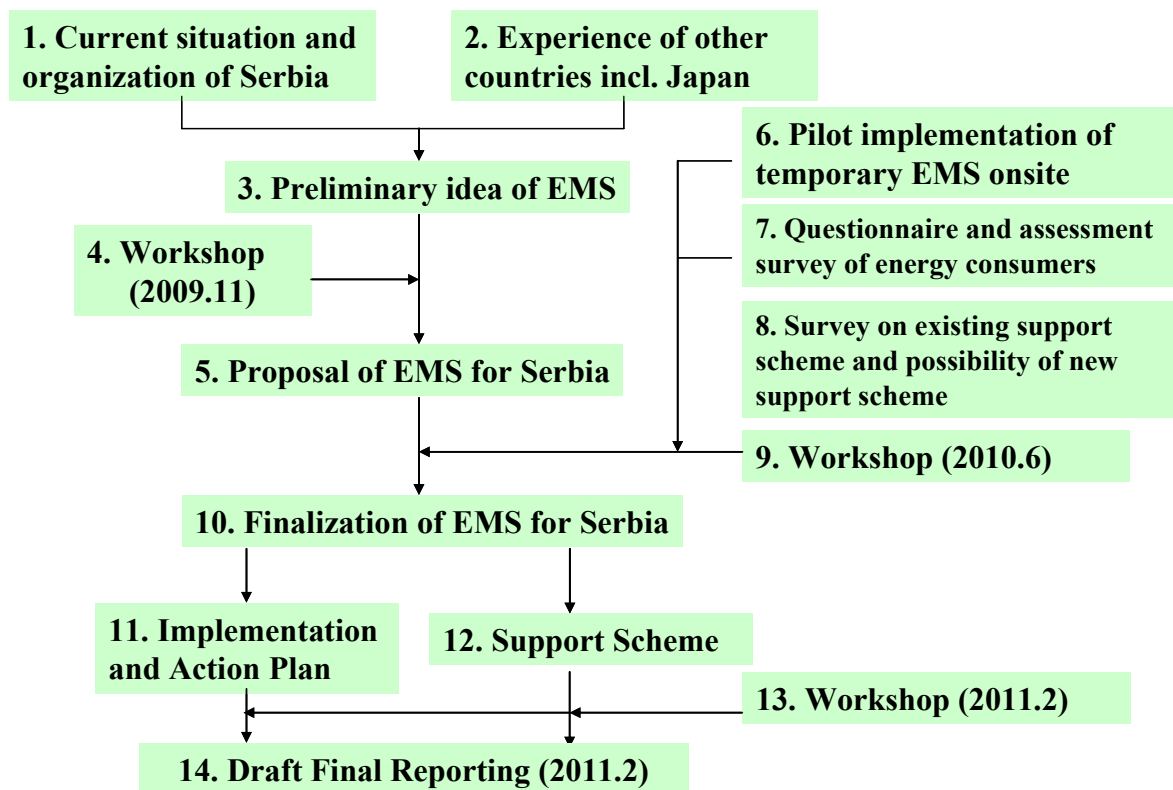


Figure 1-2 Flowchart of the Study

## 1.4.2 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 1-1 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)	<ul style="list-style-type: none"> <li>■ To grasp the local technology level of sites and confirm the availability of data to be reported</li> </ul>	<ul style="list-style-type: none"> <li>■ INNOVATION CENTER, FACULTY OF MECHANICAL ENGINEERING, Serbian Industrial Energy Efficiency Network</li> <li>■ FACULTY OF MECHANICAL ENGINEERING, Regional Euro Energy Efficiency Center, University of Kragujevac</li> </ul>
(2) Initial energy assessment	<ul style="list-style-type: none"> <li>■ To identify EE&amp;C potential in the energy consuming sectors and applicable EE&amp;C technology regarding heat and electricity</li> <li>■ To consider the implementation capacity of the Energy Management System and others</li> </ul>	<ul style="list-style-type: none"> <li>■ INNOVATION CENTER, FACULTY OF MECHANICAL ENGINEERING, Serbian Industrial Energy Efficiency Network</li> <li>■ FACULTY OF MECHANICAL ENGINEERING, Regional Euro Energy Efficiency Center, University of Kragujevac</li> </ul>
(3) Advisory work for the creation of Evaluation Criteria	<ul style="list-style-type: none"> <li>■ To formulate an Advisory Committee</li> <li>■ To facilitate discussion in the Advisory Committee</li> <li>■ To summarize the discussion</li> </ul>	<ul style="list-style-type: none"> <li>■ ENCOTECH d.o.o.</li> </ul>
(4) Advisory work for the creation of Audit Standards	<ul style="list-style-type: none"> <li>■ To make comments on proposals from the JICA Study Team and create countermeasures if any</li> </ul>	<ul style="list-style-type: none"> <li>■ ENCOTECH d.o.o.</li> </ul>

## Chapter 2 Questionnaire and Energy Audit Survey

### 2.1 Overview and Results of Questionnaire Survey

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 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

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.

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.

## 2.2 Overview and Results of Energy Audit Survey

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 and the next table shows the results;

- 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

**Table 2-1 Energy Saving Potential of the Sites of Energy Audit**

Industrial sector					
	Sub-sector	Final Energy Consumption (toe)	Energy Saving Potential		Pay Back Period (years)
			(toe)	(%)	
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 envelopes (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.

## Chapter 3 Pilot Implementation of Energy Management System

### 3.1 Overview

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.

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.

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)

### 3.2 Results

#### 3.2.1 Training Program (Component 1)

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)

### 3.2.2 EE&C Study (Component 2)

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

#### (1) Study Results (Factory A)

The EE&C potential is shown in the following table. Assuming the all eight items which were proposed and agreed 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 3-1 EE&C Potential of the Selected 8 Items**

Utility	Annual Utility Consumption ton or kWh	Quantity of Reduction ton or kWh	Factor of Intervene	Corrected Quantity of Reduction ton or kWh	Rate of Reduction %	Reduction of Utility Cost €	Investment €	Payback Period y	Remarks
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: 43.544 GJ/ton
	32,358 MWh	4,134 MWh		3,721 MWh					

#### (2) Study Results (Hospital B)

The site could not judge the adoption of the measures, because the Ministry of Health is in charge of planning investment.

