The Republic of Turkey

Ministry of Environment and Urbanization

Data Collection Survey on Efficient Energy Management of the Public Building in Turkey

Final Report

Summary

February 2013

Japan International Cooperation Agency

Electric Power Development Co., Ltd.

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13-004

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ABBREVIATION

AC	Air Conditioner
AFD	French Development Agency
APF	Annual Performance Factor
BEMS	Building Energy Management System
BEP	Regulation on Building Energy Performance
BEP-TR	Building Energy Performance – Turkish (Software name)
C/P	Counter Part
CASBEE	Comprehensive Assessment System for Built Environment Efficiency
CEC	Coefficient of Energy Consumption
COP	Co-efficient of Performance
DSI	General Directorate of State Hydraulic Works
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECCJ	Energy Conservation Center, Japan
ECTT	Energy Conservation Target Tool
EE	Energy Efficiency
EE&C	Energy Efficiency Improvement & Conservation
EECB	Energy Efficiency Coordination Board
EIE	General Directorate of Electrical Power Resources Survey and Development Administration (Elektrik Isleri Etüt Idaresi Genel Müdürlügü)
EMRA	Energy Market Regulatory Authority
En-Ver	Regulation on Efficiency Utilization of Energy Sources and Energy（Enerji Kaynaklarının ve Enerjinin Kullanımında Verimliliginin Arttırılmasına Dair Yonetmelik）
EPC	Energy Performance Certificate
ESCO	Energy Service Company
EU	European Union
EVD	Accredit Certification Energy Service Company (Enerji Verimliligi Danismanligi)
EVK	Law on Energy Efficiency（Enerji Verimlilig Kanunu）
GDP	Gross Domestic Product
GDRE	General Directorate of Renewable Energy
GEF	Global Environmental Facility
GIZ	German Agency for International Cooperation
GOT	Government of Turkey
HPC	High Planning Council
HVAC	Heating, Ventilating, and Air Conditioning
IEA	International Energy Agency
IFC	International Finance Corporation
ISO	International Organization for Standardization
IZODER	Association of Heat, water, Noise and Fire Isolators
JICA	Japan International Cooperation Agency
JPOWER	Electric Power Development Co., Ltd.
KfW	The German Development Bank
KOE	Kilogram of Oil Equivalent
KOSGEB	Small and Medium Industry Development Organization
LED	Light Emitting Diode
MENR	Ministry of Energy and Natural Resources

MMO	Chamber of Mechanical Engineer Center (CMEC)
MOD	Ministry of Development（former SPO (State Planning Organization)）
MOEU	Ministry of Environment and Urbanization
MOF	Ministry of Finance
MONE	Ministry of National Education
MOPWS	Ministry of Public Works and Settlement
MOSIT	Ministry of Science, Industry and Technology
MW	Megawatt
NECC	National Energy Conservation Center
NEDO	New Energy and Industrial Technology Development Organization
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
PAL	Perimeter Annual Load Factor
PDCA	Plan Do Check & Act
PM	Prime Ministry
PMU	Project Management Unit
PV	Photovoltaic
RE	Renewable Energy
SCOP	Seasonal Energy Efficiency Ratio (heating)
SEER	Seasonal Energy Efficiency Ratio (cooling)
SME	Small and Medium Size Enterprise
SPF	Seasonal Performance Factor
SPO	State Planning Organization
TA	Technical Assistance (Capacity Development)
TEDAS	Turkish Electricity Distribution Company
TEIAS	Turkish Electricity Transmission Company
TOE	Tonne of Oil Equivalent
TPES	Total Primary Energy Supply
TRY	Turkish Lieasi
TUBITAK (TÜBITAK)	Scientific and Technical Research Council of Turkey
UNDP	United Nations Development Programme
USD	United States Dollar
UT	Undersecretariat of Treasury
VRF	Variable Refrigerant Flow
ZEB	Zero Emission Building

Chapter 1

Introduction

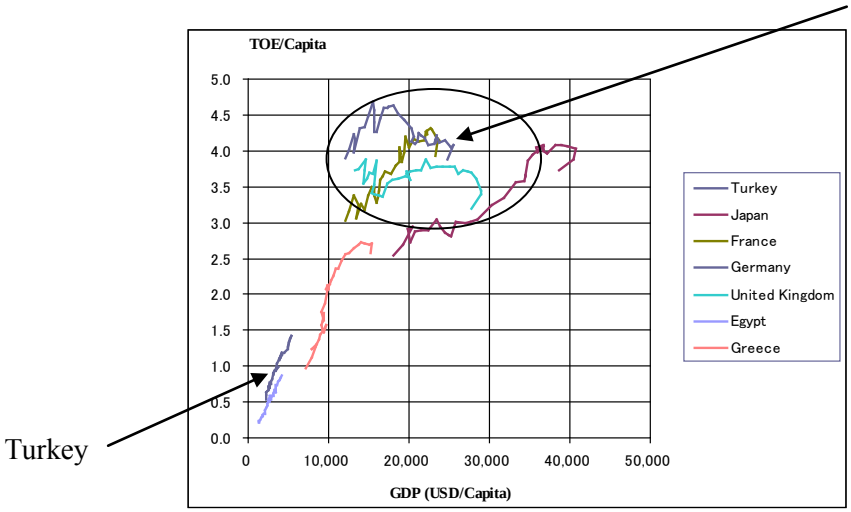
Chapter 1 Introduction

1.1 Background of Study

Turkey has a population of 73 million and is the number-one developing country in Middle East. GDP growth rate in 2010 was 8.9% in reflections of the rapid population growth and the strong increase in domestic demand in recent years.

Figure 1.1-1 shows that the GDP level of Turkey is still developing, as compared with developed countries. The GDP in Turkey continues to develop and surely the energy consumption will be expected to increase further.

The growth in economy and the increase of energy demand pose a risk for the energy security of Turkey's government. The energy import ratio becomes 73% in 2010, and Energy Efficiency Improvement and Conservation (hereinafter referred to as "EE&C") becomes an important pillar of the energy policy together with Renewable Energy (hereinafter referred to as "RE"), hydro power, and nuclear power. In this context EVK (Law on Energy Efficiency) was established in April, 2007. And EE&C in industry sector improved so much. However, EE&C implementation in residential, commercial and public sectors, which occupies 40% of the total energy consumption, is yet on the way. EE&C implementation of buildings, which has the second biggest potential of EE&C after the industry sector, is the next target to be tackled.



Source: Prepared by JPOWER from IEA 2010 Data

Figure 1.1-1 History of GDP and Energy Consumption per Capita

1.2 Purpose of Study

With the above mentioned background, Ministry of Environmental and Urbanism (hereinafter referred to as "MOEU") planned to conduct energy audits for one hundred buildings (hereinafter referred to as "100 Buildings Project") in Ankara. Referring results of the project, MOEU has a plan to apply the EE&C measures for the whole of Turkey.

The main purposes of this study are followings.

1) Before implementing 100 Buildings Project, Japan's knowhow and technologies (in both general and specific issues) for EE&C of buildings are proposed and shared with the counterpart (hereinafter referred to as "C/P"). EE&C measures and laws/regulations on EE&C implementation in buildings in Turkey are to be analyzed and effective measures to improve them should be proposed.

2) Following Turley's activities time to time, the related information, which is needed to formulate ODA-loan and technical cooperation projects in order to promote EE&C for public buildings in other cities and in private buildings in Turkey, is to be collected. And based on it, useful ideas to utilize ODA (Official Development Assistance) loan will be proposed.

Through the above activities, the capacity development of MOEU and relevant agencies should be conducted.

1.3 Outline of Study

1.3.1 Basic Policy of Study

This study was implemented based on the following policies.

Basic Policies

1. Utilizing the previous JICA cooperation results in EE&C
2. Studying current condition and problems of "regulation (stick)", "support (carrot)", and "awareness (information)", which are needed for promoting EE&C
3. Utilizing Japanese experiences and the results from EE&C studies which were conducted by JICA in Asian countries
4. Utilizing the output of NEDO Feasibility Study on EE&C pilot projects

1.3.2 Work Implementation Flow and Staffing Plan

The working implementation flow and staffing plan are shown in Figure 1.3.2-1 and -2 respectively.

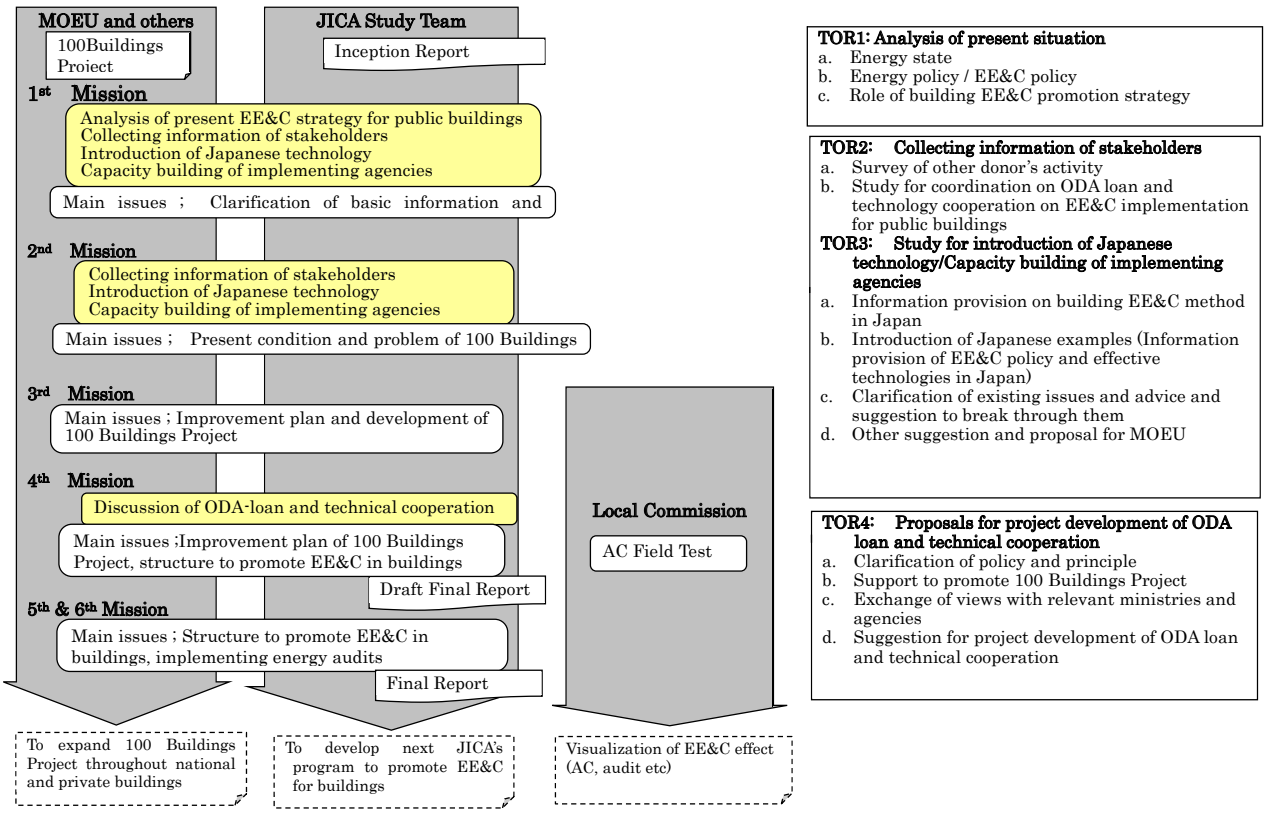


Figure 1.3.2-1 Work Implementation Flow

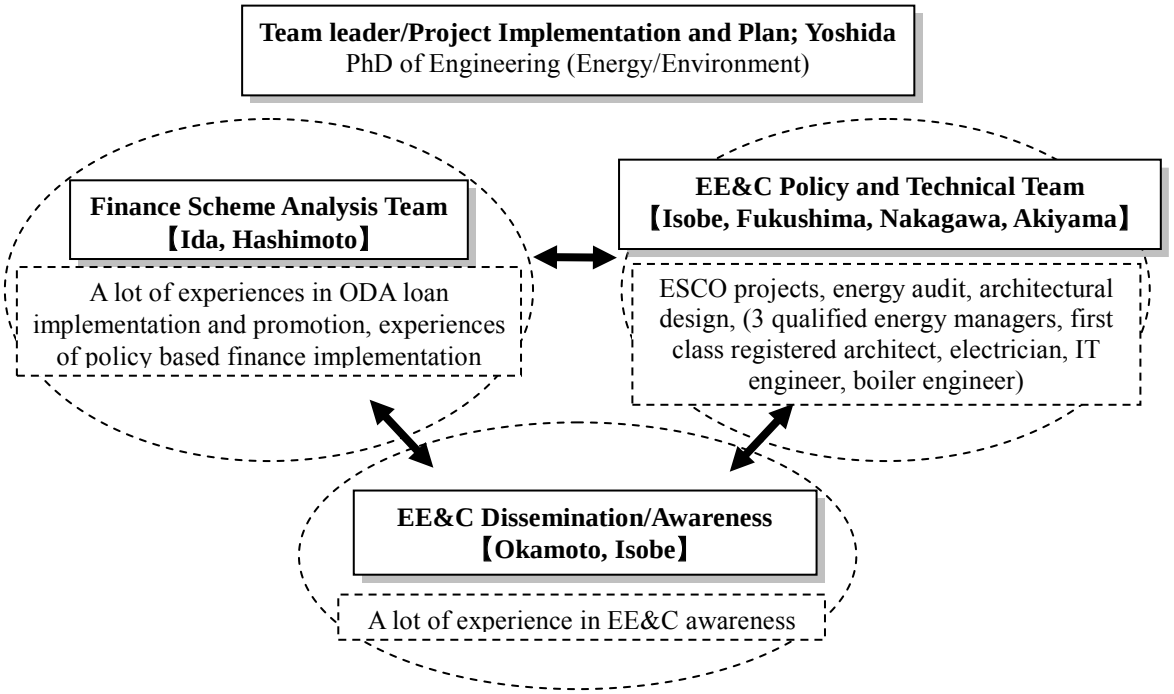


Figure 1.3.2-2 Staffing Plan

Chapter 2

Survey and Recommendations

Chapter 2 Survey and Recommendations

2.1 Confirmation on the Actions and Legal Framework for EE&C Strategy of Public Buildings

2.1.1 Energy Situation of Turkey

(1) Energy Balance of Turkey

Turkey faces a rapid and growing demand for energy. Primary energy consumption in Turkey has been continuously increasing with an annual increase rate around 4 - 4.5% in last 20 years. Turkey's primary energy consumption increased from 81.2 mil. TOE in 2000 to 114.3 mil. TOE in 2011. However, the economic crisis in the last quarter of 2008 and throughout 2009 caused a decrease in energy demand (See Table 2.1.1-1).

Table 2.1.1-1 Developments in Energy Sector of Turkey (2000-2011)

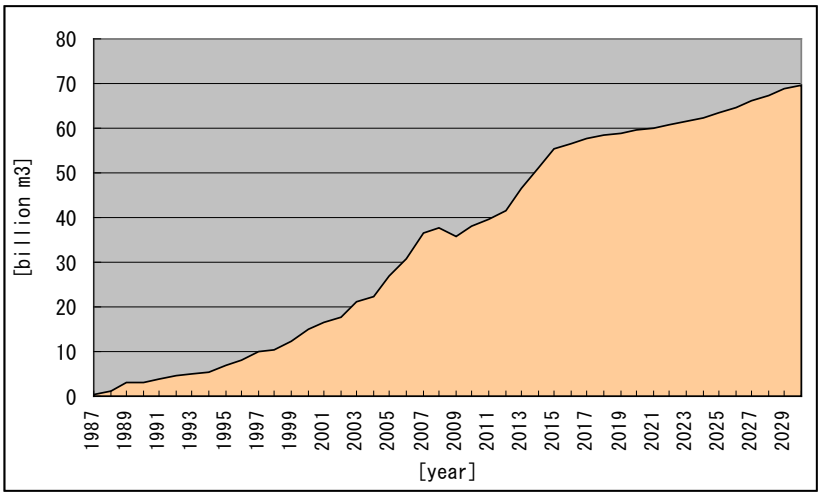
		2000	2001	2005	2008	2009	2010	2011
PRIMARY ENERGY								
Production	1,000 TOE	27,621	24,576	26,285	30,300	30,560	32,493	31,600
Consumption	1,000 TOE	81,193	75,402	90,077	108,360	103,500	109,266	114,300
Per Capita Consumption	KOE	1,264	1,103	1,313	1,525	1,440	1,477	1,555
ELECTRICITY								
Installed	MW	27,264	28,333	38,843	41,818	44,761	48,931	53,051
Thermal (*)	MW	16,070	16,641	25,917	27,625	29,416	31,780	34,163
Hydraulic (**)	MW	11,194	11,692	12,926	14,193	15,345	17,151	18,888
Production	GWh	124,922	122,725	161,956	198,418	194,813	210,000	228,431
Thermal (*)	GWh	94,010	98,652	122,336	164,301	157,360	156,496	170,959
Hydraulic (**)	GWh	30,912	24,072	39,620	34,117	37,453	54,711	57,472
Import	GWh	3,786	4,579	636	789	812	1,144	4,747
Export	GWh	413	433	1,798	1,122	1,546	1,918	3,833
Consumption	GWh	128,295	126,871	160,794	198,085	194,079	211,981	229,344
Per capita Consumption	kWh	1,997	1,851	2,345	2,787	2,699	2,865	3,099

Source: MENR, Chamber of Mechanical Engineers "TÜRKİYE'NİN ENERJİ GÖRÜNÜMÜ"uptdated version-July 2012

Although the demand for energy is dramatically increasing year by year, primary energy production in Turkey has remained relatively constant. Turkey has very limited domestic energy resources, and in 2011 72% of primary energy consumption was secured by import. The total cost of imported energy reached to USD (United States Dollar) 54 bn. and occupied the

share of 22.4% in total import of the country in 2011, which is one of the main reasons to cause a foreign trade deficit in Turkey.

Besides natural gas consumption has increased by the average of 10% every year in last 10 years. The consumption in 2011 became twice as much as that in 2003. The consumption of natural gas is assumed to keep increasing in the future and it is expected to reach 70 bn. m^3 in 2030 [1] (See Figure 2.1.1-1).