The EE&C potential of the five items (excluding some items) is shown below. Assuming that all the five items are achieved, these are expected to yield an 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 3-2 EE&C Potential of the Selected 5 Items**

Utility	Annual Utility Consumption	Quantity of Reduction	Factor of Intervention	Corrected Quantity of Reduction	Rate of Reduction	Reduction of Utility Cost	Investment		Payback Period	Remarks
	Sm <sup>3</sup> or kWh	Sm <sup>3</sup> or kWh		Sm <sup>3</sup> or kWh	%	SDR	SDR	y		
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: 34.058 MJ/Sm <sup>3</sup>
	7,544 MWh	606 MWh	-	606 MWh						

### 3.2.3 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) Feedback to Scheme Design

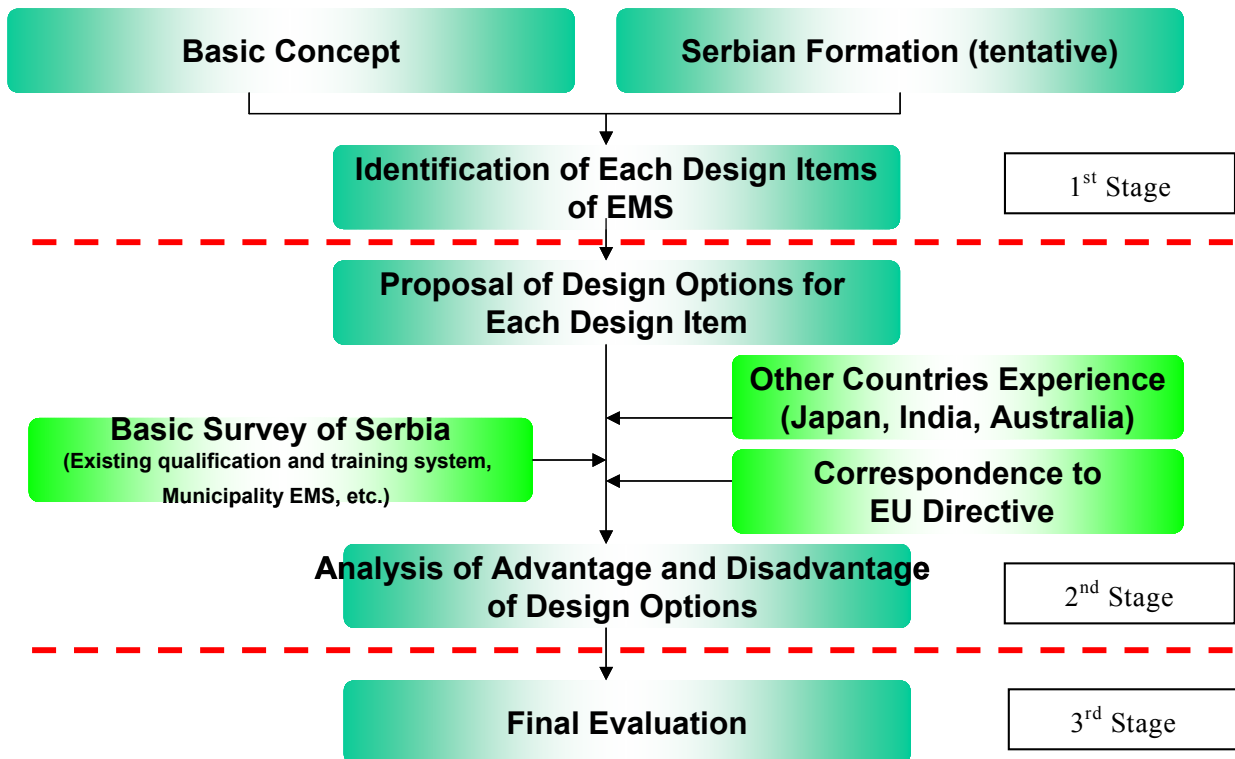
Through this pilot project, the following points can be induced;

- 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 4 Basic Policy for Scheme Design

### 4.1 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 4-1 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.

<b>1<sup>st</sup> Stage</b>	Making a consensus of the basic concept of EMS, formation and design items of EMS
<b>2<sup>nd</sup> Stage</b>	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
<b>3<sup>rd</sup> Stage</b>	Final evaluation of each design item

### 4.2 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.

#### 4.2.1 Existing Relating System of Serbia

##### (1) Municipality Energy Management System (MEMS)

###### (a) Overview

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.

###### (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

##### (2) Database (DB) System

Three existing systems are shown 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.

### (3) Current 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

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 not directly affect the security and health of human beings, the resulting conviction penalties are considerably lighter.

### (4) Training System

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.

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.

#### 4.2.2 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.

### 4.3 Energy Consumption Analysis of Serbia

#### 4.3.1 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.

#### 4.3.2 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.

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 4-1 Example of the List of Organizations for Setting Thresholds

Entities	NO.	Power use MWh	Final En. toe	Primary En. toe	ACC toe	Shares %
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
<b>WR803</b>	<b>1362</b>	<b>137</b>	<b>14</b>	<b>37</b>	<b>242,665</b>	<b>80.0</b>
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 5 Basic Design of Energy Management System

### 5.1 Abstract of Discussion Points for Scheme Design

#### 5.1.1 Selection of Design Items

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

**Table 5-1 Design Items**

Category	Design Items
1. Designation of Energy and Consumers	<ul style="list-style-type: none"> <li>• Target Sector</li> <li>• Target Energy</li> <li>• Threshold of Designated Organizations</li> <li>• Boundaries to be Designated</li> </ul>
2. Implementation Formation	<ul style="list-style-type: none"> <li>• Roles of MOME and SEEA</li> <li>• Necessity of Outsourcing on Monitoring and Checking Tasks</li> <li>• Judgment Flow of Poor Management</li> <li>• Annual Schedule and Task Allocation</li> </ul>
3. Status of Energy Manager and Accredited Energy Auditor	<ul style="list-style-type: none"> <li>• Qualification Methods for Energy Manager, Energy Officer, Accredited Energy Auditor</li> <li>• Energy Manager's Duty and Status</li> <li>• Status and Duties of Energy Officer, Accredited Energy Auditor, and Inspector</li> <li>• Assignment of Energy Manager and Energy Officer</li> </ul>
4. EE&C Activities within the Unit	<ul style="list-style-type: none"> <li>• Evaluation Criteria (Guideline) and Management Standards</li> </ul>
5. Periodical Report	<ul style="list-style-type: none"> <li>• Contents of Periodical Report</li> <li>• Collection Method of Periodical Report</li> </ul>
6. Monitoring and Check	<ul style="list-style-type: none"> <li>• Introduction of Numerical Targets its Status</li> <li>• Evaluation Method for Periodical Report</li> <li>• Evaluation Method for External Energy Audit</li> <li>• Utilization of Obtained Data (Benchmark)</li> </ul>
7. Inspection and Penalty	<ul style="list-style-type: none"> <li>• Inspection Method and Evaluation</li> <li>• Penalties and Methods</li> </ul>
8. Dissemination	<ul style="list-style-type: none"> <li>• Dissemination Programs and Expected Contents</li> <li>• Implementation Method for Dissemination Programs</li> </ul>