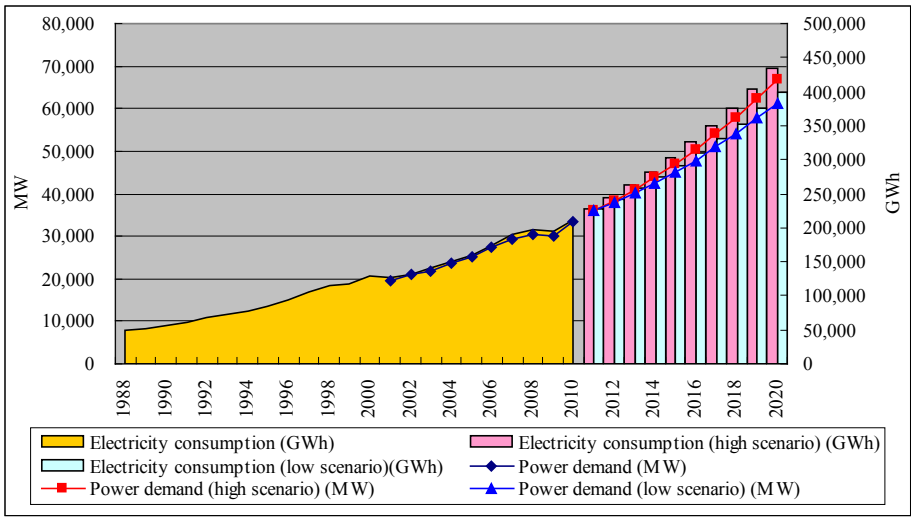
Source: Prepared by JPOWER from Chamber of Mechanical Engineers "TÜRKİYE'NİN ENERJİ GÖRÜNÜMÜ"

Figure 2.1.1-1 Demand Forecast of Natural Gas

(2) Electricity Sector

In Turkey electricity demand increased every year by 7 - 8 % in last 25 years. Although two economic crises happened in 2001 and 2008-2009, electricity consumption has increased by the average of 5.5 % every year from 1998 to 2010. Electricity consumption has almost doubled in last 12 years, and it is expected to be doubled in next 10 years (See Figure 2.1.1-2).

[1] Chamber of Mechanical Engineers "TÜRKİYE'NİN ENERJİ GÖRÜNÜMÜ

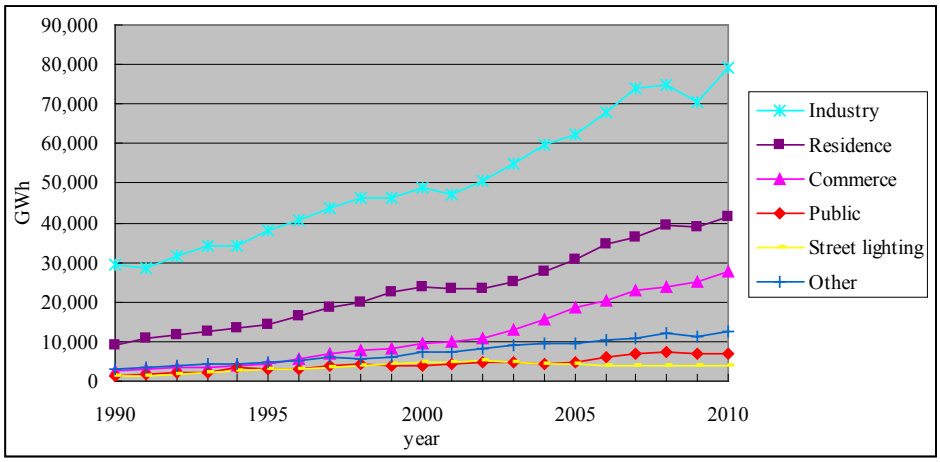


Source: Prepared by JPOWER from TEIAS "TÜRKİYE ELEKTRİK ENERJİSİ 10 YILLIK ÜRETİM KAPASİTE PROJEKSİYONU (2011 – 2020)"

Figure 2.1.1-2 Electricity Demand Projections (High and Low Scenarios)

(3) Final Energy Consumption

Electricity consumption by sector during 1990-2010 is shown in Figure 2.1.1-3. The consumption of public and residential sectors in 2010 has become 5 times as much as that in 1990. The consumption of commercial sector increased 11 times as large as that of 1990.



Source: Prepared by JPOWER from TEDAS "TURKIYE ELEKTRIK DAGITIM VE TUKETIM ISTATAISTIKLERI 2010"

Figure 2.1.1-3 Developments in Electricity Consumption by Sector

(4) Conclusion

Turkey's energy demand is increasing and the growth of economy is almost 10%/year. Especially, electricity demand of building sector, including office buildings and commercial buildings, and residential sector is increasing rapidly. One of the reasons is the increase of cooling requirement and Air Conditioner (AC) use for cooling in Turkey. This trend is supposed to continue in the future. In addition, Turkey's electricity price is also increasing in recent years and its annual increasing rate is more than 20 % in last 4.5 year. Energy price has already reached to the same level of EU and Japan. On the other hand, expensive energy price produces positive economic impact for EE&C. In this context, the potential for energy conservation in building sector is considered to be large.

Natural gas demand has also increased continuously and will reach 70 bn. m^3 in 2030. Besides natural gas consumption in building sector including residential sector has been almost flat. It is mainly used for heating, hot water supply and cooking. Since Turkey's self-sufficiency rate of natural gas is only 2% in recent years, fluctuation of the import gas price significantly influences the selling price. The effective use of natural gas is also very important for Turkey.

2.1.2 Energy Policy and EE&C Policy in Turkey

The main primary objective of Turkish energy policy has been expressed by MENR as meeting the ever-increasing energy demand in a reliable, sufficient, timely, economic, and environmentally sound manner so as to realize the economic and social development targets.

(1) Policy on EE&C and Target

a) The energy sector in Turkey has some bottlenecks such as i) the higher energy demand increase ii) the higher energy intensity (units of energy input per unit of GDP (Gross Domestic Product) than that of comparable similar countries, iii) very high dependency on foreign resources that is the important reason of foreign trade deficit, and iv) sharply increasing per capita CO_2 emission. In order to cope with these issues, Turkish government puts high priority on EE&C that the energy will be used in the most efficient and economical manner at all stages from generation to final consumption, while the energy required for economic development will be supplied in a continuous and secure manner at minimum cost[2].

b) The Government set concrete target of EE&C as energy intensity to be reduced by 10% from the 2008 level by 2015, and reduced by 20% by 2023[3].

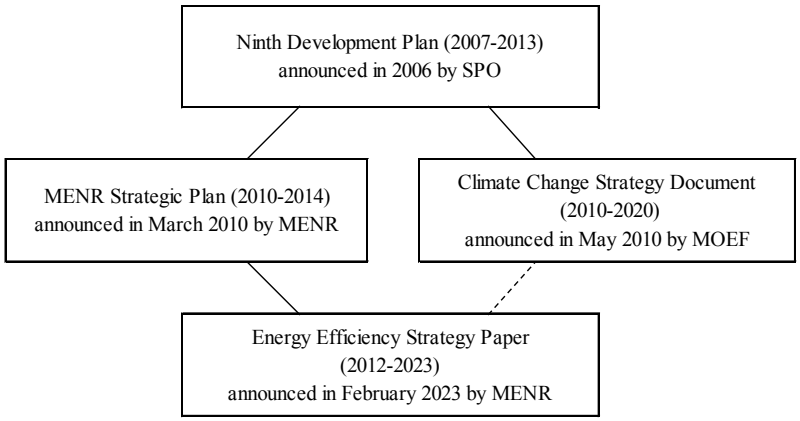
In order to reach the above target, MENR developed "Energy Efficiency Strategy Paper 2012-2023" a kind of Road Map containing action plan time-bounded in 10-year horizon.

[2] The Ninth Development Plan 2007-2013 approved by Turkish Grand National Assembly states that "Energy will be used in the most efficient and economical manner at all stages from generation to final consumption."

[3] Strategic Plan 2010-2014, MENR

In this paper, it is stated that "annual energy consumption in the public buildings and facilities shall be reduced by 10% by the year 2015, and by 20% by the year 2023."

Policy framework of energy conservation in Turkey is shown in Figure 2.1.2-1 and legal framework of energy conservation for buildings in Turkey is shown in Figure 2.1.2-2.



Note: former MOEF's function was shifted into present MOEU

Figure 2.1.2-1 Policy Framework of Energy Conservation in Turkey

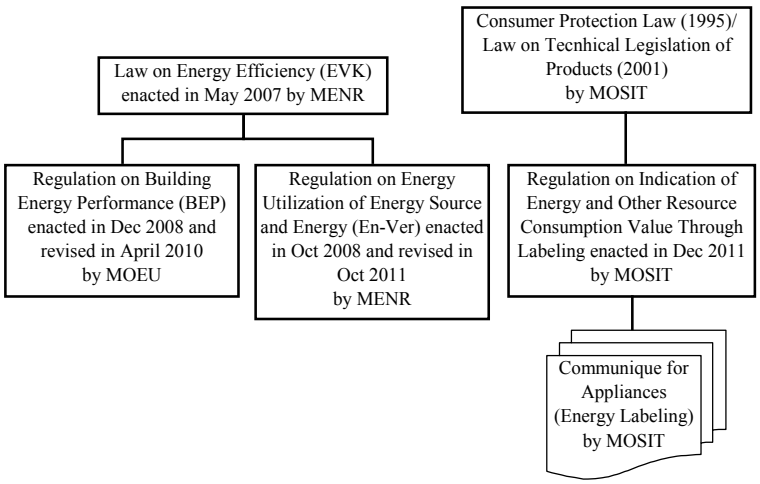


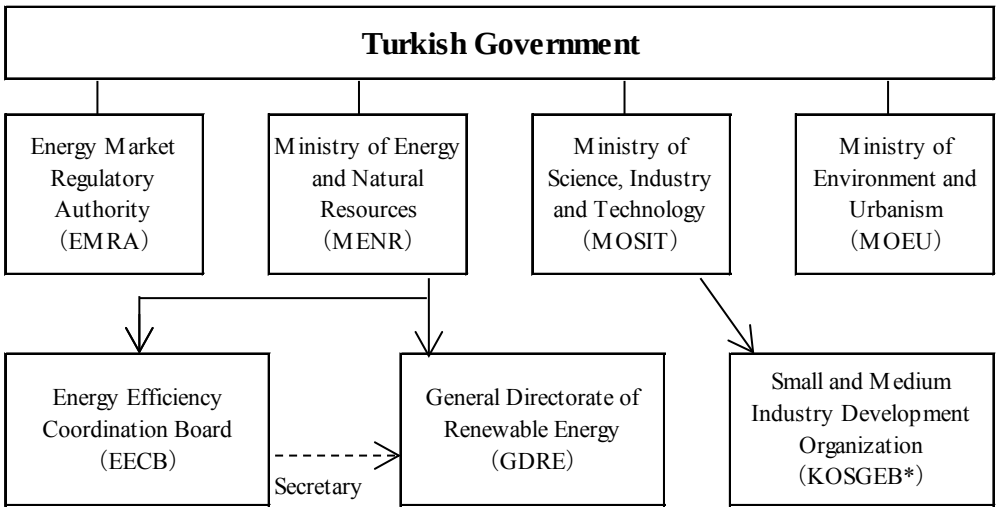
Figure 2.1.2-2 Legal Framework of Energy Conservation in Building Sector

(2) Organizational Structure to Promote Energy Conservation

National Energy Conservation Center (hereinafter referred to as "NECC") was established in the former EIE of MENR in 1992.

NECC played the central role of EE&C promotion in Turkey and had the responsibility for EE&C promotion activity, energy audit in industry sector, EE&C advice for buildings, and management of energy manger system and energy consumption database in industry and building sectors. And NECC also took a role of secretary of Energy Efficiency Coordination Board (hereinafter referred to as "EECB"). EECB, which consists of senior officers in relevant ministries and agencies, takes a role of preparing national EE&C strategies, plans, and actions.

Afterwards, in accordance with the Decree KHK/662 dated 02 November 2011, EIE was closed and a new GDRE has established as dependent body under the MENR to undertake the task of EIE except for the duty of hydraulic power generation and water usage. The administrative organization on EE&C in Turkey is shown in Figure 2.1.2-3. The EE&C measures in building sector are managed by MENR in coordination with MOEU as specified in EVK.



* KOSGEB ; an affiliated institution of MOSIT, provides subsidy for EVD project investments (including costs of trainings, energy audits and consulting fees) by SMEs

Figure 2.1.2-3 Administrative Organization on Energy Conservation in Turkey

2.1.3 Role of MOEU within EE&C Implementation Strategy for Building

(1) Strategy

MOEU's duties are, a) to prepare, enact legislations, and conduct monitoring & control of them, and b) to prepare, introduce, and establish norms and standards of professional services (technical services) for the fields of environment, settlement, and constructions. (Article 2, (1) a), Decision No. KHK/644, Degree Law on the Organization and Role of the Ministry of Environment and Urbanization)

In particular, for public buildings, MOEU's duties are to define general conditions, strategies, and standards, to define qualities of survey and construction, and to define investment projects and procedures. (Article 10, (1) a) and b), Decision No. KHK/644, Degree Law)

As to professional services for public and private buildings, MOEU's duties are to arrange, control, and monitor services for architecture, engineering, contracting, and consultancy and to define implementation of general principles, strategies, and standards. (Article 12, (1) a) and b), Decision No. KHK/644, Degree Law)

(2) Law and Regulation on EE&C

1) Regulation on Building Energy Performance (BEP)

BEP was enacted by MOPWS (Present MOEU) in December 2008. BEP was amended in April 2010 and its implementation has started in January 2011.

Purpose of BEP is to lay down the principles and essential requirements for effective and efficient use of energy and energy sources in buildings, prevention of energy waste, and protection of environment (Article 1, BEP).

BEP is applied to all buildings except for industrial buildings, temporary buildings of use for 2-year or less, buildings of useful floor area of 50m^2 or less, and buildings without heating and cooling units. BEP specifies the design criteria, which relates to energy consumption in buildings, of building design and equipment and define the calculation methods and standards for issuing the EPC (Article 2, BEP).

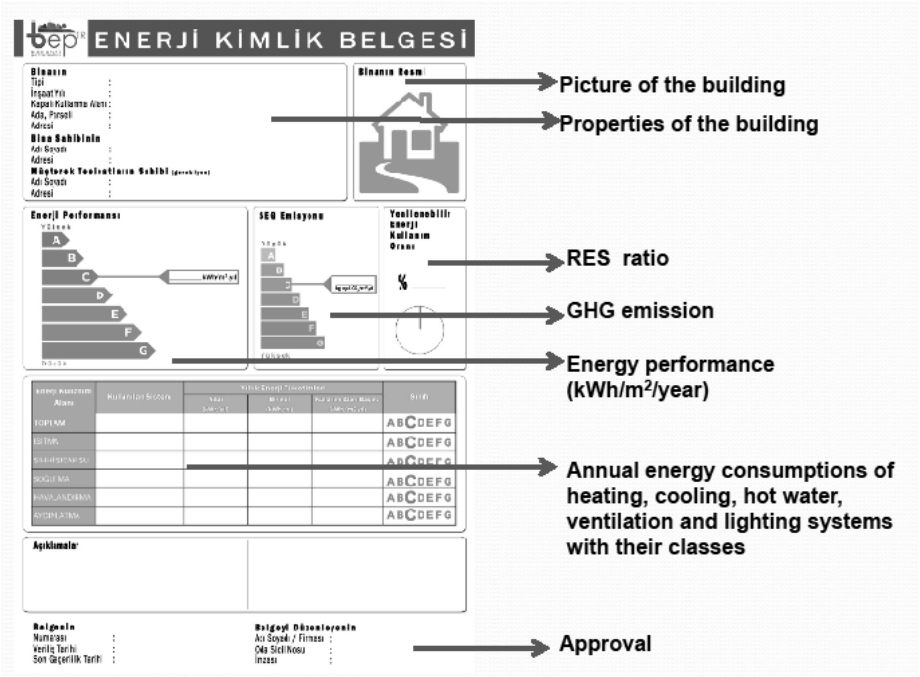
The primary target of BEP is to issue EPC, and therefore it has no power to enforce the implementation of EE&C measures.

2) Energy Performance Certificate (EPC)

The acquisitions of EPC are obligations for the buildings of useful floor area of 1,000m^2 or more, except for the buildings out of scope of BEP (Article 25 (9), BEP).

There are seven ratings, from A (the highest) to G (the lowest), in EPC. For all new buildings constructed after January of 2011, EPC scores are required to be equal or over C class in accordance with BEP. (Article 27 (5), BEP) And, all existing buildings have to acquire EPC by 2017. However, there is no obligation and no incentive for up-grading the rating, except for the cases where renovation costs exceed 25% of the appraised value of the building for property taxation. Main purpose of EPC is dissemination and awareness raising for EE&C of buildings. Main evaluation index is energy intensity (i.e. energy consumption per GDP) of building by region and type (kWh/m^{2}y) (See Figure 2.1.3-1).

There are several problems about BEP-TR, such as data-input is complicated, calculation data is cancelled in case that there is something wrong in online application. MOEU requests TBITAK to improve BEP-TR and to make it more users friendly.



Source: Residential Energy Saving Opportunities, Energy Efficiency Conference, June 3-4.2010, Prof. Dr. Sermin Onaygil, Istanbul Technical University

Figure 2.1.3-1 Form of Energy Performance Certificate (EPC)

3) Urban Transformation Law

Urban Transformation Law was enforced in May 2012. Both earthquake resistant and energy efficient buildings will be promoted in accordance with the law.

In accordance with the law, each ministry and agency will be obliged to implement bidding and construction of its own buildings. Besides, there is a grace period not exceeding three years set forth in the law, during which MOEU could also implement bidding and constructions on behalf of the other ministries. Main responsibility of MOEU is post-construction monitoring of buildings as well as the law enforcement. Japanese technical assistance is further required to promote earthquake resistant and energy efficient buildings.

(3) Project

1) 100 Buildings Project

MOEU intends to go ahead with 100 Buildings Project as the first step for promoting EE&C in public buildings in order to comply with EVK. Under this Project, 100 buildings including main buildings of ministries, schools, nursing homes and hospitals in Ankara are to be selected and EE&C audits conducted in commissions of EVDs. Through the audits, energy consumption data will be collected, the data will be analyzed, EE&C improvement measures will be proposed, and EPC will be issued by using BEP-TR. The indicative list of 100 buildings is shown in Table 2.1.3-1. Targeted buildings have been re-selected several times.