#### 5.1.2 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 5-2 Priority of Design Items**

<b>Priority S</b>	<b>Priority A</b>	<b>Priority B</b>	<b>Priority C</b>
<ul style="list-style-type: none"> <li>■ Roles of MOME and SEEA</li> <li>■ Necessity of Outsourcing on Monitoring and Checking Tasks</li> <li>■ Judgment Flow of Poor Management</li> </ul>	<ul style="list-style-type: none"> <li>■ Target Sector</li> <li>■ Target Energy</li> <li>■ Threshold of Designated Organizations</li> <li>■ Boundaries to be Designated</li> <li>■ Annual Schedule and Task Allocation</li> <li>■ Qualification Methods for Energy Manager, Energy Officer, Accredited Energy Auditor</li> <li>■ Tasks of Accredited Energy Auditor</li> <li>■ Evaluation Criteria (Guideline) and Management Standards</li> <li>■ Contents of Periodical Report</li> <li>■ Introduction of Numerical Targets and its Status</li> <li>■ Utilization of Obtained Data (Benchmark)</li> <li>■ Assignment of Energy Manager and Energy Officer</li> </ul>	<ul style="list-style-type: none"> <li>■ Status and Duties of Energy Manager</li> <li>■ Status and Duties of Energy Officer</li> <li>■ Status and Duties of Accredited Energy Auditor</li> <li>■ Status and Duties of Inspector</li> <li>■ Collection Method of Periodical Report</li> <li>■ Evaluation Method for Periodical Report</li> <li>■ Evaluation Method for External Energy Audit</li> <li>■ Inspection Method and Evaluation</li> <li>■ Penalties and Methods</li> </ul>	<ul style="list-style-type: none"> <li>■ Dissemination Programs and Expected Contents</li> <li>■ Implementation Method for Dissemination Programs</li> </ul>

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.

## 5.2 Basic Design

### 5.2.1 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

### 5.2.2 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) 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.

**Option 1: MOME is responsible for monitoring and inspection role**

**MOME:**

- Law and regulations
- Registration of Designated Organizations and Energy Manager
- Check and monitoring of Designated Organization
- Inspection

**SEEA:**

- Training and qualification authority
- Arranging training program and examination

**Option 2: SEEA is responsible for monitoring and inspection role**

- |  |
|--|
| <p><b><u>MOME:</u></b></p> <ul style="list-style-type: none"> <li>- Law and regulations</li> </ul>   |
| <p><b><u>SEEA:</u></b></p> <ul style="list-style-type: none"> <li>- Registration of Designated Organization and Energy Manager</li> <li>- Check and monitoring of Designated Organization</li> <li>- Inspection</li> <li>- Training and qualification authority</li> <li>- Arranging training program and examination</li> </ul> |

(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.

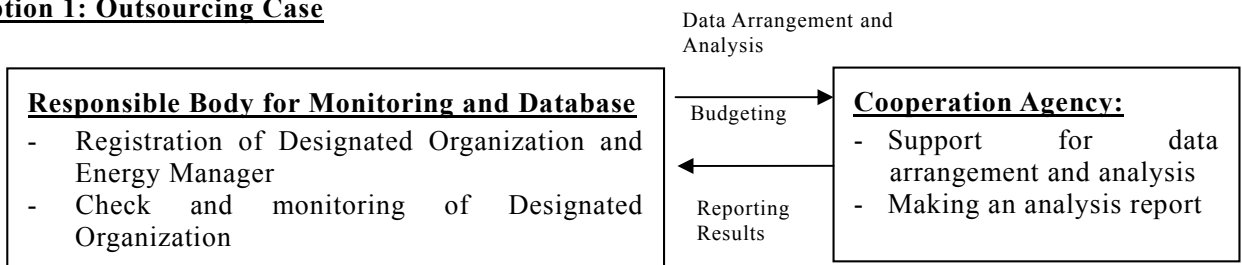
- To enforce to request and monitor the data form Designated Organizations, MOME seems to be suitable for such tasks.
- MOME, that is presently managing GIS-DB, should directly manage the nation-wide energy data as well, in terms of efficient administration.

(2) 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**



**Option 2: Non-Outsourcing Case**

- |   |
|---|
| <p><b><u>Responsible Body for Monitoring and Database</u></b></p> <ul style="list-style-type: none"> <li>- Registration of designated consumers and Energy Manager</li> <li>- Check and monitoring of designated consumers</li> <li>- Data arrangement and analysis</li> <li>- Making an analysis report</li> </ul> |
|---|

(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.

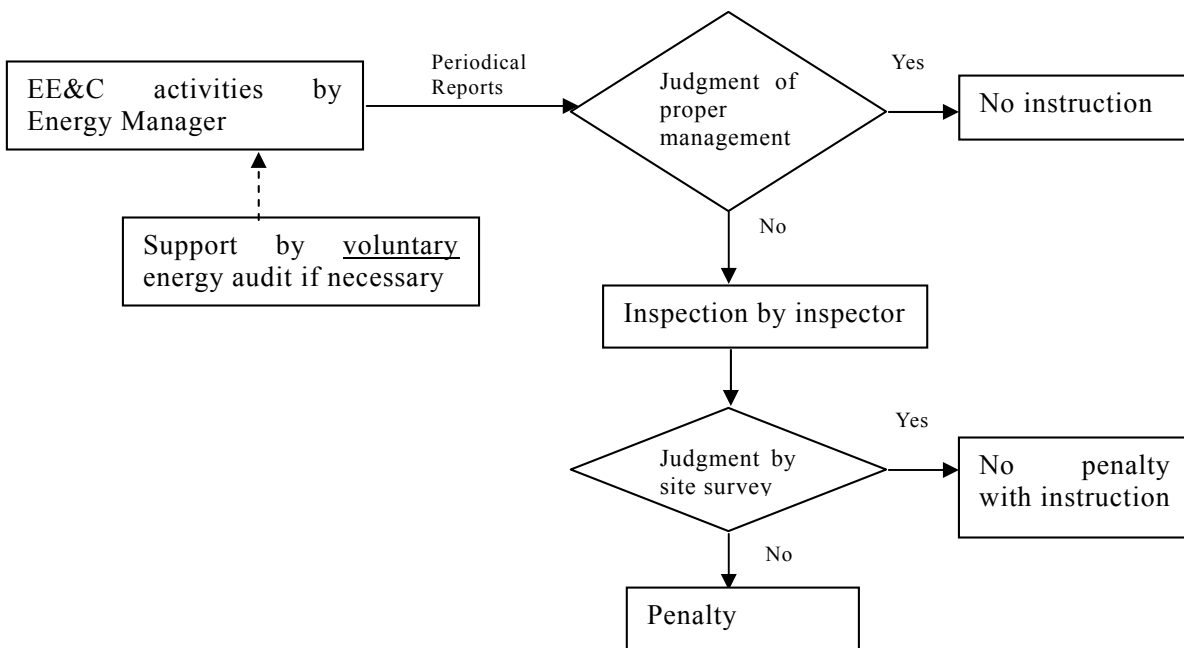
(3) S-3: Judgment Flow of Poor Management

(a) Study Options

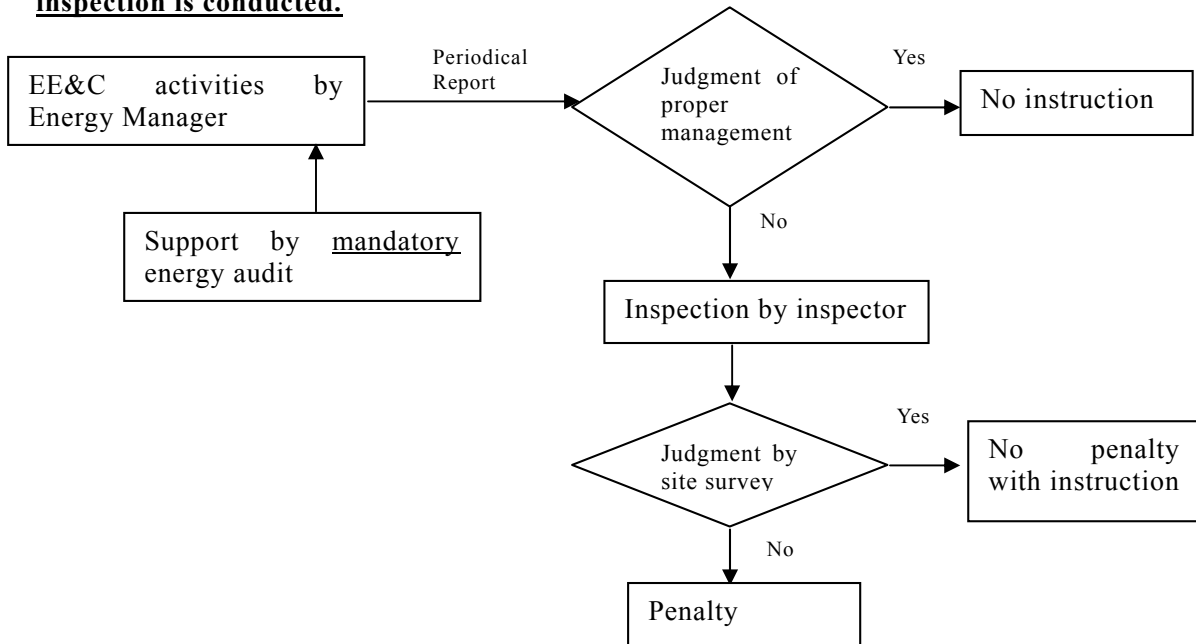
The following 3 options have been proposed as the flow of judgment to be adhered to in determining the existence of poor management practices:

- 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

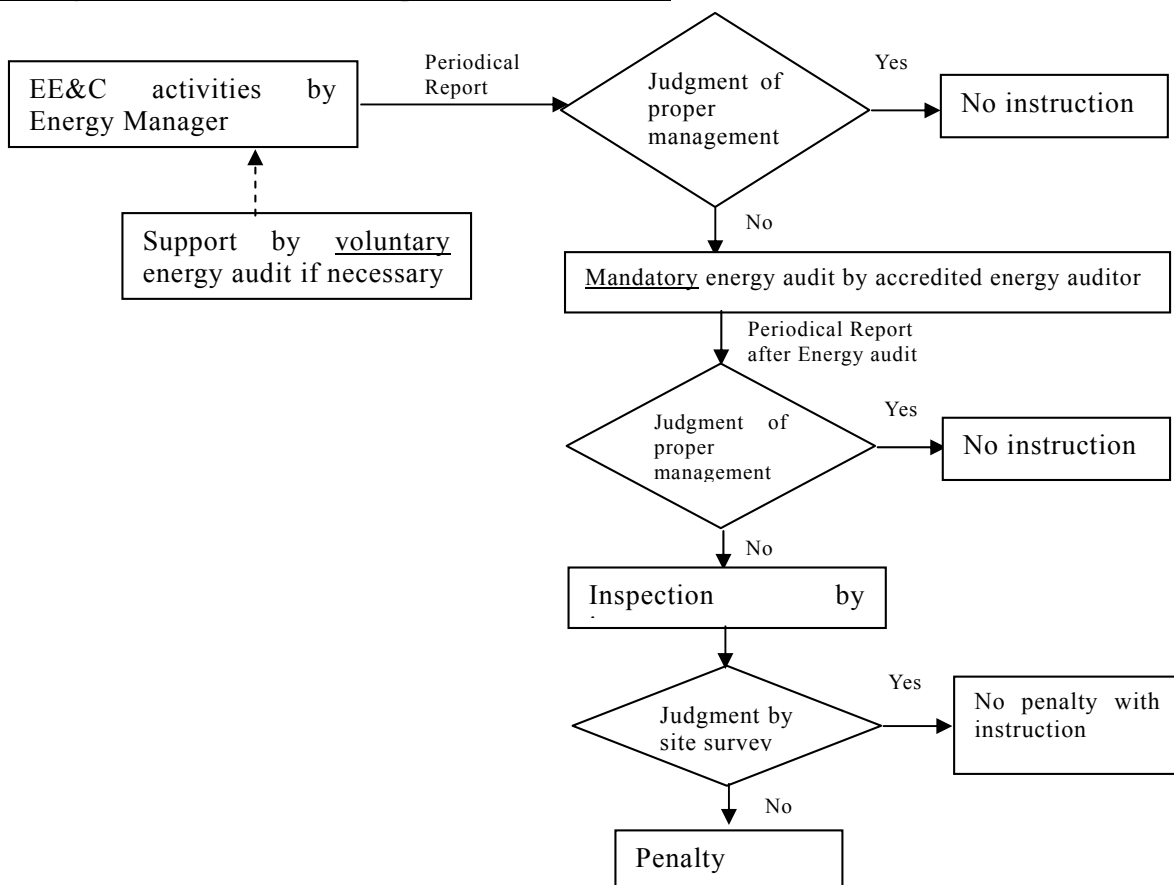
**Option 1: Voluntary energy audit is conducted if the Designated Organization needs. When poor management is found through Periodical Report, inspection is conducted.**