The results of the project will be reported to Prime Ministry (PM), Ministry of Development (MOD), and Undersecretariat of Treasury[4] (UT). Since MOEU has no enforceable power for EE&C improvement works of each ministry and agency, the Ministry plans to utilize the power of a Prime Ministry Circular to enforce the improvement works by each ministry and agency[5].

Table 2.1.3-1 Indicative List of Selected Public Buildings for 100 Buildings Project[6]

NO.	NAME OF INSTITUTION AND ORGANIZATION	QUALITIES OF BUILDINGS					TOTAL
		OFFICE	HOTEL/ HOSPITAL	SHOP/ RESTAURANT	HALL	OTHERS	
1	RADIO AND TELEVISION HIGH COUNCIL	1					1
2	CONSTITUTIONAL COURT	1					1
3	NATIONAL ACCOUNTING	2				1	3
4	MINISTRY OF FOOD, AGRICULTURE AND HUSBANDRY	7					7
5	SOCIAL SECURITY INSTITUTE	7					7
6	SUPREME COURT	2					2
7	MINISTRY OF CULTURE AND TOURISM	5	1		3		9
8	CAPITAL MARKETS BOARD OF TURKEY	1					1
9	TURKISH STATISTICAL INSTITUTE	1					1
10	MINISTRY OF FINANCE	9		1			10
11	MINISTRY OF INTERIOR	5			1		6
12	COUNCIL OF HIGHER EDUCATION	6					6
13	MINISTRY OF FOREIGN AFFAIR		1				1
14	MINISTRY OF TRANSPORT	6		1			7
15	MINISTRY OF JUSTICE	2					2
16	MINISTRY OF FOREST AND WATER WORKS	4					4
17	MINISTRY OF NATIONAL DEFENSE	2	6				8
18	GENERAL DIRECTORATE OF TURKISH RADIO AND TELEVISION	7					7
19	MINISTRY OF ENERGY AND NATURAL RESOURCES	9			1	1	11
20	COMPETITION AUTHORITY	1					1
21	MINISTRY OF ENVIRONMENT AND URBANIZATION					1	1
22	MINISTRY OF HEALTH		1				1
23	TURKISH ELECTRICITY DISTRIBUTION COMPANY	2	1				3
TOTAL		80	10	2	5	3	100

Source: MOEU

(4) MOEU's Activities and Problems

In accordance with EVK, MOEU enacted BEP, obligates to acquire EPC for buildings over a certain size, and intends to improve and promote EE&C in buildings. As a specific project, MOEU launched the 100 Buildings Project that is a pilot project for central governments' buildings to promote EE&C.

MOEU is responsible for preparation of legislations and implementation of projects in order to realize sustainable buildings and EE&C retrofitting for public buildings in accordance with the Energy Efficiency Strategy Paper 2012-2023, which was compiled by MENR and approved by

[4] At present, MOEU has no plans to report the results of the project directly to local governments, but would naturally present it at the next Energy Efficiency Congress, which is held every year. MOEU currently has information exchange with local governments through the training of BEP-TR. Cooperation with local governments should be strengthened further through this channel.

[5] Information acquired through interview with the Energy Efficiency Department of MOEU in May 2012

[6] As of Oct. 2012

High Planning Council (hereinafter referred to as "HPC") headed by the prime minister.

Top-down style is popular to make decisions for policies and projects in Turkey. EE&C regulations and projects of MOEU are also implemented in top-down styles. In general, this top-down style can make a decision speedy. On the other hand, higher knowledge, rich experiences, and adequate understandings of actual conditions are needed to prepare and implement policies and projects.

MOEU is facing problems of lack of knowledge and experiences and does not have very strong connections with the project implementation bodies. Technical assistance is needed to prepare and implement policies and projects. Considering the situation above, in 2.4.2 recommendation of a project scheme for EE retrofitting in Government buildings will be proposed.

2.2 Gathering Information about Multilateral and Bilateral Donor Agencies

As of end-November 2012, major multilateral donor agencies (WB, EU, EBRD, UNDP) and bilateral donor agencies (KfW/GIZ, AFD and JICA) either have ongoing projects or pursue the possibility of promoting EE in Turkey's building sector. (See Table 2.2-1 for the details) Among the above agencies:

- Those interested in financing public sector buildings (both central and local government owned buildings) are KfW, AFD, JICA and EBRD (indirectly via ESCOs)
- Those mainly focused on financing commercial buildings and municipalities are WB, EBRD and AFD
- Those currently providing technical assistance to public buildings sector (including EE retrofit and capacity development of MOEU) are EU and UNDP
- Those considering utilizing EVDs and developing ESCO market in Turkey are EBRD, WB and JICA
- Those utilizing or going to utilize Eligible Equipment List as a method of cutting loan processing or implementation transaction costs are EBRD, WB and JICA.
- Those acquired Clean Technology Fund (CTF) funds are EBRD's Turkish Turkey Sustainable Energy Financing Facility (TurSEFF, 2010-2012) and WB's Private Sector RE and EE Project Phase 2 (2009-2014)

Table 2.2-1 Summary of Activities of Multilateral and Bilateral Donor Agencies in Promoting EE in Turkey

Issues	JICA	KfW (+GIZ)	AFD	WB	EU	EBRD	UNDP	EIB
Main focus on EE	(Idea) Public sector buildings EE (future, SME, Industry)	Public sector buildings EE retrofit covering all climate regions	RE, Industry EE, SME EE	RE, Industry EE, SME EE, Commercial Buildings EE	Energy sector: 1) RE, 2) Alignment to EU Aquis (Energy Legislation), 3) Nuclear safety	Small scale EE/RE including 1) Commercial buildings 2) ESCO financing	Energy Sector Projects: 1) Industry EE, 2) Appliances EE, 3) Buildings EE	Industry RE/EE SME RE/EE (mainly RE)
Public buildings EE	(Idea) - TA for buildings EE; - TA & finance for Urban Transformation Project	Eur 110 mil. secured for subsidized loans for public sector buildings EE retrofit	Started to pursue EE in public sector buildings since March 2012, earmarked Eur 100 mil. for EE projects	Under joint management of EU's FY2012 energy sector funds, SME EE will be pursued	FY 2011 budget: Retrofit of 2 buildings and MOEU capacity building	Not yet, but considering financing public buildings via ESCOs (Established ResiSEFF & MunSEFF for buildings EE/RE)	1) Buildings EE Project; 2) Southeast Anatolia RE/EE Project; 3) Sustainable Cities Project	Not considered
Implementation scheme	(Idea) Setting up Project Management Unit with approval of High Planning Council/ Prime Ministry	Sovereign loan to UT: 1) Bundling individual ministries' retrofit investment budgets 2) Loan to one ministry with large building stock	"Climate Turkey Program": Credit lines (non-sovereign loans) for commercial banks and municipalities (in future) both sovereign & non-sovereign loans to municipalities	"RE/EE Project Phase 2" "SME EE Project" Credit line (sovereign loans) for intermediary banks with UT credit guarantee	FY 2012 budget (EE component): Grants for FS/TA for Industry and SME EE market development (Joint management with WB)	"TurSEFF": Credit line (non-sovereign loans) for 5 partner banks (all private banks)	"Buildings EE Project" Capacity development, awareness raising, monitoring, demonstration	RE/EE Project: Credit lines for 3 policy-based banks (TSKB, TKB, Vakif Bank) with EC grants SME RE/EE Project: Credit lines for 4 private banks
Sub project formation	(Idea) 100 Buildings Project in Ankara, 1000 Buildings Project	1) MOEU's100 Buildings Project (1000 Buildings Project) and other 2) MONE, MOH, etc.	-	Clients of partner banks, initially (ESCO projects, later)	MENR and MOEU propose to Ministry of EU Affairs, main TK coordinator of EU program	Project implementation team proactively assist partner banks (TA, regular meetings, etc.)	"Buildings EE Project" Chosen by UNDP/Turkish Government (GDRE, MOEU, TOKI, MONE.)	Clients of partner banks
Sub-Project/Project approval method	(Idea) Bundling Method (EE Equipments List Method); Energy Audit method	-	-	"SME EE Project" Standardization by using "Shopping list" (line of product)	Big Umbrella method: lump-sum approval of big portfolio which includes several projects under energy sector	1) List of Automatically Eligible Equipments and Suppliers 2) Energy Audit 3) Simplified energy audit	-	All sub-project require ex-ante approval by EIB
TA	(Idea) TA for MOEU, GDRE, EVDs, etc.	GIZ provides TA (Euro 6.5 m)	TA to raise awareness among SMEs, industries, and bank managers and employees	TA for intermedary banks (Vakif Bank, Ziraat Bank), EVDs	TA for MOEU, EVDs	TA for partner banks, vendors (suppliers, etc.) and sponsors	"Buildings EE Project" TA for GDRE, MOEU, etc.	TA for partner banks (EE project appraisal, marketing, etc.)
ESCO/EVD	(Idea) EVD capacity development via OJT and ESCO market development	Not considered	Will conduct capacity development of EVDs & ESCOs as part of KOSGEB capacity development program to enhance SME EE (2013-2015)	- EVD capacity development with GEF fund, awareness raising - EVD capacity building, ESCO market development under EU FY2012 funds	Trainings, Awareness raising, information dissemination	Support the materialization of Energy Performace Contracts	"Southeast Anatolia RE/EE Project"(Initial plan to hold 10 audits using EVDs and 2 EE retrofit implementation)	Not considered
Turkish C/P	(Idea) MOEU (MENR, MOD, PM, UT)	not yet defined Turkish C/P	Intermediary banks (private banks) (In future) Municipalities via private banks (non-sovereign) and Iller Bank (sovereign)	MENR & Intermediary banks (Development banks and state owned banks)	FY2011 budget: MOEU FY2012 budget: MENR FY2013 budget: MOEU	Commerical sector building owners, municipalities, EVDs (indirectly public sector building owners)	Buildigs EE ⇒GDRE Southeast Anatoria RE/EE ⇒Regional Development Admnistration Sustainable Cities Project ⇒MOEU, municipalities	Intemediary banks (development banks, state-owned and private banks)
Use of CTF	-	-	-	RE/EE 2: USD 100 mil. SME EE: USD 50 mil.	-	TurSEFF: USD 50 mil. Resi SEFF: n.a. MunSEFF: n.a.	-	-

Source: Compiled by JICA Study Team based on the information acquired through interviews with respective agencies and disclosed information on public websites

2.3 Introduction of Japanese EE&C Technologies and Capacity Development of Implementing Organizations for 100 Buildings Project

As of January 2013, the 100 Buildings Project implementation is delaying. Under this situation the Study Team has carried out seminars, field surveys of buildings and information exchange with various related organizations and MOEU.

Extensive information exchange carried out both through meetings and seminars to support MOEU's tasks are as follows;

a) Implementing policy and measures, which are defined under the Energy Strategy Paper 2012 - 2023

b) Improvement of the function of BEP-TR

c) Implementing another EE&C policies and selecting eligible EE&C technologies referring best practices in Japan

The outline and major findings of seminars, building field surveys and hearings are summarized hereinafter.

2.3.1 Capacity Development for EE&C Policy Making

In order to promote EE&C effectively three strategies, which are shown in Figure 2.3.1-1 should be implemented at the same time. In Turkey some rules and regulations have been enacted, however structured and comprehensive awareness and support programs have not been formulated enough. It is needed to enhance the programs focusing on awareness and governmental support.

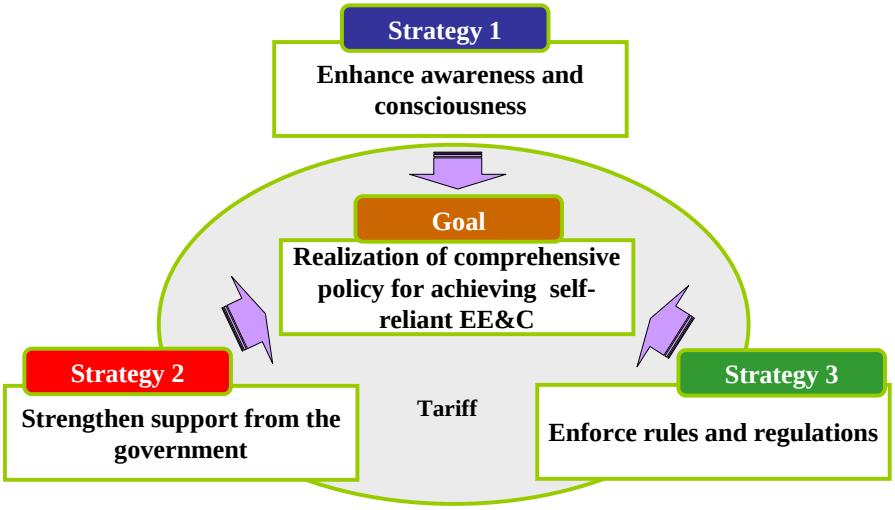


Figure 2.3.1-1 Integrated Strategy Needed for Promoting EE&C

In the light of above mentioned integrated strategy, the key issues and potential measures to increase effectiveness of EE&C in Turkey initially defined by the Study Team are as follows;

(1) Enhance Awareness and Consciousness

1) In Turkey legal frame work for labeling has already established. However efforts to display EE performance on energy consuming products are not sufficient.

2) Data base structures and analysis of collected data related to energy consumption, buildings and equipment etc. are not enough, which is required to establish baseline for the governmental strategy to develop implementation roadmap of EE measures and monitoring of the implementations.

3) Although GDRE and MOEU have been carried out some activities and have mandates EE&C, setting up an organization in charge of awareness, dissemination and database (like Energy Conservation Center, Japan (hereinafter referred to as "ECCJ")) might be functional.

4) Regarding technical aspect for promoting EE&C, importance of insulation and reduction of consumed energy in air conditioning (heating and cooling) should be recognized by public and responsible authorities. In this context, for instance mitigation of 1 degree on AC setting temperature means 7 to 10 % saving.

These are to be checked and discussed in Turkey;

Cooling;	Japan	Government campaign	28 ^{0}C
	Turkey	MENR Regulation28097/2011	24 ^{0}C
Heating;	Japan	Government campaign	20 ^{0}C
	Turkey	MENR Regulation28097/2011	22 ^{0}C

(2) Strengthen Financial Support Mechanism

1) There are three financial support measures, namely, tax incentives program, subsidy/rebate program and policy-based finance program. Among these three financial support measures, policy-based finance program has been the most effective in Japan. It may be also effective in Turkey to apply this policy-based finance program. However one of the problems to apply low interest loan for building EE&C retrofitting is that there are not appropriate (experienced) local banks for the execution of low interest loan in Turkey. There should be developed a scheme for Turkey similar to Japan.

2) Japan's Governmental financial source for EE&C comes from mainly tax on fuel, Energy Special Account, is unique and to be referred in Turkey. There are different taxes on fuels in Turkey also. If at least small portion of these taxes could be allocated, this Special Account can be structured for Turkey also.

(3) Evaluation Method of Energy Conservation

1) Improvement of BEP-TR

BEP-TR has enough scope to enforce insulation of buildings. To improve the function of BEP-TR, the development of some energy management tool and easy input operation should be considered. In Japan evaluation method of energy conservation, which utilizes Japanese evaluation tool, PAL (insulation) and CEC (equipment efficiency), equivalent of Turkish BEP-TR, has been applied. And it is regulated to submit the evaluation result before new construction in Japan. Besides for the purpose of evaluation of middle size and small sized buildings, simplified evaluation method, Point Method (without PAL/CEC calculation), was introduced. In order to promote energy conservation of large number of middle size and small sized buildings, this simplified evaluation method is worth being referred (See Figure 2.3.1-2 and Table 2.3.1-1 and -2).