**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.**



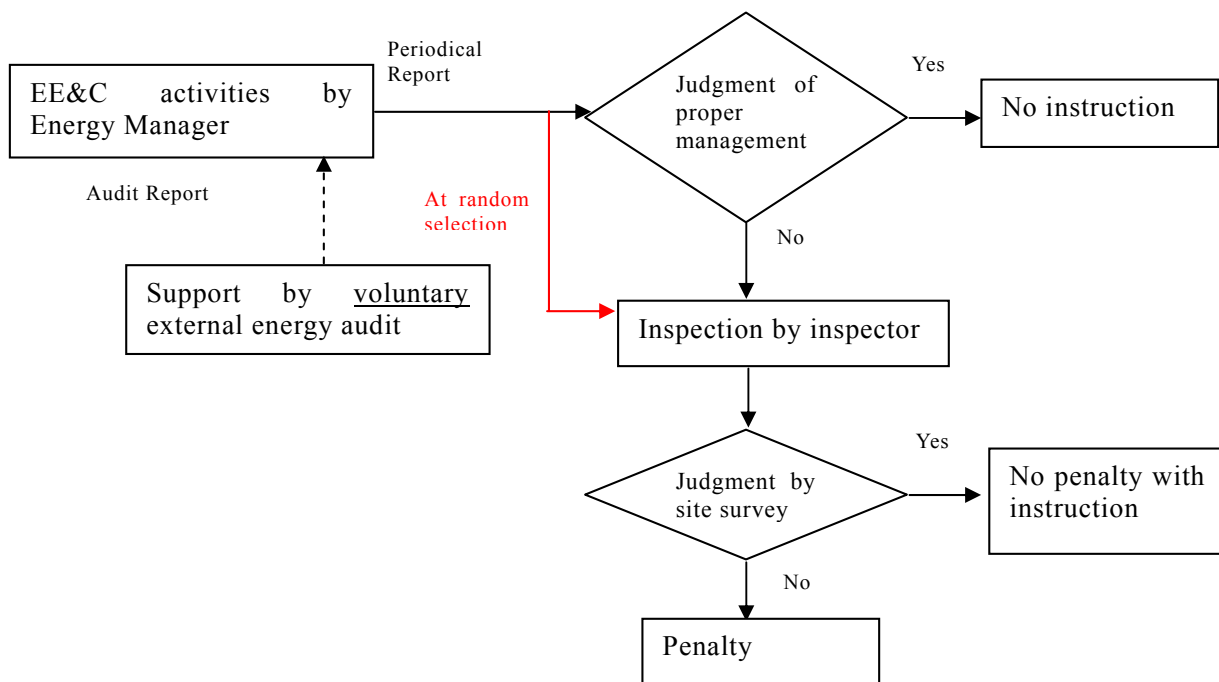
(b) Consultation Result

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.



### 5.2.3 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.

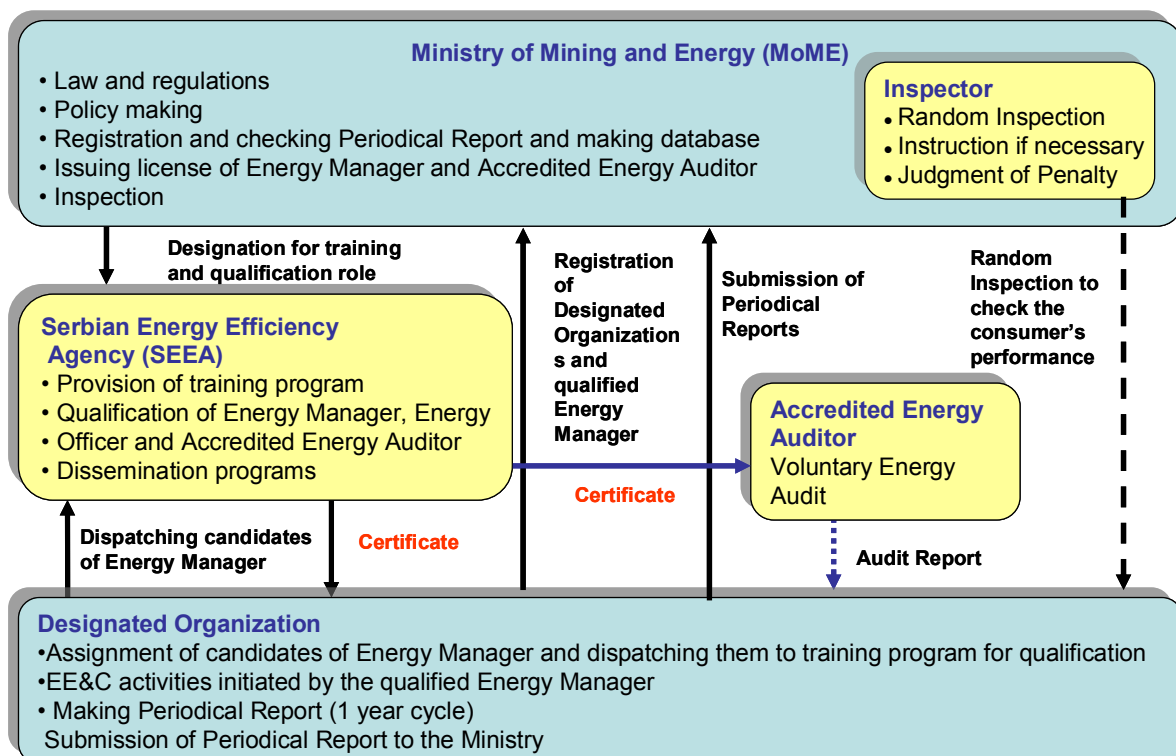


Figure 5-1 Implementation Formation for Serbian EMS (Tentative)

## Chapter 6 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.

### 6.1 Current Situation of the Energy Efficiency Fund

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.

**Table 6-1 Summary of Energy Efficiency Fund Concept**

Fund Source	Purpose
<ul style="list-style-type: none"> <li>■ 1 % of Electricity Tariff</li> <li>■ 0.5 % of Gas and liquid fuel energy consumption price</li> <li>■ A part of the donor’s grant and loan funds</li> </ul>	<p>Targeting corporations or individuals, their energy efficiency improvements and renewable energy usage promotion of industrial and municipality systems, such as the below projects:</p> <ul style="list-style-type: none"> <li>■ Support by financing the project and guarantee of finance, subsidies, and other grants funded, etc.</li> <li>■ 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</li> <li>■ Financial cooperation for research and development by the Ministry of Science and Environment<sup>1)</sup></li> </ul>

(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).

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.

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.

- Securing the financial source for the energy tariff
- Analysis on current situation based on updated information (examining donor funds, reflecting the result of the existing financial schemes and others)
- Drafting Special Law and Regulations on the Establishment of the EEF

## **6.2 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.

### **6.2.1 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 6-2 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	Residential	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:

#### 【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.

### 6.3 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.

#### 6.3.1 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.

### 6.3.2 New Scheme for Energy Efficiency (Long Term Vision)

Having examined the answers to the questionnaire submitted to participating enterprises, public entities, and consultants at the work shop of this study, the following items for which the majority of respondents claim the necessity were considered.

- Low interest rate loan
- Subsidy
- Tax incentives

#### (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:

- ✓ In the case of a low-interest rate loan: the estimation based on the conditions in the table shows that if the support scheme targets this scale of the project, 220 to 270 loans can be disbursed yearly.
- ✓ In the case of a subsidy: the estimation based on the conditions in the table shows that it is possible to provide subsidy 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 cases 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 6-3 Simulation of the Loan and Subsidy if the EEF as a Financial Source (Example)**

(1,000EUR)

Year	Year 1	Year 2	Year 3
<b>Revenue</b>	<b>31,614</b>	<b>35,396</b>	<b>39,155</b>
<b>Expenditure</b>			
<b>Loan</b> <sup>1)</sup>	22,130	24,777	27,409
<b>Subsidies</b> <sup>2)</sup>	3,090	3,600	3,850
for Energy Audit <sup>3)</sup>	90	100	100
for EE & RE project <sup>4)</sup>	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.

## ■ 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.
- MOMÉ 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. Other points should be further examined later depending on the scale of the financial sources and specific target entities and equipment.

**Table 6-4 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 Ministry 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.

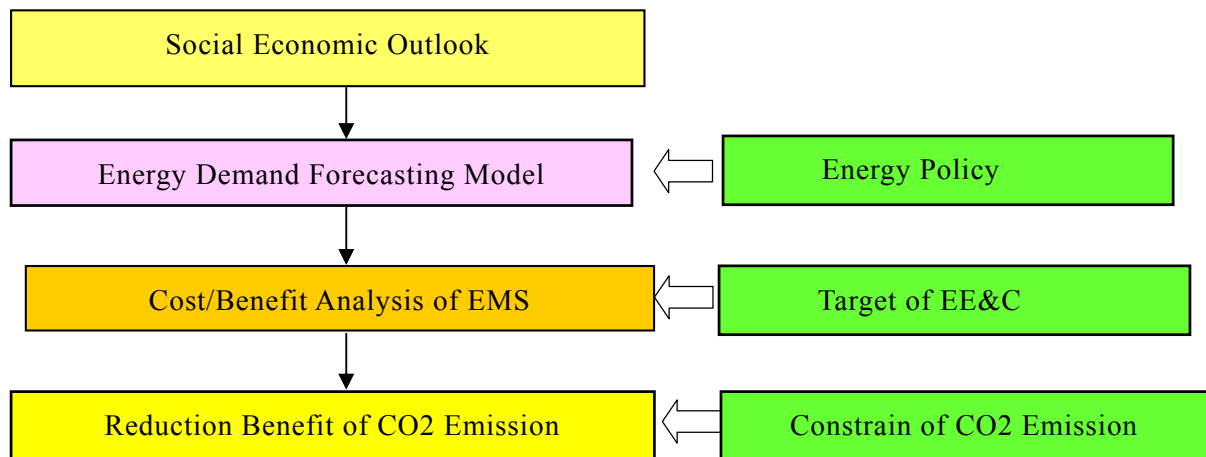
Furthermore, in the case of the reduction of income and property tax, it requires prudent consideration upon implementation. Operating under the premise that the reduction on those taxes will serve as an incentive to those enterprises, it is imperative that the financial management of the enterprises 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 considered, 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 7 Economic Evaluation

### 7.1 Methodology of the Evaluation

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 CO<sub>2</sub> 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.
- CO<sub>2</sub> reduction after introducing EMS should be estimated.



**Figure 7-1 Evaluation Methods of EMS**

### 7.2 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 CO<sub>2</sub> Emission”, and “National Economic Benefit and Cost”. This section summarizes the results of such analysis as follows.



### 7.2.1 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 7-1 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.

### 7.2.2 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 7-2 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.

### 7.2.3 Reduction of CO2 Emissions

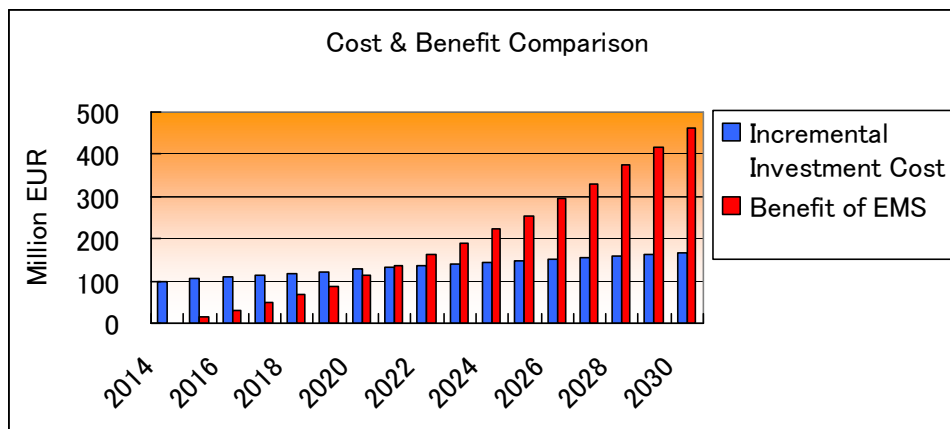
CO2 emissions reduction is one of international promises nowadays. Furthermore, it also is one of those hurdles that Serbia must overcome in order to be eligible to join the EU regime. According to the trial calculations, EMS can realize a 9 % decrease of CO2 emissions in 2030 when compared to the Base case as “Without EMS”.