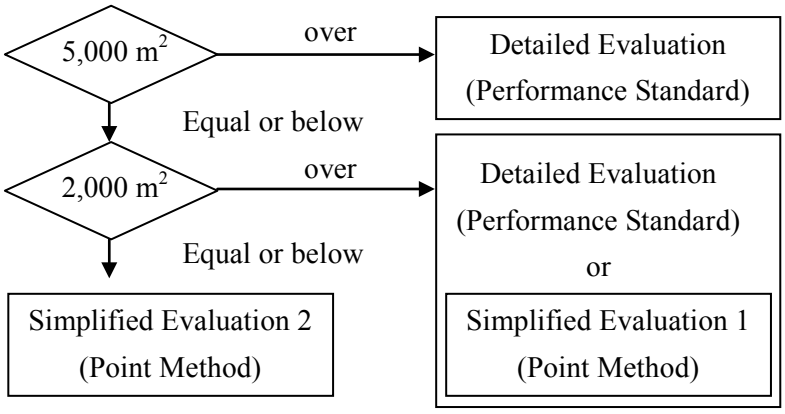


Figure 2.3.1-2 Japanese Evaluation Method by Building Size

Table 2.3.1-1 Evaluation Items of Japanese Point Method (1)

	1. Building heat loss	2. Air conditioning	3. Ventilation
	1) Basic building design	1) Reducing of fresh air heating /cooling	1) Control system
	Direction, plan, core position and floor height	Working time and pre-heating time	CO^2, human sensor, temperature control, linkage to lighting, time schedule etc.
	2) Wall/roof insulation	2) Location of outdoor unit and length of pipe	2) Efficiency of motors
	3) Window insulation	3) Efficiency of air conditioner	3) Introduction of natural ventilation
	4) Solar heat control	4) Adjustment point	4) Adjustment point
Total point	100 ≦ Clear		
	100 > Not good		

Table 2.3.1-2 Evaluation Items of Japanese Point Method (2)

	4. Lighting	5. Hot water supply	6. Elevator
	1) Efficiency of lighting fixture	1) Piping root and insulation	1) Control system
	Type of lamps, efficiency of fixture	Insulation for pipes, bulbs and flange, root of pipe line and pipe diameter	Inverter control and regenerative control
	2) Control system	2) Control system	
	Human sensor, day light/dimmer control, brightness control, time schedule, zone or spot control etc.	Circulation pumps, water tap of lavatory and shower	
	3) Placement of fixtures luminous level and interior finish	3) Efficiency of heat source	
	Task and ambient lighting, room shape and interior color	Efficiency of heat source, solar heating and heat recovery	
	4) Adjustment point	4) Adjustment point	4) Adjustment point
Total point	100 ≦ Clear		
	100 > Not good		

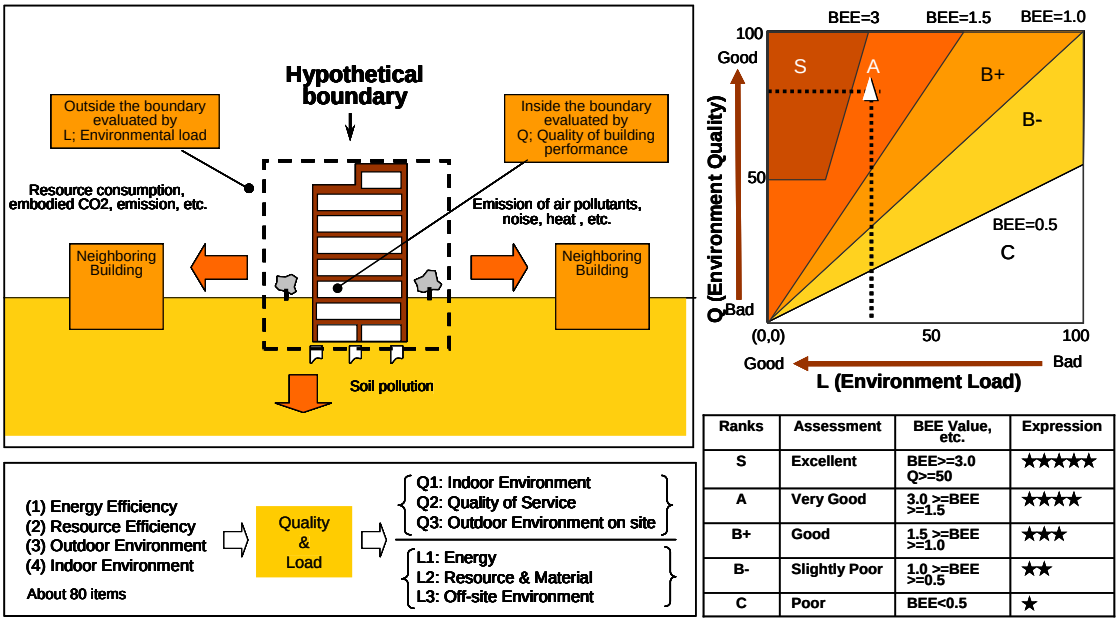
2) Assessment tool for sustainable building

The concept of Japanese assessment tool for sustainable building, CASBEE may be good reference for Turkey to develop Turkish sustainable building standard with the aspects of energy efficiency and earthquake resistance. The referential points for Turkish Government are as follows.

a) Target of assessment

Target of assessment is shown in Figure 2.3.1-3.

i) Quality of building performance (Indoor environment, quality of service including earthquake resistance, and outdoor environment onsite) and ii) Environmental load (energy, resource & material, and off-site environment) are assessed. Detailed categories are shown in Table 2.3.1-3 and -4. Weighting coefficients among the categories is shown in Table 2.3.1-5, which were decided by academy people and the total for Quality of building performance and the total for Environmental load is 1.0 each.



Ranks	Assessment	BEE Value, etc.	Expression
S	Excellent	BEE>=3.0 Q>=50	★★★★★
A	Very Good	3.0 >=BEE >=1.5	★★★★
B+	Good	1.5 >=BEE >=1.0	★★★
B-	Slightly Poor	1.0 >=BEE >=0.5	★★
C	Poor	BEE<0.5	★

Source: JaGBC (Japan GreenBuild Council) / JSBC (Japan Sustainable Building Consortium)

Figure 2.3.1-3 Target of CASBEE Assessment

Table 2.3.1-3 Target of CASBEE Assessment (1)

	Large Category	Middle Category	Small Category
Environment Quality of the Building	**Q1. Indoor Environment**	**Noise**	**Noise, Sound Isolation, Sound Absorption**
		Thermal Comfort	**Room Temperature Control, Humidity Control, Type of AC System**
		Lighting & Illumination	**Daylight, Anti-glare Measures, illuminance Level, Lighting Controllability**
		Air Quality	**Source Control. Ventilation, Operation Plan**
	Q2. Quality of Service	**Service Ability**	**Functionality and Usability, Amenity, Maintenance Management**
		Durability & Reliability	**Earthquake Resistance, Service Life of Components, Reliability**
		Flexibility & Adaptability	**Spatial Margin, Floor Load Margin, System Renewability**
	Q3. Outdoor Environment on Site	**Preservation & Creation of Biotope**	
		Townscape & Landscape	
		Local Characteristics & Outdoor Amenity	**Attention to Local Characteristics & Improvement of Control, Improvement of Thermal Environment on Site**

Source: Technical Manual (2010 Edition) of CASBEE for New Construction / Japan Sustainable Building Consortium (JSBC)

Table 2.3.1-4 Target of CASBEE Assessment (2)

	Large Category	Middle Category	Small Category
Environment Load Reduction of the Building	**L1. Energy**	**Building Thermal Load**	
		Natural Energy Utilization	
		Efficiency in Building Service System	
		Efficient Operation	**Monitoring, O&M System**
	L2. Resources & Materials	**Water Resources**	**Water Saving, Rainwater, Graywater**
		Reducing Usage of Non-renewable Resources	**Reducing Usage of Materials, Continuing Use of Existing Structure Frames etc, Use of Recycled Materials as Structural Frame Materials, Use of Recycled Materials as Non-structural Materials, Timber from Sustainable Forestry, Efforts to Enhance the Reusability of Components and Materials**
		Avoiding the Use of Materials with Pollutant Content	**Using Materials without Harmful Substances, Elimination of CFCs and Halons**
	L3. Off-site Environment	**Consideration of Global Warming**	
		Consideration of Local Environment	**Air pollution, Heat Island Effect, Load on Local Infrastructure**
		Consideration of Surrounding Environment	**Noise, Vibration & Odor, Wind/Sand Damage & Daylight Obstruction, Light Pollution**

Source: Technical Manual (2010 Edition) of CASBEE for New Construction/Japan Sustainable Building Consortium (JSBC)

Table 2.3.1-5 Weighting Coefficients of CASBEE

Assessment Categories		
Q1 Indoor Environment	Non-factory	Factory
	0.40	0.30
Q2 Quality of Service	0.30	0.30
Q3 Outdoor Environment on Site	0.30	0.40
LR1 Energy	0.40	
LR2 Resources & Materials	0.30	
LR3 Off-site Environment	0.30	

Source: Technical Manual (2010 Edition) of CASBEE for New Construction/Japan Sustainable Building Consortium (JSBC)

b) Existing typical assessment tools for sustainable building

Existing typical assessment tools for Sustainable Building are summarized in Table 2.3.1-6.

Table 2.3.1-6 Comparison among CASBEE, LEED and BREEAM

	CASBEE	LEED	BREEAM
	(Comprehensive Assessment System for Building Environmental Efficiency)	(Leadership in Energy and Environmental Design)	(Building Research Establishment Environment Assessment Method)
Establishment	Japan 2004	U.S. 1998	England 1990
Target	All buildings	High grade (25%) buildings	High grade buildings
Evaluation categories	6 large categories focusing environment,service level, reliability (incl. earthquake resistance) and flexibility etc.	5 large categories focusing environment and well-being	9 large categories focusing environment and health
Easiness of input	NO3	NO1	NO2
Application	Applied for many Japanese municiparities	Linked to asset evaluation, commercial	Applied for EU countries
Quality (Q) & Environmental load (L) evaluation	Separate evaluation BEE (Building Environmental Efficiency) = Q/L	Mixed evaluation Total score	Mixed evaluation Total score
URL	http://www.ibec.or.jp/CASBEE/english/index.htm	http://www.usgbc.org/	http://breeam.org/

i) CASBEE (Japan)

- Applicable for all buildings
- Evaluating building quality, including earthquake resistance, except environmental aspects
- Utilizing Japan's domestic simulation tool PAL (Perimeter Annual Load Factor) /CEC (Coefficient of Energy Consumption)
- Introduction to local government

ii) LEED (US)

- International software
- Applicable for only high grade buildings
- Targeting property appraisal

iii) BREEAM (UK)

- Spread in EU
- Targeting high grade buildings

(4) Summary of Recommendations

Summary of recommendations for Turkish Government are described as follows.

1) Enhance awareness and consciousness

a) Obligation to display EE performance on energy consuming products

b) Structuring and utilization of database for energy consumption on buildings and equipments

c) Establishment of an organization focusing on awareness and dissemination for EE&C

d) Investigation and discussion on the recommended room air temperature

2) Strengthen financial support mechanism

a) Establishment of policy-based finance program, which has been the most effective in Japan

b) Utilization of a part of taxon fuel as a financial source for EE&C (referring Japanese Special Account)

3) Evaluation method of energy conservation

a) Establishment of simplified evaluation method for middle and small sized buildings, (e.g. Japanese Point Method).

b) Recommendation for establishing Turkish sustainable building standard

Turkish Government would like to issue the licenses for all the buildings of commercial, service, and luxury residences with 10,000m^2 or more of floor areas. Besides in Urban Transformation Law, it is stipulated to keep not only energy efficiency but also earthquake resistance for the target buildings. Referring these backgrounds and the existing typical assessment tools for sustainable building, CASBEE (Japan), LEED (US), and BREEAM (UK), the following measures were recommended for MOEU to introduce.

i) Standard should be applicable for all buildings.

ii) Evaluation of building quality, including earth quake resistance, should be included.

iii) Linkage with BEP-TR, Turkish assessment tool for insulation and EE&C performance, should be ensured.

iv) Introduction (applicable) to local governments is necessary.

2.3.2 Implementation of Energy Audits

The Study Team conducted energy audits for 2 buildings of 100 Buildings Project from November to December 2012. The outlines and facades of the target buildings are described below. (See Table 2.3.2-1, Figure 2.3.2-1, Table 2.3.2-2, and Figure 2.3.2-2)

(1) Outline

1) Target buildings

a) DSI Buildings

Table 2.3.2-1 Outline of DSI Buildings

Building name	Floor area (m^2)	Floor number	Construction year
A	29,449	13	1969
B	3,291	3	1969
C	7,444	7	1980
Conference hall	830	2	
Total	41,904	-	-

Figure 2.3.2-1 Facade of DSI Buildings

b) EM Hospital

Table 2.3.2-2 Outline of EM Hospital

Building name	Floor area (m^2)	Floor number	Construction year
Out-patient building	8,000	3	2003

Figure 2.3.2-2 Facade of EM Hospital

2) Audit team formation

4 JICA Study Team members, 6 members from 5 EVDs, and 4 local staffs

3) Energy audit work flow

Energy audit was carried out for 16 days, starting with the kick-off meeting on 27th November 2012 and ended in the workshop on 12th December. The work flow of energy audit is shown in Figure 2.3.2-3.

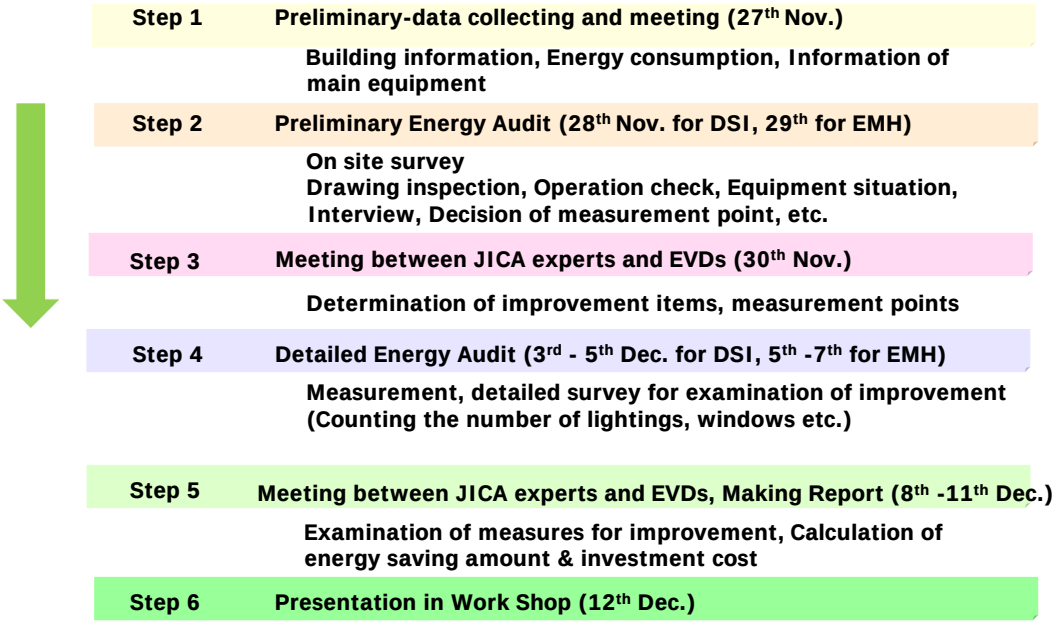


Figure 2.3.2-3 Energy Audit Work Flow

(2) Summary of Recommendations

1) Common issues for DSI Buildings and EM Hospitals

Table 2.3.2-3 shows the summary of EE&C recommendations. And Table 2.3.2-4 and -5 show the summary of recommendations for DSI Buildings and EM Hospital respectively.

Table 2.3.2-3 Summary of EE&C Recommendations for DSI Buildings and EM Hospital

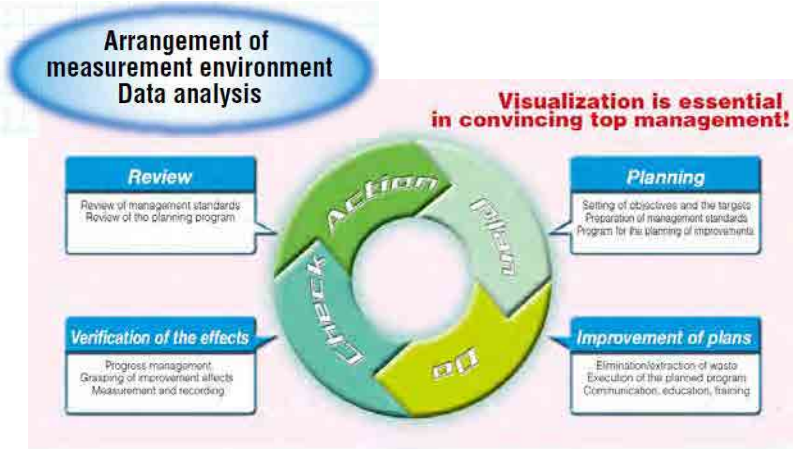
Measures	DS Buildings	EM Hospital
Zero cost	Formulating PDCA cycle, target setting based on data	
	Efficient operation of boiler (time and units)	
	Reduction of night time electricity consumption based on daily load curve	
	Open/close operation of blinds and windows	
		Reduction of fresh air for AC
		Utilizing motionsensor in wash rooms
Small investment	Insulation for valves	
	Adjustment of boiler air ratio	
	Introduction of electronic ballast	
	Insulation for pipes	
	Introduction of room temperature control system	
	Replacement of hot water circulation pumps	
	Introduction of motion sensor in wash rooms	
Large investment	Insulation for waidows and walls	Introduction of heat recovery HVAC system
	Introduction of heat recovery ventilation system	

a) Common items for DSI Buildings and EM Hospital

At first Zero cost measures (management and more effective operation) are strongly recommended to apply.

i) Formulation of PDCA cycle

Through Target setting (Referring data), everybody's participation, discussion for energy and cost saving periodically (formulating PDCA cycle), 5% saving is expected to be achieved. Figure 2.3.2-4 and -5 show images of PDCA cycle.



Source：Energy Conservation for Hospital, ECCJ

Figure 2.3.2-4 Formulation of PDCA Cycle to Promote Energy Conservation

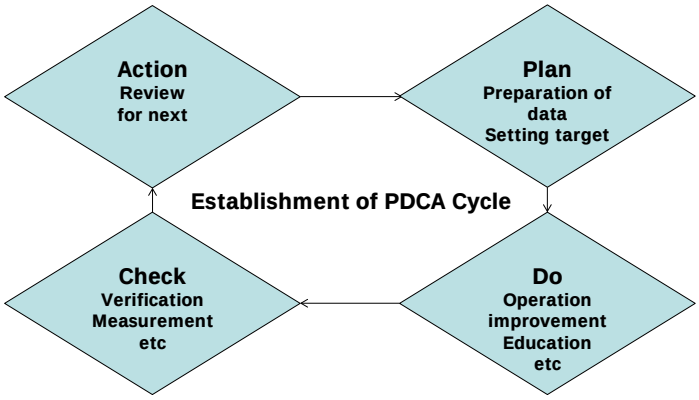


Figure 2.3.2-5 Next Action Plan for Energy Conservation to be Implemented Tomorrow

ii) Optimization of boiler operation (Later start operation, reduction of operating units)

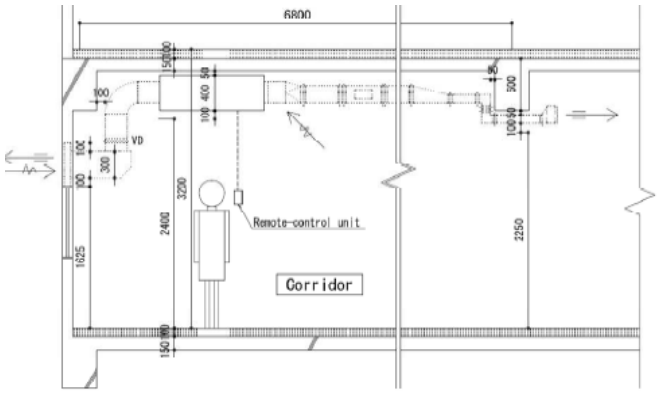
iii) Window operation

- Establishment of the rule for window opening and room air temperature setting
- At winter peak time, by closing blinds, 0.5W/m^2 energy can be saved, It means about TRY 3.0 reduction/y/m^2

And in winter time a lot of officers are feeling hot and open windows to adjust room air temperature. To avoid these in-efficient manners, the introduction of controlling technologies and efforts to realize suitable room air temperature is needed.

Besides introduction of heat recovery mechanical ventilation equipment (HEX) is worth being considered (See Figure 2.3.2-16).