**Table 7-3 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%

#### 7.2.4 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 7-2 Cost and Benefit Trends**

## Chapter 8 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.

### 8.1 Overview of the Scheme

#### 8.1.1 Implementation Structure

The following structure was proposed for the Serbian Energy Management System.

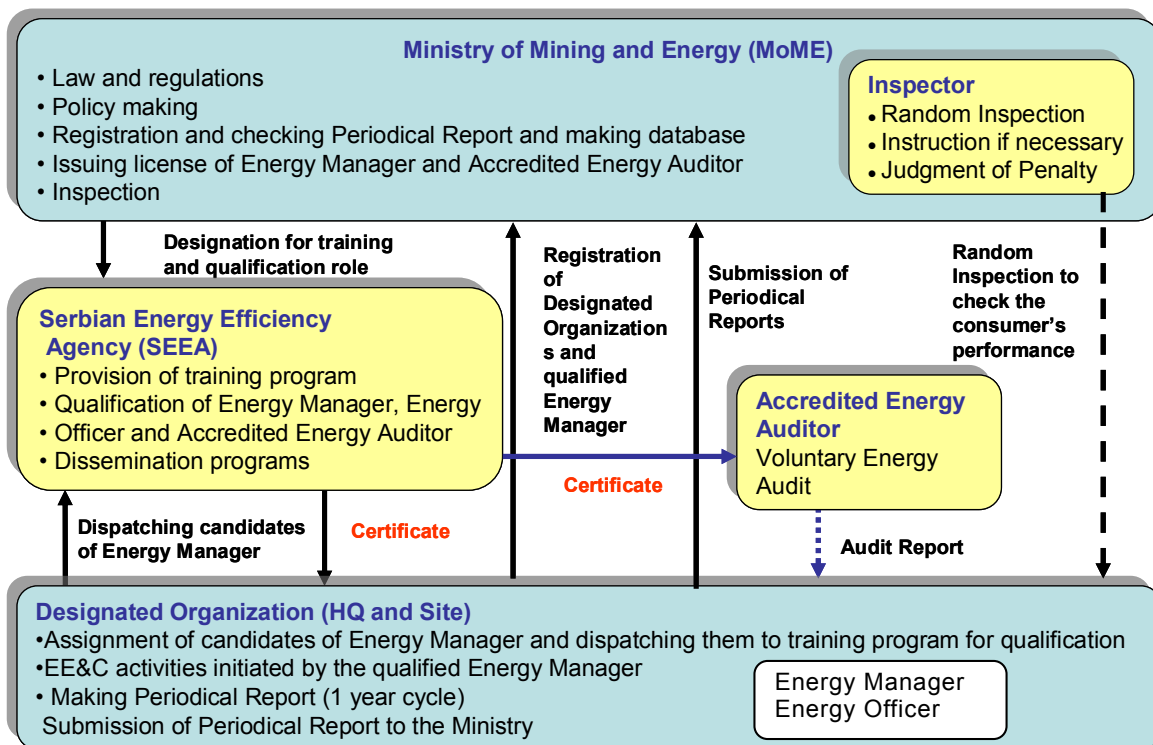


Figure 8-1 Implementation Structure of Serbian EMS

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 MOMÉ. 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 MOMÉ.

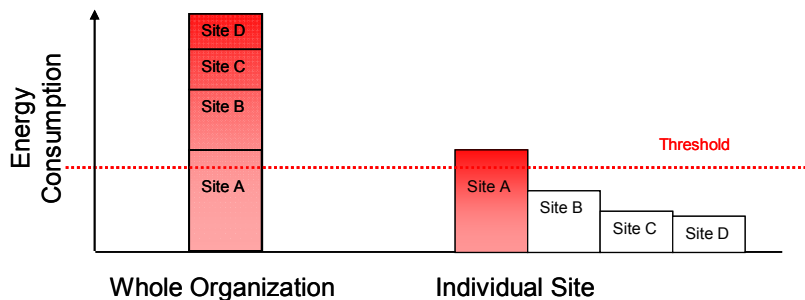
### 8.1.2 Monitoring the Targets of the Energy Management System (Designated Organizations)

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 8-1 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 than 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 8-2 Image of Designation for Organizations and Sites (Red is Designated)**

## 8.1.3 Roles of Qualified Persons

## (1) Roles of Qualified Persons









Roles of qualified persons are summarized as follows.

**Table 8-2 Roles of Qualified Persons**

Status	Category	Roles
Energy Manager	HQ Energy Manager	<ul style="list-style-type: none"> <li>- Promotion of EE&amp;C activities in the whole organization (Designated Organization)</li> <li>- Having responsibility for creating the Periodical Report of the whole organization including sites</li> </ul>
	Factory Energy Manager / Building Energy Manager	<ul style="list-style-type: none"> <li>- Promotion of EE&amp;C activities in the Designated Site</li> <li>- Having the responsibility for creating a Periodical Report of the site</li> </ul>
Energy Officer	Energy Officer	<ul style="list-style-type: none"> <li>- Support the activities for the outsourcing of the Energy Manager</li> </ul>
Accredited Energy Auditor	Accredited Energy Auditor	<ul style="list-style-type: none"> <li>- Conducting an Energy Audit based on the Audit Standards</li> </ul>

## (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.

	HQ of Factory Company	Designated Factory Site	HQ of Building Company	Designated Building Site
Energy Manager				
Outsourced Energy Manager + Energy Officer			 	 

**Figure 8-3 Assignment of Qualified Persons (1/2)**

	Municipality		Ministry	
	HQ	Municipality's Control Facilities*1	HQ	Ministry's Control Buildings
Energy Manager	👤	👤	👤	👤
Outsourced Energy Manager + Energy Officer		👤 👤	👤	👤 👤

\*1: Heat supply plant under the control of Municipality is categorized into Factory.

Figure 8-4 Assignment of Qualified Persons (2/2)

#### 8.1.4 Official Qualification System

The following figure is an overview of the Official Qualification System for Energy Manager, Accredited Energy Auditor and Energy Officer.