500m^3／h HEXs



Source : Energy Conservation Renovation Study for Existing Office Buildings, Oct. 2013, NEDO

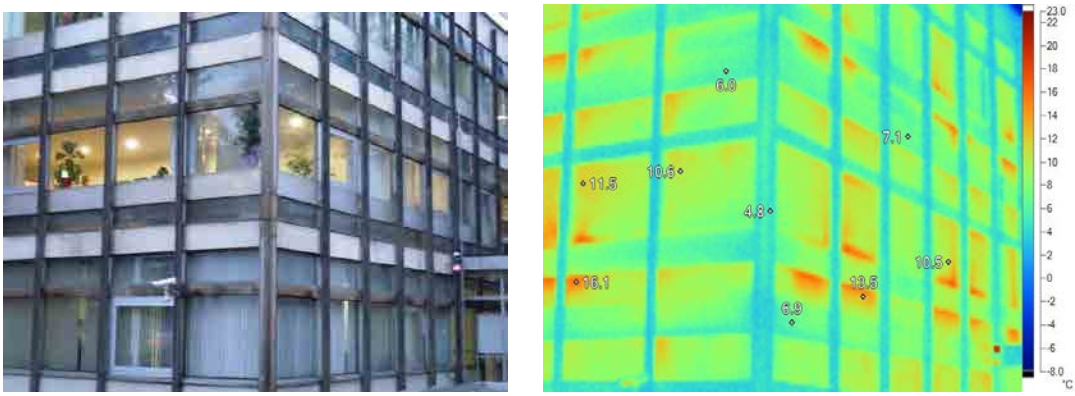
Figure 2.3.2-6 Example of Heat Recovery Mechanical Ventilation (HEX)

b) Recommendations for DSI Buildings

In DSI Buildings i) there is huge (16%) potential by Zero cost energy conservation (management and operation improvement), ii) there is largest potential by improvement of insulation, and iii) including ZERO cost measures, simple payback period for recommended measures (mix) is around 6 years, and iv) EE&C potential is estimated as 27 - 47%.

The problem of DSI Buildings is evidently the lack of insulation for windows and walls.

This means heat loss and money loss through windows and walls. It is estimated that the energy (money) loss through windows and walls of DSI buildings is TRY 456,000/y. And accumulated amount since 1969 is TRY 18,000,000 (present value equivalent) (See Figure 2.3.2-7).



(Normal camera view) **(Thermo camera view)**

Figure 2.3.2-7 Heat Loss through Windows and Walls in DSI Buildings

Besides the procedure for retrofitting of insulation improvement are shown in Figure 2.3.2-8. Key points are reducing heating and cooling load first, introducing temperature control valves second, and introducing high efficient equipment for reduced loads next. And after the introduction of these measures, suitable operation should be implemented.

Table 2.3.2-4 Summary of Proposal for DSI Buildings

Measure	Cost (TL)	Benefit(TL/y)	Simple Pay Back Period	Energy Saving Ratio (%)
1.Operation & management				
(1) Formulating PDCA cycle	0	64,000	0.0	5.0
(2) Blind for heating period	0	21,000	0.0	1.5
(3) Reduction of boiler operaion hours	0	92,000	0.0	7.9
(4) Improvement of hot water boiler operation	0	27,000	0.0	2.3
2. Room temperature control				
(1) Thremo control, inverter	43,000	96,000	0.4	8.3
3. Improvement of insulation				
(1) Wall and window	3,000,000	228,000	13.2	21.2
(2) Insulation for valves and pipes	18,000	20,000	0.9	1.7
(3) Introduction of mechanical ventilation	360,000			
4. Improvement of boiler control				
(1) Boiler air ratio adjustment	6,000	22,600	0.3	1.9
5. Lighting				
(1) Introduction of electronic ballast	5,000	1,100	4.4	0.1
(2) Introduction of motion sensor for WC	5,200	1,400	3.7	0.1
6. Circulation pump for heating & cooling				
(1) Introduction of high efficiency motor	18,000	2,600	6.8	0.2
Adjustment of energy saving in boiler		(14,600)		
Total Case1: Room temp control (1+2+4+5+6)	77,200	313,100	0.2	
Total Case2: + Insulation (1+2+3+4+5+6)	3,412,200	465,100	7.3	

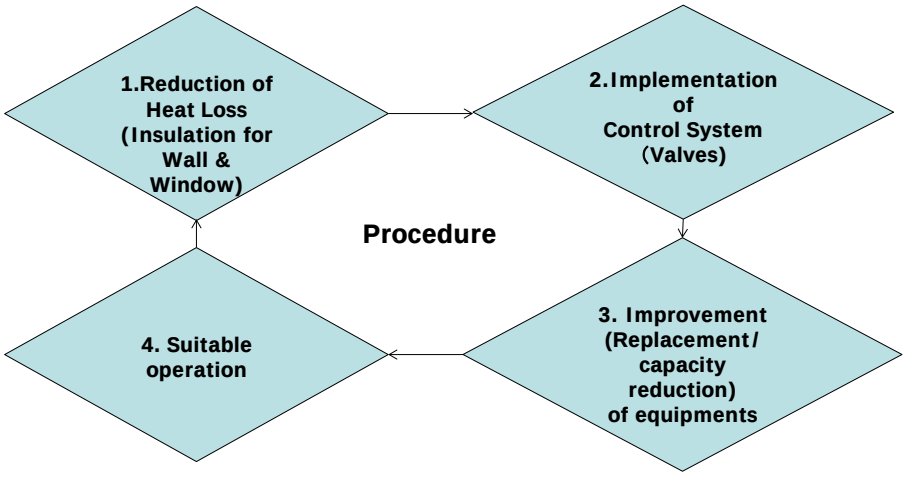
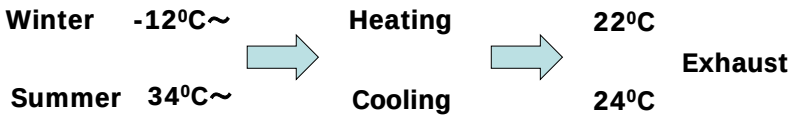


Figure 2.3.2-8 Procedure for Retrofitting of Insulation Improvement

c) Recommendations for EM Hospital

In EM Hospital i) there is huge (30%) potential by ZERO cost energy conservation (management and operation improvement), ii) there is largest potential by reduction of fresh air intake, and iii) including ZERO cost measures, simple payback period for recommended measures (mix) is around 1 - 3 years, and iv) EE&C potential is estimated as 28 - 38%.

The problem of EM Hospital is evidently that as for air conditioning and ventilation, 100% all fresh air intake and exhaust, no recovery system has installed. As shown in Figure 2.3.2-9, this situation is equivalent to throwing heated or cooled air away outside.



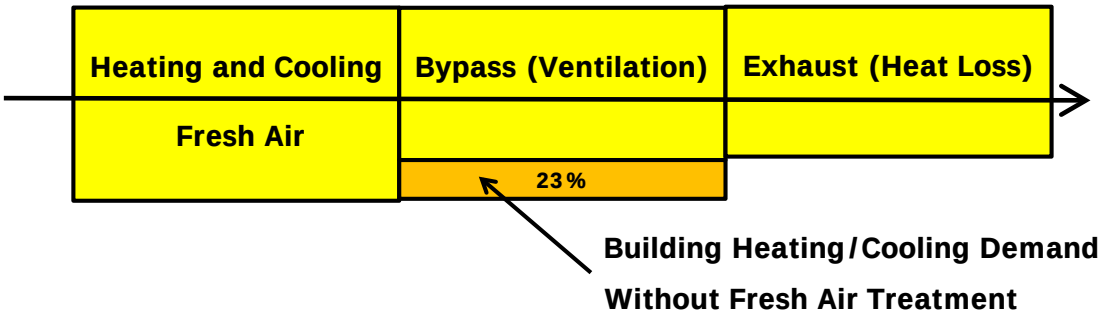


Figure 2.3.2-9 Heat Loss in Air Conditioning and Ventilation in EM Hospital

Besides, the procedure for change in air conditioning and ventilation system of insulation is shown in Figure 2.3.2-10. Key points are clarification of heat loss through ventilation first, designing heat recovery ventilation/air conditioning system and temperature control system second, and introducing high efficient equipment for reduced loads next. And after

the introduction of these measures, suitable operation should be implemented.

Table 2.3.2-5 Summary of Proposal for EM Hospital

Measure	Cost (TL)	Benefit(TL/y)	Simple Pay Back Period	Energy Saving Ratio
1.Operation & management				
(1) Formulating PDCA cycle	0	30,000	0.0	5.0
(2) Blind for heating period	0	1,700	0.0	0.3
(3) Reduction of boiler operaion hours	0	17,000	0.0	2.0
(4) Improvement of boiler operation	0	8,000	0.0	1.0
(5) Change setting of motion sensor for WC	0	600	0.0	0.1
2. Air conditioning & ventilation				
(1) Reduction of fresh air heating/cooling load				
1) Case 1 Reductio of fresh air to 30,000m3	0	48,000	0.0	19.0
2) Case 2 Introducing HEX and control	150,000	73,500	2.0	45.0
3) Case 3 Replacement of AHU	422,000	66,000	6.4	40.0
(2) Boiler air ratio adjustment	6,000	6,700	0.9	0.8
(3) Insulation for valves	2,400	2,400	1.0	0.3
4. Lighting				
(1) Introduction of electronic ballast	3,300	670	4.9	0.1
Adjustment of energy saving in boiler		(1,700)		
Total Case1 Reduction of fresh air	11,700	113,370	0.1	
Total Case2 Introducing small HEX	161,700	138,870	1.2	
Total Case3 Replacement of AHU	433,700	131,370	3.3	

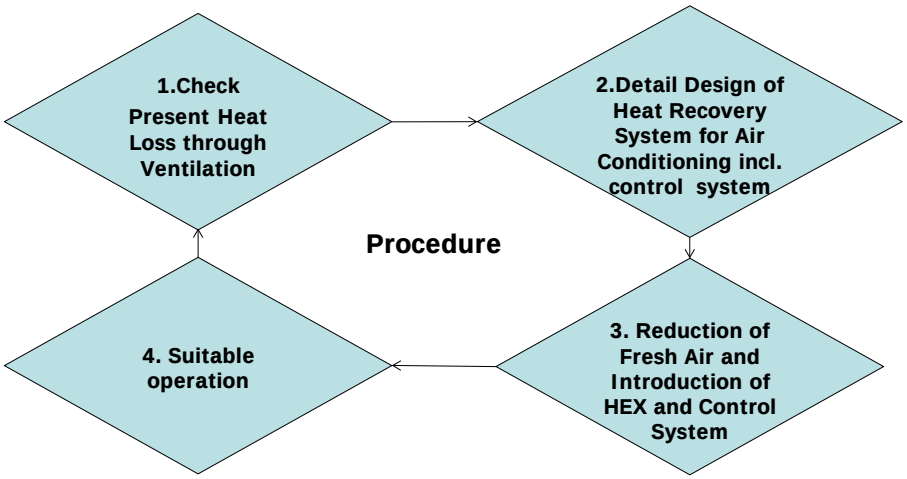


Figure 2.3.2-10 Procedure for Change in Air Conditioning and Ventilation System

2) Recommendations for Turkish Government

Referring the above analyzed energy audit result, recommendations for Turkish Government are summarized as follows. By breaking through them, the potential of ZERO cost EE&C can be expanded.

a) Enhancing EVD's capacity development by OJT is a high priority issue (Soft technology, lack of experiences).

i) Proposal based on measured data

e.g. Improving boiler operation
Adjustment of boiler air ratio
Proposal based on daily electricity load curve

ii) Proposal based on cost benefit analyses

iii) Proposal to implement heat recovery HVAC system

b) Suitable room air temperature should be realized.

i) Many people are feeling hot in winter time (Opening window).

ii) Temperature control system has not been implemented.

c) Night time electricity consumption should be reduced.

In Japan stand-by & IT (server & PC etc.) electricity is dominant.

2.3.3 Present EE&C Condition and Target Technologies in Turkish Government Buildings

(1) Applicable EE&C Technologies for Turkey (Draft)

Considering the hearing result from related technical organizations, EVDs, the findings from energy audits, and preliminary energy audits, Turkish typical EE&C technologies in existing government buildings and economically feasible typical technologies, which is considered to be applicable for Turkish public buildings, are summarized in Table 2.3.3-1. These technologies are considered to be common for all types of buildings.

Table 2.3.3-1 Technologies of Existing Buildings and for EE&C Retrofitting

Item	Typical technology of existing buildings	Technology for EE&C retrofitting	Typical manufacturer's country for EE&C technology
1. Building Materials			
Insulation (Wall)	None or less	EPS, rock wool (fire protective part)	Domestic
Insulation (Roof)	None or less	XPS, glass wool, SPF (spray polyurethane foam)	Domestic
Glass and Sash	Single glass, partially pair glass, Low-e not yet, non-insulated sash	Low-e pair glass with insulated sash	Mainly domestic (with Japanese and French Low-e glass)
Entrance	Air curtain, rotary/double door	Air curtain, rotary door, double door	Domestic, EU
2. Heat Sources			
Boiler	Large and not so efficient	Smaller and more efficient and insulation	Domestic, EU
Insulation of boiler	Partially	Equipped	Domestic
Insulation of valves	None or less	Equipped	Domestic
Insulation of pipes	Glass wool is used already or partially	Equipped	Domestic
3. Air Conditioning and Ventilation			
Heating	Gas hot water boiler, partially split AC with non-inverter	High efficient gas hot water boiler, split AC with inverter	Domestic, EU, Japan, Korea
Cooling (partially)	Split AC with non-inverter	High efficient split AC with inverter	Japan, Korea
Cooling (medium scale)	Split AC with non-inverter	Replace with high efficient central system such as VRF	Japan, EU
Central cooling	Central air cooling	High efficient cooling system	USA, EU, Japan, Korea
Ventilation	No ventilation	Ventilation by HEX, central system	Domestic, EU, Japan
Pumps and fans	Not high efficient	High efficient pump and fan with inverter	EU
4. Hot Water			
Water heater	Boiler	High efficient gas boiler, heat pump	Domestic, Japan
5. Lighting			
Usage of daylight	Already	Usage including solar duct	EU
CFL	Already	Less	EU
T5 and T8 with high frequency control	Rarely	Less	EU
LED	None	Equipped (Design and price should be secured) not now but near future	EU, Japan
Sensor and lighting control	Motion sensor is pupular	Advanced	Domestic
Reflector	Already	Equipped	Domestic
6. BEMS			
BEMS	None	Future	EU, USA, Japan
7. CHP			
Co-generation or tri-generation	None	Equipped in hospitals, hotels etc	EU, China (Absorption chiller)
8. Renewable Energy			
Solar heater	None	Recommended	Domestic
Solar cell	None	Recommended	EU, Japan, China
Heat pump (soil, water)	None	Recommended	EU, Japan, Korea

In order to promote EE&C in buildings, Heating, Ventilating and Air Conditioning (hereinafter referred to as "HVAC"), insulation and lighting are the three major technologies to be improved. And the combination of Turkish, Japanese and EU's eligible technologies can contribute to promote EE&C in buildings.

Especially the insulation for walls and roofs, which contributes the reduction of energy consumption very high, the Study Team had meetings with IZODER (Association of Heat,

Water, Noise and Fire Isolators) (Insulation Association) and manufacturers and conducted several field surveys (retrofitting for insulation).

Target standard insulation model for the insulation retrofitting for the government buildings, which the Study Team recommends, is Expanded Polystyrene (EPS) for walls and Extruded Polystyrene (XPS) for roofs. The thickness needed is defined in TS825 (See Figure 2.3.3-1 and -2)[7].

The insulation added is not so heavy that usually the effect for the building physical strength is considered to be less (Average budget needed for adding insulation is TRY40-50/m^2 (including plastering and painting)).

Besides as a target standard insulation model for windows, the Study Team recommends pair glass with Low-e glass and insulated sash. Insulated sash can be provided by domestic manufacturers. Besides Low-e glass can be provided by Japanese manufacturers (Nippon Steel Glass and Asahi Glass) and French manufacturer.

Figure 2.3.3-1 Target Standard Insulation Model (EPS)

Figure 2.3.3-2 Retrofitting to Add Insulation for Existing Building

The first priority is adding insulation on walls/roofs and change into insulated sash. And next is change into high-efficient heating and cooling equipment for the reduced heating/cooling demand.

Regarding cooling equipment, introducing inverter technology is effective. Japanese manufacturers (incl. Turkey-Japan joint venture) can contribute to provide inverter technology for split type air conditioners and VRF (Variable Refrigerant Flow) air conditioners.

(2) Summary of Recommendations

The summary of recommended technologies, which is estimated economically feasible and can contribute Turkish government buildings EE&C are as follows.

[7] Major materials for insulation on walls and roofs are the followings; i) EPS in short for wall, ii) XPS in short for roof, iii) Rock wool for the wall where fire protection is needed (over 21m height) and iv) Glass wool for interior insulation

i) External wall and roof insulation (e.g. EPS for walls and XPS for roofs)

ii) Pair glass (with low-e glass and insulated sash)

iii) Inverter technology for air conditioning (incl. VRF)

iv) Insulation for heating pipes and valves

v) Heat recovery ventilation

vi) Inverter technology for pumps and fans

vii) Hot water supply by solar heat

viii) Heat pump system

2.3.4 AC (Air Conditioner) Field Test

For air conditioners (ACs), which are the most electricity consuming equipment in buildings, the field test of measuring electricity consumption in the actual offices in Istanbul is being carried out. The purposes of this field test are as follows;

a) Electricity consumption of inverter ACs and non-inverter ACs is measured in the actual offices. Compared with both consumption data, energy saving by introduction of inverter ACs is clarified (Visualization of the energy saving effect).

b) The necessity of introducing Seasonal Performance Factor (hereinafter referred to as "SPF") and Annual Performance Factor (hereinafter referred to as "APF"), which will be used worldwide as ISO 16358 in 2013, is recognized (For the details of SPF and APF, refer to the following Section (1)).

(1) SPF and APF

1) Movement of SPF and APF

Energy Efficiency Ratio (hereinafter referred to as "EER") and Coefficient of Performance (hereinafter referred to as "COP"), which evaluate the energy efficiency at the rated time, have been used in the past. However, with the spread of inverter ACs, which, following the fluctuation of the actual load, can operate, it is found that the existing EER and COP can't evaluate the performance of variable operation.

Recently, preparation and introduction of SPF and APF, which can evaluate seasonal and/or annual energy performance, as the evaluation standard, are starting in Japan and other countries. SPF and APF will be standard as ISO16358 in 2013 and will start operation of this standard.

SPF and APF will be also introduced in Europa. Therefore, it is expected that spread of inverter ACs in Turley will is promoted by the introduction of this standard.

2) Outline of SPF and APF

a) EER and COP

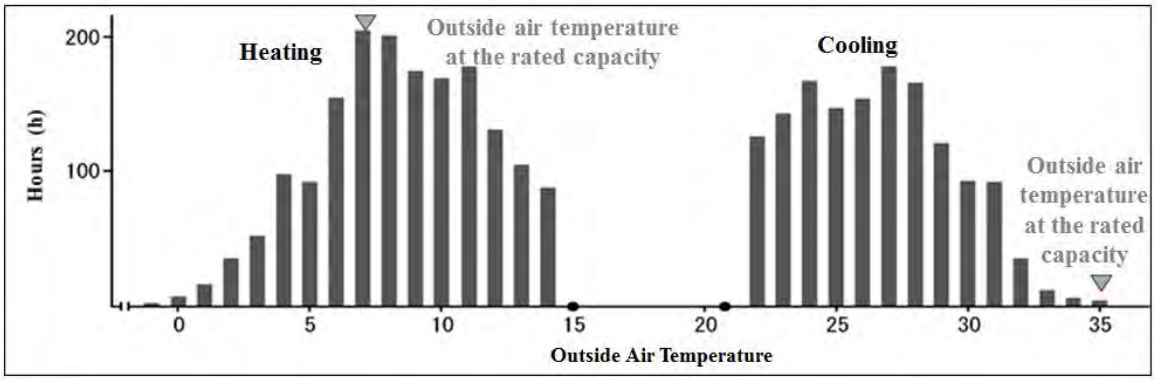
EER and COP, which are the existing energy efficiency evaluation standard, evaluate ACs only by using the capacities at the rated points.

$$EER = \frac{\text{Cooling Rated Capacity (W)}}{\text{Cooling Rated Energy Consumption (W)}}$$

$$COP = \frac{\text{Heating Rated Capacity (W)}}{\text{Heating Rated Energy Consumption (W)}}$$

b) Outside air temperature in cooling and heating period

Distribution of outside air temperatures for calculating APF of the commercial and office buildings in Japan is shown in Figure 2.3.4-1. EER and COP can't evaluate the actual situation, since electricity consumption for cooling or heating in the actual operation varies in accordance with the change of outside air temperature. It is also funded the rated points of EER and COP are not always the representative points.



Source; Report of Air Conditioner Standard Subcommittee, Energy Efficiency Standard Subcommittee, Advisory Committee for Natural Resource and Energy

Figure 2.3.4-1 Distribution of Outside Air Temperatures for Calculating APF of the Commercial and Office Buildings in Tokyo

c) Energy efficiency for partial load

Energy efficiency of ACs for partial load is shown in Figure 2.3.4-2. Inverter ACs have high energy efficiency for partial load. As shown in Figure 2.3.4-1, Distribution of outside air temperature, there are many operations under the partial load in actual operation. So, Inverter ACs, as compared with non-inverter ACs, can bring out high energy efficiency for actual operation.

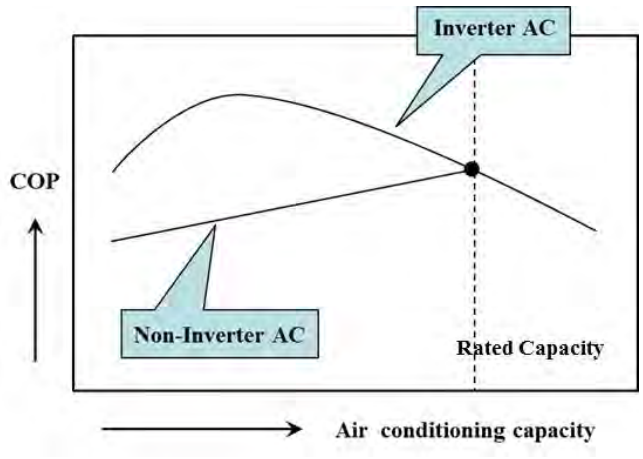


Figure 2.3.4-2 Energy Efficiency of ACs for Partial Load

d) SPF and APF to be defined in ISO 16358

In order to evaluate ACs on the near-actual operation conditions, SPF and APF, as new energy efficiency evaluation standards, which are calculated by using total loads for AC and the characteristics of electricity consumption of AC in cooling, heating, and annual periods, are defined.

i) Cooling Seasonal Performance Factor (CSPF)

$$\text{CSPF} = \frac{\text{Cooling Seasonal Total Load (CSTL) (W)}}{\text{Cooling Seasonal Energy Consumption (CSEC) (W)}}$$

ii) Heating Seasonal Performance Factor (HSPF)

$$\text{HSPF} = \frac{\text{Heating Seasonal Total Load (HSTL) (W)}}{\text{Heating Seasonal Energy Consumption (HSEC) (W)}}$$

iii) Annual Performance Factor (APF)

$$\text{APF} = \frac{\text{CSTL (W)} + \text{HSTL (W)}}{\text{CSEC (W)} + \text{HSEC (W)}}$$

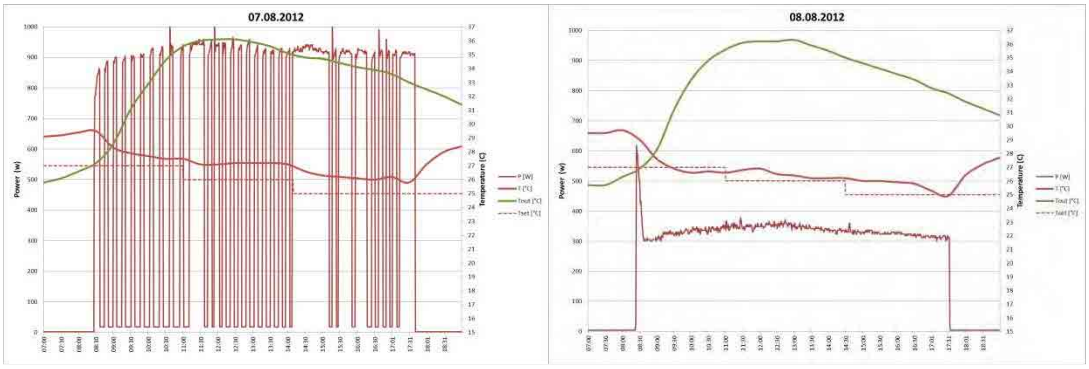
In order to calculate SPF and APF, the energy consumption is not measured in actual field. In accordance with ISO 16358, the total heat load is prepared in consideration of each local climate in Turkey and the energy consumption is prepared by using a) the rated capacity and the half capacity for cooling, b) the rated capacity, the half capacity, and the low temperature capacity for heating. And the SPF and/or APF are calculated by the total heat load and the energy consumption.

(2) AC Field Test

1) Result of measurement

AC field text was conducted by using inverter AC and non-inverter AC with same EER and same COP. Electricity consumption of both ACs was measured in actual offices in Istanbul.

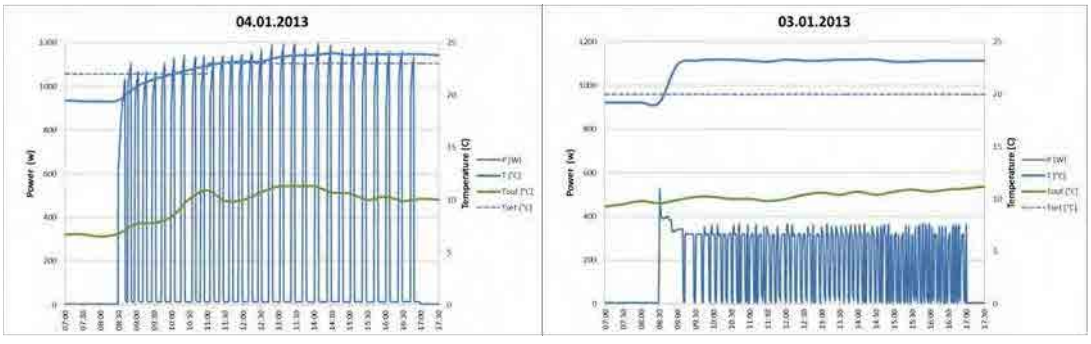
On the typical two days, which have similar outside and indoor air temperatures, daily electricity consumption of non-inverter and inverter ACs for cooling is shown in Figure 2.3.4-3 (for cooling). Inverter AC continuously operates at the low power and non-inverter AC repeatedly operates at the high power and stop in operation hours. The Figure specifically shows the feature for energy efficiency of inverter AC.



Note; P: Power, T: Air temperature in room, Tout: Outsilde air temperature, Tset: Set temperature

Figure 2.3.4-3 Daily Electricity Consumption of Non-inverter and Inverter ACs for Cooling

On the typical two days, which have similar outside and indoor air temperatures, daily electricity consumption of non-inverter and inverter ACs for heating is shown in Figure 2.3.4-4 (for heating). This field test for heating was conducted in the limited period, which has low heat load without peak period. Therefore, electricity savings was confirmed but the situation, which not only non-inverter AC but also inverter AC operated and stopped repeatedly, arisen.



Note; P: Power, T: Air temperature in room, Tout: Outsilde air temperature, Tset: Set temperature

Figure 2.3.4-4 Daily Electricity Consumption of Non-inverter and Inverter ACs for Heating

2) Result of analyses

As the result of the field test, the followings are found and confirmed;

a) As compared with non-inverter ACs, inverter ACs have 20% energy saving potential for cooling, 30% for heating, and 26% for total of cooling and heating. (This field test was conducted in the limited period. Especially, the field test for heating was not conducted in the peak season. As a result, analysis for heating was conducted based on the limited and less data, compared with the analysis for cooling.)

b) The existing EER and/or COP, which are evaluation by the rated input and output, are difficult to evaluate the energy efficiency of inverter ACs. Therefore, the introduction of SPF and APF, which are new evaluation factors, is needed.

On the other hand, there are needs for cooling in peak summer season, however the demand (kWh) in cooling period is not large in Istanbul. Under such conditions, in order to promote EE&C through the introduction of inverter ACs, it seems to be effective to select ACs with suitable capacity, not an oversized capacity, and with a wide control range.

In addition, it is expected to increase the use of inverter ACs, as equipments for both heating and cooling, in the south areas of Turkey, where cooling demand is large and gas has not been delivered for heating.

(3) Summary of Recommendations

The result of the field test will be shared with MOEU and the relevant governments and agencies in the seminar which was held in Ankara on 30th January 2013. In the seminar, the energy saving effect of inverter ACs was shown and the necessity of introducing SPF and APF was recognized. And four recommendations from the AC field test are as follows;

a) This field test was conducted in the limited period, which the peak period for heating was not included especially. For the improvement of analyses accuracy, the further continuous study should be needed.

b) Since Turley has various meteorological and special local conditions, AC field test should be spread to other regions to collect and analyze the data based on the regional characteristics.

c) SPF and APF in Turkey should be prepared and introduced, considering meteorological and special local conditions in Turkey, in accordance with ISO 16358 to be issued in this year.

d) In Turkey, SPF and APF should be introduced as the evaluation method and inverter ACs should be disseminated for promoting EE&C.

2.4 Recommendation of a Project Scheme for Energy Efficiency Retrofitting in Government Buildings

2.4.1 Confirmation of Government Policy and Objectives

(1) Necessity and Rationale of EE Retrofitting in Government Buildings

There are two kinds of important requirements obligated to the Government, legal and policy requirements in EE&C in public sector buildings in Turkey. One is a legal requirement by En-Ver (2011) under Energy Efficiency Law of 2007. In this regulation, it is stated that "The energy use of the buildings and enterprises belong to public sector shall be reduced by at least 20% in the year 2023 compared to the year 2010." in Article 31. The other is a policy requirement stipulated in the Energy Efficiency Strategy Paper 2012-2023. In response to the above legal requirement, the Energy Efficiency Strategy Paper specifies an action "The efficiency improvement projects shall be prepared by making energy audits in the buildings and facilities of the public enterprises and the budget allowances of the maintenance shall be used for these projects with priority" as SP-06/ST-01/A-01 under the target of "Annual energy consumption in the public enterprises buildings and facilities shall be decreased as 10% by the year 2015 and as 20% by the year 2023."

(2) Expected Outcomes

1) Industry was the dominant energy consumer for the last years. However, because of the economic contraction in 2008, the building sector has become the largest energy consuming sector with a share of 36% in 2008 and 40% in 2009 in total consumption. By 2010, the share decreased to 35% despite the fact that its energy consumption had actually increased to 28.9 mil. TOE. The out of total 8.6 mil. buildings in Turkey, majority of buildings (more than 90%) was built before 2000, the year new thermal insulation regulations came into operation. Judging from several energy audit studies indicates that 30% energy saving could be achieved in building sector without much difficulties[8].

2) The public sector buildings also have large energy saving potentials. It is, however, difficult to indicate the potential saving volumes quantitatively, as statistics of energy consumption in public sector buildings are not collected comprehensively. In any case, there must be untouched sizable EE&C potentials in public sector buildings.

[8] Strengthening the Capacity of the Ministry of Public Works and Settlement for Improving the Energy Performance of Buildings; Action Plan for Improving the Energy Performance of Buildings in Turkey, May 2011

(3) The Government Plan

1) The relevant government ministries such as MOEU and MENR consider EE&C in public sector buildings is untouched and thus has large energy saving potentials. After getting the lessons and feedback from this project, MOEU has idea to extend similar studies to promote EE&C to 1,000 public buildings nationwide, if possible.

2) Not only the line ministries, but also agency responsible for national development such as MOD also recognizes the importance and effectiveness of EE&C especially in public buildings. This sector has already become a focused target.

3) The Energy Efficiency Strategy Paper 2012-2023, issued in February 2012 (See 2.1.2 and 2.1.3), and reconfirms the government priority on energy efficiency improvement in public buildings. The Government, therefore, plans to implement the program by creating comprehensive implementing framework together with institutional/human resource development and finance mechanism. The Government also considers it as a smart way to mobilize multilateral/bilateral donor assistances (technical assistance and loan assistance) from countries with experiences and know-how of EE&C, such as Japan, in order to implement large scale program in an effective manner.

2.4.2 Recommendation of a Project Scheme for Energy Efficiency Retrofitting in Government Buildings

(1) Principal Barriers and Counter Measures

The Study Team assumes that the target segment at initial stage is "Energy Efficiency Retrofitting of Central Government Buildings[9]." Eligibility criteria for sub-project may include a) reducing energy consumption by more than 20%, and b) recovering full investment cost by reduction of energy bill within five years[10]. Apart from several procedural/regulatory difficulties, there are two major root causes, which have hampered EE in public sector buildings from implementation.

1) Size of sub-projects varies, from large ones such as a whole building refurbishing with energy efficiency improvement to small replacement of one split-type AC. But majorities are small ones. Being a small size makes transaction cost relatively high, which includes monetary costs, human resources, and time.

2) Energy saving brings a tangible benefit of financial savings. As it is in a form of reduction of budget expenditure, savings cannot be used by the organization which really made the savings, but kept by the authority that manages the government budget. Therefore, not many organizations have so far become serious about energy saving.

[9] As the same implementation model can be applied to municipal buildings with slight modification for funding, a parallel program may be commenced once the central government program become on track.

[10] The figures "20%" and "five years" are just examples.

Table 2.4.2-1 shows the solutions for the above two fundamental barriers.

Table 2.4.2-1 Principal Barriers and Possible Counter Measures

Principal Barrier	Counter Measure
Majority of sub-projects are "small," thus involves relatively high transaction costs	- To standardize investment decision and procedures of sub-projects so as to process easily - To use eligible equipment list for automatic sub-project approval - To bundle a large number of the same kind, small sized sub-projects into one large batch. At the same time, establish the Project Management Unit (hereinafter referred to as "PMU") for the entire project implementation, from budget handling, procurement, contract, so as to avoid the implementation by each ministry.
Little (no) interest for energy saving by building owner agencies (ministries), due to lack of financial benefits	- Not only raising awareness, educational, but also guidance, enforcement by authoritative power; - To set up, for example, the PMU in the highly recognized agency such as the Prime Ministry or in MOEU with support from and coordination with higher government authorities. - Another approach is to make the program compulsory by law, by regulation, or by the issuance of a Prime Ministry Circular so as to ensure that no agency could dismiss the implementation of EE&C improvements in buildings.

With an understanding of principal barriers and counter measures mentioned above, the target of future assistance program is to implement energy efficiency retrofitting of public buildings in an efficient manner and to realize potential benefits within the shortest possible time.

Proposed future assistance program is divided into the following three different components. (See Figure 2.4.2-1)

1) Financial (ODA loan) assistance for implementation of EE&C of public buildings

2) Technical assistance mainly to PMU for a smooth, efficient and effective implementation of the above EE&C investment project

3) Technical assistance aimed toward the broader capacity development for EE&C in Turkey, which at the same time would strengthen the prerequisites for the success of EE&C of public sector buildings

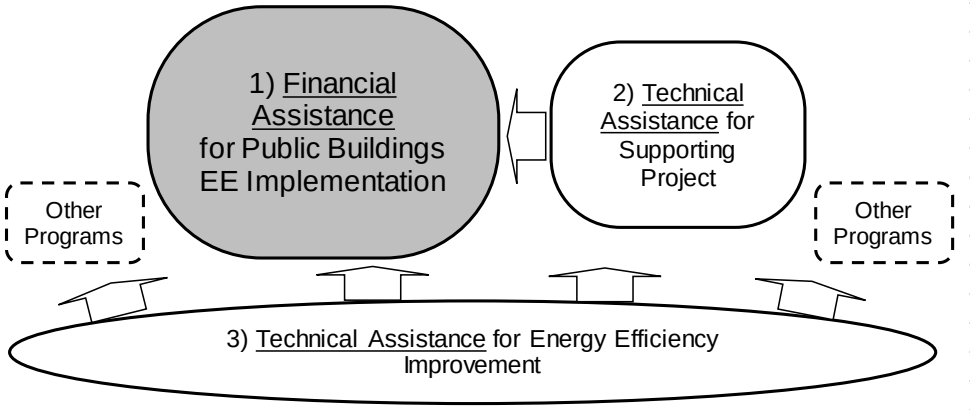


Figure 2.4.2-1 Three Broad Components of Future Assistance Program

(2) Financial Assistance Project

This is concessional loans extended by bilateral and/or multilateral donor(s) to the Government of Turkey represented by UT.