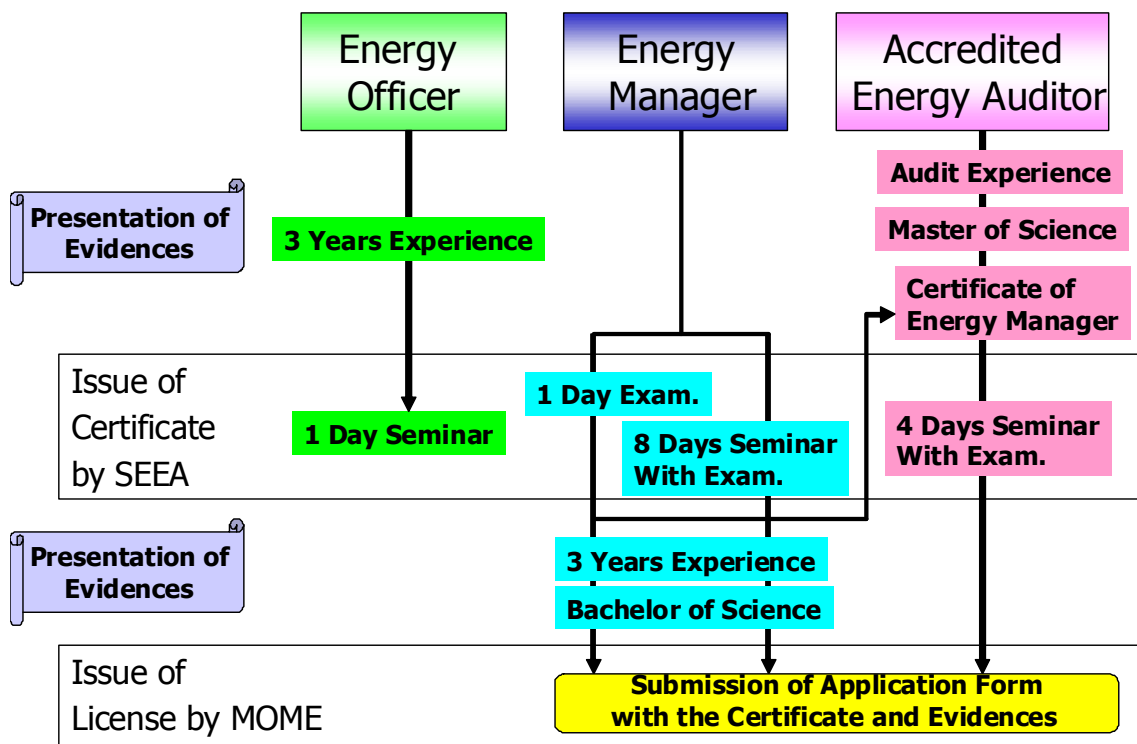


Figure 8-5 Overview of the Official Qualification System

- 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.

## 8.2 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 Euros.

### 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 Euros by 2020 and 28 million Euros 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.

**8.3 Overall Schedule and Action Plan**

8.3.1 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.

Phase	2011	2012	2013	2014	2015	2016	2017
Preparation	■						
Beginning				■			
Routine							■
<b>Milestone</b>							
Law	▲						
Regulation		▲					
EM Exam and Training		▲	▲	▲	▲	▲	▲

Figure 8-6 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.

### 8.3.2 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.

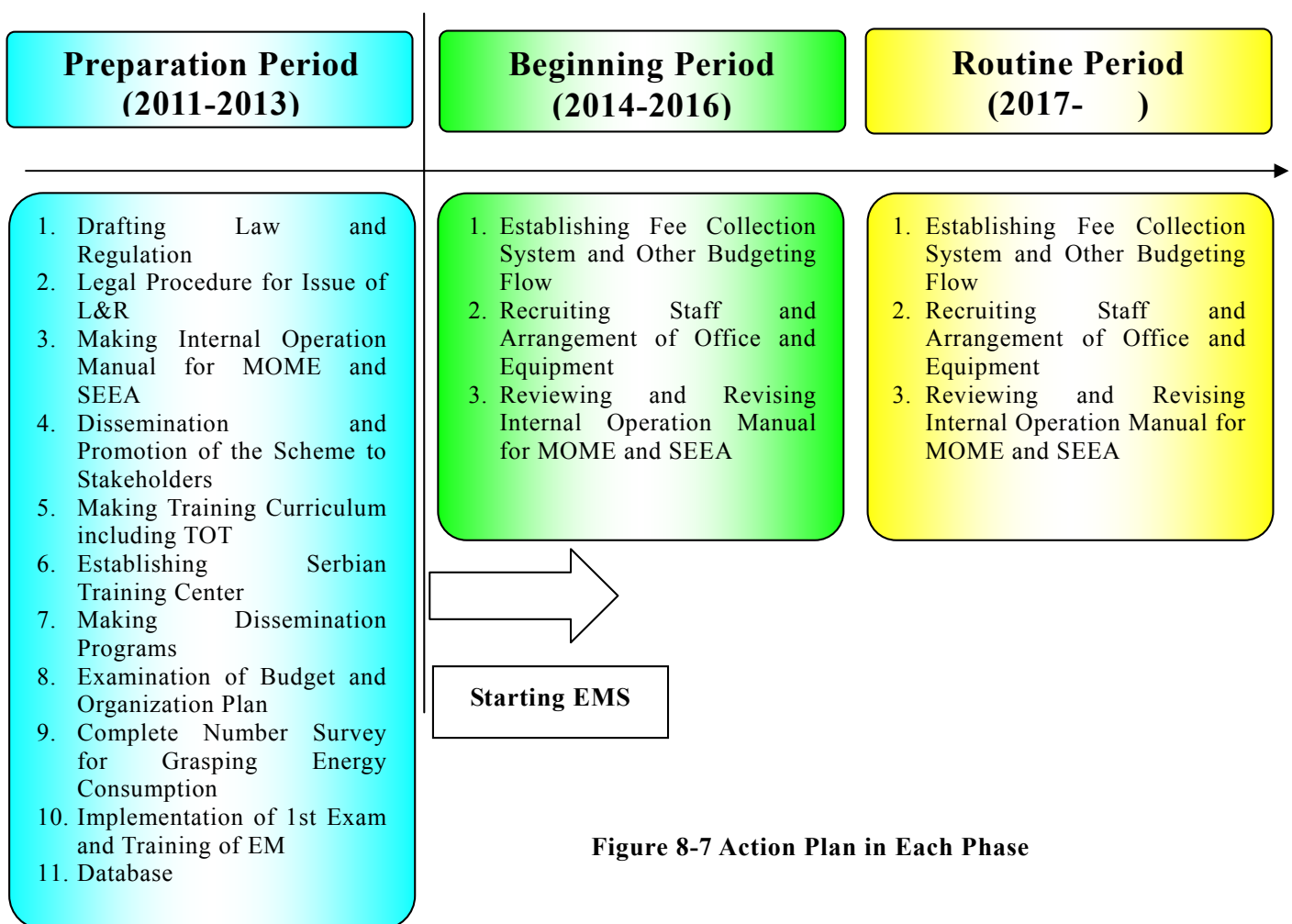


Figure 8-7 Action Plan in Each Phase

### 8.3.3 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