The approach of Government of Turkey for public sector energy efficiency is shown in the item SP-06/ST-01/A-1 of Energy Efficiency Strategy Paper 2012-2023, "The efficiency improvement projects shall be prepared by making energy audits in the buildings and facilities of the public enterprises and **some parts of the budget allowance of the maintenance shall be used for these projects with priority**. Prime Ministry Circular numbered as 2008/2 shall be revised in this direction by MENR. It is however concerned this approach discourages willingness of government ministries for EE&C because of using allocated maintenance budget. Approach must be end-users (Ministries and General Directorates) friendly by responding to barriers explained in Table 2.4.2-1 Principal Barriers and Possible Counter Measure.

By taking above factors into considerations, the Project for Energy Efficiency Retrofitting in Government Buildings (The Project) has been designed and proposed in this study. The Project has two intended outcomes, namely; a) realization of energy savings in public sector buildings, which account for a part of the government's saving target of decreasing as 10% by 2015 and by 20% by 2023, and b) leading EE retrofitting of private sector buildings by showing success cases in public sector buildings.

Several important features of the Project are as follows;

- Utilization of Two implementation methods
- Establishment of a powerful PMU with implementation authorities and enforcement tools
- Structuring framework agreement for a large-number of small-scale sub-projects in consistent with Turkish Law
- Implementation of sub-project by PMU for other ministries by delegation of authority to PMU
- Evaluation of tender not by price of bids, but selecting the economically most

advantageous tender by taking into account the factor other than price

- Purchasing only high energy efficiency equipment by using energy labeling regulations
- Direct financial beneficiary will be GOT through reduced energy purchase bills

1) Utilization of two implementation methods

There are two methods of sub-project implementation (See Figure 2.4.2-2).

- Energy Audit Method: Energy audits will be done (like 100 Buildings Project) for buildings having high energy saving potentials, based on which sub-projects consisting of several EE&C measures will be formulated. Sub-projects will then be appraised and approved by the PMU, if eligibility criteria are met. Approved sub-projects will be implemented by building owners, i.e. Ministries and General Directorates, with comprehensive support from PMU for energy audit, budget provision (finance) preparation of detail design and tender documents, tender support, implementation support.
- Bundling Method: This is a single most promising EE&C measure, in which small scale but large number of thematic sub-projects, such as replacement of ACs, will be bundled across ministries and administrations, and implemented and financed by the PMU.

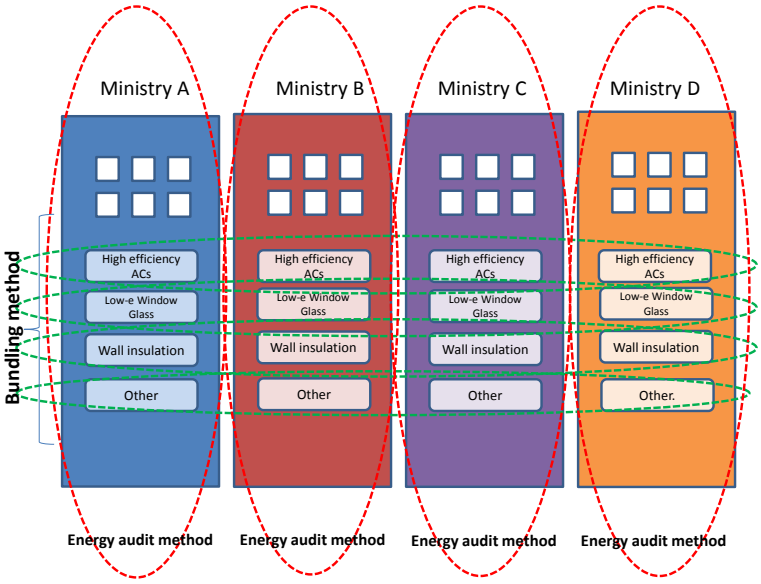


Figure 2.4.2-2 Energy Audit Method and Bundling Method

2) Establishment of a powerful PMU with implementation authorities and enforcement tools

PMU will be created in the higher level of government structure or in the MOEU with support from and coordination with higher government authorities. It must become a powerful enough organization to control all ministries including their General Directorates, and other central governments public administrations (in a sense, all ministries are expected to act according to the instructions from the PMU). The present roles and

responsibilities given to MOEU with regard to implementation of EE retrofitting of all public sector buildings are not explicitly mandated. It is therefore recommended to make it as a role of MOEU together with authorities and responsibilities, by amending establishment law of MOEU or Energy Efficiency Law. Another approach is to make the program compulsory by law, by regulation, or by a decision of HPC and/or the issuance of a Prime Ministry Circular so as to ensure that no agency could dismiss the implementation of EE&C improvements in buildings (See Figure 2.4.2-3).

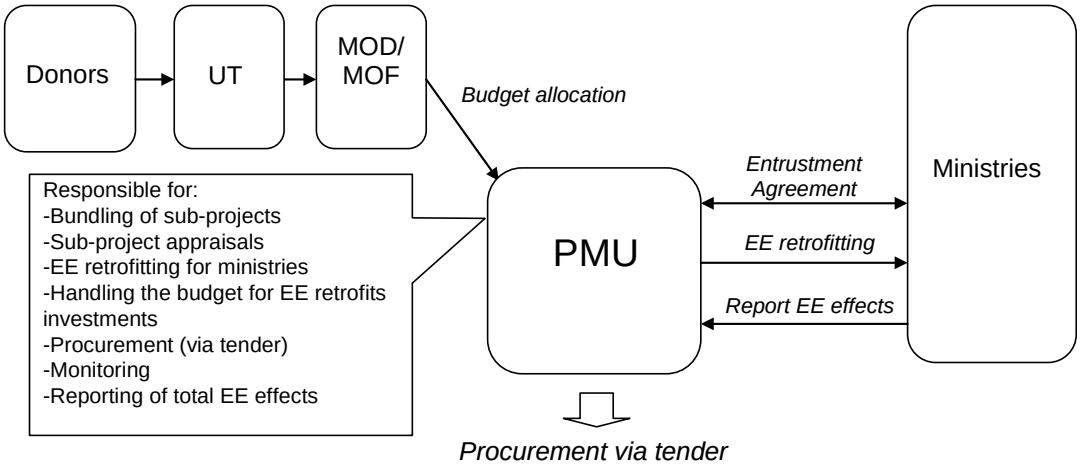


Figure 2.4.2-3 Role of PMU

The PMU Management Team consists of government officials seconded from relevant ministries and recruited from outside the government. The PMU's roles and functions include;

- Overall project implementation and management
- Financial management including loan management
- Establishment of sub-project eligibility criteria, including making and updating "the List of Eligible EE&C Equipment"
- Appraisal and approval of submitted sub-projects in accordance with sub-project eligibility criteria
- Sub-project formation for challenging areas shall be done by the Technical Pool under the PMU subcontracted to EVDs
- Confirmation of responsibilities of participating ministries and administrations, by signing agreement with each participant.
- Procurement, contract, and implementation management in case of Bundling Method (All responsibilities are with the PMU, not participating ministries, etc.). Actual design and constructions works are to be undertaken by subcontracted EVDs
- Monitoring of sub-project progress and project outcomes
- Awareness raising, dissemination of information about project outcomes

The Project implementation steps and the agencies involved are summarized in Table 2.4.2-2 and -3. Here MOEU would take the leadership, irrespective of the fact whether the PMU is established above the line ministries or not to implement the Project. It is important that at the stage of identification of sub-projects, PMU/MOEU shall take leadership in collecting information from relevant stakeholders by interacting proactively with them. At the tender stage, sub projects are to be screened via energy audits for large-scale EE retrofitting sub-projects, while for many small-scale sub-projects bundled into one batch were to be screened based on tender documents (which define standard specifications and the minimum procurement amount). Lastly, strict monitoring shall be conducted by PMU/MOEU in order to calculate the cost effectiveness and EE&C effects of the Project.

Table 2.4.2-2 Project Implementation Steps and Agencies Involved (Case of Energy Audit Method)

Project Implementation Steps	JICA	Ministries	PMU	MOEU	EVDs	Suppliers/ Contractors
(1) Identification of sub-projects	S	P	P	S	S	S
(2) Request for participation		P				
(3) Acceptance for participation			P			
(4) Initial energy audit by computer software			P		S	
(5) Agreement for investment		P	P			
(6) Appraisals for eligibility/approval	S		P			
(7) Agreement for sub-project implementation		P	P			
(8) Tender/ Tender documents		P	S		S	P
(9) Tender evaluation		P	S			
(10) Negotiation and signing of contract for supply/works		P			S	P
(11) Supervision of works			P		S	
(12) Final acceptance		P				
(13) Operation maintenance		P				
(14) Outcome monitoring	S	P	S	S		

P: Primaliry Responsible Agency
S: Supporting Agency

Table 2.4.2-3 Project Implementation Steps and Agencies Involved (Case of Bundling Method)

Project Implementation Steps	JICA	Ministries	PMU	MOEU	EVDs	Suppliers/ Contractors
(1) Identification of sub-projects	S	P	P	S	S	S
(2) Request for participation			P			
(3) Acceptance for participation		P				
(4) Initial energy audit by computer software					S	
(5) Agreement for investment		P	P			
(6) Appraisals for eligibility/approval	S		P			
(7) Agreement for sub-project implementation		P	P			
(8) Tender/ Tender documents			P		S	P
(9) Tender evaluation			P			
(10) Negotiation and signing of contract for supply/works			P		S	P
(11) Supervision of works			P		S	
(12) Final acceptance		P	S			
(13) Operation maintenance		P				
(14) Outcome monitoring	S	P	S	S		

P: Primaliry Responsible Agency
S: Supporting Agency

3) Structuring framework agreement for a large-number of small-scale sub-projects

As a counter measure against large-number of small-scale works, Framework Agreement (Contract) stipulated in Additional Article 2 of Public Procurement Law No. 4734 of 2002 can be applied by PMU. This is an agreement between one or more contracting authorities (PMU representing all other ministries) and one or more tenderers (manufacturer, supplier, contractor), which establishes the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, the quantity envisaged. It is, however, that current Public Procurement Law does not allow framework agreement across ministries. Therefore, amendment of Public Procurement Law is required with regard to a new clause that enables frame work agreement among ministries, including budget appropriation and spending for other ministries by a representing ministry (MOEU/PMU). The Public Procurement Policy Department of the Ministry of Finance is undertaking a process of amending it in consultation with relevant ministries and departments.

4) Implementation of sub-project by PMU for other ministries and agencies by delegation of authority to PMU

According to the Establishment Law of MOEU[11], the Ministry is already mandated to implement retrofit investments (budget acquisition & procurement included) for other

[11] 29/6/2011 No.644 KHK

ministries but only upon the requests of other ministries[12]. It is considered to be much faster, efficient and effective, if implemented by PMU/MOEU rather than implemented by each ministry. This, either implemented by PMU with delegation (Bundling Method), or implemented by each ministry with support from PMU (Energy Audit Method), must be done by exchanging written agreement between PMU and participating ministries.

5) Evaluation of tender not by price of bids, but selecting the economically most advantageous tender by taking into account the factor other than price

It is important to ensure energy efficiency improvement (energy savings) by all sub-projects. Therefore, tenders should not be awarded to a bidder who only submit the lowest price, but must be evaluated and awarded to the bidder who offers most economically advantageous proposal in life time (Life Cycle Cost). Public Procurement Law No. 4734 of 2002 allows an evaluation and award in Article 40: "In cases where it is not possible to determine the economically most advantageous tender on the basis of the lowest price only, the economically most advantageous tender shall be determined by taking into account the factors other than price such as operation and maintenance costs, cost-effectiveness, productivity, quality and technical merit. In tender procedures where the economically most advantageous tenders shall be determined by taking into account the other factors in addition to the price, these factors must be stated in the tender documents and where possible, must be expressed in monetary values. Relative weights shall be determined in tender documents for the factors which cannot be expressed in monetary values."

6) Purchasing only high energy efficiency equipment by using Energy Labeling regulation

There are several regulations in relation to requirements in energy efficiency in public sector procurements. These are;

Regulation on Labeling of Products by Consumption of Energy and Other Resources dated 09/12/2011 No: 2011/2257

Public procurement and incentives

ARTICLE 10 - (1) In relation to the products included in the application communiqués, goods within the scope of Public Procurement Law dated 4/1/2002 and 4734 numbered, to be purchased by the Administrations; to ensure that the application of high-efficiency class and high performance level, in terms of energy consumption or if any, to provide more efficient classes specified in the Application Communiqués, may make necessary modification on technical specifications, in accordance to the communiqués

(2) Government administrations prefer products, taking into account the criteria of cost-effectiveness, economic feasibility, technical suitability and sufficient competition aspects, in the conditions of the highest level of performance and in high-efficiency class.

[12] Article 10 General Directorate of Construction, "(1) c) Public buildings and facilities belonging to public institutions and agencies covered by the budget needs to prepare programs, studies and projects, and perform or make cost calculations, confirm or make the approval, construction, retrofitting, as amended, and perform or make substantial repairs.

Regulation Regarding the Increase of Energy Efficiency dated October 27, 2011 No. 28097

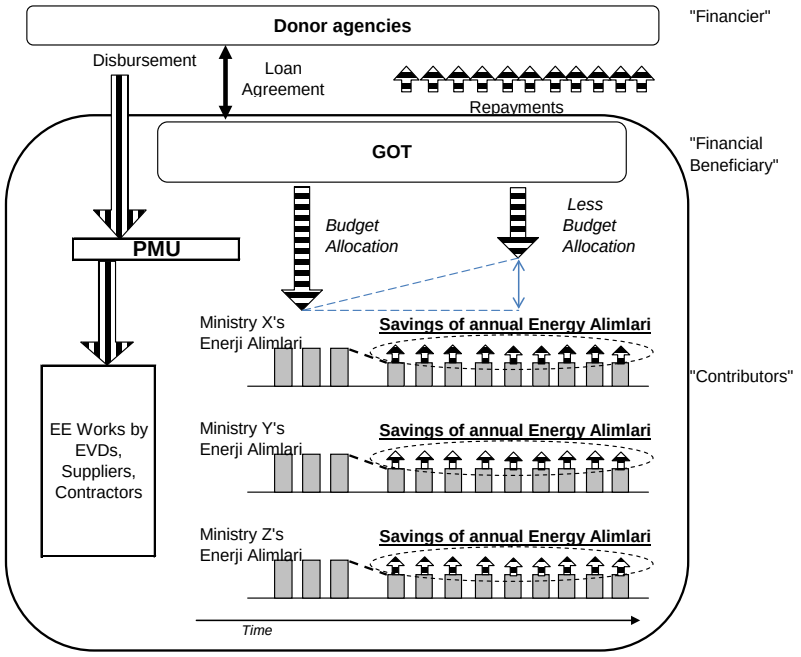
ARTICLE 31 Measures to be taken with priority for increasing the energy efficiency in the buildings and enterprises belong to the public sector; (1) The energy use of the buildings and enterprises belong to public sector shall be reduced by at least twenty percent in the year 2023 compared to the year 2010

(2) Choosing among the air conditioners with at least A class label in new purchases.

7) Direct financial beneficiary will be GOT through reduced energy purchase bills

Project costs will be the total sum of the EE retrofit investments of ministries and agencies. This is financed through PMU by budget. Financiers are JICA and/or multilateral/bilateral donor agencies.

The primary financial beneficiary of the Project will be the Turkish Government through reduced energy purchase bills (i.e. fuel, oil & petroleum and electricity purchase costs) of central government ministries and agencies (See Figure 2.4.2-4).



Note: Enerji Alimlari = Energy purchase = coal, gas + oil + electricity + others

Source: Budget classification 03.2.3

Figure 2.4.2-4 Quasi-collection of Funds through Energy Savings and Loan Repayments

(3) Sub-project Implementation Steps

As suggested in the previous sections, two kinds of implementation methods are proposed in the loan project, namely, Energy Audit Method, and Bundling Method. As explained in sub-section 1) above, types of retrofitting works and role-sharing among organizations are very much different between these two methods. Especially with regard to roles and responsibilities, while each Participating Ministry/Directorate shall take the leading role in Energy Audit

Method, in Bundling Method, PMU established within MOEU will play the leading role in implementing the sub-projects of several ministries.

Step-by step work flow and assignment of each work to relevant organizations is shown in Figure 2.4.2-5 for Energy Audit Method and Figure 2.4.2-6 for Bundling Method.

As shown in Figure 2.4.2-5, while various supports are provided by PMU, the decisions shall be made by each Participating Ministry/Directorate, for (7) approval (decision) for sub-project implementation, (9) tender, (10), tender evaluation and (13) final acceptance. On the other hand, in case of Bundling Method shown in Figure 2.4.2-6, most decisions with regard to project implementation shall be made by PMU, i.e. decisions involving (5) tender, (6) tender evaluation, (8) issuing of work order and supervision of works and (9) final acceptance.

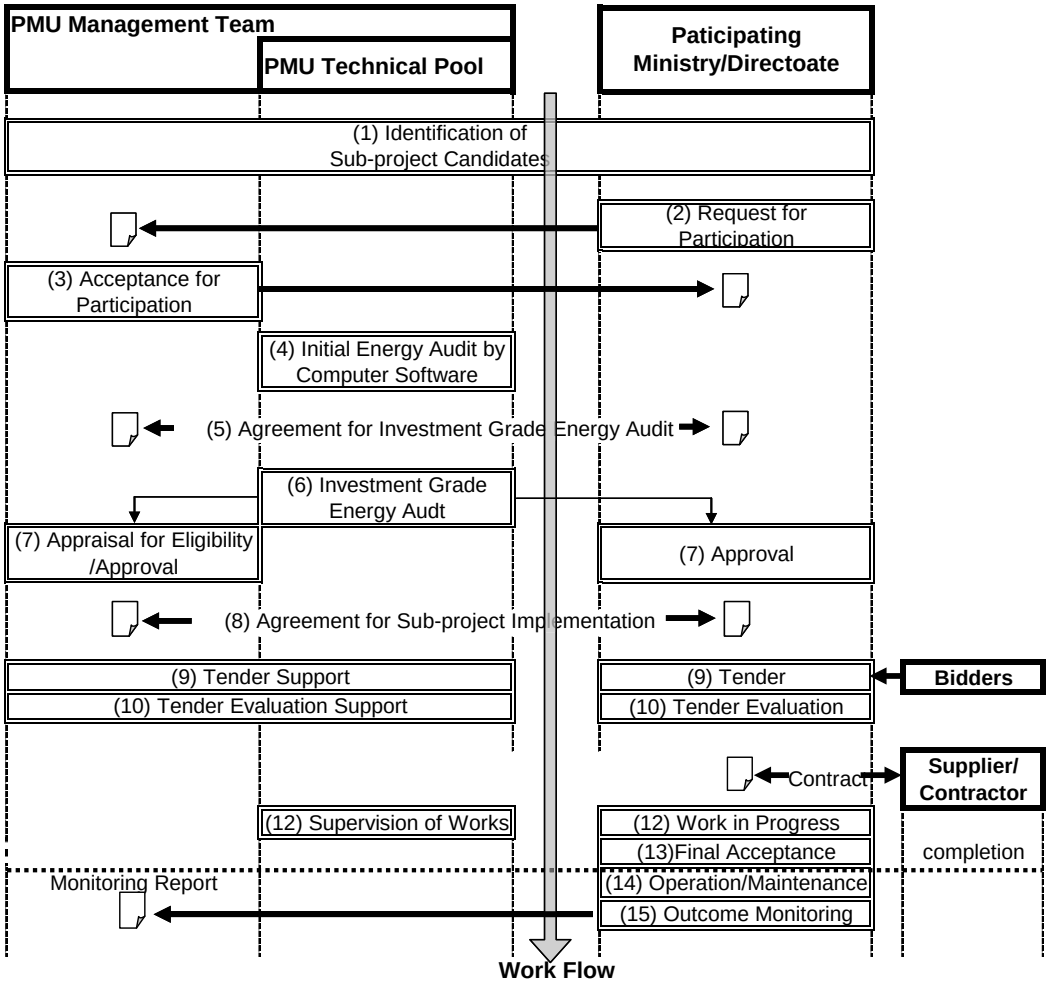


Figure 2.4.2-5 Step-by-Step Work Flow for Energy Audit Method

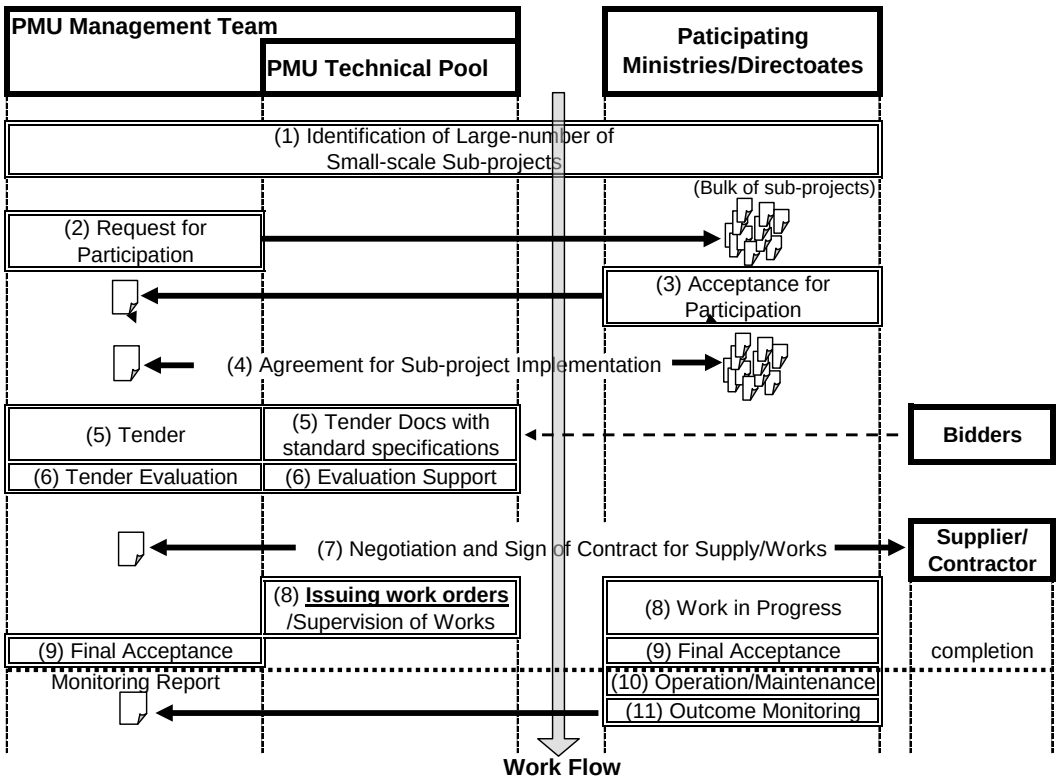


Figure 2.4.2-6 Step-by-Step Work Flow for Bundling Method

(4) Timeframe for Preparation and Implementation of the Project (Draft)

Table 2.4.2-4 shows the target time frame for preparation and implementation of the Project (Draft).

Table 2.4.2-4 Target Time Frame for Preparation and Implementation of the Project (Draft)

2013	➢ Project formation and preparation of project proposal (including energy audits under 100 Building Projects and under other programs) ➢ Obtain approval at EECB as the Project to implement an action of No. SP-06/ST-01/A-01 of Energy Efficiency Strategy Paper ➢ Obtain approval for the Project from the HPC as inter-ministerial government priority project ➢ Obtain approval under Public Investment Program ➢ Amendment of relevant sections for framework agreement in Public Procurement Law ➢ Negotiation with JICA/donor agencies for project loan ➢ Budgeting (in bulk) as capital investment project in multi-year
2014	➢ Implementation of first sub-project ➢ Continuation of formulation and implementation of sub-projects
2015	➢ Continuation of formulation and implementation of sub-projects
2016	➢ Continuation of formulation and implementation of sub-projects

Among above future schedule, the year of 2013 as preparation period is of critical importance. The first action must be forming consensus at EECB for the project and its implementation mechanism. At the same time, needs assessment through implementation of energy audits of

public sector buildings is to be carried out to identify targeting areas and suitable technologies, and to figure out total quantities for such investment. Based on this needs assessment Project Fiche for Public Investment will be prepared and submitted to the Ministry of MOD. As the Project is not implemented by a ministry, but involves all ministries, it is recommended the Project to be authorized as a national important project by HPC.

These project formation and authorization process must be completed in the first half of 2013 in order for the Project to be included in the Government Budget for 2014-2016. In addition to budgeting process, for timely and smooth and implementation of the Project, amendment of the Public Procurement Law must be completed or nearly completed within 2013. (See Figure 2.4.2-7)

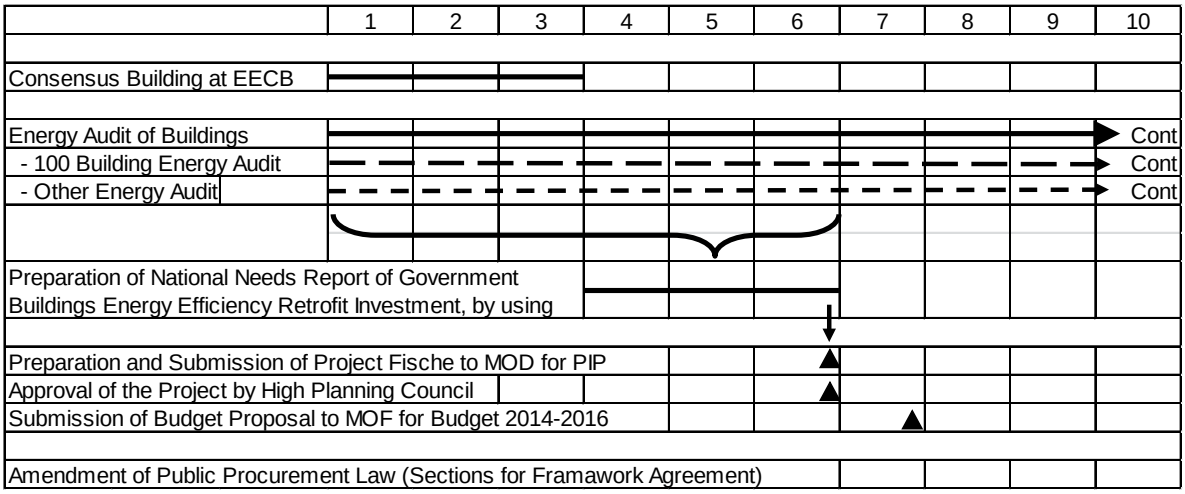


Figure 2.4.2-7 Action Plan for 2013

(5) Technical Assistance to Support the PMU

This implies both the technical assistance (TA) to support capacity development of the PMU as well as the complementary support duties of the PMU where lacking capability in short term. The TA support will be gradually phased out according to the progress of technical transfer. Scope of TA to support capacity development of PMU includes;

- Sub-project formation, and conducting energy audit
- Preparation of tender specifications, support for tender evaluation
- Support for construction supervision
- Monitoring project outcomes
- Awareness, public relations

(6) Candidates of JICA's Next Technical Assistance Program

The Study Team had several meetings with MOEU and related organizations focusing on the candidates of JICA's next technical assistance programs. The candidates of JICA's next technical assistance program are shown in Table 2.4.2-5. Among them, which were requested by Turkish Government, the most effective programs to implement, and in which Japanese

technologies contribution is considered to be large, are as follows

Theme No1: Establishment of sustainable buildings assessment tool

Based on SP -02 “To reduce energy demand and carbon emissions of the buildings; to promote sustainable environment friendly buildings using renewable energy sources”, Energy Efficiency Strategy Paper 2012-2023, Responsible ministry: MOEU

Theme No2: Capacity development for EE auditors, EVD association

Based on SP -01 “To reduce energy intensity and energy losses in industry and service sectors”, Energy Efficiency Strategy Paper 2012-2023, Responsible ministry: MENR

Theme No3: Capacity development for Energy efficiency standard

Based on SP -03 “To provide market transformation of energy efficient products”, and SP-07 “To strengthen institutional capacities and collaborations, to increase use of state of art technology and awareness activities, to develop financial mechanism except public financial institutions”. Energy Efficiency Strategy Paper 2012-2023, Responsible ministry: MOSIT

Table 2.4.2-5 Candidates of JICA's Next Technical Assistance Program

Themes		Executing Agency	Project Purpose	Outputs/Activities	Background	Target Group/ Beneficiaries	Duration
1	Establishment of sustainable buildings assessment tools	MOEU	Support for Establishment of the tools to assess sustainable buildings	Support for Establishment of Turkish assessment methodology and tool of sustainable buildings, considering EE, environmental impact and resistance against earthquake etc. Capacity development of staffs of MOEU and related organizations and introduction of the concept of sustainable building for public buildings will be achieved. Activity1 : Support to establish Turkish sustainable building assessment tool Activity2 : Visiting Japan to learn the operation of CASBEE Based on EE Strategy Paper 2012-2023 SP-02 "To reduce energy demand and carbon emissions of the buildings; to promote sustainable environment friendly buildings using renewable energy sources"	Establishment of standard for Turkish sustainable building is urgently needed (next year) MOEU would like to learn from Japan	MOEU, Municipality, Building designer, Building owner	Half a year
2	Capacity development for EE auditors, EVD association	MENR, EVD Association	EVD capacity development	Capacity development of MENR staff and EVDs by OJT Smooth implementation of EE retrofit investments Audit and reporting Activity1 : Procedures for energy audit, and format of reporting (Soft technology) Activity2 : On-site training Capacity development to introduce ESCO scheme Activity3 : Understanding of ESCO and leasing contract scheme Activity4 : Procedures to formulate ESCO business Activity5 : Training in Japan Based on EE Strategy Paper 2012-2023 SP-01 "To reduce energy intensity and energy losses in industry and service sectors"	Result of energy audits for 2 buildings, it was found that the potential of energy conservation was larger than expected. This knowledge can be applied to the other buildings in Turkey. MENR and EVD Association would like to learn from Japan	MENR,EVDs, Building owner, industry	1 year
3	Capacity development for Energy efficiency standard on AC etc.	MOSIT	Improvement of energy efficiency standard, market transformation of energy efficient products and enhance institutional capacities and collaborations to improve technologies and awareness activities	Support to improve and disseminate Turkish energy standard system and enhance institutional capacities and collaboration in order to ensure inclusion of important items and avoid intrusion of low price low efficiency equipment into Turkish market. /Ensure selection of high efficient equipment via public procurement Activity1: Understanding of Japanese top runner mechanism (Top runner mechanism is suitable for exporting countries) Linkage to labeling institutional responsibility and collaboration should be recognized. Activity2 : Training in Japan (lecture and visiting retail shop/ manufacturer) Activity3 : Formulate action plan for Turkish top runner mechanism (target setting reflecting Turkish market condition) Based on EE Strategy Paper 2012-2023 SP-03 "To provide market transformation of energy efficient products" and SP-07 "To strengthen institutional capacities and collaborations, to increase use of state of art technology and awareness activities, to develop financial mechanism except public financial institutions"	There are 12,000,000ACs and 150,000 AHUs in Turkey. And half of them were installed over 15 years ago. How to change them to efficient ones, how to formulate more suitable standard and how to create onward spiral market are large Issue. MOSIT would like to learn from Japan At the same time, technical troubles in Turkey's market, which may be caused by the spread of Inverter AC should be considered. (THD: Total Harmonic Distortion etc.)	MOSIT, Consumer, Manufacturer	1year
4	Improvement of energy data collecting mechanism	MENR	Improvement of energy data collecting mechanism and preparation of the baseline energy statistics	Find more effective way to collect periodical energy consumption data under EC Law and figure out energy consumption baseline by sector utilizing IT infrastructure Activity1 : Establishment of a prototype on web-based periodical energy consumption data collecting Activity2 : Pilot operation of the web-based data collecting system Activity3 : Establishment of energy consumption database and baseline by sector Activity4 : Training for data management in Japan Based on EE Strategy Paper 2012-2023 SP-01 "To reduce energy intensity and energy losses in industry and service sectors"	Energy consumption data for buildings has been collected under the regulation. However it has not been utilized well, and not shared with other ministries.	MENR, Building owner industry	1-2 years
5	Establishment of group management system for building energy consumption	MENR,MOEU	Establishment of web-based group management system for building energy consumption	Establishment of Prototype of web-monitoring and future IT management (Future linkage to Theme4) Activity1 : Establishment of prototype of web-monitoring system for consumers' energy consumption Activity2 : Field test of web-based energy management system (incl. demand response) for buildings (group management) Activity3 : Establishment of analysis and utilization mechanism for the above collected data Activity4 : Training in Japan Based on EE Strategy Paper 2012-2023 SP-01 "To reduce energy intensity and energy losses in industry and service sectors"	MOEU has a plan to establish energy consumption database for buildings. However it has not been established. And MOEU is interested in introducing web-monitoring system for government buildings.	Large Building owner, MOF, MENR,MOEU	2 years

(7) Summary of Recommendations

The Study Team had discussions and collected related information to illustrate a functional implementation scheme on the "Project for Energy Efficiency Retrofitting of Central Government Buildings". The following implementation scheme is proposed with due considerations to (i) size of sub-projects varies, but majorities are small ones; (ii) not many government organizations have so far become serious about energy saving.

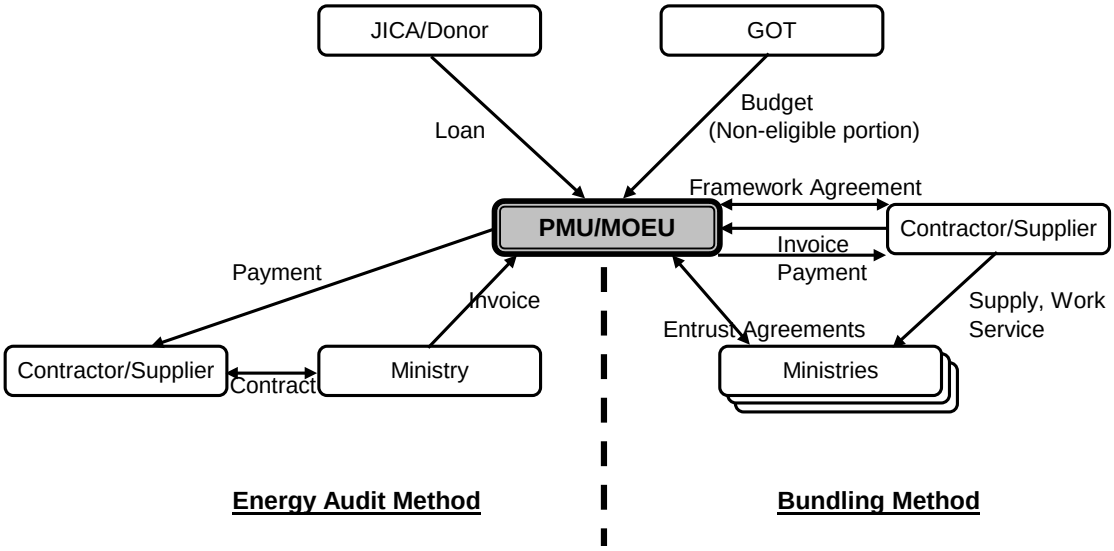


Figure 2.4.2-8 Project Scheme for Energy Efficiency Retrofitting in Government Buildings

The Project has several important features of the Project are as follows;

- Utilization of Two implementation methods (Energy Audit Method and Bundling Method)
- Establishment of a powerful PMU with implementation authorities and enforcement tools
- Structuring framework agreement for a large-number of small-scale sub-projects in consistent with Turkish Law
- Implementation of sub-project by PMU for other ministries by delegation of authority to PMU
- Evaluation of tender not by price of bids, but selecting the economically most advantageous tender by taking into account the factor other than price
- Purchasing only high energy efficiency equipment by using energy labeling regulations

As project preparations for implementation, the following activities are recommended to be carried out in 2013;

- Project formation and preparation of project proposal (including energy audits under 100 Building Projects and under other programs)
- Obtain approval at EECB as the Project to implement an action of No. SP-06/ST-01/A-01 of Energy Efficiency Strategy Paper
- Obtain approval for the Project from the HPC as inter-ministerial government priority project

- Obtain approval under Public Investment Program
- Amendment of relevant sections for framework agreement in Public Procurement Law
- Negotiation with JICA/donor agencies for project loan
- Budgeting (in bulk) as capital investment project in multi-year